CRISIS MANAGEMENT BY SUGARCANE GROWERS OF NORTHERN KARNATAKA – AN ANALYSIS

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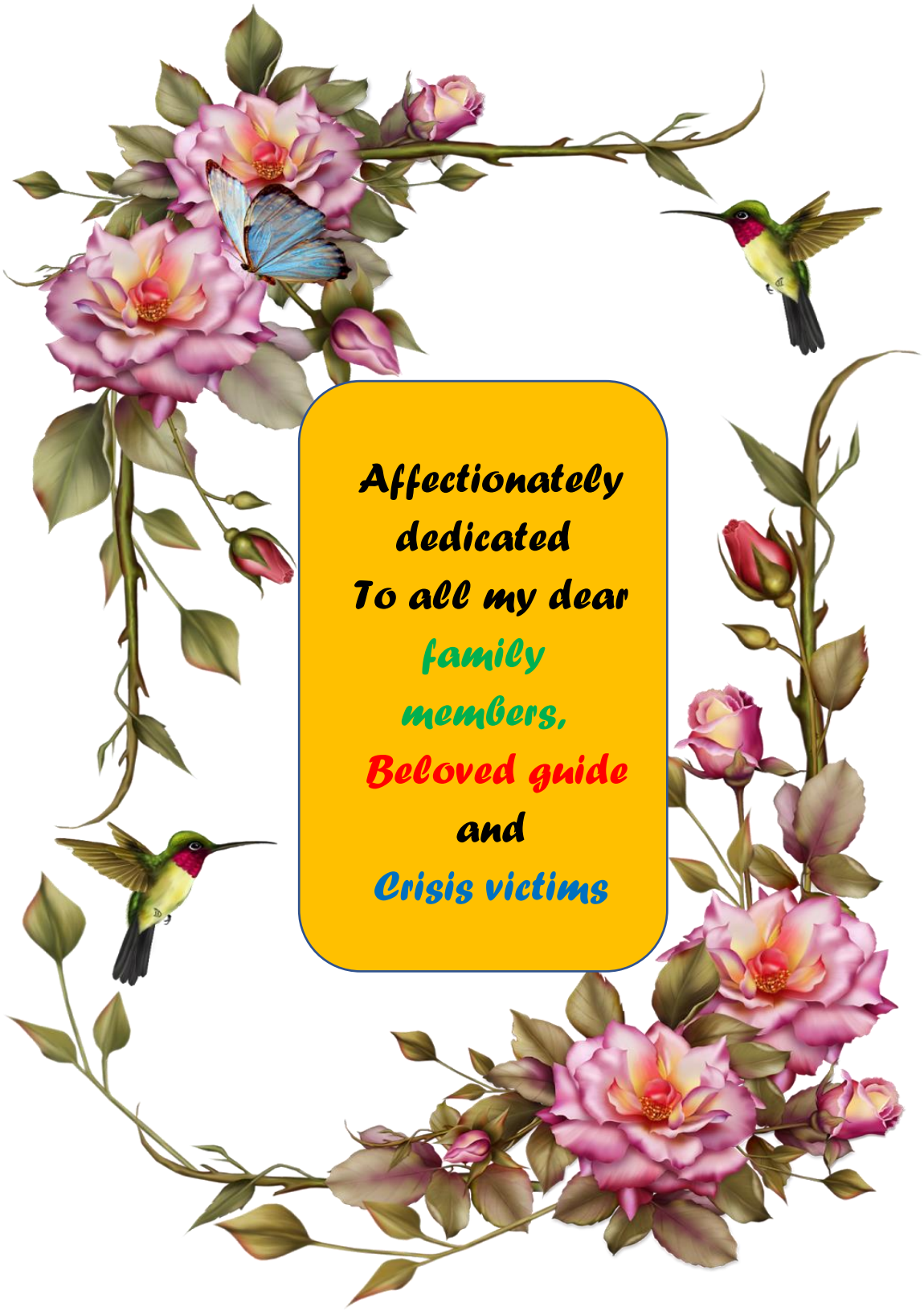

Affectionately
dedicated
To all my dear
family
members,
Beloved guide
and
Crisis victims

DEPARTMENT OF AGRICULTURAL EXTENSION
UNIVERSITY OF AGRICULTURAL SCIENCES,
GKVK,BANGALORE -560 065

CERTIFICATE

This is to certify that the thesis entitled **"CRISIS MANAGEMENT BY SUGARCANE GROWERS OF NORTHERN KARNATAKA – AN ANALYSIS"** submitted by **Mr.MUTTEPPA CHIGADOLLI, ID. No. PALB 8031** in partial fulfilment of the requirements for the award of the degree of **DOCTOR OF PHILOSOPHY** in **AGRICULTURAL EXTENSION** of the University of Agricultural Sciences, Bangalore is a record of *bona-fide* research work carried out by him during the period of his study in this University under my guidance and supervision and the thesis has not previously formed the basis for the award of any other degree, diploma, associateship, fellowship or any other similar titles.

Bengaluru
February, 2022

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With regardful memories ……

It is my pleasure to glance back and recall the path one traveled during the day of hard work and perseverance. In every one's life, the day arises when one has to shape the feelings in words. Sometimes, the words become unable to express the feelings of the mind, because, the feelings of heart are beyond the reach of the words. When, I came to complete this manuscript, so many memories have rushed through my mind which is full of gratitude to those who encouraged and helped me at various stages of this research. It gives me immense pleasure to record my feelings at this place.

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Bengaluru. (MUTTEPPA CHIGADOLLI)
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CRISIS MANAGEMENT BY SUGARCANE GROWERS OF NORTHERN KARNATAKA – AN ANALYSIS

MUTTEPPA CHIGADOLLI

THESIS ABSTRACT

The present study was conducted in Belagavi and Bagalkot districts of Karnataka during 2020-21 to know the crisis management behaviour, adoption of crisis mitigation mechanisms and awareness of sugarcane growers about crisis and its management. Data was collected from 80 head reach, 80 mid reach and 80 tail end sugarcane growers constituting to the total sample size of 240. The results revealed that little more than two-fifth (40.42 %) of growers belonged to the average crisis management behaviour category followed by better (30.41 %) and poor (29.17 %) categories. More than one-third of respondents belongs to moderate (36.25 %) and better (33.75 %) decision-making ability categories respectively followed by poor (30.00 %) category. More than one-third of respondents belongs to moderate (37.92 %) adaptability category followed by better (31.25 %) and poor (30.83 %). Majority (71.25 %) of respondents are under the moderate to poor economic performance categories followed by better (28.75 %). More than two-fifth of respondents (41.25 %) belonged to high adoption of crisis mitigation mechanisms followed by medium (33.75 %) and low (25.00 %). Significant percentage (40.83%) of growers belonged to moderate awareness category followed by poor (30.42 %) and better (28.75 %) categories. The stepwise regression analysis indicated that fifteen independent variables out of twenty-three are influencing the crisis management behaviour to an extent of 80.70 per cent. The major constraints of growers at different phases of crisis management were delay in disbursement of fair and remunerative price bonus, load shedding during the summer and disconnection of electricity for long duration led to crop losses. The top suggestions to overcome these constraints were fair and remunerative price and sugarcane price should be disbursed immediately, government should provide atleast eight hours' regular supply of electricity for irrigation and measures should be taken for faster installation of electricity lanes to start water supply.

February, 2022 **(Y. N. Shivalingaiah)**

Dept. of Agricultural Extension Major Advisor
UAS, GKVK, Bengaluru-560065.

ಉತ್ತರ ಕರ್ನಾಟಕದ ಕಬ್ಬು ಬೆಳೆಗಾರರಿಂದ ಬಿಕ್ಕಟ್ಟು ನಿರ್ವಹಣೆ – ಒಂದು ವಿಶ್ಲೇಷಣೆ

ಮುತ್ತೇಪ್ಪಾ ಚಿಗಡೊಳ್ಳಿ

ಪ್ರಬಂಧ ಸಾರಾಂಶ

ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವನ್ನು ಕರ್ನಾಟಕದ ಬೆಳಗಾವಿ ಮತ್ತು ಬಾಗಲಕೋಟೆ ಜಿಲ್ಲೆಗಳಲ್ಲಿ 2020-21ರ ಅವಧಿಯಲ್ಲಿ ಬಿಕ್ಕಟ್ಟು ನಿರ್ವಹಣೆಯ ನಡವಳಿಕೆ, ಬಿಕ್ಕಟ್ಟು ತಗ್ಗಿಸುವ ಕಾರ್ಯವಿಧಾನಗಳ ಅಳವಡಿಕೆ ಹಾಗೂ ಬಿಕ್ಕಟ್ಟು ಮತ್ತು ಅದರ ನಿರ್ವಹಣೆಯ ಬಗ್ಗೆ ಕಬ್ಬು ಬೆಳೆಗಾರರ ಜಾಗೃತಿ ಮಟ್ಟವನ್ನು ತಿಳಿಯಲು ನಡೆಸಲಾಯಿತು. ಈ ಅಧ್ಯಯನದ ಒಟ್ಟು ಮಾದರಿ ಗಾತ್ರ 240 ರಷ್ಟಿದೆ, ಅದರಲ್ಲಿ 80 ಮೊದಲ ಹಂತ, 80 ಮಧ್ಯಮ ಹಂತ ಮತ್ತು 80 ತಳಹಂತದ ನದಿಯಿಂದ ನಿರಾವರಿ ಪಡೆಯುವ ಕಬ್ಬು ಬೆಳೆಗಾರರಿಂದ ದತ್ತಾಂಶವನ್ನು ಸಂಗ್ರಹಿಸಲಾಗಿದೆ. ಐದನೇ ಎರಡರಷ್ಟು (40.42-%) ಬೆಳೆಗಾರರು ಮಧ್ಯಮ ವರ್ಗದಲ್ಲಿ, ನಂತರ ಉತ್ತಮ (30.41-%) ಮತ್ತು ಕಳಪೆ (29.17-%) ಬಿಕ್ಕಟ್ಟು ನಿರ್ವಹಣಾ ನಡವಳಿಕೆ ವರ್ಗಗಳಿಗೆ ಸೇರಿರುತ್ತಾರೆ. ಮೂರನೇ ಒಂದು ಭಾಗಕ್ಕಿಂತ ಹೆಚ್ಚಿನ ಕಬ್ಬು ಬೆಳೆಗಾರರು ಮಧ್ಯಮ (36.25-%), ಉತ್ತಮ (33.75-%) ಮತ್ತು ಕಳಪೆ (30.00-%) ನಿರ್ಧಾರ ತೆಗೆದುಕೊಳ್ಳುವ ಸಾಮರ್ಥ್ಯದ ವರ್ಗಗಳಿಗೆ ಅನುಕ್ರಮವಾಗಿ ಸೇರಿರುತ್ತಾರೆ. ಮೂರನೇ ಒಂದು ಭಾಗಕ್ಕಿಂತ ಹೆಚ್ಚಿನವರು ಮಧ್ಯಮ (37.92 %), ಉತ್ತಮ (31.25 %) ಮತ್ತು ಕಳಪೆ (30.83 %) ಹೊಂದಿಕೊಳ್ಳುವಿಕೆ ವರ್ಗಗಳಿಗೆ ಅನುಕ್ರಮವಾಗಿ ಸೇರಿರುತ್ತಾರೆ. ಪ್ರತಿಕ್ರಿಯಿಸಿದವರಲ್ಲಿ ಹೆಚ್ಚಿನವರು (71.25 %) ಮಧ್ಯಮದಿಂದ ಕಳಪೆ ಹಾಗೂ ಉತ್ತಮ (28.75-%) ಆರ್ಥಿಕ ಕಾರ್ಯಕ್ಷಮತೆಯ ವರ್ಗಗಳ ಅಡಿಯಲ್ಲಿದ್ದಾರೆ. ಪ್ರತಿಕ್ರಿಯಿಸಿದವರಲ್ಲಿ ಐದನೇ ಎರಡರಷ್ಟು ಉತ್ತಮ (41.25-%), ಮಧ್ಯಮ (33.75-%) ಮತ್ತು ಕಡಿಮೆ (25.00-%) ಬಿಕ್ಕಟ್ಟು ತಗ್ಗಿಸುವಿಕೆಯ ಕಾರ್ಯವಿಧಾನಗಳ ಅಳವಡಿಕೆ ವರ್ಗಗಳಿಗೆ ಸೇರಿರುತ್ತಾರೆ. ಗಮನಾರ್ಹ ಶೇಕಡಾವಾರು 40.83 ರಷ್ಟು ಬೆಳೆಗಾರರು ಮಧ್ಯಮ ಜಾಗೃತಿ ವರ್ಗಕ್ಕೆ, ನಂತರ ಕಳಪೆ (30.42 %) ಮತ್ತು ಉತ್ತಮ (28.75-%) ಜಾಗೃತಿ ವರ್ಗಗಳಿಗೆ ಸೇರಿರುತ್ತಾರೆ. ಇಪ್ಪತ್ತೂರರಲ್ಲಿ ಹದಿನೈದು ಅಧೀನವಲ್ಲದ ಅಸ್ಥಿರಗಳು ಬಿಕ್ಕಟ್ಟು ನಿರ್ವಹಣಾ ನಡವಳಿಕೆಯ ಮೇಲೆ ಶೇಕಡಾ 80.70 ರಷ್ಟು ಪ್ರಭಾವ ಬೀರುತ್ತಿವೆ ಎಂದು ಹಂತ ಹಂತದ ಹಿಂಜರಿತ ವಿಶ್ಲೇಷಣೆಯು ಸೂಚಿಸಿದೆ. ಬಿಕ್ಕಟ್ಟು ನಿರ್ವಹಣೆಯ ವಿವಿಧ ಹಂತಗಳಲ್ಲಿ ಬೆಳೆಗಾರರ ಪ್ರಮುಖ ನಿರ್ಬಂಧಗಳೆಂದರೆ ನ್ಯಾಯಯುತ ಮತ್ತು ಲಾಭದಾಯಕ ಬೆಲೆಯ ಕೊಸರುಹಣ ವಿತರಣೆಯಲ್ಲಿ ವಿಳಂಬ, ಬೇಸಿಗೆಯಲ್ಲಿ ಲೋಡ್ ಶೆಡ್ಡಿಂಗ್ ಮತ್ತು ದೀರ್ಘಾವಧಿಯವರೆಗೆ ವಿದ್ಯುತ್ ಸಂಪರ್ಕ ಕಡಿತದಿಂದಾಗುವ ಬೆಳೆ ನಷ್ಟ. ಈ ಅಡೆತಡೆಗಳನ್ನು ನಿವಾರಿಸಲು ಪ್ರಮುಖ ಸಲಹೆಗಳು ನ್ಯಾಯಯುತ, ಲಾಭದಾಯಕ ಬೆಲೆ ಮತ್ತು ಕಬ್ಬಿನ ಬೆಲೆಯನ್ನು ತಕ್ಷಣವೇ ವಿತರಿಸಬೇಕು, ಸರ್ಕಾರವು ನೀರಾವರಿಗಾಗಿ ಕನಿಷ್ಠ ಎಂಟು ಗಂಟೆಗಳ ಕಾಲ ನಿಯಮಿತವಾಗಿ ವಿದ್ಯುತ್ ಸರಬರಾಜು ಮಾಡಬೇಕು ಮತ್ತು ನೀರು ಸರಬರಾಜು ಪ್ರಾರಂಭಿಸಲು ವಿದ್ಯುತ್ ಮಾರ್ಗಗಳನ್ನು ತ್ವರಿತವಾಗಿ ಅಳವಡಿಸಲು ಕ್ರಮಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳಬೇಕು.

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I INTRODUCTION

Crisis conditions are extremely harmful to farming people and cause considerable loss to national economies and the overall development of a country. It is a highly familiar fact that today's crisis and disasters are often due to human interfering activities (Anonymous, 2011a) causing changes in the natural balance of the universe. Agriculture is one of the sectors that was most affected by the crisis. In agriculture, crisis is any unforeseen situation that endangers the viability of agricultural holdings, in the form of low crop prices and low farm income, either at localized level/ whole sector of production/ wider geographical level. It may be caused by natural disasters like floods, drought, diseases and pests, economic factors and unforeseeable disruption of market access (Anonymous, 2005).

Crisis and disasters triggered by natural hazards between 2003 to 2013 caused an economic damage and loss of US$ 1.5 trillion globally and US$ 550 billion in developing countries affecting 2 billion people. The agriculture sector alone absorbed around 22 per cent of total damage and losses, accounting for US$ 80 billion in crop and livestock production losses with an annual average of US$ 7.3 billion damage and losses caused by natural hazards/crisis. Within the agriculture sector, the crop sub-sector absorbs over 42 per cent of the total damage and losses caused by natural calamities while the livestock sub-sector accounts for nearly 36 per cent. In Asia, production losses amounted to roughly US$ 48 billion. Correspondingly, it accounts for 60 per cent of total losses in all developing countries. The most significant damage and losses in the Asian continent were due to floods i.e., 77 per cent of the region's losses is due to floods. Floods and droughts together accounted for 83 per cent of total crop and livestock production losses, showing the severe impact of climate-related crisis and disasters on the agriculture sector (Anonymous, 2015). When considered at a country level, India was most affected by crop and livestock production losses because of repeated floods between 2004 to 2013. India single-handedly accounted for more than one-third of total cereal losses among 67 countries.

The crisis and disaster-related loss in crop and livestock production was estimated at US$ 280 billion between 2008–2018. Further, these have impacted the agricultural sectors of developing countries' economies over US$ 108 billion due to damaged or lost crops and livestock. During this decade (2008-2018), the Asian continent was the most hard-hit region, with overall economic losses of around US$ 49 billion, followed by Africa at US$ 30 billion and Latin America and the Caribbean at US$ 29 billion. Drought is the most destructive and damaging crisis affecting agriculture, which has caused US$ 37 billion in crop and livestock

production losses. Floods were the second severest crisis which affected the agriculture sector and affected a total of US$ 21 billion of crop and livestock production losses for 2008 to 2018. These two-crisis accounted to 19 per cent of total losses (Anonymous, 2021a).

The crisis and disasters disproportionately affect food insecure, low-income and hapless poor people of rural areas as more than 75 per cent (over 2.5 billion people globally) of whom obtain their daily living from agriculture and allied sectors. With the agriculture sector's innate interactions with the environment. Disasters and crisis do not just have immediate, short-term effects, they diminish livelihoods and national development gains that took years to build (Anonymous, 2016). Crisis and disasters disrupt livelihoods and add risks, damage and stress of crisis to farmers' livelihoods.

Crisis is not only harmful to human and physical capital but also threatens India's economic development very seriously. India's geo-climatic conditions, along with its high degree of socio-economic vulnerability, makes it one of the most crisis prone countries in the world (Anonymous, 2011b). India is highly vulnerable to floods, droughts, cyclones, earthquakes, landslides, avalanches and forest fires. Out of 36 states and union territories in the country, 27 of them are prone to crisis and natural calamities. According to the National Disaster Management Authority, around 40 million hectares of land in India is exposed to floods (around 12 per cent of the total land area), 68 per cent of farm land is vulnerable to droughts, landslides and avalanches, 58.6 per cent of the land mass is earthquake-prone and tsunamis as well as cyclones occur regularly over 5,700 km coastal belt. These vulnerable conditions of India, placed it amongst the 14th most vulnerable country in the world to crisis and disasters, due to extreme weather-related events. Further, economic losses in India due to such calamities accounted for around US$ 13,789 million, the 4th highest in the world (David *et al*, 2019). Floods are the most frequently occurred calamity in India, accounting for 52 per cent of the total calamities, followed by cyclones (30 %), landslides (10%), earthquakes (5%) and droughts (2 %) (Parida and Goel, 2020).

In India, around 68 per cent of the farming land is susceptible to drought in varying degrees (of which 35 % land is drought prone: receives rainfall between 750 mm and 1125 mm and 33 % land is chronically drought prone; rainfall less than 750 mm). Twenty-three of the thirty-six states and Union Territories in the country are prone to floods and affecting 40 million hectares of land. It means around one-eighth of the country's geographical area, is prone to floods. The Government of India approximated that the annual agricultural income is likely to decline by 15-18 per cent on average and up to 20-25 per cent for non-irrigated areas. India has

suffered a huge crop loss on 18.17 million hectares of land, roughly 8.5 per cent of the total gross cropped area, due to floods (Anonymous, 2018). The estimated economic losses caused by the weather-related crisis and disasters in India in the last decade were- 2019 Floods (US$ 15.71 billion), 2018 Kerala Floods (US$ 4.25 billion), 2017 Bihar Floods (US$ 1.6 billion), 2016 Cyclone Vardah (US$ 1 billion), 2015 Chennai Floods (US$ 2.2 billion), 2014 J&K floods (US$ 16 billion), 2014 Hudhud Cyclone (US$ 7 billion), and Uttarakhand floods (US$ 1.1 billion) and Cyclone Phailin (US$ 0.64 billion).

The Indian agriculture sector is extremely vulnerable to the natural hazards borne crisis causing the largest economic losses in India with at least one-third of total annual losses on average. First, the decline in crop yields has lead to reduction in agricultural revenues and second, increasing crop losses due to extreme weather events is leading to current average losses estimated at least US$ 4.5 billion or around 0.25 per cent of India's GDP. These intensifying adverse impacts are a serious concern for India, as 85 per cent of the country's farmers have poor financial resilience (Charanjith Singh, 2019).

Karnataka state is one of the calamity-prone states in Southern India due to its geo-environmental diversity and exposure to crisis. The state is prone to different kinds of crisis such as droughts, floods, cyclones, hailstorms, landslides and earthquakes. Out of total geographical area of Karnataka, 80 per cent is susceptible to drought, 22 per cent is prone to moderate earthquakes, 24 per cent is prone to cyclones and heavy winds and more than 30 per cent is prone to landslides. While many of these vulnerabilities are on account of natural causes, many times human action often exacerbates is a contributing factor. In addition to vulnerability to natural hazards, vulnerability to pest and disease outbreaks is on the rise (Anonymous, 2020a).

Karnataka stands second position among states affected by droughts after Rajasthan. Once in every 2.5 years, the state experiences drought with more than 100 taluks declared as drought affected. Around 157 taluks in 2012, 125 taluks in 2013, 136 taluks in 2015, 164 taluks in 2016 and again 164 taluks in 2018 were declared as drought affected taluks which indicates the severity of the drought situation in Karnataka (Anonymous, 2021b). Despite frequent droughts and acute water shortage during summer months, floods are common in Belagavi, Bagalkot, Vijayapura and other districts of Northern Karnataka. In the Northern Karnataka region, Krishna and Godavari river basin caused floods even when the state was wretched under drought like conditions due to heavy discharge of backwater from Maharashtra reservoirs (Anonymous, 2021b).

In Karnataka, the destructive floods and landslides caused damage to around 9.70 lakh hectares of agriculture, horticulture and plantation crops and large sheathes of the fields are heavily silted due to changes in river course and flood. Landslides and mudslides in multiple locations have completely destroyed around 13,663.51 ha of agriculture and horticulture areas and caused an estimated crop loss of ₹15,230 crores in 2019 floods (Anonymous, 2019a). Similarly, during the 2020 floods in Karnataka around 4.03 lakh ha of agriculture (3.31 lakh ha), horticulture (0.32 lakh ha) and plantation crops (0.38 lakh ha) have been damaged. Besides, 812 ha of agricultural land are heavily silted and 334 ha of agricultural land has been irreversibly damaged. The crop loss due to floods and landslides is estimated at ₹5,510 Crore (Anonymous, 2020b).

Belagavi district has witnessed severe floods during the years 2005, 2006, 2009, 2012, 2017, 2018, 2019, 2020 and 2021 due to heavy rainfall and release of excessive water from Koina dam of Maharashtra state to the river Krishna and its tributaries. During 2005, 2006, 2019 and 2021 flood, Belagavi district experienced heavy loss of life and property. Athani, Chikodi and Raibag were severely affected due to floods from river Krishna. Gokak from the Ghataprabha river and Ramdurga from the Malaprabha river. Drought is a common occurrence in the district almost every year due to river dry off during summer months (Anonymous, 2020a).

Drought is a common occurrence in the Bagalkot district every year. In the year 2005-06, 146 villages of Bagalkot district were affected due to floods in the Krishna, the Malaprabha and the Ghataprabha rivers. The main cause for floods was the sudden release of water from Koina and Ujoni dams, caused flooding in the Krishna river, the release of water from Hidakal dam caused flooding in the Ghataprabha river and water discharged from Navilu Theertha dam caused flooding in the Malaprabha river. Around 36 villages of Jamkhandi taluk were affected by floods and also 40 villages of Mudhol taluk were affected due to the release of water in Ghataprabha river from Hidakal dam and Markandeya barrage. Almost 28 villages of Hunagund taluk and 20 villages in Bagalkot taluk were affected due to the excess release of water from Almatti dam and back water from Narayanpur dam. In Badami taluk 12 villages were affected due to floods in the Malaprabha river. The floods in Ghataprabha affected 40 villages in Mudhol taluk and flood in the Malaprabha river affected 21 villages in Hunagund taluk and 22 villages in Badami taluk. All the taluks of Belagavi and Bagalkot districts were declared as drought affected taluks during 2015, 2016, 2018 and 2019 (Anonymous, 2021b).

Sugarcane is an important commercial crop cultivated in more than hundred countries. The worlds' production rose from just below 448 million tonnes harvested on around 8.9 million hectares in 1961 to over 2 billion tonnes at about 27 million hectares in 2018. Brazil is the world's largest producer of sugarcane (37 % of world production in 2017), with impressive expansion rates observed every year. India is the second-largest producer in the world with 18.70 per cent of worlds' production. Peru and Guatemala, instead had the highest sugarcane productivity of 121 tonnes/ha and 118 tonnes/ha, respectively (Anonymous, 2019c).

Today, sugarcane cultivation and the sugar industry stand as supporting pillars of the Indian agriculture economy. India holds second position in both area and production of sugarcane (area 50.6 lakh hectares; 341.20 million tonnes of production; productivity of 70 to 75 tonnes/ha) after Brazil, followed by China, Pakistan and Thailand. Among 20 sugarcane cultivating states, Karnataka stands third position in both area and production (3.70 lakh ha area under sugarcane; 307.84 lakh tonnes of production with average productivity of 83.20 tonnes/ha) only after Uttar Pradesh and Maharashtra (Anonymous, 2020c). Belagavi is the leading producer of Sugarcane in Karnataka with an area of 1,20,762 hectares and 90.67 lakh tonnes of production with productivity of 75.08 tonnes/ha followed by Bagalkot (58,913 ha; 45.90 lakh tonnes; 78.08 tonnes/ha), Mandya (28,847 ha; 14.47 lakh tonnes; 110.30 tonnes/ha) and Vijayapur (22,734 lakh ha; 14.47 lakh tonnes; 63.60 tonnes/ha) (Anonymous, 2020c).

Total arrears to sugarcane farmers in India have crossed ₹20,000 crores. The root cause for price arrears' is the demand and supply mismatch. India is the second largest producer of sugar (17.10 %) in the world after Brazil. Within India, Uttar Pradesh (36.1 %), Maharashtra (34.30 %) and Karnataka (11.70 %) are the three largest producers. Sugar production in India has increased from 24.8 million tonnes in 2015-16 to 35.5 million tonnes in 2019-20. But the domestic demand remains stagnant at around 26 million tonnes. The increasing mismatch has further depressed sugar prices resulting in upsurge of sugar arrears. In order to fix this, the Government of India has majorly focused on technology fix instead of crop shift by diverting sugarcane directly to ethanol production. But the major problem in this regard is that most of the mills are not coming forward to produce ethanol with the fear of crude oil price fall in future will affect them badly as ethanol distilleries need huge investment.

In Karnataka, around ₹450 crores of sugarcane arrears were there as of March 2020. Belagavi has ₹84 crores of price arrears and Bagalkot has ₹43 crores. The 2019 floods, caused around 4,00,000 tonnes of sugarcane damage in Karnataka. Similarly, during 2020 floods, total of 43,000 ha crops were damaged due to floods in Belagavi alone, the major affected crop was

sugarcane by around 17,877 hectares. In Karnataka, due to severe floods during 2019, sugar production reduced by 3.2 MT (2019) from 4.43 MT (2018). Heavy rains have affected the North Karnataka districts like Belagavi, Bagalkot and Vijayapur districts. As a result, the area under cane for 2020 was reduced to 4 lakh hectares against 5 lakh hectares in 2018-19 (Anonymous, 2019a).

When we compare the productivity of Karnataka, it is observed that there was a decline in the productivity of the state from 105-110 tonnes/ha (2006-07) to 90-95 tonnes/ha (2020-21). In recent years, country has witnessed the price crisis across the sugarcane growing states of India. Along with the price crisis, sugarcane farmers are facing various crisis like floods, droughts, hikes in input cost, pest and disease outbreaks, severe usage of chemical fertilizers and prolonged irrigation has led to the decrease in cane yield. Problems with export policies which have affected the sugarcane growers. The varying degrees of crisis conditions were affecting farming community mentally, financially, socially and their coping capacities. As a testimony to these crisis, farmers' suicides were more in the sugarcane growing areas like Belagavi and Mandya (Anonymous, 2019b). Apart from these various crisis situations in sugarcane farming, area under sugarcane is still increasing due to the increased irrigation facilities with modern technologies over the years.

Crisis and disasters are increasing year by year and are expected to intensify with the changing climate, which in turn caused damage particularly to the livelihoods of smallholders and subsistence farmers, pastorals and landless labour. By definition, crisis is unforeseen and may exceed individual coping capacity and has a significant negative impact on economic viability and livelihood security of whole communities. The growing frequency and intensity of the crisis are jeopardizing agricultural production systems. Thus, in order to reduce the vulnerability and negative effects of the crisis on sugarcane growers' lives, understanding the crisis management behaviour, crisis mitigation mechanisms adoption and awareness about crisis and crisis management in agriculture and specifically in sugarcane farming and assistance received from different development agencies is of utmost importance. The study of crisis management helps in improving crisis preparedness, mitigation, response and recovery through formulation of location-specific suitable strategies by the concerned departments and other stakeholders involved (Anonymous, 2021c). Integrating agriculture, livelihoods and environmental issues into crisis management efforts and risk reduction strategies are particularly important for poor farming communities, which are at greatest risk of natural crisis.

Therefore, it is imperative to know the crisis management behaviour, awareness and crisis mitigation mechanisms of sugarcane growers.

Keeping all this in view, the present study was planned with the below-mentioned specific objectives:

1. To develop and standardize the crisis management behaviour scale to analyze the crisis management behaviour of sugarcane growers
2. To know the adoption of crisis mitigation mechanisms by sugarcane growers to reduce crisis effect
3. To understand the awareness level of sugarcane growers about the crisis and its management in sugarcane farming and to know the benefits received during crisis and its management
4. To study the personal, socio-economic, organizational and psychological characteristics and to know their association with the crisis management behaviour of sugarcane growers
5. To document success stories of crisis management in sugarcane farming
6. To document constraints experienced by sugarcane growers in managing crisis and to enlist the suggestions given by them to overcome the crisis

Hypothesis:

1. There is no significant difference in the crisis management behaviour among sugarcane growers
2. There is no significant difference among sugarcane growers' adoption of crisis mitigation mechanisms
3. There is no significant difference between the awareness about crisis and its management level of sugarcane growers
4. There is no association between personal, socio-economic, organisational and psychological characteristics with the crisis management behaviour of sugarcane growers

Scope of the study

Farmers in Northern Karnataka, especially the sugarcane growers of Belagavi and Bagalkot districts have been practicing sugarcane farming on contextual basis beyond their control. Based on observational experience of researcher and evidences of literature, crisis in sugarcane and agriculture is real, happening and some are unavoidable. The complexities associated in farm occupation have become manifold. The river basin areas in the Karnataka state, where the majority of the farmers' livelihoods are tangled with farming pursuits which

pose challenges to farming with equal opportunities, would seriously threaten to push them to face more unpredictable situations like floods and droughts. The unpredictable rainfall pattern and increased intensity of floods and drought are affecting sugarcane cultivators seriously. Sometimes, they need to make informal decisions in order to survive in farming and sustain their living. When we compare the productivity of Karnataka over the years, it is observed that there was a decline in the productivity of the state from 105-110 tonnes/ha (2006-07) to 90-95 tonnes/ha (2020-21). Along with the price crisis, sugarcane growers are facing various crisis like floods, droughts, hikes in input cost, pest and disease outbreaks, severe usage of chemical fertilizers and prolonged irrigation has led to the decrease in cane yield. Problems with export policies which have affected the sugarcane farming community mentally, financially, socially and their coping capacities. As a testimony to these crisis situations, farmers' suicides were more in the sugarcane growing areas like Belagavi and Mandya (Anonymous, 2019b).

Crisis and disasters are increasing year by year and are expected to intensify with the changing climate, which in turn caused damage, particularly to the livelihoods of smallholders and subsistence farmers, pastorals and landless labourers. The growing frequency and intensity of the crisis conditions are jeopardizing sugarcane production. Thus, in order to reduce the vulnerability and negative effects of the crisis on sugarcane growers' lives, understanding the crisis management behaviour, crisis mitigation mechanisms adopted by sugarcane growers and their awareness about crisis and its management in agriculture and specifically in sugarcane farming and benefits received from different development agencies is of utmost importance in present situation. The study of crisis management helps in improving crisis preparedness, mitigation, response and recovery through formulation of location-specific and suitable strategies by the concerned departments and other stakeholders (Anonymous, 2021c). Integrating agriculture, livelihoods and environmental issues into crisis management efforts and risk reduction strategies are particularly important for poor farming communities, which are at greatest risk of natural crisis. Therefore, it is imperative to know the crisis management behaviour, awareness and crisis mitigation mechanisms adopted by sugarcane growers. Small and marginal farmers being the most vulnerable to face the challenges posed by crisis and disasters, farming communities have always been responding through their own mechanisms. However, sugarcane growers need to understand the magnitude and consequences of crisis on their livelihoods. They need to sustain themselves. But this may require the support of development agencies. Importantly, the study attempt to assess the adaptations of sugarcane growers in response to the prevailing crisis in sugarcane farming and crisis mitigation mechanisms taken by them besides understanding their awareness about crisis management.

The designed study is intended to evolve meaningful sugarcane crisis management scale which serves as a tool for estimating crisis management behaviour of sugarcane growers.

Based on the results of this study, it is hoped that appropriate strategies can be worked out to create awareness and suitable mechanisms to enable farmers to handle their crisis situations better by improving their farm income and livelihood.

Operational definitions

- **Crisis:** Crisis is operationally defined as a situation of concentrated period of disturbance in sugarcane farming caused by the change in various factors affecting sugarcane yields and thus, the sugarcane growers' income.
- **Crisis management behaviour (CMB):** It is operationally defined as the individual sugarcane growers' ability to manage/overcome/resolve the crisis in sugarcane farming, which is assessed by the decision-making ability, adaptability and economic performance of sugarcane growers.
- **Decision-making ability (DMA):** It is operationally defined as the ability of sugarcane growers to select appropriate production alternatives and plan of actions by systematic approach for achieving maximum returns in identified crisis situations.
- **Adaptability:** It is operationally defined as behavioural actions (survival strategies) undertaken by the sugarcane growers to face the prevailing crisis and also anticipated future crisis. These behavioural actions are confined to sugarcane production, soil and water conservation, drought and flood, financial and price, labour, livestock, thrash management and adaptations needed by institutions according to the sugarcane growers.
- **Economic performance:** It is operationalized as performance or management of the sugarcane farm by taking important major and subsidiary enterprises to get maximum profit. It will be evaluated using Cropping Intensity (CI), Crop Yield Index (CYI), B:C ratio, Gross income (GI) and Net income (NI).

Limitations of the study

Since the survey was conducted by a research scholar who had limited resources for his effort, the study was confined to only two sugarcane growing crisis affected districts of the state. The survey did not suffer due to any peculiar limitations other than the common ones like time, finance, mobility and physical facilities. Despite of all these, all sincere attempts were made by the investigator to conduct the study as objective as possible by deliberately pursuing all

standard norms of scientific research while carrying out the investigation. Hence, findings have to be viewed in the particular situations prevailing in the study area and cannot possibly be generalized to a wider geographical area. However, these findings will be applicable wherever similar conditions exist.

Organization and presentation of study

The thesis is systematically delineated in seven chapters. The first chapter is devoted to the pinnacle 'Introduction' where in need of the study, statement of the problem, objectives, operational definitions, special features and limitations of investigation are presented. The Second chapter deals with the 'Review of Literature' related to the investigation based on its objectives orderly. The Third chapter deals with the 'Methodology' followed in conducting research and quantification procedures followed in analyzing the collected data. The Fourth chapter comprehends the 'Results and Discussions' of the investigation, which consists of detailed presentation of findings of the study along with justifications. Chapter Five summarizes the investigation, followed by the Sixth chapter listing the 'References' and lastly, 'Appendices'.

II REVIEW OF LITERATURE

The purpose of this chapter is to report the findings and assessments of active investigators, theoreticians and practitioners in various fields on different aspects of study in the light of objectives set forth for the present study. As the planned research is new in its subject treatment, the previous studies on this aspect are rare. However, to augment this scarcity, an attempt is made here to put together some of the closely related research outcomes related to the study undertaken. The literature review on different dimensions of the topic under study is presented on the following heads. In addition to the review of literature conceptual model formulated for the study is also furnished.

2.1 Concept of crisis

2.2 Crisis management concept and research outcomes

2.3 Crisis management dimensions

2.3.1 Decision making ability – concept and research results

2.3.2 Adaptation concept and research results

2.3.3 Economic performance and its influencing factors

2.4 Adoption of crisis mitigation mechanisms

2.5 Awareness about crisis and crisis management in agriculture and sugarcane production.

2.6 Relationship between personal, socioeconomic, psychological and organizational characteristics with crisis management.

2.7 Constraints experienced by the sugarcane growers in managing the crisis and suggestion to overcome the crises

2.7.1 Constraints experienced by the sugarcane growers in managing the crisis

2.7.2 Suggestions to overcome the constraints faced in sugarcane crisis and its management

2.8 Conceptual model

2.1 Concept of crisis:

The term crisis has been used variedly by historians, sociologists, psychologists, economists, philanthropists, academicians and political experts under different contexts. Therefore, it is sensible to have an insight into the denotations and definitions of prevailing researchers in the field. This is predominantly useful in structuring systematic knowledge on the concept of crisis help in internationalizing the term crisis in the contemporary study.

Barnard (1938) stated that crisis is a situation which confronts decision makers with an opportunity for response, either action or inaction.

Parad and Caplan (1960) defined crisis in leadership psychology context as a period of disequilibrium, over powering the individual's homeostatic mechanism. During crisis, a person is faced by problem which is of basic importance to him because it is linked with his fundamental instinctual needs.

Rapoport (1962) indicated that crisis is said to be produced by a hazardous event which is threatening instinctual needs where persons are more susceptible to influence.

Hermann (1963) identified three dimensions of crisis in organizational context namely, i) threat to managerial values, ii) short response time and iii) a situation unanticipated by organization.

Seligman (1963) conceptualized the crisis as a grave and sudden disturbance of economic equilibrium.

Miller and Iscoe (1963) reviewed traits of crisis as used in psychological and sociological studies and they elaborated that: i) a crisis situation is acute rather than chronic, even though its length is unspecified, ii) crisis results in behaviour that is frequently pathetic, iii) crisis threatens the goal of victims, iv) crisis is relative, v) crisis causes tension and stress among the victims including physical tension and anxiety.

North *et al.* (1963) described the crisis in simple words as a "turning point".

Caplan (1964) defined crisis as concentrated phase of disturbance often characterized by intense upset, pre-occupation, emotional churning, sense of inadequacy and openness to the input of other people.

Robertson (1970) expressed the meaning of the word crisis in Chinese language that it symbolizes two characters: one meaning "danger" (which is implicit in crisis) and second "opportunity" (for constructive action to solve the problem).

Stallings (1971) claimed that a crisis generating event is one which destructs existing patterns of relationship within a social system as a whole and its environment.

Eysenck and Arnold (1972) described that the term crisis is used to explain sudden cessation of a state which gravely endangering the life. Analogously, a crisis is thought of dramatic decision by mental conflicts.

Wolman (1973) accorded that, the crisis involves a particular periods of development during which the individual is susceptible to change. During these times, a person may progress or regress. Intervention at those times consists of aiding the individual to progress.

Almond *et al.* (1973) defined the term "crisis as an abnormal event".

Johnston and Taylor (1986) opined that the term crisis can be substituted by problem without losing any meaning.

Godelier (1987) stated that crisis is a period of transformation or transition in an irreversible process from which requires a radical change compulsorily.

Rame gowda (1991) stated crisis as situation of concentrated period of disturbance caused by low and erratic rainfall affecting the farm yields and farmers' income, there by stimulating action on the part of farmers to satisfy his family needs.

Chambers (1992) reported that effective irrigation management can enhance the productivity, equity, stability and utility to farmers.

Srinivas (1993) stated that crisis management is the ability of farmers to withstand the difficulties and undertake behavioral actions (survival strategies) to combat the prevailing crisis situation and also anticipated future crisis. The behavioral actions are confined to adaptation, crop management, diversification of crop, labour, desire for changing the existing system and financial adjustment.

Jyothi (2000) defined the crisis as an unsatisfactory and sometimes, unexpected situation in which information available to tomato growers is inadequate. She stated crisis level as the degree of unsatisfactory situation which is the cumulative effect of human, situational and organizational 'factors and information source consultancy of tomato growers.

Fink (2002) defined crisis in organizational context as "any prodromal situation that rounds the risk of escalating in intensity, falling under close media scrutiny, interfering with the normal operations of business, jeopardizing the positive public image presently enjoyed by a company or its officers and damaging a company's bottom line in any way".

Luecke and Barton (2004) described the crisis as “a process of change - either sudden or evolving– that results in an urgent problem that must be addressed immediately”.

Oommen (2005) reported that “crisis and contention do not surface instantly in any society they are rooted in history”.

Boin *et al.* (2005) defined the crisis as “a serious threat to the basic structures or the fundamental values and norms of a system, which under time pressure and highly uncertain circumstances necessitates making vital decisions”.

Smith and Elliott (2006) accorded that “crisis is a damaging event or series of events, that display emergent properties which exceed an organization’s abilities to cope with the task demands that it generates and has implications that can effect a considerable proportion of the organization as well as other bodies. The damage caused can be physical, financial or reputational in its scope. In addition, crises will have both a spatial and temporal dimension, that invariably occur within a sense of ‘place’. Crises normally ‘triggered’ by an incident or another set of circumstances, that exposes the inherent vulnerability that has been embedded within the ‘system’ over time”.

Praveena (2010) defined crisis as a situation of concentrated period of disturbance caused by drought, rainfall, hail storms, pest and disease epidemics affecting the farm yields and farm income thereby simulating action on the part of respondents to satisfy his family needs.

Vinay Kumar (2015) stated that crisis is a situation created out of family or social and natural environmental factors affecting psychological social and economic equilibrium of individuals, families and societies as whole.

Deon Canyon (2020) defined the crisis as “an uncertain situation possessing latent risks and opportunities that must be resolved within a given time frame.”

The literature cited above revealed that the concept of crisis is viewed variedly by scientists representing different disciplines. It is defined and understood variedly by different type of scientists to suit their situation. Therefore, before anything, a distinction could be first made between vernacular use of term crisis and different attempts to give it a theoretical status. Also, in view of this, an inclusive definition of crisis which is enough to be applicable to the various meaning and application of term has to be evolved. But this is beyond the scope of the

present study. However, in the light of aforementioned view it could be inferred that a crisis is operationally defined as a situation of concentrated period of disturbance caused by floods, drought, price arrears, lower yields (production), financial, thrash issues, livestock, and labour crisis situations affecting sugarcane yields and sugarcane growers' income.

2.2 Crisis management-concept and research findings

2.2.1 Concept of crisis management:

Srinivas (1993) stated that crisis management is the ability of farmers to withstand the difficulties and undertake behavioral actions (survival strategies) to combat the prevailing crisis situation and also anticipated future crisis. The behavioral actions are confined to adaptation, crop management, diversification of crop, labour, desire for changing the existing system and financial adjustment.

Pearson *et al.* (1997) accorded that the crisis management is helping to avert crises or more effectively managing those that do occur.

Luecke and Barton (2004) reported that crisis management is part of a larger system of organizational risk management. Ideally begins before a crisis actually occurs with a thorough audit to identify the major problems and prioritize risks. It is all about crisis recognition then addressing the contained problem.

Mitroff (2004) explained that the crisis management is primarily reactive and addresses crises only after they have happened.

Regester and Larkin (2005) reported that crisis management is about recognizing and taking the appropriate actions to remedy the crisis situations.

Devlin (2007) stated that crisis management refers to the special measures taken to solve problems caused by a crisis, to confine or minimize any damage to the organization’s reputation or image.

Zala (2008) reported that crisis management involves a kind of activities done by the farmers to find out suitable solution during the time of crisis creating adverse conditions to stand against by planning, decision making and intervention of certain technological adoption.

Gohil (2010) defined the crisis management as the ability of the farmers to withstand the crisis which is assessed by decision making ability, adaptability and climatic performance of farmers.

Praveena (2010) denoted that crisis management refers to the efficient use of resources by the respondents to avoid or minimize the losses before, during and after the occurrence of the crisis.

Somashekhar (2010) opined that crisis management in the context of irrigation water as the ability of farmers to withstand and manage the crisis induced by the water scarcity and unequal distribution through institutional, technological, adoptability and social factors so as to derive maximum benefits from irrigated farming.

Vaidya (2011) reported that crisis management involves all kinds of activities carried out by the poultry farmers to survive against various crisis as and when faced by them in past or existing span of experience of poultry farming. It has been conceptualized and measured in terms of application of certain practices to stand against the crisis, risks, uncertainties or troublesome situations as and when aroused in the complete span of poultry farming due to climate, weather, odd situations, parasites, disease, economy and other factors.

Vinay Kumar (2015) defined crisis management caused by climate change as an ability of farmers to manage/overcome/resolve the climate induced crisis, which is assessed by the decision-making ability, adaptability and economic performance of farmers.

Deon Canyon (2020) reported that crisis management involves the measures and methodologies used to recognize, control and limit the damage of a crisis and its ripple effects.

Based on the reviews of different experts, in the present study crisis management behaviour of sugarcane growers is operationally defined as the degree to withstand, manage and resolve the crisis conditions with respect to production, soil and water conservation, drought, flood, financial, price, labour, livestock and thrash management which is measured by the decision-making ability, adaptability and economic performance of sugarcane growers.

2.2.2 Previous research findings/outcomes related to crisis management:

Manas (1997) found that 69 per cent of the total farmers have medium level of crisis managerial skill while, 18 per cent and 13 per cent of them belonged to high and low crisis managerial skill categories.

Kriemer (1999) reported that to invest in sustainable disaster mitigation, a partnership between public and private sector is essential for better management and faster recovery.

Mavi (2001) stated that yield and quality of agriculture produce can be improved, when a specifically tailored weather support is available to the needs of agriculture. Further, it can greatly contribute towards making short term adjustments in daily agricultural operations which minimize input losses resulting from adverse weather conditions.

Kumar and Nanda Kumar (2003) identified the drought crisis mitigation measures like watershed development plan, development of drinking water projects, ground water management, fodder management, pasture development, development of cottage and handicraft industries, improved irrigation techniques, afforestation, shifting cropping pattern and avoidance of migration.

Jagadeesha (2006) put forward that to overcome the 'severe yield loss from coconut Eriophyid mite crisis, majority of the respondents (77%) used chemical treatment, followed by nutrient management (74 %), growing intercrops and mixed crops (69 % and 68 %), adopting water management practices (67%), toddy extraction (64%) and taking of subsidiary enterprises (58%). Only 4 per cent of them had leased out coconut garden and 2 per cent of the respondents left out the coconut garden fallow.

Mishra (2007) reported that in the Oran tribes of Orissa state when faced with the crisis of food scarcity; 25 per cent of households have reduced their quantity of consumption to one fourth of the normal and 40 per cent of the respondents reduced the quantity of consumption to half.

Zala (2008) revealed that majority of cotton farmers adopted crop rotation invariably (88.64 %), practiced inter cropping in cotton (86.36 %) and avoided deep sowing (78.66 %).

Somashekhar (2010) reported that substantial amount of the respondents belongs to high irrigation water crisis management group (36.66 %) followed by medium (33.33 %) and low (30.00 %) levels of irrigation water crisis management group respectively.

Vinay Kumar (2015) reported that about 43 per cent of fishery farmers were in medium crisis management level and nearly equal per cent (28 %) of them were in low and high crisis management level groups.

2.3 Crisis Management dimensions

2.3.1 Decision making ability – concept and research results

2.3.1.1 Concept of decision making ability:

Rame gowda (1991) stated that decision making ability is the ability of farmers to select appropriate production alternatives and plan of action by systematic approach for achieving maximum returns in a given farming situation.

Vinay Kumar (2015) explained that decision-making ability is an ability of farmers to select appropriate production alternatives and plan of action by systematic approach for achieving maximum returns in a given farming situation.

Campbell *et al.* (2016) gave a more realistic meaning of farmer decision making related to climate uncertainty that it improves preparation for and adaptation to climate change, which is expected to be most severe among farmers in developing countries.

Waldman *et al.* (2017) explained that decision making and climate change among farmers in developing countries address risk, few address the more subjective nature of uncertainty. In other climate decisions, such as choosing seed varieties, farmers are overloaded with too much information and some of that information is not accurate.

Zonneveld *et al.* (2020) developed the seven-step decision-making process considering smallholders lives and their work with cropping, pasture, and agroforestry systems as principal components of farm systems in these regions. The seven steps include: defining farmers' goals, assessment of enabling factors, assessment of disabling factors, assessment of current and future climate-related production risks, gap analysis of functional diversity in farm systems, selection of on-farm diversification options and evaluation and learning from past experiences.

2.3.1.2 Previous research findings/outcomes related to decision making ability:

Rame gowda (1991) revealed that decision making ability of farmers increased from low to high crisis management group and from marginal to big farmers. The mean decision making ability of crisis management groups as well as farmer’s categories varied significantly. Further, he reported that decision making ability varied according to crisis management groups as well as farmer’s categories.

Pannell *et al.* (2006) found that farmers make many decisions based on a combination of intuitive production decisions, lifestyle and cultural factors, and their own personal or family's goals. Management changes are unlikely to be even considered unless farmers can be convinced these changes are consistent with their goals.

Ravi (2007) reported that 38.75 per cent of the farmers had low farm decision making ability followed by high farm decision making ability (33.12%) and 28.13 per cent of them belonged to medium farm decision making ability category.

Sidram (2008) found that 46.67 per cent of the pigeon pea farmers belonged to high decision-making ability category with mean score of 10.55 followed by 34.17 and 19.17 per cent of respondents belonged to medium and low decision-making ability categories with mean scores of 7.46 and 5.69 respectively.

Swain *et al.* (2011) reported that availability of ICTs to farmers to help them with their decision making process are well documented. He explained this with a documented example, that the use of GPS related data for tracking livestock and areas currently harvested, ongoing satellite imagery of crop conditions and weather forecast data, short and long term have increased their incomes and reduced their work drudgery. Further, they reported that smart-phones with the internet services makes these devices revolutionary.

Vinay Kumar (2015) reported that mean decision-making score of fishery-based farmers showed an increasing trend from low (26.74) to high (36.89) crisis management groups. Decision-making ability of the farmer within the low, medium and high crisis management groups was also on the rise from marginal to big farmers. Similarly, total mean decision making ability score increased from marginal farmers to big farmers while the increase was minimal from marginal to small and big farmers. Based on the results, it could be inferred that the farmers of high crisis management group in general and big farmers in particular had highest decision-making ability mean scores, (36.89 and 33.66 respectively) in sharp contrast to low crisis management group and marginal farmers (26.74 and 31.40 respectively). Also, the moderate mean scores of decision-making ability scores were recorded for medium crisis management group (32.49).

From the literature, it is evident that there are no simple patterns of decision correlation in agriculture environment and a more in-depth understanding of decision-making processes is needed which addresses questions of identity and social influences on agriculture sector.

2.3.2.1 Adaptation concept and research findings

2.3.2.1 Concept of adaptation:

Brammer (1987) reported that farmers' crisis and disaster adaption practices should be documented to provide the basis for designing pragmatic research, extension and development programmes.

Rame gowda (1991) reported that adaptability refers to the behavioral actions (survival strategies) undertaken by the farmers to face the prevailing drought and also anticipated future droughts. These behavioral actions are confined to crop management, silvic-horticulture, soil and water conservation, irrigation, sericulture, livestock, land use, labour, finance and family adjustments.

Anonymous (2001) demarcated adaptation as the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploit beneficial opportunities. Different patterns of adaptation can be observed including anticipatory and reactive adaptation, private and public adaptation along the autonomous and planned adaptation.

Anonymous (2004) symbolized adaptation is the process or outcome of a process that leads to a reduction in harm or risk of harm or realization of benefits associated with climate variability and climate change.

Lim *et al.* (2005) explained that adaptation is a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed and implemented.

Vinay Kumar (2015) reported that adaptations are the survival strategies undertaken by the farmers to face the prevailing crisis and also anticipated future crisis. These actions are confined to crop production, horticulture, soil and water conservation, irrigation, fishery, livestock, land use pattern, flood, labour, financial and family management.

Shanabhoga *et al.* (2020) defined that adaptation strategies are the adjustments or remoulding of techniques or practices which are adopted by farmers in their farming such as alteration in crop production, soil and water management, flood management, land use, labour use, livestock management, financial management and family management to cope with the losses or to take benefit of changes in climate.

From the reviews it was clear that adaptations of farmers vary based on prevailing conditions and situations. These adaptations might be scientific or unscientific but practiced by farmers to survive from the crisis conditions.

2.3.2.2 Research findings related to Adaptability /adaptations:

Ronak and Niranjan (2008) reported that in Dhala region of Rajasthan, the farmers have been blending traditional and improved farming practices to adapt to changes by including practices like mulching, new seeds, vermicomposting, crop diversification and green manuring in their agriculture system to reduce their vulnerability.

Raj pal *et al.* (2008) reported that the farmers of Himachal Pradesh region converted the climate change problem in to opportunity by shifting to crops like kiwi, pomegranate etc and are getting good yield.

Onyeneke and Madukwe (2010) reported the adaptation methods in Rain Forest Zone of Nigeria as portfolio diversification (20.00%) followed by the use of irrigation method (3.30%) and 43.30 per cent of the farmers did not taken any adaptation methods.

Dejene (2011) identified the adaptation strategies in Adiha region of Ethiopia and they were using of advanced irrigation methods, planting early maturing variety, drought resistant crop varieties, soil conservation and water conservation practices.

Ofuokus (2011) reported that 39.69 per cent of the farmers have not adapted to climate change and those who adapted to climate change followed various adaptation strategies such as planting trees (21.37%), applying soil conservation (15.26%), using different crop varieties (7.63%), changing planting dates (6.10%), irrigation (5.34%), using heat tolerant species (3.05%), and cooling livestock pens with fans (1.52%).

Sofoluwe *et al.* (2011) observed that majority (66.00%) of the respondents employed late planting, planting trees, irrigation and soil conservation, 2.80 per cent adapted planting different varieties and 28.20 per cent did not adapted any measures in Osun state, Nigeria.

Coretha and Muchapondwa (2012) identified the adaptation measures practiced by the farmers in Tanzania were short season crops (24.10%), crops resistant to drought (17.30%), changing planting dates (11.30%), planting trees (7.40%) and irrigation (5.60%).

Phokele and Mpandeli (2013) reported that 60.00 per cent of farmers preferred improved irrigation systems as one of their adaptation strategies followed by 53.00 per cent of farmers thought in changing use of fertilizers, chemicals and pesticides and 50.00 per cent of farmers preferred crop diversification in Limpopo province of South Africa.

Ikheloa *et al.* (2013) showed that 55.96 per cent of the respondents were adapted crop diversification + soil conservation techniques + different planting and harvesting dates followed by 31.92 per cent were used crop diversification + soil conservation techniques and 12.13 per cent were used crop diversification alone.

Negash (2013) identified that multiple cropping is the most preferred adaptation strategy while livestock is the least preferred adaptation strategy and the second most preferred adaptation strategy is soil conservation measures followed by irrigation and then changing planting dates in North Shoah Zone of Amhara region, Ethiopia.

Shivamurthy *et al.* (2015) identified the adaptation strategies initiated by the farmers in eastern dry zone of Karnataka were use of short duration verities, dairying, drip irrigation, cultivating horticulture crops and soil and water conservation measures such as farm ponds, ridges and dead-furrows and mulching.

Vinay Kumar (2015) reported that mean adaptability scores of farmers increased from low to high crisis management group as well as from marginal to big farmers. Also, mean adaptability scores of crisis management groups as well as farmers' categories differed significantly.

Shanabhoga *et al.* (2020) reported that nearly half (48.89 %) of the respondents belonged to medium level category followed high-level (27.78 %) and low-level (23.33%) categories of overall adaptation strategies adopted by the paddy growers.

From the various studied it can be observed that the crisis adaptations of farmers changes with the region, crop and availability of resources. Hence the adaptation strategies for sugarcane farmers may vary based on their crisis conditions.

2.3.3 Economic performance

Rame gowda (1991) analyzed the economic performance was analyzed on three indicators viz., crop yield index, benefit-cost ratio and gross income. i) Crop yield index: is a percentage comparison of the yields of all dryland crops on a given farm with the average yields

of these crops in the proximity. ii) Benefit-cost ratio: is the ratio of total income to the total variable costs of dryland crops. iii) Gross income: is the summation of farm, wage and nonfarm earnings of a farmer.

Vinay Kumar (2015) defined the economic performance as the performance or management of the farm by taking important major and subsidiary enterprises to get maximum profit. It was analyzed/ measured using three indicators: crop yield index, cropping intensity and net income.

Research findings related to economic performance

Vasanth Kumar (2000) reported that more than half of the big growers (53%) were in high overall economic performance category followed by medium (30%) and low (17%) categories. In case of small growers considerable (40 %) of growers were under low economic performance level category whereas an equal per cent of growers were under high (30%) and medium (30%) categories of overall economic performance.

Ramanna *et al.* (2001) revealed that half of sunflower seed producers belonged to low annual income group followed by medium (32.34 %) and high (17.66 %) income group respectively.

Manjunatha (2002) revealed that as high as 53.30 and 41.70 per cent of the beneficiaries and non-beneficiaries had high economic motivation. Again, about more than one third of beneficiaries (33.30%) and non-beneficiaries (38.30%) had medium economic motivation. While, 18.40 per cent and 20.00 per cent of them had less economic motivation.

Sudhakar (2002) observed that under irrigated conditions nearly half (45.00%) of the respondents had high level of annual income followed by medium (30.00%) and low (25.00%) levels of annual income.

Nagabhushana (2007) reported that majority (56.67%) of potato farmers fall under medium income category followed by low income (23.33%) and high (20.00%) income level respectively.

Gangadhar (2009) revealed that two-fifth (40.83%) of respondents were grouped under the annual income category of ₹ 20,000-30,000 followed by ₹ 10,000-20,000 (19.16%), ₹ 30,

000-40,000 (17.50 %), more than ₹ 40, 000 (14.16 %) and less than ₹ 10, 000 (8.33 %) categories.

Ahmed *et al.* (2010) analyzed the economic efficiency of rice-fish and rice monoculture farming in Bangladesh using data envelopment analysis (DEA). Among rice-fish farmers, the overall input-oriented technical efficiency was 98 per cent and the cost efficiency was 86 per cent. Forty-one per cent of rice-fish farmers were technically efficient. On the other hand, only a few rice-fish farmers were cost efficient (4 %).

Raut *et al.* (2011) The cropping intensity is defined as the number of crops farmer grown in a given agricultural year on the same field which is another means of intensified production from the same piece of land to enhance economic returns.

Karri Narasimha (2013) reported that the gross income per hectare for planted sugarcane crop is estimated at ₹1.42 lakhs and for ratoon crop it is ₹1.23 lakhs for jaggery making farmers. But the net income per hectare is ₹ 77,427 for planted crop and 63,323 for ratoon crop. For Gur farmers, the ratio is comparatively high for ratoon crop. It is estimated at 1.44 for owner and 1.33 for tenant.

Vinay Kumar (2015) reported that crop yield indices increased sharply from marginal to big farmers. Major percentage of small (60 %) and marginal (81 %) farmers were practicing mono/single cropping system. Nearly 26 per cent of farmers were practicing double cropping and only negligible per cent (12.50 %) of farmers doing triple cropping system. The B-C ratios of big farmers were slightly better than marginal and small farmers.

Rajendraprasad (2016) revealed that majority (63.33 %) of the sugarcane growers had medium level of economic performance followed by equal per cent (18.33 %) of the sugarcane growers had low and high level of economic performance.

Praveen (2017) found that the cost of cultivation of organic and inorganic planted sugarcane was ₹1,55,550/ha and ₹1,64,874/ha, respectively. The corresponding values for ratoon crop were ₹1,13,419/ha and ₹1,20,874/ha. Net returns from organic sugarcane were higher than inorganic sugarcane. Net returns obtained from organic planted, organic ratoon, inorganic planted and inorganic ratoon sugarcane were ₹1,89,450/ha, ₹1,95,071/ha, ₹1,73,660/ha and ₹1,76,668/ ha respectively.

Veeresh *et al.* (2019) reported that the total cost of cultivation of sugarcane in Bagalkot is ₹115,503 per hectare with gross returns about ₹2,64,500 and the B: C ratio 2.29.

Dipendra *et al.* (2019) revealed that the sugarcane production in the study area was profitable with benefit cost ratio (B:C) 1:1.38 and 1:1.34 for main and ratoon crops, respectively. The net income was NRs. 91,369.70 and NRs. 36,065.00 for main and ratoon crops, respectively. *(NRs: Nepali Rupees)*

Padmavathi *et al.* (2020) reported that the profitability of sugarcane cultivation over cost A2 (paid out of his pocket) and cost C2 (comprehensive cost/hidden cost) in Karnataka is high about ₹ 31,488/ha and ₹ 21,425/ha in 2009-2010.

Verma and Solanki (2020) reported that the overall cost of cultivation of sugarcane was found to be ₹ 87491.30 per hectare and cost of production was ₹ 105.70 per quintal of sugarcane. The yield of sugarcane was 831.23 q/ha in sample farms. The input output ratio over total cost was 1:2.56.

The various studies have indicated that under normal conditions the sugarcane growers had better economic performances with B:C ratio of almost equal to or more than 1:2.00 as well as under crisis situations the cropping intensity changes as noticed in various literature.

2.4 Adoption of crisis mitigation mechanisms

Suresh Kumar (1994) revealed that 38.33 per cent of the cyclone affected respondents belonged to lower level of coping mechanisms followed by 36.67 per cent of the respondents with average coping mechanism. Some of the reasons for low and medium coping mechanism are low attitude towards cyclone disaster management, lack of knowledge about disaster preparedness and lack of sufficient community support.

Suresha *et al.* (1995) concluded that to overcome the economic crisis, 34.5 per cent of the farmers indicated that they cut down the regular expenditure and majority of the farmers did not avail help from commercial banks or Government agencies regularly. But 39.50 per cent of the farmers sold the properties occasionally to ease out economic crisis.

Kiran (1996) found that almost 30 to 40 per cent of the respondents do not have any idea about coping mechanisms to be practiced, crop and cattle insurance as a source of coping mechanism, adjustment of cropping mechanism, mixed farming as part of mitigation

mechanism. Further, fifty per cent of the affected respondents did not adopt any coping mechanisms for soil erosion during cyclone disaster and about· 62 per cent of the respondents felt that the support from local government agencies in extending coping mechanisms was inadequate.

Krishna Prasad (1998) inferred that majority of the prawn growers had medium cyclone disaster coping mechanism (40.84 %) followed by 35 per cent of the prawn growers had low coping mechanism and 24.16 per cent who had high coping mechanism.

Kiran and Sudershan (1999) reported that about 54 per cent of the respondents agreed that crop insurance is one of the best coping mechanisms with regards to the disaster of cyclone.

Kriemer (1999) studied the modalities of creating partnerships for disaster management and reported that to invest in sustainable disaster mitigation, a partnership between public and private sector is essential.

Rani and Dodia (2000) considered the evidence on coping strategies in rural India. It shows that one of the most favoured mechanism is that of diversifying into non-farm activities and seasonally migrating to other areas.

Mavi (2001) reported that when a specifically tailored weather support is available to the needs of agriculture, it can greatly contribute towards making short term adjustments in daily agricultural operations which minimize input losses resulting from adverse weather conditions and can markedly improve the yield and quality of agriculture products.

Kumar and Nanda Kumar (2003) identified few droughts mitigation measures like watershed development plan, development of drinking water projects, ground water management, fodder management, pasture development, development of cottage and handicraft industries, improved irrigation techniques, afforest ration, shifting cropping pattern and avoidance of migration.

Mishra (2007) reported that in the Oraon tribes of Orissa state when faced with the crisis of food scarcity; 25 per cent of households have reduced their quantity of consumption to one fourth of the normal and 40 per cent of the respondents reduced the quantity of consumption to half.

Praveena (2010) revealed that more than half (56.67%) of the respondents had medium level of adoption of crisis mitigation measures followed by low and high adoption level. For

mitigating the crisis of drought, most of the respondents adopted the common practices like frequent intercultivation, regular weeding and raising intercrops. Other scientific practices like irrigating alternate rows, mulching, foliar application of nutrients and anti transpirants were adopted by only a few respondents. The technical practices preferred in rank order were using nearby water sources to irrigate the crop (90%), reduced the area under irrigation (80%), deepened existing wells or dug new wells (56.67%), conserved fodder by rationalized use (46.67%), and as a last resort switched over to drought hardy crops like castor (13.33%). The non-technical practices adopted in rank order were ailment of loans to meet the family expenses (73.33%), generated income by selling cattle (40%), leased out the land or gave the land for crop sharing (40%), reduced the household consumption by eating one meal a day (30%), sold the property like landhouse (26.67%) and migrated to potential areas (16.67%).

Aravinda (2011) reported that mitigation mechanism is the ability of an individual to cope up with the disaster situation to reduce their effects. Under the circumstances of increased frequency and intensity of floods, farmers need to possess knowledge about mitigation mechanisms for better preparedness and adaptation.

Dickie *et al.* (2014) identified the four greenhouse gas mitigation options in the agricultural sector in order to namely shift consumption patterns, focus on key agricultural producers that can achieve major productivity gains, pursue catalytic and cross-cutting interventions. Achieving high productivity, low emissions in agriculture across the globe will require that mitigation practices be incorporated into the daily business of actors across the agricultural sector and they should take a rational approach to agricultural carbon sequestration.

Iheke and Agodike (2016) reported that climate change mitigation measures mostly adopted by the farmers of Nigeria were drainage/flood barrier construction, multiple cropping, mulching, use of improved varieties of crops, change of planting date, irrigation of crops, planting of cover crops, and tree planting.

Aryal *et al.* (2020) recommended the mitigation options in agriculture practices and technologies to reduce GHG emissions from agricultural production systems in South Asia that simple changes in agronomic practices, such as tillage methods, water application, and nutrient management, can significantly reduce GHG emissions from agricultural lands.

The literature reviews have indicated that farmers were adopted different crisis mitigation mechanisms which varies based on their severity, frequency and type of crisis.

2.5 Awareness about crisis and its management in agriculture and sugarcane production.

Rogers and Shoemakers (1971) considered awareness as a function of an innovation decision process when the individual exposed to an innovations existence and gains some understanding of its functions.

Nimje *et al.* (1990) observed that three-fifth (60.00 per cent) of cotton growers were having medium awareness of different dry land cotton technology. Only 21.00 per cent and 19.00 per cent of the respondents were having high and low level of awareness respectively.

Angadi *et al.* (1992) stated that more than half (58.00 per cent) of the farmers possessed medium awareness about improved cultivation practices of groundnut under crisis situations.

Amir (1996) revealed that 70.83 per cent of summer groundnut growers had medium level of awareness, whereas 15.00 per cent and 14.17 per cent had high and low level of awareness about improved summer groundnut production technology.

Verma (2000) found that majority of the respondents (69.92 per cent) had medium awareness of groundnut production technology, whereas 16.41 and 13.67 per cent respondents had low and high level of awareness, respectively regarding groundnut production technology.

Sagwal and Malik (2001) reported that 55.00 per cent of the respondents had high level of awareness about essential production practices and the remaining 45.00 per cent had medium level of awareness regarding essential production practice of rice.

Chaudhury *et al.* (2002) revealed that 51.67 per cent of the farmers possessed high level of awareness about maize production technology whereas 48.33 per cent of the respondents had low level of awareness.

Sulemankhan *et al.* (2002) reported that 50.67 per cent of the rice growers had a medium level of awareness about eco-friendly rice production technology.

Trivedi *et al.* (2002) revealed that 67.00 per cent of the respondents had medium level of awareness about recommended practices of lily cultivation.

Gakkhar *et al.* (2003) reported that 60.00 per cent had higher level of awareness; whereas 43.40 per cent of non-beneficiaries had lower level of awareness about integrated cattle development scheme activities.

Lakera and Sharma (2003) stated that more than three-fifth (66.88 %) of beneficiaries had medium awareness followed by high (31.25 %) and low (1.87 %) level of awareness, respectively. Whereas, more than three-fourth (75.63 %) of non-beneficiaries were in medium awareness category followed by low (21.87 %) and high (2.50 %) level of awareness respectively about improved mustard production technology under crisis conditions.

Patel (2003) stated that majority (70.87 per cent) of the onion growers possessed medium level of awareness followed by low (16.50 per cent) and high (12.63 per cent) level of awareness, respectively.

Javia (2004) stated that majority of groundnut farmers (64.00 per cent) had medium level of awareness followed by 21.00 per cent and 15.00 per cent with low and high awareness about recommended groundnut production technology, respectively.

Sahoo (2004) found that majority (73.33 per cent) of the groundnut growers had medium awareness about eco-friendly practices followed by 18.34 and 8.33 per cent with high and low level of awareness, respectively.

Patel (2005) stated that majority of groundnut growers (71 per cent) had medium level of awareness followed by 19 per cent and 10 per cent with high and low levels of awareness about organic farming practices.

Chavda (2005) concluded that 81.33 per cent of Bt. Cotton growers had medium level of awareness by 10.67 per cent high and 8.00 per cent level of awareness about distinctive feature of Bt. Cotton, respectively.

Kotadiya (2006) reported that the mean scores with respect to level of awareness of beneficiary and non-beneficiary farmers was 28.51 and 19.33 respectively.

Gohil (2010) showed that majority (80.50 per cent) of the cotton growers had medium awareness level of crisis management practices whereas 12.00 per cent and 7.50 per cent of respondents had low and high level of awareness about crisis management practices, respectively.

Aravinda (2011) reported that majority of farmers knew about instant measures taken during incidence of floods like, monetary compensation (91.25%), temporary relief (71.25%) and shifting to safer places (62.5%). However, a majority of them lacked the knowledge of preparedness activities to cope with or mitigate the adverse effects of floods like mixed farming

(16.75 %), forming check bunds (20 %), construction of infiltration channels (37.50 %) and soil reclamation (38.75 %).

Meludu (2011) reported that one-fourth (25%) of the respondents receives information about disaster and disaster management from the local leaders and local means of passing information respectively. Fifteen per cent of the respondents receive information from the radio as well as from friends and relatives. While very few (5%) of the respondents receive information from the newspaper and television respectively. The problem of epileptic power supply may not enable the respondents to utilize television.

Saravanan and Manivannan (2017) reveled that among the twenty-five crisis situations, heavily rainfall during monsoon, occurrence of blue tongue and sheep pox were perceived to be the major crisis situations.

The studies on awareness about the crisis and its management by farmers under different crisis situations indicated that major part of respondents fall under poor awareness about the crises and their management to reduce its effect on farmers.

2.6 Association between personal, socioeconomic, psychological and organizational characteristics with crisis management.

Webber (1976) noted that there is a need to utilize the internal physical, social and psychological aspects of a community to deal with crisis management in an effective manner.

Jyothi (2000) found that crisis management of tomato growers was found to have significant association with education, family type, prior exposure to crisis, management orientation, risk willingness, deferred gratification, achievement motivation, cosmopoliteness, extension participation, social interdependence, social participation, economic status, input support and marketing support. Whereas age, farming experience, experience in tomato cultivation and operational land holding were found to have no significant relationship with crisis level of tomato growers.

Gohil (2010) concluded that there was negative and significant association between adoption of crisis management practices of cotton growers and their age. It reveals that as age increased, the adoption of crisis management practices decreased.

Deressa *et al.* (2011) in their study reported that farmers' perception of climate change was significantly related to the age of the head of the household, wealth and awareness of climate change.

Vinay Kumar (2015) observed that age, land holding and involvement in crisis management had a positive and significant relationship at 5 per cent level whereas, education, farming experience, prior exposure to crisis, cosmopoliteness, social participation, social interdependence, mass media exposure, scientific orientation, farming commitment, deferred gratification, risk willingness, achievement motivation, economic status, irrigation facility, extension organisation support, production input support, innovative proneness and village extension participation had a positive and significant relationship with the perception of climate change by farmers at 1 per cent level of significance.

Gohil *et al.* (2016) reported that age and index of farm experience were negatively and significantly associated with the level of adoption of crisis management practices. The characteristics like education, social participation, irrigation index, yield level, management orientation, innovativeness, risk orientation and extension participation had positive and highly significant relationship with crisis management practices. Further, there was a non -significant association exists between crisis management practices with their size of land holding, irrigation index and cropping intensity.

Nkosingiphile *et al.* (2019) showed that late harvesting (by up to three weeks), late fertiliser application (by up to six months and chemicals (Gramoxone) application (by up to five months) were primary challenges of sugarcane growers likely to result in declining sugarcane yield. The regression analysis reveals that significant predictors of the production function are: labour and the amount of chemicals (Gramoxone) applied which were found to be statistically significant and positively correlated with sugarcane production.

Swetha *et al.* (2019) reported that there was a positive and significant relationship between level of knowledge of sugarcane farmers on drip irrigation system and the education, trainings undergone, extension contact, sociopolitical participation, information management behaviour, risk taking ability, level of aspiration and there was a negative and significant relationship between level of knowledge of sugarcane farmers on drip irrigation system and age.

The varying nature of association exists between the farmers profile characteristics and their management adaptations, decision making and economic performances in different regions and farming type i.e., dryland or irrigated other impacting factors on their profiles.

2.7 Constraints experienced by the sugarcane growers in managing the crisis and its management and suggestions to overcome the constraints

2.7.1 Constraints experienced by the farmers in managing the crisis in sugarcane production

Jones (2003) reported that lack of information (seasonal and long-term climate changes and agricultural production) increases risks from failure associated with uptake of new technologies and adaptation measures.

Anonymous (2006) indicated that greater distance to the market where outputs are sold diminishes the probability of adaptation. Being head of the household also increases the probability that the farmer can adapt, perhaps because he or she is in control of household resources. A large number felt that lack of credit or savings represented a barrier to adaptation. This was felt most acutely in Kenya and Nigeria. Lack of access to water was anticipated to be a major problem in adaptation. Lack of access to appropriate seed, lack of security of property rights and lack of market access were hardly mentioned except in Ethiopia. Few farmers perceived lack of information about the weather or long-term climate change to be a barrier to adaptation.

Nhemachena and Hassan (2007) reported that 29.23 per cent of the respondents perceived the lack of credit, 17.43 per cent perceived the lack of forecasting information on short term variation on climate change, lack of forecasting information on long term variation on climate change (11.62%), rationing of inputs (8.27 %), lack of seed inputs (6.34%), lack of knowledge on adaptation (5.58 %), not access to water (3.40 %), lack of markets (2.52 %) and charges are expensive (1.59%) were constraints in adaptation to climate change.

Satasiya (2008) reported important constraints in adoption of castor production technology to overcome crisis were high price of improved/hybrid seeds (96.36 %), high cost of threshing (90.90 per cent), lack of irrigation facility (89.09 %), non-availability of finance in time (87.27 %), high price of chemical fertilizers (86.36 %), high price of herbicides and high price of fungicides/pesticides (85.45 %), lack of awareness about critical stages (84.54 %), high

cost of labour (82.72 %), non-contact of extension workers in villages as per time schedule (77.27 %) and unawareness about the recommendation of pesticides/fungicides (70.90 %).

Zala (2008) reported that major problems faced by the cotton growers in the management of crisis during cultivation of cotton crop were: difficult to take valid advantage of crop insurance (2.00 mean), the complex process of getting cotton crop insurance (1.97 mean), shortage of labourers (1.94 mean), lack of insect resistance varieties in cotton (1.86 mean), fluctuation of cotton price in market (1.82 mean), irregular electricity (1.81 mean), higher rate of transportation(1.78 mean), lack of awareness about cotton crop insurance (1.75 mean), lack of sufficient credit in time (1.72 mean), shortage of farmyard manure (1.70 mean), high cost of insecticides (1.67 mean) and difficult to get Kisan credit card (1.62 mean).

Trivedi (2009) reported major problems faced by the cumin growers in the management of crisis were: the process of getting cotton crop insurance is complex, lack of sufficient electricity, lack of insect resistance varieties in cotton, fluctuation of cotton price in market, irregular electricity, lack of awareness about cotton crop insurance, lack of sufficient credit in time and shortage of farm yard manure.

Gohil (2010) concluded that major constraints experienced by the cotton growers were: non-remunerative price, unavailability of certified seeds, high price of input like improved seeds, insecticides, pesticides and fungicides and lack of awareness to diagnose the pests and diseases in the crop.

Negash (2013) reported that the constraints to adapt to climate change faced by the farmers were lack of information/ awareness (34.55%), shortage of money (23.95%), shortage of land (20.40%), unsuitability of land and poor potential for irrigation (11.50%) and shortage of labour (5.60%) in North Shoah Zone of Amhara region, Ethiopia.

Fatuase and Ajibefun (2013) identified the major barriers with respect to adaptations to changing climate in Ekiti state, Nigeria were inadequate funds (89.60%), inadequate information (64.40%), shortage of labour (41.50%), shortage of land (34.10%), inadequate technology know-how (29.60%) and others (23.00%).

Ifeanyi and Issa (2013) reported that the barriers faced by the cassava farmers in adapting to climate change related crises were land and labour constraints, non - accessibility/ availability of farm inputs, non-availability/high cost of farm inputs, information constraints,

poor agricultural extension service delivery, income constraints and government unfavourable attitude towards climate change issues.

Anonymous (2013) identified the key constraints which requires Government of India's intervention in the following categories: a) Cropping aspects requiring consolidation / enhanced support b) Policy / strategic interventions c) Simplification of administrative constraints.

Krishnappa and Dayananda (2015) reported that farmers are under utter loss due to delayed or non-buying of sugarcane and on the other side the industries who buy the sugarcane do not pay the cash on time which caused a serious agrarian crisis. In addition to that, there was an increase in cultivation costs and a decline in agricultural income, which is pushing farmers into a debt trap. So the sugarcane growers are facing problems and not getting sufficient return from sugar industries on time. Hence, farmers are committing suicides every day.

Vinay Kumar (2015) reported that higher labour wage rate, low price for the produce in the market, absence of government policy on climate change, non-availability of timely inputs, higher cost of the agricultural inputs etc. were major constraints experienced by the farmers to initiate adaptation measures to mitigate crisis of climate change.

Chand *et al.* (2016) revealed that in Parbhani district at large, several constraints such as extreme drought condition, lack of finance and credit facilities, delay in transportation of cane, payments not done in time, non-remunerative price of the produce, trouble by harvesting gang, poor road conditions, non-availability of ready use FYM and inadequate irrigation facilities were amongst the major constraints faced by the growers.

Praveen (2017) reported that majority of the farmers expressed the problem of non-availability of labour and exclusive market for the organic produce.

Saravanan and Manivannan (2017) reported that heavy rainfall during monsoon was perceived to be the most important crisis by vast majority of the respondents. Heavy rainfall during the north east monsoon in the months of October and November caused inundation surrounding the sheep farm and prevented or restricted movement of sheep for grazing.

Dipendra *et al.* (2019) reported that lower productivity, unscientific price fixation, and delay payment of the sugarcane by the sugar mills were the major problems found in the study area. Labor expenses constitute half of the total cost of cultivation, so mechanizations are needed to lower the cost and increase the profit. Co-coordination among different stakeholders,

including the government entity, is required for scientific pricing and sustainable production of sugarcane.

Satyam *et al.* (2020) listed the following major constraints in sugarcane farming viz., lack of knowledge about improved implements and spraying instruments are not available (90.84%) in rural area, non-availability of juice extractor at village (88.33%), lack of knowledge about insect pest (85.00 %), high cost of input (81.67 %) in cultivation of sugarcane and continuous adoption of traditional packages (74.16 %).

Siddu *et al.* (2021) reported that 80.14 per cent of farmers identified the non-availability of water for irrigation was their major constraint followed by erratic distribution of rainfall (76.32 %), delay in onset of monsoon (66.27 %), no credit facility (66.03 %), irregular power supply (55.59 %), high wage rates (54.48 %) and non-availability of labour (50.31 %).

From the in-depth analysis of above literatures indicated that the farmers were facing various crisis problems in sugarcane cultivation. At the same time the constraints of farmers vary with crisis type occurred in their region.

2.7.2 Suggestions to overcome the constraints in sugarcane production crisis

Ravikiran (2004) reported the important suggestions given by farmers to overcome the crisis were a change in cropping pattern, shifting to a non-cotton based farming system, strengthening of PACS to extend credit and supply quality inputs, strengthening of extension organization for effective dissemination of technical know-how and good agricultural practices, greater extent of institutional financing in agriculture and last but not the least was the government intervention in stabilizing prices and assuring remunerative prices to the farmers.

Ravisankhar (2005) reported that providing location specific weather forecasts by improving infrastructure like installing rain gauges at village level as the major suggestion expressed by the farmers in adopting weather forecasting.

Nhemachena and Hassan (2007) argued that the impact of climate change on rural farming communities can be reduced by distributing information about seasonal climate forecasts to farmers on time, so that they can make more informed farming decisions and adapt to changing conditions. They also reported that farmers with access to both input and output markets have more chances to implement adaptation measures.

Deressa *et al*. (2011) analyzed the factors affecting the choice of adaptation methods but failed to explicitly explain how farmers perceive climate change and adapt.

Krishnappa and Dayananda (2015) identified the solutions to the problems causing agrarian crisis in sugarcane like miniaturization of sugar industries, government to stop import of sugar, to encourage public to use more jaggery, mechanization of jaggery plants, license to farmers to produce alcohol from molasses and to encourage all sugar industries to have co-generation plants.

Vinay Kumar (2015) recorded the suggestions offered by the farmers to mitigate crisis of climate change were, early warning has to be given to the farmers about environmental changes, support price, incentives for increasing the green manuring, creating awareness to the farmers about appropriate adaptation measures against climate change, insurance has to be extended to all crops and demonstrating strategies and lifestyles for increased sustainability and resilience etc.

Chand *et al.* (2016) reported that cent per cent of the respondents suggested that government should provide drip irrigation facility under strict monitoring scheme to all sugarcane growers in the region. Majority of the farmers strongly suggested that adequate provisions must be in place to ensure remunerative price is paid for the produce. In addition, a large number of growers submitted request if bank loan facility could increase at nominal interest rate at times when it's required the most to overcome problems in sugarcane farming.

Praveen (2017) suggested that efforts should be made towards the encouragement of the farmers to shift over from inorganic sugarcane farming to organic sugarcane farming.

Satyam *et al.* (2020) suggested that inputs should be made timely available at low cost, availability of adequate water for irrigation of sugarcane field, regularly supply of electricity for irrigation and increase the knowledge about soil borne insect-pest and disease control.

The past suggestions of farmers to overcome their constraints at different phases vary with victims' level of resource mobilization. The suggestions range from timely supply of agricultural inputs at low cost, adequate water for irrigation of sugarcane field, regularly supply of electricity for irrigation, knowledge about soil borne insect-pest and disease control, adoption of modern package of practices, availability of technical device, to store the byproduct of sugarcane provide good stories facilities, proper harvesting schedule of sugarcane should be followed and prices of the sugarcane should be increased.

III METHODOLOGY

This chapter describes about typology of methods, approaches employed in development of the crisis management behaviour scale, investigational estimates intended to evaluate various factors and different methods embraced in conducting the study. Following are the methodologies used in conducting the present investigation and are portrayed under the following sub-headings.

3.1 Population and Locale of the study
3.2 The sample
3.3 Research design
3.4 Research variables- Dependent and Independent variables
3.5 Operationalization and measurement of dependent variables
3.6 Operationalization and measurement of independent variables
3.7 Construction of interview schedule
3.8 Data collection
3.9 Data analysis
3.10 Conceptual model of the study

3.1 Population and Locale of the study:

3.1.1 Population:

The population for the present investigation were the sugarcane growers from major sugarcane growing districts of Northern Karnataka, namely Belagavi and Bagalkot.

3.1.2 Locale of the study:

The present study was undertaken in Belagavi and Bagalkot districts of Northern Karnataka during 2020-21. These two districts were purposively selected from the sugarcane growing districts of Karnataka by keeping the following points in view.

Belagavi and Bagalkot were the leading producers of sugarcane in Karnataka with maximum area under sugarcane cultivation and production. But, the productivity of these two districts (75 to 78 tons per hectare) was far below the state average of 95 tons per hectare in 2021. This means nearly, 21 per cent yield gap was observed in sugarcane production in Belagavi and Bagalkot districts. The reasons for the decline in productivity were reported by N. S. Nijalingappa Sugar Institute, located in Belagavi district as acute water shortage during

summer months, lower ratoon yields, saline and alkali soil problems, use of imbalanced chemical fertilizers, uncontrolled faulty irrigation schedules and methods, lesser/no use of organic manures, adoption of unscientific agronomic practices in sugarcane cultivation and ignorance of measures to enhance soil productivity. Apart from that, these districts were most affected by crisis situations like low prices for produce, floods and droughts which lead to reduction in yield. Based on this, Belagavi and Bagalkot districts from northern Karnataka were selected purposively for the present research.

3.1.3 Selection of Taluks for study

From each district, two major sugarcane producing taluks which have faced crisis situations previously like flood, drought, soil deterioration, decreased productivity, price and financial crises, labour shortage and thrash issues were selected for the study. Four taluks namely, Gokak and Raibag taluks from Belagavi district, Jamakhandi and Mudhol taluks from Bagalkot district were selected. (Table 1, Fig. II).

3.1.4 Selection of villages for study

The villages were categorized into 3 types based on the distance of farmers' field from the river basin, up to 4 km in the first range as head reach, 4 to 8 km range as mid reach and 8 to 12 km in the third range as tail end villages. Accordingly, the villages that fall into these three categories were listed for each taluk. From the list, two head reach, two mid reach and two tail end villages from each taluk were selected using simple random sampling technique to know and to make comparison between the crisis management behaviour of different categories of sugarcane growers. Totally twenty-four villages from four taluks were considered for the study. The selection of districts, taluks and villages is shown in Table 1.

3.1.5 Selection of respondents

Ten sugarcane growing farmers were selected from each selected village as the respondents for the study using systematic simple random sampling technique. Hence, a total of 240 respondents from 24 villages were selected.

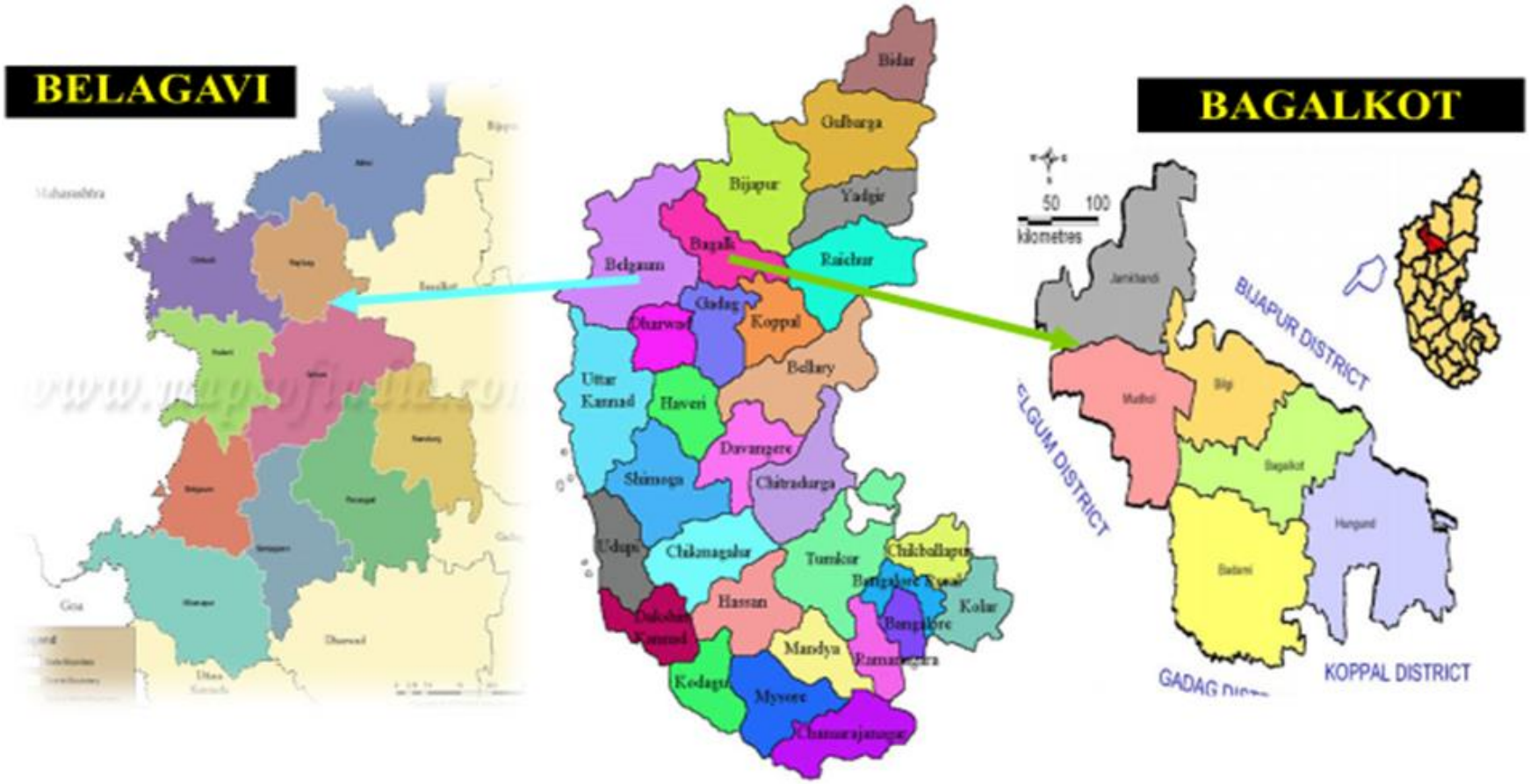

Fig 1: Map indicating the study area

3.1.6 General description of study area Northern Karnataka

Northern Karnataka is a geographical region in the Deccan plateau from 980 to 2,400 feet elevation that creates the northern part of the Karnataka state. The Krishna River and its tributaries, namely the Ghataprabha, Bhima, Tungabhadra and Malaprabha forms the major irrigation belt. Northern Karnataka lies in the Deccan thorn scrub forests eco-region, which spreads north into eastern Maharashtra with most portions of this region has black fertile soil which is more suitable for agriculture. It comprises of the districts Belagavi, Bagalkot, Vijayapura, Bidar, Gulbarga, Raichur, Bellary, Yadgir, Koppal, Gadag, Haveri, Vijayanagar and Dharwad. The region is a mixture of savannah and semi-arid climate. The region experiences moderate to heavy rainfall during the rainy season that stretches from June to September. Summer is hot with sparse rain and temperatures typically varying from 22°C to 39 °C. Certain parts of the region are well irrigated by many largest multipurpose irrigation projects, Upper Krishna Irrigation Project which includes Basava sagara and Almatti Dams, Tungabhadra Dam along with various major and minor lift irrigation projects.

Belagavi district is the largest district in the state of Karnataka with an area of 13,415 km2. It is popularly known as “Sugar bowl of Karnataka” with 1.5 lakh (1,50,000) hectares being used for commercial production and it has displaced Mandya district in sugar cane production over the last decade. The western parts of the Belagavi district (Londa and Khanapur) are adjacent to Uttara Kannada district, which has almost highland tropical climate. The stretch from Londa to Alnavar has some of the most-dense jungles on the Western coastal belt of India. They are part of the Western Ghats and their foot hills which are now protected under National Wildlife laws. Belagavi is 760 M above sea level. In winter, there is much less rainfall in Belagavi than in summer. The average temperature is 23.3 °C and about 1468 mm of precipitation falls annually.

Bagalkot is the district of Karnataka with the warm climate dry throughout the year and rainfall is scarce. The average rainfall in the region is approximately 318 mm annually. The months of September and December account for about 52% of the total annual rainfall. The Ghataprabha, Malaprabha and Krishna rivers flow through the district and are major sources of irrigation for the sugarcane belt of Bagalkot district.

Table 1: Details about the selection of respondents for the study

District	Taluks	Farmer's type	Village (Respondents)	Total respondents
1) Belagavi	1) Gokak	Head reach	Udagatti	60
			Melavanki	
		Mid reach	Maldinni	
			Upparahatti	
		Tail end	Pamaladinni	
			Sanganakeri	
	2) Raibag	Head reach	Paramanandwadi	60
			Chinchali	
		Mid reach	Yalparahatti	
			Mugalkhod	
		Tail end	Itnal	
			Kanakanawadi	
2) Bagalkot	3) Jamakhandi	Head reach	Tubachi	60
			Shurpali	
		Mid reach	Muttur	
			Zunjarwad	
		Tail end	Terdal	
			Algur	
	4) Mudhol	Head reach	Channal	60
			Mirji	
		Mid reach	Naragal	
			Malali	
		Tail end	Jaliber	
			Soragaon	
2 Districts	**4 taluks**		**24 villages**	**n=240**

3.2 The sample

A total of 240 respondents were selected through systematic simple random sampling technique from four taluks of two districts. From each taluk, 60 respondents were selected consisting of 20 head reach, 20 mid reach and 20 tail end sugarcane growers. Thus, constituting to a total sample size of 240 (Details are presented in Table 1).

3.3 Research design

Research design is the most significant and essential part of research methodology. Keeping in view the objective of the investigation, Ex-post-facto research design was employed in the present investigation. Rabinson (1976) defined Ex-post-facto research design as systematic empirical inquiry in which the independent variables have not been directly manipulated because they have already occurred or because they are inherently not manipulated. He further stated that Ex-post-facto studies can be devised to deduce theories, identify behavioural phenomena and explore conditions under which a phenomenon occurred.

3.4 Research variables

The research variables consist of dependent variables and independent variables selected in the presented study. The details of variables selected were shown in Table 2.

3.4.1 Dependent variable: Three dependent variables were considered for the present study, namely Crisis Management behaviour of the sugarcane growers, Adoption of crisis mitigation mechanisms and awareness about crisis, its management and benefits received during crisis and its management.

3.4.2 Independent variable: Twenty-three independent variables were identified based on a review of literature. These variables were grouped under personal variables, socio-economic variables, organizational variables and psychological variables. It is difficult to draw distinct demarcation lines between each group of variables, as all aspects of social life are inter-connected and interrelated with each other.

Table 2: Variables considered for the study along with their empirical measurements

SI.No.	Variables	Empirical Measurements
	DEPENDENT VARIABLES	
1.	Crisis Management behaviour	The Scale developed for the study
2.	Adoption of Crisis mitigation mechanisms	Schedule developed for the study
3.	Awareness about crisis, its management and benefits received	Schedule developed for the study
	INDEPENDENT VARIABLES	
I.	**Personal Variables**	
1.	Age	Chronological age of respondents
2.	Education	Procedure followed by Prakash (2013)
3.	Farming experience	Procedure followed by Ashokkumar (2015)
4.	Prior exposure to crisis	Schedule developed for the study
5.	Family size	Schedule developed for the study
II.	**Socio-economic variables**	
6.	Land holding	Anonymous (2019d)
7.	Annual income	Procedure followed by Naveen (2016)
8.	Cosmopoliteness	Procedure followed by Shashidhar (2004)
9.	Mass media exposure	Schedule developed Vinay Kumar (2015)
10.	Innovative proneness	Scale developed by Rame Gowda (1991) with suitable modifications
	Organizational variables	
11.	Extension support	Schedule developed by Vinay Kumar (2015) with slight modifications
12.	Production input support	Schedule developed by Vinay Kumar (2015) with slight modifications
13.	Credit support	Schedule developed by Vinay Kumar (2015) with suitable modifications
14.	Crisis management trainings needed	Schedule developed for the study
III.	**Psychological variables**	
15.	Scientific orientation	Scale developed by Supe (1969) with suitable modifications
16.	Farming commitment	Scale developed by Rame Gowda (1991)
17.	Deferred gratification	Scale developed by Rame Gowda (1991) with slight modifications
18.	Risk orientation	Scale developed by Supe (1969) with suitable modifications
19.	Achievement motivation	Scale developed by Singh (1974) with suitable modifications
20.	Perception towards crisis	Scale developed by Praveena (2010)
21.	Attitude towards crisis	Schedule developed by Anonymous (2007) with suitable modifications
22.	Knowledge	Schedule developed for the study
23.	Adoption	Schedule developed for the study

3.5 Operationalization and measurement of dependent variables:

3.5.1 Operationalization and development of scale to measure the crisis management behaviour of sugarcane growers

The quantification of agriculture development, production and behaviour of farmers has become the topic of increased research prominence. A major problem of behavioural management studies is the, development of a more accurate and truthful criterion which foresees the management behaviour of sugarcane growers. But, finding reliable and valid criterion variables is the foremost problem. Evolving a scale, particularly to measure crisis management behaviour is much more complex and needs cautious and unconventional analysis to identify the suitable dimensions which best assess the management level of farmers. However, in the past, measurement of management was done variedly by different scientists.

Wallach and Kogan (1961) conducted a survey by using forced choice technique and acknowledged that good soil conservation, more income per dollar invested and biggest yield per acre as the indicators of successful farmer cum manager. Whereas, Reiss (1949) measured farmers' management ability through judges' ratings on 328 identified factors. Similarly, Brayfield and Marsh (1957), McCormic *et al.* (1959) and Justus *et al*. (1968) also adopted the judges' rating technique to identify good managers.

Tonbary (1957) used indictors such as production levels to group average, production per unit area and economic performance to assess the managerial ability of farmers. Whereas, in the work of Kahalon and Acharya (1967), the decisions taken by different farmers pertaining to nine selected statements were ranked and converted into scores. The adaptation strategies taken up by different farmers pertaining to eleven indicators were ranked and converted into scores. The economic performance by different farmers pertaining to three indicators were ranked and converted into scores. The sum of scores was used as a crisis management scale.

A sophisticated econometric model was proposed by Beassel (1970) to measure management efficiency through productivity influenced by intensity of farming, operating efficiency, complexity of farming and potential of operating efficiency. But later, the simplified approaches by Hebbar (1975), Shanmukhappa (1978), Thimmappa (1981) and Sainath (1982) resulted in management ability indices based on weightages secured on selected management factors. Also, Samanta (1977) evolved a subjective scale of management orientation containing statements related to planning, production and marketing orientation of farmers.

Of late, similar deliberate efforts were made to evolve the management efficiency index by the identification of its components through judges' rating and computing scale values (Chari and Nandapurkar, 1987 and Nagaraja, 1989). An analysis of different devices used by the previous workers reveals that the common terms used are management ability, management efficiency, management orientation, management competence and managerial performance. In view of these, Justus *et al.* (1968) claims that various terms used to connote the effect of management or capacity of performing management function and these can be broadly defined as i) management ability – capacity of an individual to perform management function, ii) managerial performance – the extent to which and the effectiveness with which the individuals carry out the functions of management as indicated by measures of output or efficiency.

Additionally, Neilson (1980) maintained that management processes as the third component to be considered to measure the management level of farmers. In his model, he considers ability as one of the antecedents through which management process related to behavioral aspects which is different from ability and performance. The assumption that management is human behaviour probed to the development of techniques to predict managerial performance from behavioral antecedents. From the foregoing literature analysis, it could be summarized that the management behaviour of farmers has been assessed mainly by the following methods. The methods adopted and their deficiencies are summarized below.

Firstly, measurement of management input- particularly through decision-making ability of farmers. But in reality, it is difficult for a farmer to put all his decisions into action. Secondly, measurement of crisis management behaviour through adaptive behavioural actions of farmers. However, reliance on behavioral aspects alone is questionable as similar behavior by two individuals results in different effects owing to time of action, type of methodology adopted for action and intangible environmental/ soil factors. Thirdly, measurement through management output is assessed in terms of economic parameters such as productivity, benefit-cost ratio and income differences. But these are after the fact that measurement reflects profit and losses, not due to management. Also, proponents of this line of thinking assumed that profit maximization is the sole objective of farming. Further, there should be factors and resource endowments of farmers. In this situation, attributing effect to management input alone is erroneous.

Keeping these problems in view, it could be safely said that each component measures a segment of management behaviour and not management behaviour as a whole. Therefore, one should aim at a comprehensive measurement device involving a combination of

management input (DMA-Decision Making Ability), management process (Adaptations) and management output (Economic Performance) dimensions. The underlying assumption for such a type of attempt should be multiple indicators to assess the phenomenon more accurately than by a single indicator. In view of these, in the present study a prompt attempt is made to take cognizance of these deficiencies and to arrive at a composite scale, involving appropriate components which best represents the management behaviour of sugarcane farmers by gauging it from different angles under different crisis conditions in sugarcane farming.

Keeping all this in view, an attempt has been made in the present investigation to develop a scale to measure the crisis management behaviour of sugarcane growers.

In the present investigation, a crisis is operationally defined as a situation of concentrated period of disturbance caused by floods, drought, price arrears, lower yields (production), financial, thrash issues, livestock and labour crises affecting sugarcane yields and sugarcane growers' income.

Crisis management behaviour of sugarcane growers is operationally defined as their degree to withstand, manage and resolve the crises with respect to production, soil and water conservation, drought, flood, financial, price, labour, livestock, thrash and concerned institutes which is measured by the decision-making ability, adaptability and economic performance of sugarcane growers.

a) **Decision-making ability:** It is operationally defined as the ability of sugarcane growers to select appropriate production alternatives and plan of actions by a systematic approach for achieving maximum returns in identified crisis situations.

b) **Adaptability:** It is operationally defined as behavioural actions (survival strategies) undertaken by farmers to face the prevailing crisis and also anticipated future crisis. These behavioural actions are confined to sugarcane production, soil and water conservation, drought and flood, financial and price, labour, livestock, thrash management and adaptations needed by institutions according to the sugarcane growers.

c) **Economic performance:** It is operationally defined as performance or management of the farm by taking imperative major and subsidiary enterprises to get maximum profit. It will be analysed using Cropping Intensity, Crop Yield Index, B: C ratio and Net income.

The method suggested by Likert (1932) and Edwards (1969) in developing a summated rating scale was followed through six stages viz., identification of dimensions, collection of items/statements, relevancy test, item analysis, reliability and validity in development of the scale to measure the crisis management behaviour of sugarcane growers.

3.5.1.1 Identification of Components:

Three major dimensions related to crisis management behaviour were identified based on review of literature and discussion with experts in the field of extension education, economic, agronomy, entomology and other concerned departments. The identified dimensions were: (1) Decision-making ability, (2) Adaptability (sugarcane production, soil and water conservation, drought and flood, financial and price, labour, livestock, thrash management and adaptations needed from institutions according to the sugarcane growers) and (3) Economic Performance.

3.5.1.2 Collection of items/ statements:

A large number of statements were drafted on each identified dimension of crisis management behaviour based on review of various literatures, discussion with experts in field, scientists and researcher's own experience. These 168 collected statements pertaining to the crisis management behaviour of sugarcane growers were carefully edited, revised and restructured to avoid ambiguity and duplication as per the 14 criteria enunciated by Edwards (1969) and Thurstone and Chave (1929). As a consequence, 47 statements were eliminated. The remaining 121 crisis management behaviour statements were considered for further analysis.

3.5.1.3 Relevancy test:

The remaining 121 statements were sent to 160 experts in the field of social sciences working in State Agricultural Universities, Indian Council of Agricultural Research Institutes and Development departments etc., to critically evaluate the relevancy of each statement on a five-point continuum, Most Relevant (MR), Relevant (R), Somewhat Relevant (SWR), Less Relevant (LR) and Not Relevant (NR) with the score of 5,4,3,2 and 1, respectively for positive statements and scored reversely for negative statements. The judges were also requested to make necessary modifications and additions or deletion of statements, if they desired to do to make study more appropriate. A total of 83 judges returned the questionnaires duly completed and these were considered for further processing. From the data gathered, 'relevancy

percentage'(RP), 'relevancy weightage' (RW), and 'mean relevancy score' (MRS) were worked out for all the 121 statements using the following formulae:

I. Relevancy percentage (RP)

It was obtained by using the standard formula given below.

$$R.P. = \frac{(MR\times5) + (R\times4) + (SWR\times3) + (LR\times2) + (NR\times1)}{\text{Maximum possible score (i.e., } 121*5=605)} \times 100$$

II. Relevancy Weightage (RW)

Relevancy weightage was calculated by using the below given below standard formula.

$$R.W. = \frac{(MR\times5) + (R\times4) + (SWR\times3) + (LR\times2) + (NR\times1)}{\text{Maximum possible score (i.e., } 121*5=605)}$$

III. Mean Relevancy Score (MRS)

The mean relevancy score was obtained by using the given below standard formula.

$$M.R.S. = \frac{(MR\times5) + (R\times4) + (SWR\times3) + (LR\times2) + (NR\times1)}{\text{Number of judges responded (83)}}$$

Accordingly, statements having 'relevancy percentage' equivalent or more than 80.00 per cent, relevancy weightage equivalent or more than 0.80 and mean relevancy score equivalent or more than 4.00 were considered for inclusion in item analysis. Accordingly, 103 crisis management behaviour statements were retained after the relevancy test. These statements were considered for further processing, suitably modified and re-written as per the suggestions and comments of the judges/experts wherever applicable.

3.5.1.4 Item analysis:

To delineate the items based on the extent to which they can differentiate the statements about crisis management behaviour scale, item analysis was carried out on the 103 statements selected after the relevancy analysis. A sample of 32 sugarcane growers from the non-sample area, Mandya taluk of Mandya district were considered as respondents for pre-testing. The respondents were asked to indicate their degree of agreement or disagreement with each statement on a five-point continuum ranging from 'strongly agree' to 'strongly disagree'.

Based upon the total scores, the respondents were arranged in descending order. The top 25 per cent of the respondents with their total scores were considered as the high group and the bottom 25 per cent as the low group. These two groups provide criterion groups in terms of evaluating the individual statements as suggested by Edwards (1969). Thus, out of 32 sugarcane

growers to whom the items were administered for item analysis, eight sugarcane growers with the highest and eight sugarcane growers with lowest scores were used as criterion groups to evaluate individual items. The critical ratio i.e., 't' value, which analyses the extent to which a given statement differentiates between the higher and lower groups of respondents for each statement, was calculated by using the following formula:

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum X_H^2 - \frac{(\sum X_H)^2}{n} \times \sum X_L^2 - \frac{(\sum X_L)^2}{n}}{n(n-1)}}}$$

Where, $\bar{X}_H$= The mean score on given statement of the high group

$\bar{X}_L$ = The mean score on given statement of the low group

$\sum X^2_H$= Sum of squares of the individual score on a given statement for high group

$\sum X^2_L$ = Sum of squares of the individual score on a given statement for low group

n = Number of respondents in each group

$\sum$ = Summation

t = The extent to which a given statement differentiates between the high and low groups.

After computing the 't' value for all the 103 items, 82 statements with 't' value equal to or greater than 1.75 were finally selected and included in the final crisis management behaviour scale. Where all the statements were significant at 5 per cent.

Standardization of scale: The reliability and validity were ascertained for standardization of the scale.

3.5.1.5 Reliability of the scale developed

The split-half method was employed to test the reliability of the crisis management behaviour scale. The value of the correlation coefficient was 0.8509 and this was further corrected by using Spearman Brown formula suggested by Henrica *et al.* (2017) to obtain the reliability coefficient (rII) of the whole set. The reliability value of the scale was 0.9195, which is higher than the standard of 0.70 with significant one per cent level. The obtained reliability value indicates that the constructed crisis management behaviour scale was highly reliable and dependable in its measurement.

3.5.1.6 Validity of the scale

The data was subjected to statistical validity, which was found to be 0.9589 for the crisis management behaviour scale, which is greater than the standard requirement of 0.70. Hence,

the validity coefficient was found to be high. Thus, the scale developed was feasible and appropriately valid to measure crisis management behaviour of sugarcane growers.

SI. No.	Steps	Crisis management behaviour	
		Statements considered	Statements retained
1	Collection of items	168	168
2	Editing of items	168	121
3	Relevancy analysis	121	103
4	Item analysis	103	82
5	Reliability and validity	82	82
6	Administering the scale	82	82

Administration of the scale: The final scale consists of 82 statements for determining the crisis management behaviour of sugarcane growers. The response for decision-making ability will be collected on a five-point continuum, namely, strongly agree, agree, undecided, disagree and strongly disagree with assigned score of 5, 4, 3, 2 and 1 for positive statements and reverse scoring for negative statements respectively. Similarly, for adaptability five-point continuum of very greater extent, greater extent, moderate extent, least extent and very least extent with assigned weightage of 5, 4, 3, 2 and 1 for positive items and reverse scoring to negative statements. The economic performance was calculated using the standard formulae like cropping intensity, Crop Yield Index, B:C ratio and net income.

The crisis management behaviour score of a respondent was calculated by adding up the scores obtained by him/her on all items/statements for all the dimensions. Based on the total cumulative score obtained, crisis management behaviour level of sugarcane growers was classified into poor, moderate and better crisis management behaviour category by using mean and standard deviation as measures of check.

SI. No.	Category	Criteria
1	Poor	< (Mean- ½ SD)
2	Moderate	Between (Mean $\pm$ ½ SD)
3	Better	> (Mean + ½ SD

3.5.2 Operationalization of adoption of crisis mitigation mechanisms and its measurement

Adoption of crisis mitigation mechanisms is operationally defined as the extent to which a sugarcane grower is able to cope up with the crisis situations to reduce their immediate effects

by adopting suitable short-term strategies. Mitigation mechanisms adopted by the sugarcane growers were documented through personal interview using structured interview schedule. The schedule was developed with in depth review of literature related to crisis mitigation along with consultation of the experts and scientist in the field. Each statement of crisis mitigation mechanism was scored on two-point continuum namely 1 and 2 for non-adoption and adoption respectively. The respondents were categorized into three crisis mitigation mechanisms adoption categories namely low, medium and high categories using the mean and standard deviation.

SI. No.	Category	Criteria
1	Low	< (Mean- ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD

3.5.3 Operationalization of awareness about crisis, its management and benefits received during crisis and its management

Awareness was operationalized as the state of being conscious about the different crises and their management in agriculture as well as sugarcane farming by sugarcane growers. A set of statements reflecting different crises and crisis management in agriculture and sugarcane farming were identified and developed into a structured schedule through thorough review of the literatures and experts in the field. The sugarcane growing farmers' responses to the crisis management statements were documented through personal interview method using the structured pre-tested interview schedule. After reviewing and careful editing of all the collected items were prepared into a structured interview schedule and the farmers responses were documented as yes or no to the statements through interview method with scoring of '0' for 'No' and '1' for 'Yes' responses of farmers. The respondents were further classified into three awareness categories as shown below using mean and standard deviation.

SI No	Category	Criteria
1	Poor	< (Mean- ½ SD)
2	Moderate	Between (Mean ± ½ SD)
3	Better	> (Mean + ½ SD

Awareness about benefits received was operationally defined as the degree to which the farmers had received assistance in the form of information, cash and kind taken before crisis, during crisis and post crisis phases of crisis as part of crisis management. These activities range

from non-structural measures such as crop insurance to the activities like warning, evacuation, sheltering, organizing an emergency response, relief, rehabilitation etc. A set of statements reflecting various activities of crisis management comes under all the phases like before crisis, during-crisis and post-crisis management activities were collected based on thorough review of available literature, interaction with expert scientists in the field and researchers own experience. After editing and review, all the collected items were prepared into a structured interview schedule and the farmers responses were documented as yes or no to the statements through personal interview method with scoring of '0' for 'No' and '1' for 'Yes' responses of farmers. The respondents were further classified into three awareness categories as shown below using mean and standard deviation as measures of check.

SI No	Category	Criteria
1	Poor	< (Mean- ½ SD)
2	Moderate	Between (Mean $\pm$ ½ SD)
3	Better	> (Mean + ½ SD

3.6 Operationalization and measurement of independent variables

The details regarding the operationalization and measurement of 23 independent variables which are further classified into personal variables (5), socio-economic variables (5), organizational variables (4) and psychological variables (9). The details were as follows.

3.6.1 PERSONAL VARIABLES

3.6.1.1 Age

Age is operationalized as the chronological age of the respondents in complete years during investigation. The respondents were grouped into three categories based on the chronological age completed by respondents at the time of investigation.

Sl. No.	Category	Age (years)
1	Young	Less than 35 years
2	Middle	35 to 50 years
3	Old	More than 50 years

3.6.1.2 Education

It refers to formal education completed in years by the respondents. Education of the respondent was quantified by using the procedure followed by Prakash (2013) with slight modifications. The respondents were sorted under eight categories.

Sl. No.	Category	Education	Scores
1	Illiterate	Cannot read and write	1
2	Preprimary school	1-4th standard	2
3	Higher primary school	5-7th standard	3
4	High school	8-9th standard	4
5	SSLC	Completed 10th standard	5
6	ITI/PUC/Diploma	Completed 10+2	6
7	Graduate	Completed degree (10+2+3/4)	7
8	Post graduate	Above graduation (10+2+3/4+2)	8

3.6.1.3 Farming experience

It refers to total number of sugarcane growers experience in sugarcane cultivation expressed in completed years. The experience of the farmer at the time of investigation was categorized into low, medium and high categories by considering mean and standard deviation as a measure of check. Procedure followed by Ashokkumar (2015) was used for categorization. It was categorized into low, medium and high farming experience in sugarcane cultivation using the criteria shown below.

Sl. No.	Farming experience (years)	Scores
1	< 10 years	1
2	10 to 20 years	2
3	> 20 years	3

3.6.1.4 Prior exposure to crisis

It is operationalised as the number of times crises like floods, droughts, price crisis etc., experienced by the respondents during their farming duration. For every time of exposure to each crisis, one score was accorded to obtain overall score for the variable. The farmers were further grouped into three categories as low, medium and high based on the mean and standard deviation as the measures of check.

SI. No.	Category	Scores
1	Up to 5 times	1
2	5-10 times	2
3	>10 times	3

3.6.1.5 Family size

It refers to the number of members living in a farmers' family. Measurement and scoring were done using number of members present in a family as the criteria shown in below. Further, the respondents were grouped into following categories.

SI. No.	Category	Scores
1	Small (<5 members)	1
2	Medium (5-7 members)	2
3	Large (8 members and above)	3

3.6.2 SOCIO-ECONOMIC CHARACTERISTICS

3.6.2.1 Land holding

It refers to possession of the farm land in number of acres by sugarcane growers at the time of investigation. The criterion followed by the Anonymous (2019d) with slight modifications was used and the respondents grouped into four different categories as shown below.

Sl. No.	Category	Land holding (in acres)
1	Marginal farmers	Up to 2.5
2	Small farmers	2.51 to 5.00
3	Medium farmers	5.01 to 10.00
4	Large farmers	Above 10.00

3.6.2.2 Annual income

The variable was operationalized as the total annual income obtained from agriculture and allied sources during previous year as reported by the respondents at the time of investigation. Further, based on the classification made by the procedure followed by Naveen (2016), the respondents were grouped in to three categories using mean and standard deviation as measures of check.

Sl. No.	Category	Annual income (Rs)
1	Low	< (Mean- ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD)

3.6.2.3 Cosmopoliteness:

Cosmopoliteness is defined as the degree to which an individual is oriented outside his immediate social system.

The procedure adopted by Shashidhar (2004) with some modification is used to measure this variable. This involves two aspects namely frequency of visits to the nearest town and the purpose of visit to the town. The items included and scoring criteria adopted for frequency and purpose of visits outside the ones' social system is presented below.

Frequency of visit to town

SI. No.	Frequency	Score
1	Two or more visits per week	5
2	Once per week	4
3	Once in fortnight	3
4	Once in a month	2
5	Seldom	1
6	Never	0

Purpose of visiting to town

SI. No.	Purpose	Score
1	Many times, related to agriculture and allied enterprises	3
2	Sometimes related to agriculture and allied enterprise	2
3	Domestic / entertainment	1
4	No response	0

Based on the total score obtained by respondents, they were classified into three categories as described below.

Sl. No.	Category	Criteria
1	Low	< (Mean- ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD)

3.6.2.4 Mass media exposure

In the previous studies the mass media exposure was measured on passive participation i.e., ones' regularly in use of those media. The measurement of passive participation without taking into cognizance the active involvement and whether a farmer is really exposed to the topic under study or not is a false projection of results related to mass media influence. Therefore, in the present study both passive participation (reading/listening/viewing mass media) and active participation (discussion and seeking clarification about information received through mass media) were considered. In addition, exposure of farmers to crisis management practices through mass media was also ascertained.

Scoring pattern: The participation of farmers in using both print and electronic media was recorded on response options as regular, occasional and never with the scores of 2, 1 and 0. Whereas, with respect to exposure of farmers to crisis management practices by the each of the media, the scores '1' for 'Yes' response and '0' for 'No' response was awarded. The scores secured on passive and active participation along with exposure to crisis management topics for both print and electronic media were summated to obtain total score of a respondent for mass media exposure.

SI. No.	Frequency of use	Score
1	Regular	2
2	Occasional	1
3	Never	0
SI. No.	**Exposure to crisis management topics**	**Scores**
1	Yes	1
2	No	0

Thus, the total possible score ranged from 0 to 24. Based on the score obtained, the respondents were grouped into three categories using mean and standard deviation as a measure of check.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean $\pm$ ½ SD)
3	High	> (Mean + ½ SD)

3.6.2.5 Innovative proneness

It is defined as the social orientation of an individual to get linked or closely associated with change by adopting innovative ideas and practices. In other words, it refers to the behavioral pattern of an individual who has interest and desire to seek changes in the farming

and to introduce such changes in the practice when found practicable and feasible. In this study, farmers' innovative proneness was estimated by utilizing the scale developed by Rame Gowda (1991) with appropriate modifications. The statements of the scale were fitted against five continuums like 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree' with the scores of 5,4,3,2, and 1 for the positive statements and reverse scoring for negative statements. Further, respondents were categorized as low, medium and high based on mean and standard deviation as the measures of check.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean $\pm$ ½ SD)
3	High	> (Mean + ½ SD)

3.6.3 ORGANIZATIONAL CHARACTERISTICS

3.6.3.1 Extension organization support

It refers to the information and material support extended by the development departments representing agricultural and allied enterprise. The information support received by the farmers was assessed by the degree of guidance received by the farmers from the extension personnel of different development departments. The guidance areas included were water and soil conservation practices, flood relief activities, agronomic practices, livestock management practices, drought ameliorative practices, agriculture implements etc., through development programmes of state and central governments. The response for these guidance areas were recorded on the four-point continuum, very much, much, very little and never with the scores of 4, 3, 2 and 1 respectively. The cumulative scores of all statements indicating the guidance areas constituted the total score for extension information support.

The material support given by development departments to farmers was measured based on the number of benefits received by the farmers through these departments. The benefits consisted of seed and fertilizers, sugarcane planting material supply, supply of implements, forest saplings, plant protection chemicals, fodder slips supply, soil conservation structures and veterinary care. For each benefit obtained by a farmer, a score of 1 was awarded. The summation of scores against all the development departments was totaled to compute material support score for each farmer.

The scores secured on the information support and material supports were added to obtain the total score for extension organization support. Further respondents were categorized as low, medium and high based on mean and standard deviation as the measures of check.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD)

3.6.3.2 Production inputs support

Production inputs support is operationalized as the availability of production inputs in terms of the quantity required, brand and timeliness in the village or nearby town for the farmer. Schedule developed by Vinay Kumar (2015) with suitable modifications was used.

The quantity of production inputs available against the requirement of the farmers was rated on 0, 25, 50, 75 and 100 per cent with assigned scores of 0, 1, 2, 3 and 4 respectively. The availability of brand required by the farmer at nearby stores was recorded on the response options, 'available' and 'not available' with scores of one and zero respectively. After ascertaining the availability of inputs, the respondents were further probed to indicate whether the availability was timely or untimely. For timely availability and untimely availability responses, one and zero score were assigned respectively.

The addition of the scores obtained on extent of availability, type/brand and timeliness with respect to each of the production inputs formed total production input support score. Based on cumulative scores obtained respondents were categorized as low, medium and high considering mean and standard deviation as a measure of check.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD)

3.6.3.3 Credit support:

The credit support received by a farmer was analyzed for both formal and informal sources of credit on extent of credit availability, timeliness along with the special credit rebates

received during crisis years. The extent of availability of credit through formal as well as informal sources was measured separately on the continuum 0, up to 25 per cent, up to 50 per cent, up to 75 per cent and up to 100 per cent. The scores of 0, 1, 2,3 and 4 were assigned respectively for continuum ranging 0 to 100. The timeliness with respect to loan availability was assessed on response categories, 'timely' and 'untimely' with the weights of 1 and 0 respectively. Schedule developed by Vinay Kumar (2015) with suitable modifications was used.

SI. No.	Extent of availability of credit	Scores
1	0 Per cent	0
2	1 to 25 Per cent	1
3	26 to 50 Per cent	2
4	51 to 75 Per cent	3
5	75- 100 Per cent	4

SI. No.	Timeliness of credit availability	Scores
1	Timely	1
2	Untimely	0

SI. No.	Special rebate benefits	Scores
1	Received	1
2	Not received	0

The special rebate benefits received by the respondents through formal and informal sources was measured on options 'benefits received' or 'not received' with assigned weightages of 1 and 0 respectively. The addition of scores on credit availability, timeliness and special rebates benefits received was used as total score for credit support. Respondents were categorized as low, medium and high based on mean and standard deviation as a measure of check.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean $\pm$ ½ SD)
3	High	> (Mean + ½ SD)

3.6.3.4 Crisis management trainings needed

It refers to the areas in which respondents required and willing to enhance their capacity for better management of crisis situations. The list of capacity development areas for farmers were identified. The respondents were assessed on three-point continuum of most needed,

somewhat needed and not needed with the allotted weightage of 3, 2 and 1. Based on the obtained score for identified training needs, the respondents were classified into as low, medium and high based on mean and standard deviation as a measure of check.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD)

3.6.4 PSYCHOLOGICAL CHARACTERISTICS:

3.6.4.1 Scientific orientation

Scientific orientation is operationalized as the extent to which a farmer is willing and oriented towards the use of scientific as well as modern methods in agriculture.

The variable was measured by utilizing the scientific orientation scale created by Supe (1969) with the slight modifications. The scale consists of six items with 3 three-point continuums as 'Agree', 'Undecided' and 'Disagree', in which five items were positive and are scored by assigning two to 'Agree' response, one for undecided and zero for 'disagree' response. The scoring criteria was reversed in case of second item which is negative. The sum of scores obtained for all statements by sugarcane growers indicates the scientific orientation of a farmer. The total score ranges from 0 to 12. The level of scientific orientation was categorized into three categories as indicated below using the mean and standard deviation as the measures of check.

Sl. No.	Category	Criteria
1	Low	<(Mean – ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	>(Mean + $^1/_2$ SD)

3.6.4.2 Farming commitment

It is defined as the degree to which an individual is committed to farming as a profession despite all obstacles in it. This variable was measured by the procedure adopted by Rame Gowda (1991) with suitable modification. Visualizing the importance of this variable in farming, totally 10 items were included in farming commitment. The response of the farmers with respect to each item were collected on four-point continuum namely strongly agree, agree, undecided and disagree with assigned weightages of 3, 2, 1 and 0 for the positive statements and the scoring was reversed for negative statements. The sum of the scores on all the items

forms the total score for farming commitment of a farmer. The respondents were categorized into three categories as indicated below using the mean and standard deviation as the measures of check.

Sl. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + $^{1}/_{2}$ SD)

3.6.4.3 Deferred gratification

It is operationalized as the postponement of immediate satisfaction by a farmer in anticipation of future rewards. The procedure followed by Rame Gowda (1991) with suitable modification was used by keeping the research demand in view. The set of statements which expresses deferred gratification were considered. The responses for deferred gratification statements were collected on four-point continuum of strongly agree, agree, undecided and disagree with the scoring of 3, 2, 1 and 0 respectively for positive statements and reverse scoring pattern was followed for negative statements. There were five positive and five negative statements in the scale. Further, the respondents were arranged into three classes by taking the mean and standard deviation as measures of check.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD)

3.6.4.4 Risk orientation:

The term risk orientation was operationalized as the degree to which the farmers are oriented towards risk bearing, uncertainty handling and to face the issues in working circumstances or the extent of farm**e**rs' willingness in undertaking risk while adopting farm innovations in crisis management.

The risk orientation was estimated with the assistance of scale developed by Supe (1969). The scale comprises of six statements and these were scored on two-point continuum as "agree" and "disagree". There were four positive items and two negative items. The scoring pattern for positive items were as 2 for agree and 1 for disagree and for the negative statements

the reverse scoring was followed. Based on the scores, the respondents were classified into three categories as detailed below.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean ± ½ SD)
3	High	> (Mean + ½ SD)

3.6.4.5 Achievement motivation

Achievement motivation in the present study was operationalised as a value associated with a farmer which drives him to excel in farming and related fields and thereby attain sense of personal accomplishment.

The scale developed by Singh (1974) with suitable modifications was used in the study. The scale had six statements with three positive and three negative statements. The response for each of the statement was recorded on four-point continuum. The scoring pattern of 4, 3, 2 and 1 was followed for positive statements and reverse scoring for negative statement. Based on the scores, the respondents were classified into three categories detailed below.

Sl. No.	Category	Criteria
1	Low	< (Mean - $^1/_2$ SD)
2	Medium	Between (Mean ± $^1/_2$ SD)
3	High	> (Mean + $^1/_2$ SD)

3.6.4.6 Perception towards crisis:

It is the favourable or unfavorable opinion of respondents towards the crises like drought, flood, aberrant rainfall/hailstorm, pest and disease epidemics etc. The scale developed by Praveena (2010) with relevant modifications was used in the study. The scale consists of a set of ten statements about the perception of farmers towards crises. The responses were recorded on three-point continuum Agree, Undecided and Disagree with assigned scoring of 3, 2 and 1 respectively for positive statements and reverse scoring for negative statements. Based on the cumulative scores obtained, respondents were categorized into three categories detailed below.

Sl. No.	Category	Criteria
1	Poor	< (Mean - $^1/_2$ SD)
2	Moderate	Between (Mean ± $^1/_2$ SD)
3	Better	> (Mean + $^1/_2$ SD)

3.6.4.7 Attitude towards crisis

An attitude is operationalized as an organized predisposition to think, feel, perceive and behave towards a referent or cognitive object. It is an enduring structure of beliefs that predisposes the individual to behave selectively towards attitude referents (Kerlinger, 1966). Attitude towards crisis and its management was measured by using the modified scale of Anonymous (2007). The scale consists of 8 statements, of which four statements are positive and the rest four are negative. The scoring pattern was as follows. Based on the cumulative scores obtained by respondents, they were categorized into three categories as detailed below.

SI.No.	Category	Positive statements	Negative statements
1	Strongly agree	5	1
2	Agree	4	2
3	Undecided	3	3
4	Disagree	2	4
5	Strongly disagree	1	5

Sl. No.	Category	Criteria
1	Negative	< (Mean - $^1/_2$ SD)
2	Neutral	Between (Mean ± $^1/_2$ SD)
3	Positive	> (Mean + $^1/_2$ SD)

3.6.4.8 Knowledge:

Knowledge as a body of understood information possessed by an individual. Knowledge is defined as the things known to an individual and represented cognitive domain. Knowledge in this study was operationalized as the quantum of scientific information known to the respondents about the improved methods of sugarcane cultivation as well as good crisis management practices identified for sugarcane crop production.

A teacher made knowledge test was used to measure the knowledge level of sugarcane growers about recommended sugarcane cultivation practices along with good crisis

management practices identified in sugarcane farming. The test consisted of 27 knowledge items, which were mainly from package of practices (PoPs) of the University of Agricultural Science, Dharwad and good crisis management practices suggested by the experts of sugarcane. Thus, the schedule consisting of 27 knowledge items was used for the data collection from respondents. The questions were asked to the farmers by the researcher and the answers expressed by the farmers were noted accordingly. The answer to the question were quantified by giving two score to the correct knowledge and one score to the incorrect knowledge. As a result, the maximum score that one could get was 54 and minimum was 27. Based on the total score, the respondents were categorized into low, medium and high knowledge by using mean and standard deviation as a measure of check.

Sl. No.	Category	Criteria
1	Low	< (Mean - $^1/_2$ SD)
2	Medium	Between (Mean ± $^1/_2$ SD)
3	High	> (Mean + $^1/_2$ SD)

3.6.4.9 Adoption of recommended sugarcane cultivation practices

According to Rogers (1993), adoption is a decision to continue full use of an innovation. It is defined as the integration of an innovation into a farmer's normal farming activity over an extended period of time.

Thus, adoption can be termed as a behavioural response. It is the overt behaviour of a farmer expressed in terms of aggregate adoption scores obtained by him with respect to recommended technologies of sugarcane crop as per package of practices of UAS, Dharwad and good crisis management practices suggested by experts of sugarcane. The methodology followed to measure the adoption level is as follows. The set of statements indicating the recommended sugarcane cultivation practices were prepared by using the package of practice of University of Agricultural Sciences, Dharwad as well as good crisis management practices suggested by sugarcane experts. For each statement, the responses collected on two-point continuum namely adopted and not adopted with scores of 1 and 0 respectively. The total score for a respondent is obtained by summing up the score for each individual practice. Based on the scores obtained, respondents were categorized in to three categories based on the following criteria.

Sl. No.	Category	Criteria
1	Low	< (Mean - $^1/_2$ SD)
2	Medium	Between (Mean ± $^1/_2$ SD)
3	High	> (Mean + $^1/_2$ SD)

3.7 Constraints experienced by sugarcane growers in managing crisis

Constraints are the felt needs or problems which requires long term solutions. To know the constraints faced by the sugarcane growers, the schedule was developed and respondents were asked to indicate their responses to each question as 'Yes' or 'No'. The percentage and rank order were used to tabulate the data.

3.8 Suggestions given by sugarcane growers to overcome the crisis

Suggestions are the hints/ideas of solutions to overcome problematic situations as expressed by the individuals for further improvement in managing crisis. In the present study, the suggestions expressed by the sugarcane growers for overcoming the crises at different stages were also sought and expressed in terms of frequencies, percentage and rank order.

3.9 Development of interview schedule for data collection

A structured interview schedule was developed with the help of experts in the concerned field, which included crisis management scale and all the research variables considered for the study.

3.10 Data collection

Individual meeting technique was utilized under a casual atmosphere to collect information with the assistance of meeting plan. Each inquiry was disclosed to the respondent with equivalent accentuation. The casual discourses and perceptions were likewise held to comprehend the respondent and the circumstance in detail which thus was useful in better interpretation of the outcomes in the full setting of material and non-material connections existing in the community.

Plate 1: Data collection from the sugarcane growers

Plate 2: Data collection from the sugarcane growers

Plate 3: Data collection from the sugarcane growers

Plate 4: Data collection from the sugarcane growers

Plate 5: Data collection from the sugarcane growers

Plate 6: Data collection from the sugarcane growers

3.11 Statistical tools employed for analysis of data

The gathered data were scored, quantified, analyzed, categorized and tabulated by using the following statistical tools and techniques. Keeping in view the objectives of the study, the data were subjected to different statistical tests with the suggestions of statistician. The statistical methods used in the present investigation were described here under.

3.11.1 Mean

Sum of the observed values of a set divided by the number of observations in the set is called a mean or an average. The calculated mean was used for grouping the respondents.

3.11.2 Standard deviation

The positive square root of the variance is called standard deviation. It explains the average amount of variation on either side of the mean. The mean and standard deviation were used to classify the farmers into three following categories.

SI. No.	Category	Criteria
1	Low	< (Mean - ½ SD)
2	Medium	Between (Mean $\pm$ ½ SD)
3	High	> (Mean + ½ SD)

3.11.3 Frequency

Frequency is a representation that displays the number of observations within a given interval.

3.11.4 Percentage

Percentage was used to make the simple comparison of different groups where ever needed.

3.11.5 Chi-square test

A Chi-square test is a hypothesis testing method. The chi-square test was used for checking of whether the observed frequencies in one or more categories match expected frequencies. It is also used to know whether the association exist between two data sets.

3.11.6 Stepwise regression analysis

Stepwise regression is a way to build a model by adding or removing predictor variables, usually via a series of F-tests or T-tests. The variables to be added or removed are chosen based on the test statistics of the estimated coefficients.

3.11.7 Statistical tools used

For the data entry and descriptive statistics MS excel was used and for application of statistical tests SPSS software was used.

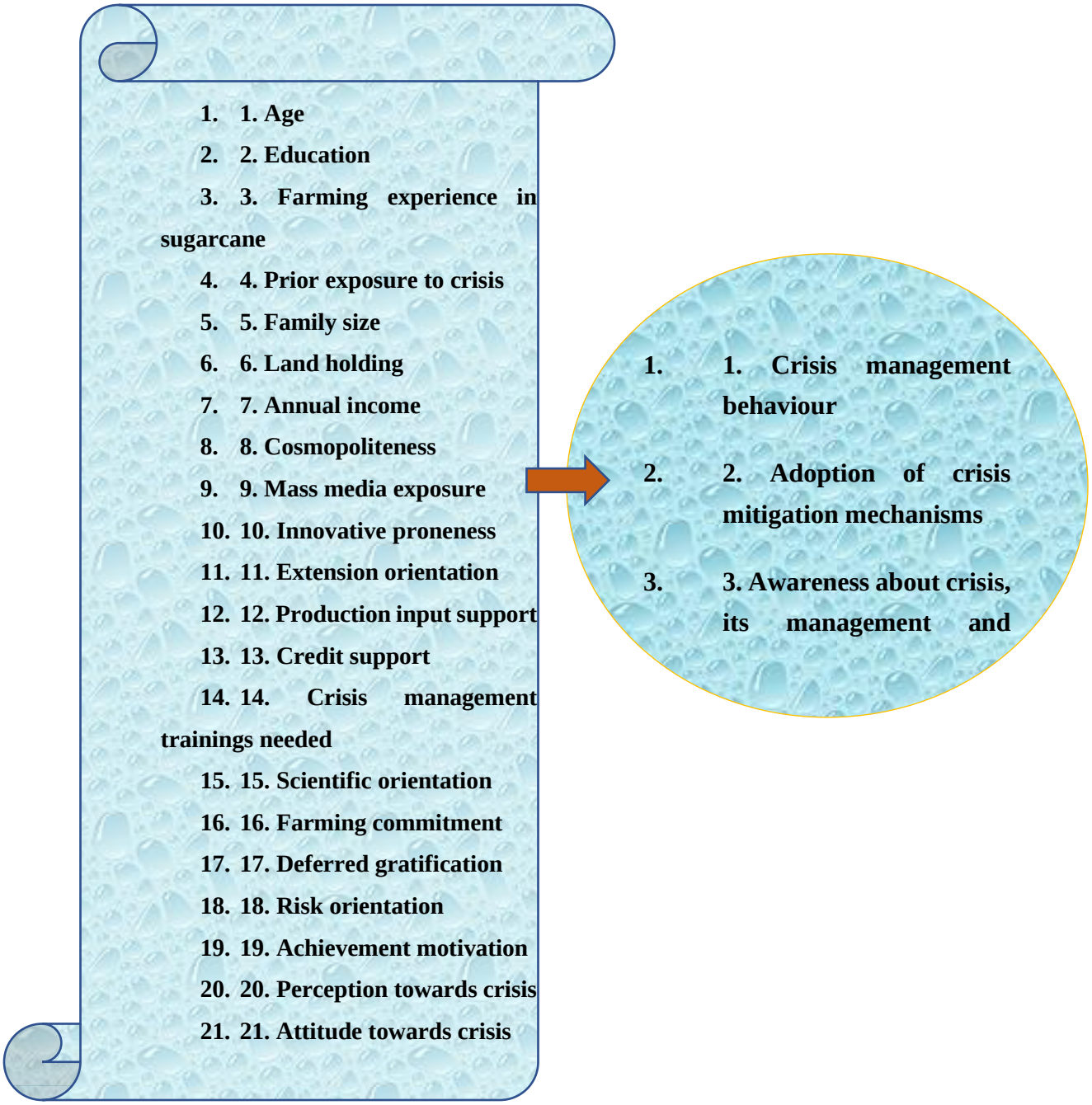

Fig. 2: Conceptual model of the study

IV RESULTS AND DISCUSSION

The detailed findings of the research study are presented in this chapter under the following headings along with discussions.

4.1 Overall crisis management behaviour of sugarcane growers

4.1.1 Dimension wise overall distribution of sugarcane growers

4.1.1.1 Overall decision-making ability of sugarcane growers

4.1.1.2 Overall adaptability of sugarcane growers to the crisis situations

4.1.1.3 Overall economic performance of sugarcane growers

4.2 Statement wise crisis management behaviour of sugarcane growers

4.2.1 Statement wise decision-making ability of sugarcane growers

4.2.2 Statement wise adaptability of sugarcane growers

4.2.3 Mean scores of different indicators of economic performances

4.3 Crisis mitigation mechanisms adopted by sugarcane growers to reduce the effect of crisis

4.4 Awareness about the crisis and its management in agriculture and sugarcane farming

4.5 Awareness about the benefits received by sugarcane growers at different phases of crisis and its management.

4.6 Personal, socioeconomic, organizational and psychological characteristics

4.7 Association between personal, socioeconomic, organizational and psychological characteristics with crisis management behaviour of sugarcane growers

4.8 Stepwise regression analysis showing relative importance of various independent variables in explanation of crisis management behaviour of sugarcane growers

4.9 Case studies related to crisis management in sugarcane farming

4.10 Constraints experienced by sugarcane growers in managing crisis at different phases

4.11 Suggestions given by the sugarcane growers to overcome the constraints faced by them in managing crisis

4.1 Overall crisis management behaviour of sugarcane growers

The Table 3 and Fig. 3 indicated the overall crisis management behaviour of head reach, mid reach and tail end sugarcane growers. With respect to head reach, sugarcane growers more than two fifth (41.25 %) of respondents belongs to the better crisis management behaviour category followed by moderate and poor crisis management category with 37.50 per cent and 21.25 per cent respectively. This might be due to the reasons that head reach sugarcane growers were more prone and face the severity of crisis like floods as their fields are located in the river basin areas. They also took adaptations to different crisis based on their severity like jaggery making of rejected cane and to overcome price crisis, field clearing, excavation of drainages around the field, application of cattle dung + cattle urine slurry and green mulching mainly to overcome the fertility lost due to floods. Being the irrigation water is critical requirement, they do follow and practice the drought ameliorative practices during summer to avoid the river dry off and post floods consequences like electric lanes damage. Some farmers tried drip irrigations but due to blockage of filters and drip pipe holes discontinued its use in head reach region. The spending of head reach sugarcane growers was bit more as sugarcane is their major crop and derive their substantial part of income from it and also investments to overcome the crisis situations.

With respect to mid reach sugarcane growers, less than two-fifth (38.75 %) of them belongs to the moderate crisis management behaviour category followed by better (32.50 %) and poor (28.75 %) crisis management categories respectively. The probable reasons for this trend of results are that the mid reach sugarcane growers were good decision-makers in consultation with the development departments, peer group discussion with fellow farmers, prior exposure and also based on their experience. With respect to the adaptations to crisis situations, mid reach farmers have adapted to various crisis situation based on the frequency of crisis occurrence and its severity on crops. They also considered the expenses of adaptations before undertaking them as it affects their livelihoods. Tail end farmers economic performance was better compared to the head reach and mid reach sugarcane growers as they get better yields as well as high cropping intensity than head reach farmers and uses the local available resources for crisis management.

Similarly, among the tail end sugarcane growers more than two fifth (45.00 %) of them belongs to the moderate crisis management behaviour category followed by poor (37.50 %) and better (17.50 %) crisis management behaviour categories respectively. This trend of results is mainly possible due to the reasons that they wait till the occurrence of crisis especially floods

and droughts. Because the severity was less compared to other categories of sugarcane farmers. But they adapted to crisis situation based on severity. As we observe in case of acute water shortage, they adapted the drip irrigation systems as well as the canal water has helped them to sustain to some extent, uses stored water in wells along with water from streams in critical cases. The good economic performance with cultivation of two or more intercrops especially vegetable crops along with sugarcane helped them to gain good returns. Similarly, the decision-making ability of tail end sugarcane farmers also seems good. They took calculative decisions in all spheres of the farm activities like selection of variety and intercrops, cost benefit analysis before sending sugarcane for crushing to factory or jaggery makers, mulching, arranging capitals, land development and fertility management activities.

Table 3: Overall crisis management behaviour of sugarcane growers.

SI. No.	Category	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f	%	f	%	f	%	f	%
1	Poor (< 273.34)	17	21.25	23	28.75	30	37.50	70	29.17
2	Moderate (273.34 to 289.93)	30	37.50	31	38.75	36	45.00	97	40.42
3	Better (>289.93)	33	41.25	26	32.50	14	17.50	73	30.41
	Mean: 281.6333			**SD: 16.5895**					

X^2 Value=11.86* ; * Significant at 1 per cent level of significance

In crisis management behaviour, little more than two-fifth (40.42 %) of sugarcane growers belongs to the moderate crisis management behaviour category followed by better (30.41 %) and poor (29.17 %) crisis management behaviour categories respectively with marginal differences. Further, the bird eye view of Table 3 indicated that 70.83 per cent of sugarcane growers belongs to the moderate to better crisis management category and 29.17 per cent falls in poor crisis management category. This might be due to reasons that the exposure of sugarcane growers to crisis was more. Further, farmers opined that if the crisis situations like pests, labour shortage, finances and price crisis can be managed effectively. But, crisis situations like floods and droughts cannot be managed effectively as the sugarcane is irrigation intensive crop and severity of these crisis situations was such that farmers cannot control them because of limited capacities in all aspects especially when its severity is crosses the sugarcane growers coping limits. Further, the chi-square indicated the existence of significant difference

in crisis management behavior of sugarcane growers with their category at one per cent level of significance. The findings were somewhat similar to findings of Vinay Kumar (2015).

4.1.1 Dimension wise overall distribution of sugarcane growers

In this section, the distribution of sugarcane growers in identified crisis management dimensions under different categories were presented. The identified broad dimensions of crisis management were decision-making ability, adaptability and economic performance in sugarcane farming. Based on the total scores obtained for each dimension of crisis management the sugarcane growers were categorized into poor, moderate and better categories using the standard deviation and mean.

4.1.1.1 Overall decision-making ability of sugarcane growers

The Table 4 and Fig. 4 indicated the overall decision-making ability of head reach, mid reach and tail end sugarcane growers. With respect to head reach sugarcane, growers more than two fifth (42.50 %) of them belongs to the better decision-making ability category followed by poor (33.75 %) and moderate (23.75 %) decision-making ability categories respectively. With respect to mid reach sugarcane growers, two-fifth (40.00 %) of them belongs to the moderate decision-making ability category followed by better (36.25 %) and poor (23.75 %) decision-making ability categories respectively. Similarly, among the tail end sugarcane growers less than half (45.00 %) of them belongs to the moderate decision-making ability category followed by poor (32.50 %) and better (22.50 %) decision-making ability categories respectively.

In overall decision-making ability more than one-third of sugarcane growers belongs to the moderate (36.25 %) and better (33.75 %) decision-making ability categories respectively followed by poor decision-making ability category with 30.00 per cent. The findings were in congruence with the findings of Vinay Kumar (2015). The possible reasons might be that farmers made the decisions rationally based on their experience and previous exposures to crisis along with suggestions from the fellow farmers who are successful by using local methods. Majority of head reach farmers either established or sent their sugarcane to jaggery making units as farmers get more price than factory as well as prices were paid immediately within a month by the owner of jaggery unit and also flooded cane not accepted by factories. Although development departments and factories informed the farmers with high yielding and improved varieties very few have decided to adopt them mainly due to the insufficient availability of planting material or unknown sources of materials availability. Surplus availability of irrigation water except in summer months and post floods damage of electric lanes made them to think of

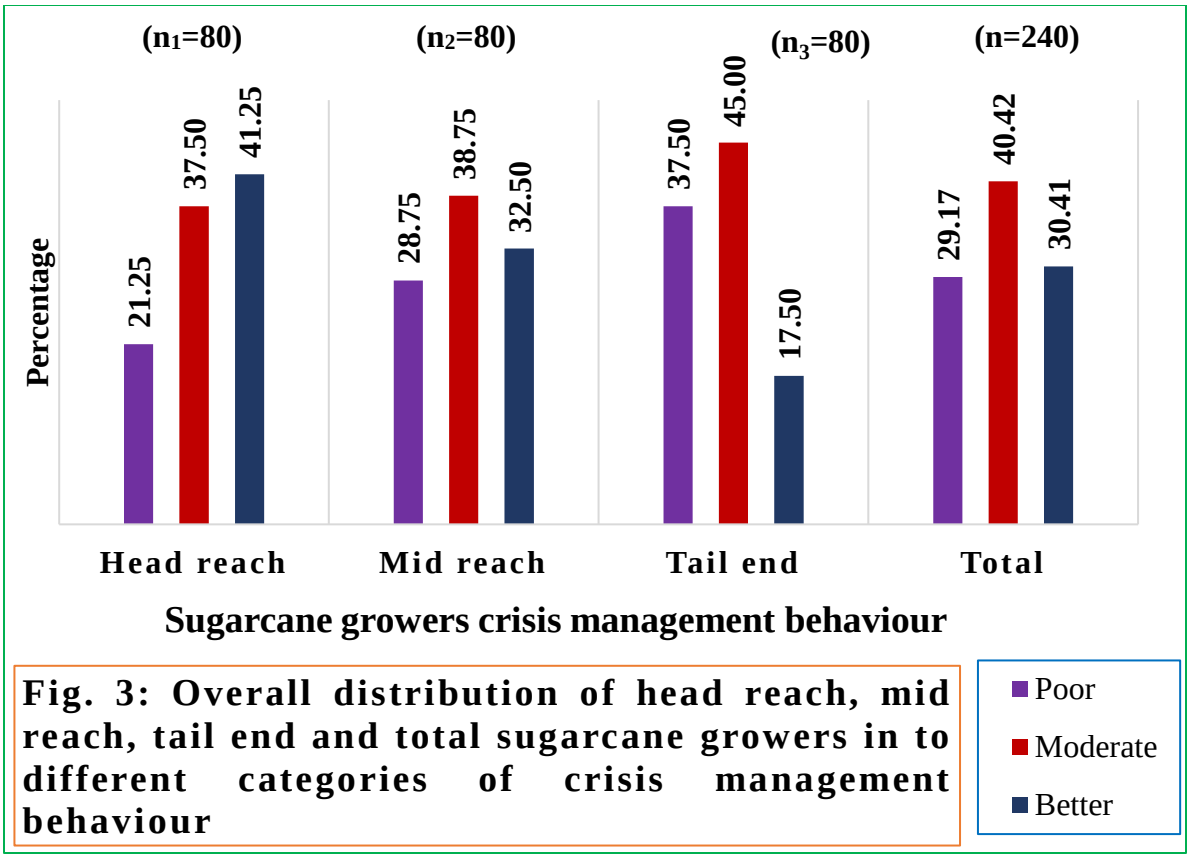

Fig. 3: Overall distribution of head reach, mid reach, tail end and total sugarcane growers in to different categories of crisis management behaviour

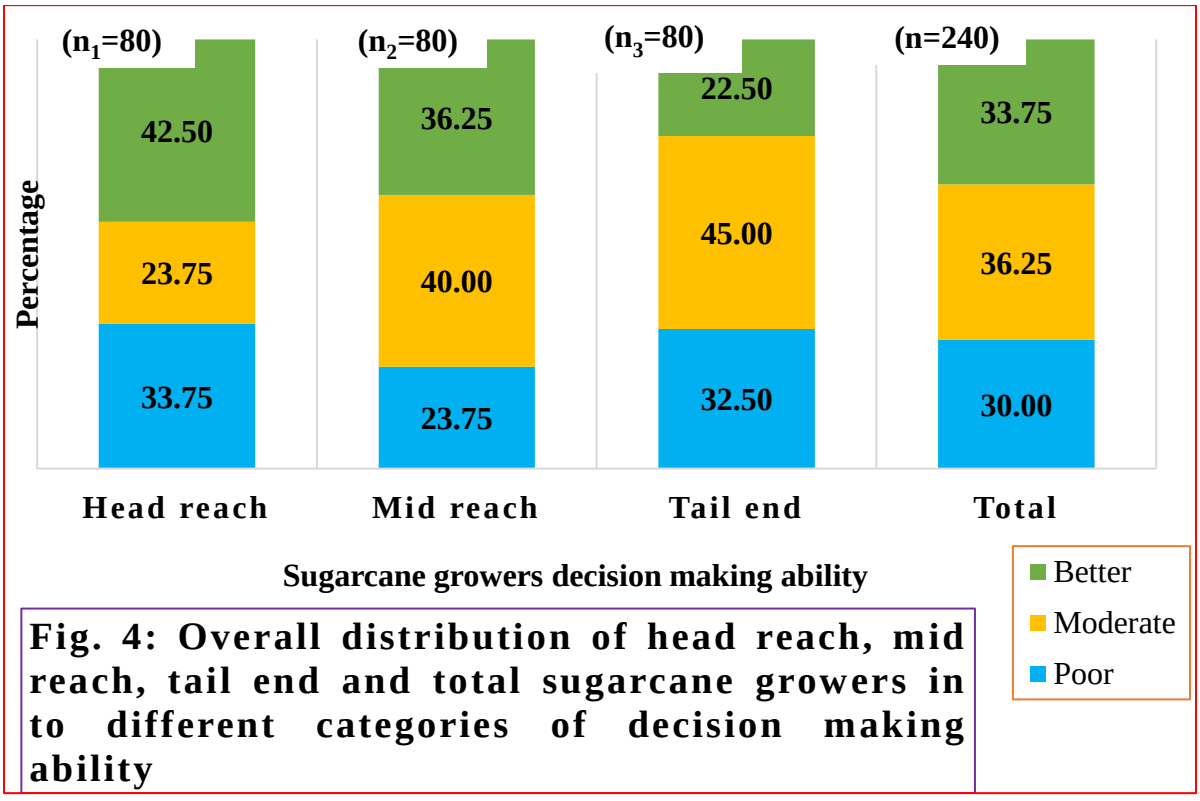

Fig. 4: Overall distribution of head reach, mid reach, tail end and total sugarcane growers in to different categories of decision making ability

and adopt the water saving irrigation methods. Further, weather related information not available to all the farmers' as only few registered farmers are getting the weather updates as well as the market updates from APMCs. Due to the urgency and sufficient needs for money made the farmers to seek financial assistance from informal credit sources and non-institutional sources.

Table 4: Overall decision-making ability of sugarcane growers.

SI. No.	Category	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n =240)	
		f	%	f	%	f	%	f	%
1	Poor (<31.36)	27	33.75	19	23.75	26	32.50	72	30.00
2	Moderate (31.36 to 36.76)	19	23.75	32	40.00	36	45.00	87	36.25
3	Better (>36.76)	34	42.50	29	36.25	18	22.50	81	33.75
Mean: 34.0583				**SD:** 5.3972					

X^2 Value=11.99* ; * Significant at 1 per cent level of significance

The chi-square test results revealed that there was significant difference exists between the decision-making ability categories with sugarcane growers of different regions at one per cent significance level.

4.1.1.2 Overall adaptability of sugarcane growers to the crisis situations.

The Table 5 and Fig. 5 depicted the overall distribution of head reach, mid reach and tail end sugarcane growers based on the obtained adaptability scores. With respect to head reach sugarcane growers, more than two fifth (42.50 %) of them belongs to the moderate adaptability category followed by better (38.75 %) and poor (18.75 %) adaptability categories respectively. With respect to mid reach sugarcane growers, more than one third (35.00 %) of them belongs to the moderate adaptability category followed by better and poor adaptability categories with 32.50 per cent equally. Similarly, among the tail end sugarcane growers more than two fifth (41.25 %) of them belongs to the poor adaptability category followed by moderate (36.25 %) and better (22.50 %) adaptability categories respectively. In overall adaptability, less than two-fifth of sugarcane growers belongs to the moderate (37.92 %) adaptability category followed by better (31.25 %) and poor (30.83 %) adaptability categories respectively. The adaptability results were in congruence with the Shanabhoga *et al.* (2020).

In a nutshell, majority of sugarcane growers belongs to the moderate to better adaptability category. The probable reasons might be the crises have exceeded the coping limits

of sugarcane farmers especially during floods in the head reach and mid reach regions whereas in tail end region farmers have adapted well to water scarcity i.e., drought. Further, farmers altered their sowing dates and adopted chemical methods of pest and disease management and also, they focused more on low/no cost methods to reduce the vulnerability of crisis.

Table 5: Overall adaptability of sugarcane growers to the crisis situations.

SI. No	Category	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f	%	f	%	f	%	f	%
1	Poor (<225.98)	15	18.75	26	32.50	33	41.25	74	30.83
2	Moderate (225.98 - 237.14)	34	42.50	28	35.00	29	36.25	91	37.92
3	Better (> 237.14)	31	38.75	26	32.50	18	22.50	75	31.25
	Mean: 231.5583					**SD: 11.1653**			

X^2 Value=10.79* ; * Significant at 5 per cent level of significance.

The chi-square test tabulated between the sugarcane growers' adaptability categories and sugarcane growers' categories indicated that there was significant difference in adaptability of sugarcane growers at five per cent of significance level.

4.1.1.3 Overall economic performance of sugarcane growers.

The Table 6 and Fig. 6 indicated the overall economic performance of head reach, mid reach and tail end sugarcane growers. With respect to head reach sugarcane growers, less than two fifth (38.75 %) of them belongs to the poor economic performance category followed by moderate (32.50 %) and better (28.75 %) economic performance categories respectively. With respect to mid reach sugarcane growers, two-fifth of them belongs to the moderate economic performance category followed by poor (36.25 %) and better (23.75 %) categories. Similarly, among the tail end sugarcane growers less than half (48.75 %) of them belongs to the moderate economic performance category followed by better (33.75 %) and poor (17.50 %) economic performance categories respectively. In overall, economic performance more than two-fifth of total sugarcane growers belongs to the moderate (40.42 %) economic performance category followed by poor (30.83 %) and better (28.75 %) economic performance categories respectively.

Further bird eye view on Table 6 highlighted that majority (71.25 %) of sugarcane growers were under the moderate to poor economic performance categories. Similar trend has been observed among the mid reach and tail end farmers but in case of head reach farmers most

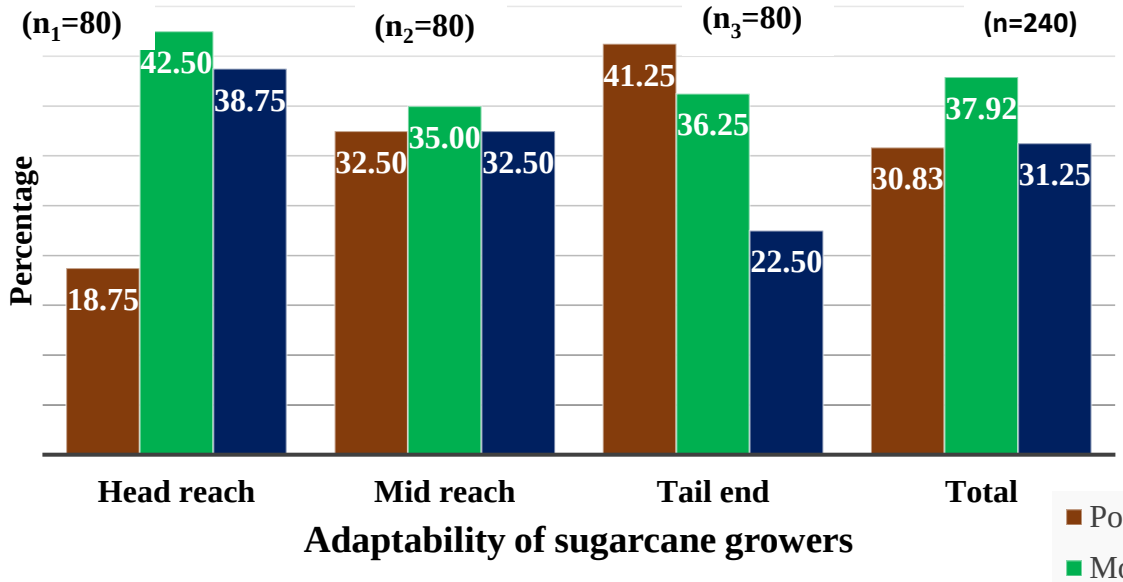

Fig. 5: Overall distribution of head reach, mid reach, tail end and total sugarcane growers in to different categories of adaptability

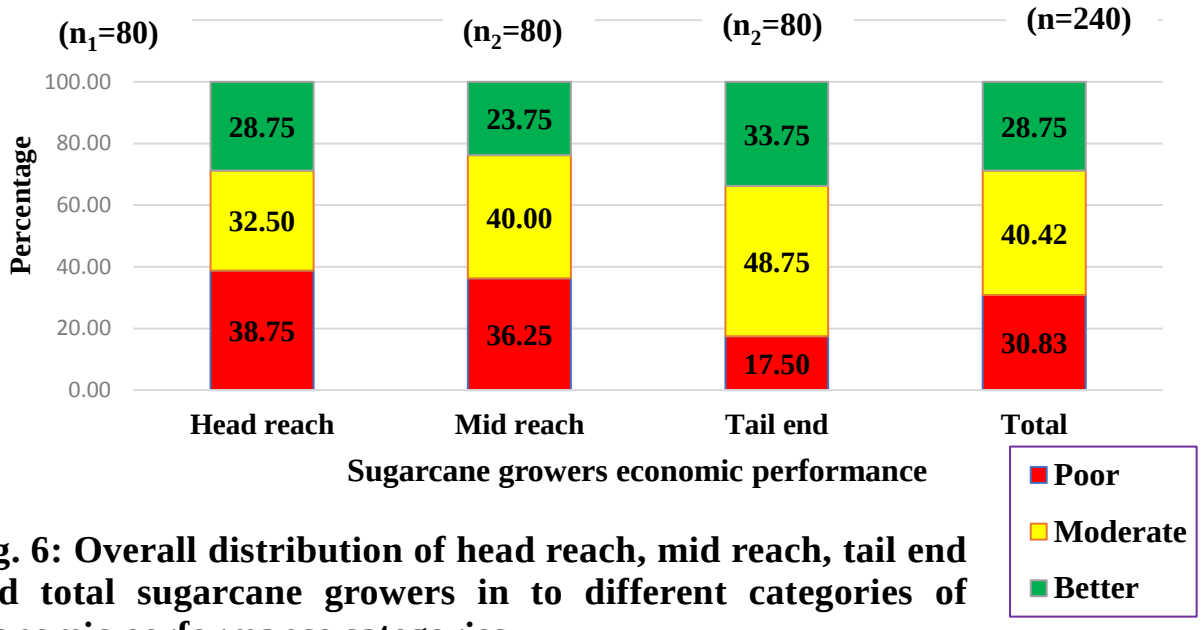

Fig. 6: Overall distribution of head reach, mid reach, tail end and total sugarcane growers in to different categories of economic performance categories

belongs to poor economic performances category. The possible reasons might be that the average yield of sugarcane was less in head reach region due to floods and non-adoption of water saving irrigation methods whereas reverse trend has been observed among the mid reach and tail enders who adopted the drip irrigation to provide critical irrigations to sugarcane crop. Further, head reach farmers grown maize as the intercrop which is also an input intensive/ exhaustive crop but in case of mid reach and tail end regions, variety of intercrops like beetroot, tomato, coriander, black gram, soya bean, onion, marigold, etc., have been grown by sugarcane farmers. The growing of different intercrops helped the mid reach and tail end sugarcane farmers to earn an additional income directly. Further, growing of pulses, legumes, vegetables as intercrops indirectly helped in soil fertility enhancement and adding organic matter into the soil. Also, the head reach farmers opined that they did not rotate the crops as they mainly prepare jaggery and sell it to the traders from whom they brought money in advance for investments as well as to run their jaggery production units. Mid reach and tail end cultivators were planned in such way that part of the sugarcane farm should be rotated with the other high returns commercial crops like turmeric every year. Further, the decisions were made on sending their produce to factory or jaggery makers considering the prevailing market conditions i.e., market costs and returns analysis. The application of chi-square test to economic performance categories with farmers' categories indicated that there was significant association between the economic performances of farmers with the farmers' categories at five per cent level of significance indicating the strong association of sugarcane farmers' categories with their economic performances. The chi-square results revealed that the significant difference in the economic performances of sugarcane growers exists at five per cent significance level.

Table 6: Overall economic performance of sugarcane growers.

SI. No	Category	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f	%	f	%	f	%	f	%
1	Poor (<7.02)	31	38.75	29	36.25	14	17.50	74	30.83
2	Moderate (7.02 to 9.01)	26	32.50	32	40.00	39	48.75	97	40.42
3	Better (> 9.01)	23	28.75	19	23.75	27	33.75	69	28.75
	Mean: 8.0167					**SD: 1.9873**			

X^2 Value=11.01* : * Significant at 5 per cent level of significance

4.2 Statement wise mean crisis management behaviour of sugarcane growers

In this section the results related to crisis management behaviour of sugarcane growers were ranked based on the mean score obtained for their agreement to the each given statements of crisis management dimensions of decision-making ability and adaptations to crisis situations by sugarcane growers. Accordingly, the statements were ranked based on the obtained mean scores in descending order.

4.2.1 Statement wise mean decision-making ability of sugarcane growers.

The Table 7 indicated the statement wise decision-making ability of head reach, mid reach and tail end sugarcane growers as a part of crisis management behaviour in sugarcane farming. In this regard, the head reach sugarcane growers first ranked statement of decision-making ability is the 'decision on selection of specific new varieties of sugarcane like drought tolerant varieties/ submergence/flood tolerant varieties / healthy setts' followed by 'decision on selling sugarcane to jaggery makers or factories based on cost and returns analysis to overcome delayed payment' (Rank II) and 'decision to access finance from formal/ informal sources of credit to cope with crisis (Rank III). The possible reasons might be planting of healthy setts is first priority for every farmer to get good yield, readiness to adopt the submergence/drought tolerant and better sugar recovery varieties of sugarcane provided the planting material is made available in sufficient quantities and timely. Further, the head reach sugarcane growers preferred to sell their produce to jaggery makers/ prepare jaggery on their own because almost every year their fields were affected by floods to some severity. The flood hit cane was rejected by factories and if they purchased also offer lesser price along with mal-practicing in weighing due to poor sugar recovery. Some farmers expressed that on an average one to two quintal per ton of yield was reduced in weighing when compared to private/ local weigh-bridges. Also, a discussion with cane development officers of private factory, they expressed that the submerged sugarcanes' recovery per cent almost reduces up to two per cent based on severity as well as more expenses in processing due to dirt and mud layer on sugarcane. This will further reduce their FRP price which is provided purely based on extra recovery over average sugar recovery percentage. Further, at the time of crisis most of the head reach farmers preferred to borrow money from the informal sources over the formal sources because of timely availability, the urgency to take rehabilitation and reconstructive activities and sufficient access to credits. But to access the finances from formal sources requires needs particular period of time to check and follow protocols. The non-formal sources of credits arranged by sugarcane growers were varying. Most of the farmers borrowed money from

jaggery traders with the agreement to supply particular quantity of jaggery as well as from local money lenders and local goldsmith. Further, few farmers don't have record of rights on their name but still cultivating based on bond paper agreement of purchased land and also, the amount disbursed by PACS and banks was very low.

The first ranked decision-making ability statement to crisis management in sugarcane farming by mid reach sugarcane growers is the 'decision on development of contingency crops plans prior to crisis occurrence' followed by 'decision on selection of the irrigation methods based on the water availability (Rank II)' and 'decision on selling sugarcane to jaggery makers or factories based on cost and returns analysis to overcome delayed payment (Rank III)' as observed from Table 7. The possible reasons might be the agriculture was major source of income and livelihood for them. Hence, to recover the losses occurred due to crop failure alternative preparations in the form of identifying the suitable crop to the season, sources of inputs and arrangements for investments for growing alternative crops was planned by farmers in advance. Farmers preferred to flooded irrigation during water availability till the intercultivation and earthing-up after that they decided to use the drip irrigation by storing water in wells/farm ponds and streams to provide critical irrigations using 2 horse power motors/tractors/generators. Further, farmers of mid reach area preferred to sell their produce to factories because of more tonnages as well as less prices quoted by jaggery makers due to poor recovery of jaggery and problems with hardening of jaggery due to irrigation with bit saline water from streams during acute water shortage and electricity problems on river basin to save crops.

Whereas, the tail end sugarcane growers first ranked decision-making ability statement to crisis management in sugarcane farming is the decision on selection of the irrigation methods based on the water availability followed by decision on development of contingency crop plans prior to crisis occurrence (Rank II) and decision on selection of intercrops based on analysis of costs, benefits and returns (Rank III) as evident from the Table 7. The probable reasons might be that very few tail-end farmers have owned lift irrigation systems from river and others have in partnerships and preferred the drip irrigation from stored water from bore wells and lifted river water in open wells. Few farmers stated that after earthing-up only installed the drip pipes to avoid the blockages, labour shortage and also due to the presence of intercrops. Before the onset of the summer season, the farmers followed two flooded irrigations either in alternate or all rows to increase moisture content in soil as well as to promote decomposition of de-thrashed leaves. Most of the times these farmers prepared well in advance to handle the crises by growing

multiple crops along with sugarcane as well as alternative crop in case of crop failures. Farmers planned for various intercrops like vegetables, tubers and pulses namely tomato, beetroot, carrot, coriander, fenugreeks, soya bean, black gram etc. The logic behind this as expressed by sugarcane farmers was to sell if good prices prevail in market otherwise it was mulched in soil. Farmers were planned the intercrops in such way that the returns from intercrops help them to reduce cost of production of main crop. Further, tail end farmers were more oriented towards the prices of produce as they grown the intercrops with sugarcane based on their experience in market and at least one of the family members were involved in marketing of their produce. If the sugarcane crop was damaged to non-recoverable extent then the sugarcane was slashed off immediately and cultivated high return short duration crops like cabbage, watermelon, cauliflower and also few farmers grown flower crops like marigold for festive seasons after their main crop failed.

With respect to the overall sugarcane growers' decision-making ability, the first ranked decision making ability statement is the decision on development of contingency crops plans prior to crisis occurrence followed by decision on selection of the irrigation methods based on the water availability (Rank II), decision to access finance from formal/ informal sources of credit to cope with crisis (Rank III), and decision on selling sugarcane to jaggery makers or factories based on cost and returns analysis to overcome delayed payment (Rank IV) as evident from the Table 7. The probable reasons were discussed individually at different farmers' category level. Apart from that most of the farmers depend on agriculture as their major source of income as well as livelihood. Hence, the sugarcane farmers prepared well to tackle crisis situations with contingency crops to stabilize their income and get minimum returns even under crisis period. Based on the water availability farmers decided to take the irrigation methods. During the surplus availability of water sugarcane farmers preferred flooded irrigation but in water shortage conditions tail end and mid reach cultivators preferred the drip irrigations and alternate rows wetting but head reach farmers preferred solely alternate furrow wetting method because of blockage of drip filters due to direct flow of river water into them and caused damage to pipelines with created pressure leading to leakage of pipelines. They also decided to take financial assistance from the non-institutional sources as they were providing immediately in sufficient amount without much of paper works by keeping the trusted person as guarantee. These non-institutional sources consist of friends, relatives, goldsmith, jaggery traders, cloth merchants and local leaders / heads of villages / land lords.

Table 7: Statement wise decision-making ability sugarcane growers.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
1.	Decision on development of contingency crops plans prior to crisis occurrence	3.25	IV	3.20	I	3.39	II	3.28	I
2.	Decision on selection of the irrigation methods based on the water availability	2.94	VI	3.16	II	3.51	I	3.20	II
3.	Decision to access finance from formal/ informal sources of credit to cope with crisis	3.31	III	3.11	IV	3.14	IV	3.19	III
4.	Decision on selling sugarcane to jaggery makers or factories based on cost and returns analysis to overcome delayed payment	3.34	II	3.14	III	3.04	VI	3.17	IV
5.	Decision on selection of intercrops based on analysis of costs, benefits and returns	2.64	X	3.10	V	3.26	III	3.00	V
6.	Decision on selection of labour or mechanization based on prevailing situation	3.16	V	2.93	VIII	2.73	X	2.94	VI
7.	Decision on selection of adhoc advises during crisis from scientific community and peer groups	2.83	VIII	3.05	VI	2.88	VIII	2.92	VII
8.	Decision on selection of farm activities based on weather forecasts to overcome uncertainties	2.86	VII	3.03	VII	2.78	IX	2.89	VIII
9.	Decision on selection of specific new varieties of sugarcane like Drought tolerant varieties/ Submergence/flood tolerant varieties/ Healthy setts	3.44	I	2.78	XI	3.11	V	3.11	IX
10.	Decision on value added products preparation based on market demand to overcome price crisis like jaggery and ethanol production	2.51	XI	2.85	IX	2.91	VII	2.76	X
11.	Decision on use of institutional sources of information like price forecasting, input supply and advisory services	2.69	IX	2.84	X	2.70	XI	2.74	XI

4.2.2 Statement wise mean adaptability of sugarcane growers to different crisis situations

In this section the statement wise adaptations of sugarcane growers to different crisis situations like production crisis, soil and water conservation, drought and floods, price and financial crisis, livestock crisis, labour crisis, thrash management and adaptations needed from institutions under adaptability dimension of crisis management identified in sugarcane farming were documented and presented using the mean scores obtained for each statement under each sub-dimension.

4.2.2.1 Statement wise mean adaptability of sugarcane growers to production crisis management.

The Table 8 depicts the statement wise adaptations of head reach, mid reach and tail end sugarcane growers to production crisis situations faced in sugarcane farming. With respect to head reach sugarcane growers, majority of them identified and first ranked the statement 'alteration in sowing dates to reduce the vulnerability of crisis on sugarcane' as the adaptation to production crisis management followed by 'carrying out proper ratoon management practices like stubble shaving and gap filling (Rank II) and to control wooly aphid- spray 2ml chlorpyriphos 20 E.C. or dimethoate @ 1.7ml per liter of water (requires 300-liter solution per acre) (Rank III). The interactions with farmers indicated that most severely affected and frequently faced crisis was floods followed by droughts as well as pest and disease outbreak especially wooly aphid. They adapted to flood and drought crises by early planting sugarcane as it helped them to reach the grand growth stage which cause rarely/ less damage to the crop as well as to cover the land by crop canopy during summer along with dethrashed leaves as mulch to conserve soil moisture. Further, if the crop damage is severe farmers usually go for clearing the field, shaved stubbles to promote uniform regrowth and gap filling to enhance the sugarcane tillers and plant population. They also indicated that slashing and allowing to regrow ratoon reduces up to one-fourth of production costs of sugarcane from replanting. The wooly aphid outbreak in sugarcane was mainly due to prolonged cold weather conditions as expressed by farmers but critical observation indicated that the flooded irrigation in black soil which absorbs and retain more water for longer duration coupled with rains might also be the reasons. For this, head reach farmers responded to manage it by chemical method for early control as its poor management leads to the stunted growth of sugarcane as well as yields reduction to greater extent.

The mid reach sugarcane growers, first ranked production crisis adaptation statement is the carrying out proper ratoon management practices like stubble shaving and gap filling, followed by the statement to control wooly aphid- spray 2ml chlorpyriphos 20 E.C. or dimethoate @ 1.7ml per liter of water (requires 300-liter solution per acre) (Rank II) and the statement to control white grub- stagnation of water for 48 hrs. /drenching imidacloprid / chlorpyriphos @ 1 liter per acre (Rank III) as observed from Table 8. The main reason as expressed by mid reach farmers for stubble shaving is to avoid the multiple tillers which later turn to be grassy shoots and dries off before maturity. In addition to that non-shaving of stubbles lead to lodging of sugarcane due to its loose roots above ground level leading to crop dry. Hence stubble shaving promoted the uniform growth of healthy tillers and if any gaps were filled with sugarcane seedlings purchased from the nurseries at Rs. 2 to 4 per seedling to grow along with tillers. Further, the mid reach sugarcane farmers followed the chemical methods to control wooly aphid and white grub (root grub). The attack of wooly aphid stunted the growth and reduced the tonnage if not treated early. The shoot and root borer usually observed during summer months due to the drip irrigation adoption and no disinfestation of farm yard manure (FYM) before application. Water is stagnated if available in sufficient quantity otherwise chemicals were drenched through drip and sprayer.

The first ranked adaptation of tail end sugarcane growers to production crisis is to control of white grub-by stagnation of water for 48 hrs. /drenching imidacloprid / chlorpyriphos @ 1 liter per acre followed by the statement grown fodder species as wind breakers on bunds to prevent crop lodging (Rank II) and the statement wrapping and propping of canes to prevent crop lodging (Rank III). The probable reasons might be the infestation of white grubs (root borer) was major problem due to improper crop rotations, less flooded irrigations during summer months and lack of disinfectation of FYM as well as early planting. Hence to control the pests, chemicals were drenched based on recommendations of para extension workers as expressed by farmer. Further, they expressed that due to heavy winds and soil properties susceptible to the lodging of crop which gets them the poor yield as well as labours demand more wages at the time harvesting. Farmers tried and adapted to reduce crop lodging by planting wind breakers which acts as fodder to small animals on regular basis like sesbania grandiflora (marachogache) and fodder slips on bunds. Further, they also adopted the wrapping and propping of 8-10 sugarcane plants together to prevent from lodging.

In overall, the sugarcane growers opined that carrying out proper ratoon management practices like stubble shaving and gap filling was the first ranked production crisis adaptation

statement followed by the statement to control white grub- stagnation of water for 48 hrs. /drenching imidacloprid / chlorpyriphos @ 1 liter per acre (Rank II), to control wooly aphid- Spray 2ml chlorpyriphos 20 E.C. or dimethoate @ 1.7ml per liter of water (requires 300-liter solution per acre) (Rank III), reduced the tillers/ plant population of sugarcane during stress season (Rank IV), and wrapping and propping of canes to prevent crop lodging (Rank V) were the other major adaptations to the production crisis by sugarcane growers. The findings especially chemicals methods for pest and disease management were in congruence with Jagadheesha (2006). The critical observations indicated that the adaptations to production crisis management varies with the sugarcane growers type depending on their realistic problems in fields and crisis faced in given condition. Based on which, the adaptations were undertaken by the sugarcane growers to get better yields and returns.

Table 8: Adaptation patterns of sugarcane growers related to production crisis.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
1.	Carrying out proper ratoon management practices like stubble shaving and gap filling	3.86	II	4.10	I	3.63	V	3.86	I
2.	To control white grub- stagnation of water for 48 hrs. /drenching imidacloprid / chlorpyriphos @ 1 liter per acre	3.15	V	3.55	III	3.84	I	3.51	II
3.	To control wooly aphid- Spray 2ml chlorpyriphos 20 E.C. or dimethoate @ 1.7ml per liter of water (requires 300-liter solution per acre)	3.68	III	3.79	II	3.03	VII	3.50	III
4.	Reduced the tillers/ plant population of sugarcane during stress season	3.21	IV	3.40	IV	3.64	IV	3.42	IV
5.	Wrapping and propping of canes to prevent crop lodging	3.11	VI	3.31	V	3.71	III	3.38	V
6.	Grown fodder species as wind breakers on bunds to prevent crop lodging	3.09	VII	3.26	VI	3.73	II	3.36	VI
7.	Alteration in sowing dates to reduce the vulnerability of crisis on sugarcane	4.05	I	2.14	VII	3.25	VII	3.15	VII
8.	To control top and early shoot borer-trichogramma chilonis eggs @ 60000 / 5 times at 10 days interval after 4 weeks of planting / use of chlorpyriphos @ 1.2 liter per acre	3.03	VIII	3.01	VII	3.26	VI	3.10	VIII

4.2.2.2 Statement wise mean adaptability of sugarcane growers to soil and water conservation in sugarcane crisis management.

The Table 9 depicts the adaptations of head reach, mid reach and tail end sugarcane growers related to soil and water conservation as part of crisis management in sugarcane farming. The head reach sugarcane growers first ranked adaptation pattern to soil and water conservation was 'practiced green / dry mulching by growing green manure crops and thrash residues' followed by application of farm yard manure and tank silt to enhance soil fertility and water holding capacity of the soil (Rank II), and constructed bunds and stabilized with grasses to conserve soil and moisture (Rank III). The reasons that farmers gave were the green mulching with crotalaria juncea (Senabu) has reduced the burden of weeding along with adding fertility to soil and making the soil smooth. Further, in subsequent years farmers used the thrash mulch in alternate rows as it enhances the soil fertility along with conservation of soil moisture and increasing the length/time between irrigation schedules by a week. To avoid the rat biting problems in sugarcane thrash was mulched in alternate rows. The head reach farmers also informed that due to the frequent floods, the fertile soil has been lost and in order to recover that tank silt is applied along with FYM before planting and poultry manure between rows after floods. They also opined that mild type of floods enhanced the soil fertility by deposition of silt load. Further, they have constructed the bunds with grasses as well as fodder grasses to avoid soil losses and stabilized the bunds to prevent soil erosion as well as to conserve the soil moisture along with fodder to cattle in river basin and flood prone areas.

With respect to mid reach sugarcane growers' adaptations to soil and water conservation in sugarcane crisis management, the first ranked statement was practiced green/dry mulching by growing green manure crops and thrash residues followed by practiced water saving irrigation methods like alternate furrow wetting and drip irrigation methods (Rank II) and application of farm yard manure and tank silt to enhance soil fertility and water holding capacity of the soil (Rank III). These farmers mainly focused on green mulching in first year that too with tomato because good price fetches good additional income otherwise mulched in soil to enhance soil fertility along with fruits. Along with tomato, leafy vegetables and pulses were grown as intercrops. In subsequent years, thrash mulching was done uniformly across the field after raking and bailing using leftover thrash to conserve soil moisture as well as to grow intercrops in between by dibbling. Further, they indicated that mulching has reduced the weeds, retained the moisture for longer duration and reduced the soil erosion in low lands. Due to deficit water, farmers followed water saving irrigation methods like drip and alternate furrow

wetting methods to save their crop during moisture stress conditions like droughts as well as to use water more judiciously. Drip irrigation also helped them in drenching as well as application of fertilizers to root zone directly. Further, mid reach farmers have opined that they applied the tank silt, FYM, poultry manure and soil from other places to overcome the salinity, water stagnation problems and to improve the soil fertility. Further, few farmers in order to fill the bunds collapsed on stream basin areas applied soil and tank silt by mixing stones and rough rocks in equal proportions. That helps farmers to retain the soil moisture as well as to conserve the soil fertility.

The tail end sugarcane growers ranked the statement application of farm yard manure and tank silt to enhance soil fertility and water holding capacity of the soil as first adaptation mechanism to conserve soil and water followed by the statement constructed farm pond and percolation pits for rain water harvesting and ground water recharge (Rank II) and the statement followed water saving irrigation methods like alternate furrow wetting and drip irrigation methods (Rank III). The reasons might be the saline stream and poor quality bore well water use for irrigation during summer and stagnation of canal water in fields due to poor drainage has led to the soil salinity. Which in turn reduced the germination and growth of crop. Hence, application FYM, poultry manure, soil and silt application reduced the salinity as well as increases the soil fertility and moisture retention capacity as expressed by farmers. Due to the long distance from river basin, increased cases of pipelines damage and pipeline tapping for domestic and cattle use by others, made them to irrigate by mixing river water with bore-wells in open-wells/ farm ponds through drip irrigation system and canal water for flooded irrigation as well as streams/dykes during summer to save crop. Further, they stored the water in the farm ponds to provide the critical irrigations as well as constructed percolation pond to enhance ground water recharging to prevent dry off of bore wells and open wells.

Table 9: Adaptation patterns of sugarcane growers related to soil and water conservation in crisis management.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
1.	Followed green / dry mulching by growing green manure crops and thrash residues.	3.85	I	4.24	I	3.79	IV	3.96	I
2.	Application of farm yard manure and tank silt to enhance soil fertility and water holding capacity of the soil	3.63	II	3.69	III	4.26	I	3.86	II
3.	Followed water saving irrigation methods like alternate furrow wetting and drip irrigation methods	2.76	VI	4.06	II	3.89	III	3.57	III
4.	Followed crop rotation to retain soil fertility after three harvests	3.29	V	3.28	V	3.60	V	3.39	IV
5.	Constructed bunds and stabilized with grasses to conserve soil and moisture	3.53	III	3.49	IV	3.08	VI	3.37	V
6.	Levelled the land to promote uniform infiltration	3.38	IV	3.24	VI	1.98	VII	2.87	VI
7.	Constructed farm pond and percolation pits for rain water harvesting and ground water recharge	2.04	VIII	2.26	VIII	4.10	II	2.80	VII
8.	Constructed water ways along the slope for safe disposal of rain water to avoid soil loss	2.70	VII	2.98	VII	1.83	VIII	2.50	VIII

In nutshell, the total sugarcane growers adapted to soil and water conservation in sugarcane crisis management. The first ranked adaptation statement was 'followed green / dry mulching by growing green manure crops and thrash residues' followed by the statement application of farm yard manure and tank silt to enhance soil fertility and water holding capacity of the soil (Rank II) and the statement followed water saving irrigation methods like alternate furrow wetting and drip irrigation methods (Rank III) were the major adaptations to soil and water conservation by total sugarcane growers is the.

4.2.2.3 Statement wise mean adaptability of sugarcane growers to flood and drought crisis management in sugarcane.

The Table 10 depicts the statement wise adaptations of head reach, mid reach and tail end sugarcane growers to the flood and drought crisis management in sugarcane farming.

4.2.2.3.1 Statement wise mean adaptability of sugarcane growers to flood crisis management in sugarcane.

The glimpses on Table 10 shows the adaptations of sugarcane growers to the flood crisis management in sugarcane farming. Based on the mean scores obtained by respective sugarcane growers the flood adaptation statements were ranked. The head reach sugarcane growers first ranked but mid reach and tail end sugarcane growers ranked second the statement early sowing of sugarcane to reach that growth stag**e** which has minimum damage and effects on cane yield as the adaptation to flood management. The rationale behind the adaptation as expressed by head reach farmers was that based on their previous experiences and exposure to the floods. Further, most of the farmers prefer to plant in October/November so that, by monsoon season crop will be of six to eight months old which can tolerate water stagnation as well as drought conditions by increased crop canopy and mulching dethrashed leaves on ground. The dethrashed leaves help to retain moisture for longer period and prevent loss of top fertile layer of soil.

Table 10: Adaptation pattern of sugarcane growers related to flood and drought crisis management.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
	Flood								
1.	Draining out the flooded water in field as soon as possible	4.12	II	3.95	I	3.08	I	3.72	I
2.	Early sowing of sugarcane to reach that growth stag**e** which has minimum damage and effects on cane yield due to flooding	4.21	I	3.93	II	2.99	II	3.71	II
3.	Field is cleared immediately and grown short duration crops like maize/wheat after flood occurrence	3.91	IV	3.23	IV	2.16	V	3.10	III
4.	Slashing of severely damaged cane to promote ratooning	3.94	III	3.39	III	1.44	IX	2.92	IV
5.	Construction of stone or sandbag structures to avoid water and silt load into field	3.70	V	2.94	V	1.61	VIII	2.75	V
6.	Cultivating varieties tolerant/resistant to waterlogging and salinity	2.83	VI	2.35	IX	2.70	III	2.63	VI
7.	Restoration of normal soil characteristics by wetland restoration practices	2.73	VII	2.78	VII	2.18	IV	2.56	VII
8.	Use of hazard insurance for crops	2.44	VIII	2.60	VII	2.03	VI	2.36	VIII
9.	Use of desalination systems in the sugarcane field (nanofiltration, microfiltration and solar energy)	2.25	IX	2.86	VI	1.84	VII	2.32	IX
	Drought								
1.	The stripped lower leaves and thrash residue of sugarcane is useful as mulching to conserve soil moisture	4.21	I	3.64	I	4.28	I	4.04	I
2.	The temporary farm pond/bore well in river or deepened the existing bore wells to provide critical irrigations using improved irrigation methods	3.61	II	3.34	II	4.15	II	3.70	II
3.	Increased use of organic manure with gradual reduction of chemical fertilizers	3.29	III	3.23	III	3.53	IV	3.35	III
4.	Earthing-up in main sugarcane and ratoon crop helps in soil and moisture conservation and to remove excess water	3.13	IV	3.18	V	2.85	VII	3.05	IV
5.	Foliar spraying of 2.5% urea & 2.5% KNO_3 / anti-transpirants during water stress results in better crop growth and increases yield	2.81	V	3.20	IV	2.96	VI	2.99	V
6.	Reducing the area under sugarcane in forthcoming years	2.31	VI	2.35	VII	4.08	III	2.91	VI
7.	Cultivating drought tolerant and short duration varieties	2.14	VII	2.66	VI	3.33	V	2.71	VII

Similarly, the mid reach, tail end and total sugarcane growers ranked first but head reach farmers second ranked the adaptation statement drain out the flooded water from the field as soon as possible to flood management in sugarcane farming. The stagnated water in the field was drained out to dry the field and promote the aeration to the silt sunken roots of cane. This might be due to their experience in farming as well as lesser exposure to severe floods. Based on their experience due to heavy rains/ overflow of stream into field, the water accumulated was drained out to avoid crop damage and disease outbreaks.

Further, the head reach and mid reach farmers third ranked adaptation statement was slashing of severely damaged cane to promote ratooning but the tail end farmers third ranked adaptation statement to floods management is cultivating varieties tolerant to waterlogging and salinity. This trend of result might be due to fact that the severity of damage caused by floods is high in head reach and mid reach area compared to tail end region as they are far from river basin. Further, the immediate slashing of sugarcane promotes the ratooning of sugarcane as well as reduces the extra expenditures on replanting to some extent. In case of improper growth of ratoon crop, contingency crops like maize, wheat, vegetables like cabbage, cauliflower, carrot as well as watermelon and marigold were grown based on the time and their convenience.

4.2.2.3.2 Statement wise mean adaptability of sugarcane growers to drought crisis management in sugarcane.

The glimpses of the Table 10 depicted the adaptation patterns of head reach, mid reach and tail end sugarcane growers to manage drought crisis in sugarcane farming. Irrespective of their category sugarcane farmers first ranked statement was the stripped lower leaves and thrash residue of sugarcane is useful as mulching to conserve soil moisture as their adaptation to drought crisis followed by the statement the temporary farm pond/bore well in river or deepened the existing bore wells to provide critical irrigations using improved irrigation methods (Rank II). The probable reasons might be that the thrash residues are available at zero cost/no cost. It additionally becomes the compost after the decomposition and helps in moisture retention by enhancing soil carbon and organic humus. Sugarcane farmers also expressed that it enhances water holding capacity of soil along with reducing the weeds in field. Further, farmers also expressed that it conserved the soil from erosion in runoff areas/ low land fields as well as in flood prone fields. The farmers expressed different reasons for water saving irrigation methods adaptation. The head reach farmers adapted only alternate furrow wetting method by digging temporary bore-wells in dried off river itself whereas most of mid reach and tail end farmers

adapted both alternate furrows wetting as well as drip methods of irrigation based on their convenience and water availability in open wells, bore wells, streams as well as from canals by storing in water storage structures to provide critical irrigations to save crops during water shortage/drought. The findings are in relevance with Kumar and Nanda Kumar (2003) findings.

4.2.2.4 Statement wise mean adaptability of sugarcane growers to price and financial crisis management in sugarcane.

Table 11 depicts the statement wise adaptations of sugarcane growers to the price and financial crisis management in sugarcane farming. The adaptation statements were ranked using mean scores obtained.

4.2.2.4.1 Statement wise mean adaptability of sugarcane growers to price crisis management in sugarcane.

The glimpses of Table 11 indicated the head reach, mid reach and tail end sugarcane growers' adaptations to the price crisis in sugarcane. Irrespective of farmers' category most of them ranked the statement wholesale-based selling of sugarcane to the jaggery makers as first rank. The reasons as expressed by the farmers were the wholesale selling to jaggery makers reduces faulty weighing, no need of labours for harvesting as it was the responsibility of jaggery makers to clear the field by the end of mutually agreed time. Further, they received their payments up to 50% in advance and remaining amount within 2-4 weeks after complete harvest and selling of jaggery. Some of them also opined that they have received the money from the owners in emergency conditions hence sold it to them. Further, the submerged and flood affected sugarcane was rejected by the factories and faulty weighing due to poor recovery from flood affected cane forced them to prepare jaggery or to sell their produce to jaggery makers on available good prices. The second ranked statement is that jaggery production to overcome delayed payment. Although the wholesale selling reduces their responsibility, farmers went for jaggery production on rental basis mainly because of the jaggery unit owners rejected to buy their produce because of some technical and production issues like submergence in water, growing in slightly saline soils and poor recovery of jaggery from sugarcane and late hardening of jaggery. Under such conditions, farmers came forward to produce jaggery by paying rent to the jaggery unit owners where farmers have responsibility of harvesting and carrying cane from field to jaggery production unit as well as final selling of the jaggery. The third ranked adaptation statement to price crisis is sold sugarcane for setts/seed purpose. The reasons expressed by farmers that at least one fourth of sugarcane fields have been replanted every year

as a part of rotation and at least one fourth of the head reach farmers replanted canes due to flood damages. Further, farmers said that the nursery people will come and purchase from them based on the quality to establish seedlings in nursery. Apart from that few farmers were selling for aesthetic purposes mainly during festivals like Ugadi, Navaratri and Dasara by transporting it to major cities like Belagavi, Mumbai, Kolhapur and other nearby major cities where they get around Rs. 10-20 for each sugarcane plant.

4.2.2.4.2 Statement wise mean adaptability of sugarcane growers to financial crisis management in sugarcane.

The insights into Table 11 provided the adaptability of sugarcane growers as part of crisis management in the context of financial management. The different trend of results between the farmers' categories can be seen with respect to the financial management. The head reach sugarcane growers expressed that the first ranked adaptation statement to financial crisis is saved money during normal year to utilize the same during crisis period followed by the statement mortgaged valuable assets like gold/home to meet capital needs (Rank II) and the statement borrowed loan from non-institutional sources like money lenders (Rank III). The similar trend of results can be observed with respect to the total sugarcane growers' financial management adaptations to crisis management in sugarcane farming. The probable reasons might be their earlier exposure to the crises and also most of them are small to medium farmers who usually think twice before investing in anything and their poor conditions made them to save the extra earnings to save during normal years. Some also expressed that usually saved money for the social, family and devotees functions was used during crisis to meet immediate needs and during ceremonies borrowed from money lenders and others. Further, farmers also expressed that if crisis management requires small amounts/investments to recover, then they usually preferred to get mortgaged loans on gold and other precious materials from goldsmiths and private / local cooperative banks because of lower interests and quicker availability of loan to them. The farmers also indicated that if investment to undertake recovery, rehabilitation, prepare for crisis adaptations as well as other developmental works farmers preferred to get loan from non-institutional money lenders because of its timely availability in sufficient amount although there is high interest on principle. The major contributors to non-institutional sources of lending were the jaggery traders, cloth merchants, local leaders and goldsmiths.

Similarly, mid reach sugarcane growers first ranked adaptation statement is mortgaged valuable assets like gold/home to meet capital needs as adaptation to financial crisis management followed by the statement saved money during normal year to utilize the same

during crisis period (Rank II) and the statement borrowed loan from non-institutional sources like money lenders (Rank III). The reasons expressed by farmers were that mortgaging will reduce the interest rates as well as sufficient loans are approved by money lending agencies. The farmers also saved the money from the additional earnings by paying the pigmies every week to cooperative society as well as in the form of gold, silver and other valuable items which they can use at any time. The savings in the form of money has led to spending unnecessarily and also due to drinking habits of few family persons preferred to pay pigmies as systematic investment plans. The farmers who have good contacts with shop owners by regular purchasing in their shops as well as taking their fellow farmers to purchase from them like goldsmiths, cloth merchants, kirana stores etc., are providing loan to them by keeping the leader as a guarantee. Apart from that local money-lenders are providing money to all the farmers at needy time by keeping some known person to them as the guarantee. The loan is available in sufficient quantity and timely. Further, farmers also indicated that farmers have not paid dues for longer duration in the bank, left until the waive-off by government and made one-time settlements which is hindering the farmers to get institutional credit support.

Table 11: Adaptation pattern of sugarcane growers related to price and financial crisis management.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
	Price crisis management	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**
1.	Wholesale based selling of sugarcane to the jaggery makers	4.23	I	4.39	I	4.33	I	4.32	I
2.	Jaggery production to overcome delayed payment	4.10	II	3.44	II	3.45	II	3.66	II
3.	Sold sugarcane for setts/seed purpose	3.04	III	2.84	III	2.44	III	2.77	III
4.	Sold sugarcane to locals for juice/aesthetics purpose	1.97	V	2.80	IV	2.34	IV	2.37	IV
5.	Demand based value addition of sugarcane into powdered jaggery, liquid jaggery and flavored jaggery to get higher and immediate returns	2.59	IV	2.61	V	1.88	VI	2.36	V
6	Contract farming with jaggery makers and sugarcane factories	1.57	VI	2.03	VI	1.95	V	1.85	VI
	Financial crisis management								
7.	Wholesale based selling of sugarcane to the jaggery makers	4.23	I	4.39	I	4.33	I	4.32	I
8.	Saved money during normal year to utilize the same during crisis period	4.23	I	4.09	III	3.58	III	3.97	II
9.	Mortgaged valuable assets like gold/home to meet capital needs	3.90	III	4.19	II	3.46	IV	3.85	III
10.	Borrowed loan from non-institutional sources like money lenders	3.51	V	3.74	IV	3.81	II	3.69	IV
11.	Cultivated maize/sweet corn as intercrops over recommended intercrops in sugarcane to get additional income	3.54	IV	2.63	VI	2.40	V	2.86	V
12.	Borrowed loan from institutional credit sources like commercial bank/ Primary land development bank (PLDB) for land development / Borrowed crop loan from PACS/SHGs/Banks	2.61	VII	3.13	V	2.01	VII	2.58	VI
13.	Rearing and selling of small livestock like sheep/goat to meet emergency financial needs	3.05	VI	2.06	VII	2.05	VI	2.39	VII

Tail end sugarcane growers ranked the statement borrowed loan from non-institutional sources like money lenders as first followed by saved money during normal year to utilize the same during crisis period and mortgaged valuable assets like gold/home to meet capital needs as second and third ranked financial adaptations to crisis management in sugarcane respectively. The probable reasons might be the non-clearance of previously obtained loan by farmers with the thought of waive-off by government, improper land documents and if documents are there that too in the names of grandparents/their parents. In addition to this, they borrowed for short term as they return it in stipulated time because of their mobility and regular touch with the markets for selling their produce and contracted produce where they gain and return the borrowed money that reduced their interest rate burden. Further, farmers pay the pigmies to save the extra earnings which they use after maturity and in emergencies they will get up to 25000/- financial help for them during distress condition by considering their pigmies as securities as well as the regularity of paying the installments. If the extra loans were required immediately farmers have consulted and obtained loan by keeping their assets like tractor, gold, vehicles as the surety to some extent. Further, farmers have obtained loans especially from the factories in advance by agreeing to supply the minimum quantity of sugarcane to them. Similarly, the farmers obtained advances on interest to supply the minimum quantity of jaggery to the jaggery traders. Although, most of the farmers are obtaining loans from the primary cooperative societies on regular basis in small amounts but not specifically during the crisis periods.

4.2.2.5 Statement wise mean adaptability of sugarcane growers to overcome the labour crisis in sugarcane farming.

The glimpse of the Table 12 depicted the statement wise adaptations of head reach, mid reach and tail end sugarcane growers to overcome the labour crisis in sugarcane farming. Irrespective of the farmers' category, the sugarcane growers first ranked the statement lending loan to labours in advance as adaptation to labour crisis management in sugarcane farming. This might be due to the reasons that labours have borrowed from farmers at the time of family functions and social functions like marriages of son and daughter, baby shower, naming ceremony, fulfilling devotees wishes as well as during health emergencies like delivery, sudden illnesses etc. Apart from that they have borrowed from farmers to pay their pigmies to SHGs during non-working days. Some also borrowed from tractor owners with agreement to work during sugarcane carrying to factory as gang man / member of gang. In order to repay their borrowings to farmers they will work as the labours in their fields. Majority of them opined that

if not given money to labours during their needed time, labours go to other farmers' field who lend them money to overcome their family needs.

Similarly, head reach, mid reach and all the sugarcane growers second ranked whereas tail end sugarcane growers third ranked the statement hiring labours from nearby villages by providing transportation facilities to them. For the activities like weeding, de-thrashing and other labor-intensive tasks like wrapping of canes they hired from other villages. The reasons were that local labours wage rates are high compared to nearby villages labours by Rs. 10-20 per day per labour and also the nearby village labours working hours are more by at least two hours' difference. The local labours mostly go to work under the constructors (Goudi's) for house construction in villages and cities, canal works, road contract works etc. Further, they expressed that use of herbicides was avoided due to intercrops presence. The usage of herbicide/weedicides might lead to intercrops failure and damage as the tail end farmers cultivated vegetables and perishable crops as intercrops.

The head reach, mid reach and total sugarcane growers ranked third but tail end farmers second ranked the statement involvement of family members in farm activities during peak work by suspending their regular work as an adaptation to labour crisis. The possible reasons were that extreme non-availability of labour during peak hours was unavoidable to involve family members in the farm activities as these farm tasks are time bound and seasonal based which requires critical care at certain stages of production. Keeping that in mind they took the decisions. Apart from those farmers were growing the vegetables and perishable crops like leafy vegetables like coriander which has to be harvested during festive seasons to get better prices at that time labours are not available. The early morning before leaving to their regular work family members are involved in farm activities irrespective of the labours availability. Hence, used the family members for early morning harvesting, tying, packaging, grading and marketing purposes.

4.2.2.6 Statement wise mean adaptability of sugarcane growers to livestock management during crisis.

The bird eye view of Table 13 depicted the statement wise adaptations of head reach, mid reach, tail end and all sugarcane growers to the livestock management during crisis. Head reach, mid reach and all sugarcane growers first ranked but tail end sugarcane growers third ranked the statement growing fodder in a piece of irrigated land with forage trees/crops as livestock management adaptation during crisis period. The possible reasons might be that most of the head reach and mid reach farmers were domesticated the buffaloes and cows for milk production for home consumption as well as commercial selling which requires extra nourishment and hence, sugarcane farmers planted fodder in separate piece of irrigated land for fodder production. Whereas the tail end farmers first ranked, mid reach and total farmers second ranked and head reach farmers third ranked the statement increased the small animals like sheep/ goat and decreased the voracious feeding animals during crisis time as livestock management adaptation during crisis periods. This might be due to the reasons that the farmers believed that during droughts it is difficult for them to feed the cattle hence they kept one/two cattle for family milk consumption and concentrated on small animals as it is easy to take them for grazing in hilly regions and also during normal years. These sheep and goats also earned extra incomes from stalling/sheep penning at different farmers' field to their owners. Further, they quoted those small ruminants earned more than cattle for them. Further, head reach and mid reach farmers indicated that it was very easy for them to carry during the floods and also to feed during the summer as they can survive by grazing at any area.

Further, head reach farmers second ranked the statement purchased the fodder from fodder bank / other farmers on debt during crises as livestock management adaptation during crisis time. The reasons might be that usually farmers stored their traditional fodder in the form of dry maize and jowar fodder but due to non-availability of green fodder during crisis, made the farmers to purchase the chopped jowar and maize fodder from fodder banks/ fodder factory of Yadawad as well as fellow farmers who have surplus fodder.

Table 12: Adaptation pattern of sugarcane growers to overcome labour crisis.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Mean	Mean	Rank	Mean	Rank
1.	Lending loan to labours in advance	4.32	I	4.10	I	4.28	I	4.23	I
2.	Hiring labours from nearby villages by providing transportation facilities to them	4.13	II	3.89	II	4.04	III	4.02	II
3.	Involvement of family members in farm activities during peak work by suspending their regular work	3.48	III	3.29	III	4.09	II	3.62	III
4.	Use of herbicides and weedicides for weed management	3.22	VI	3.01	V	3.63	IV	3.29	IV
5.	Mutual understanding with friends and relatives in peak work seasons to help each other	3.38	IV	3.11	IV	2.90	V	3.13	V
6.	Use of implements/ equipments to carryout farm operations	3.30	V	2.99	VI	2.89	VI	3.06	VI

Table 13: Adaptation pattern of sugarcane growers related to livestock management during crisis.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
1.	Growing fodder in a piece of irrigated land with forage trees	4.20	I	3.98	I	3.71	III	3.96	I
2.	Increased small animals like sheep/ goat and decreased the voracious feeding animals during crisis time	3.70	III	3.83	II	4.21	I	3.91	II
3.	Increased the supplementary feeding to livestock	3.49	IV	3.38	III	3.81	II	3.56	III
4.	Purchased the fodder from fodder bank / other farmers on debt during crisis	4.03	II	3.23	IV	2.63	VI	3.30	IV
5.	Fodder preserved in the form of silage and hay for future	3.23	V	2.89	VI	3.08	V	3.07	V
6.	Shifting animals to safe places before occurrence of flood and sent to goshalas during drought	3.04	VI	2.98	V	3.15	IV	3.06	VI

Similarly, the mid reach and total sugarcane farmers third ranked and tail end farmers ranked second to the statement increased the supplementary feeding to livestock as livestock adaptation to crises. The possible reasons might be the farmers were rearing cattle for domestic milk consumption purpose and some earning their weekly groceries out of milk selling. Hence, they can't sell their cattle, they increased the use of concentrated feed during crisis to avoid reduction in yield of milk.

4.2.2.7 Statement wise mean adaptability of sugarcane growers to thrash management.

The bird eye view of Table 14 depicted the head reach, mid reach, tail end and all sugarcane growers' adaptations to the thrash residue management in sugarcane cultivation using the mean adaptability score obtained for each statement. The head reach, tail end and all sugarcane farmers first ranked and mid reach farmers second ranked the statement mulching of sugarcane thrash residue in alternate rows as adaptation to thrash residue management. The reasons as quoted by sugarcane growers were that mulching reduced the weeds in the field, increased the moisture retention for longer period and also adds organic manure to the field after decomposition. They also expressed that mulching in alternative rows gave them opportunity to grow the intercrops along with the ratoon crops. It also helped the crop to tolerate the stress conditions like drought, soil erosion due to heavy runoff of rainwater and it makes the soil properties better due to coverage and by adding humus.

Head reach, tail end and all sugarcane farmers ranked second but mid reach sugarcane farmers third ranked the statement thrash is used as firing material / biofuel in jaggery production as an adaptation to the thrash residue management in sugarcane farming. The probable reasons might be the farmers selling their produce to jaggery makers who will take the thrash residue for igniting the fire during morning and stored it to use in cold conditions which requires more fuel. The left-over thrash was either burned or mulched in alternate rows. The practice of closed row spacing might also be reason as it hinders/troubled the farmers in frequent inter-cultivation. The tail end farmers preferred to maintain minimum thrash and clear extra thrash because of rat bite problem for drip pipes if sugarcane thrash is more in the field.

Similarly, mid reach farmers first ranked but head reach, tail end as well as all sugarcane farmers third ranked the statement thrash is baled and raked to sell it to biorefineries and jaggery units as an adaptation to thrash residue management in sugarcane. The probable reasons were that the grape growers from Vijayapura district and nearby Maharashtra districts come with

their baling and raking machines. The raked bales were shared between the farmers and balers on 70:30 basis which they used for mulching in the grape fields during summer months. Hence, the farmers sold the raked bales of sugarcane thrash to the jaggery makers for fuel purpose, big dairy farmers for bedding material, sold to biorefineries as well as dry fodder with value addition to their own cattle. By this farmer get some additional income along with clearing the fields.

4.2.2.8 Statement wise mean adaptations needed from institutions/government for comprehensive crisis management according to sugarcane growers.

The bird eye view of the Table 15 depicted the adaptations needed from institutions/ government according to head reach, mid reach and tail end sugarcane growers for comprehensive crisis management in sugarcane. The adaptations indicated by sugarcane growers were ranked using the mean adaptability score obtained for each statement. Irrespective of their category, the sugarcane growers first ranked the statement government should frame rigid laws and take actions against the factory owners for delayed payment as the major adaptation needed from institution/ governments. The reasons for this might be due to the farmers' exposure to price arrears every year. The farmers also mentioned that factories made payments immediately (within thirty days) for initial procurements to attract other farmers but did not paid the price of sugarcane immediately for late senders of sugarcane to factories. In most of the cases the tractor owners carry their own labours and relatives to harvest their produce irrespective maturity of cane to get early payments from factories instead of carrying matured cane of other farmers. Hence, they strongly felt that if rigid laws were framed for delayed payments, then these flaws would be addressed and factories can also get the matured cane and better recovery which in turn can help farmers to get better FRP.

The mid reach and tail end sugarcane growers second ranked the statement uniform price for sugarcane across the country but head reach farmers second ranked the statement immediate and adequate responses from line departments to help farmers at all stages of sugarcane crisis management as adaptation needed by government / institution for comprehensive crisis management in sugarcane. The reasons might be the prices per tonne of sugarcane fixed by factories vary greatly within the taluk as well as district. Hence, there should be a uniform price for sugarcane as expressed by farmers. Further, the fair and remunerative prices provided in second instalment also vary from factory to factory. Hence, farmers strongly feel that prices should be uniform at least in a region like district/state.

Further, the sugarcane growers of all regions third ranked the statement government should replace fair and remunerative price with MSP as an adaptation needed from government to tackle sugarcane crisis. The reasons might be that farmers were of the opinion that present sugarcane pricing involves double pricing mechanism consisting of first payments (delayed) and second payment (FRP) fixed based on sugar recovery. Further, there was no guarantee of getting or announcement of FRP among farmers because in last two years FRP was not disbursed mentioning the reason sugar recovery reduced below average due to submergence in floods. Hence, farmers were in demand to provide the minimum support price for sugarcane instead of fair and remunerative prices through single pricing mechanism rather than following double pricing mechanism.

Table 14: Adaptation patterns of sugarcane growers to thrash management.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
1.	Mulching of sugarcane thrash residue in alternate rows	4.33	I	4.03	II	4.60	I	4.32	I
2.	Thrash is used as firing material / biofuel in jaggery production	4.01	II	3.56	III	4.41	II	3.99	II
3.	Thrash is baled and raked to sell it to biorefineries and jaggery units	3.94	III	4.21	I	3.79	IV	3.98	III
4.	Collected thrash is used as bedding material for livestock	3.46	IV	3.53	IV	3.78	V	3.59	IV
5.	Enriched thrash can be used as feed and fodder	2.80	V	3.46	V	4.30	III	3.52	V
6.	Thrash is burnt in the field	2.76	VI	2.53	VII	3.15	VI	2.81	VI
7.	Collected thrash is used as raw material for compost preparation	2.72	VII	2.91	VI	2.74	VII	2.79	VII

Table 15: Adaptations needed from institutions/government for comprehensive crisis management according to sugarcane growers.

SI. No.	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
1.	Government should frame rigid laws and take actions against the factory owners for delayed payment	4.46	I	4.4	I	4.15	I	4.34	I
2.	Uniform price for sugarcane across country	3.06	V	3.33	II	4.09	II	3.49	II
3.	Government should replace fair and remunerative price with MSP	3.41	III	3.19	III	3.36	III	3.32	III
4.	Immediate and adequate responses from line departments to help farmers at all stages of sugarcane crisis management	3.43	II	2.75	V	2.59	V	2.92	IV
5.	Cumbersome procedures should be made easy and immediate sanctioning of loans during crisis period	3.32	IV	2.65	VI	2.36	VI	2.78	V
6.	Government should adopt single sugarcane pricing mechanism instead of double sugarcane pricing mechanism	2.41	VII	2.80	IV	2.73	IV	2.65	VI
7.	Separate development programmes for sugarcane byproducts promotion	2.86	VI	2.49	VII	2.29	VII	2.55	VII

4.2.3 Mean scores of different indicators of economic performances.

The Table 16 depicted the mean scores of different indicators of the economic performances of head reach, mid reach and tail end sugarcane growers to know the efficiency of crisis management in sugarcane farming.

The Crop Yield Index (CYI) number expresses the average of the yields of different crops in given farm / locality (primary locality) relative to the yield of same crops on another farm / locality (secondary locality). In this study the state average yield was used as second locality yield to compare with the investigation areas primary yield. The mean CYI of head reach (95.46) and mid reach (98.77) sugarcane growers was lesser whereas tail end sugarcane growers have better CYI with index number of 101.20. This indicates that the head reach and mid reach farmers were getting the lesser yield than the state average yield but tail enders were getting more than the state average yield. On an average, total sugarcane growers had 98.48 mean CYI indicating that the average yield of study area was lesser than the state average yield. The probable reasons might be that head reach and mid reach farmers frequently affected by the crisis mainly floods and droughts which induced acute shortage of water at critical stages of the crop. The river dries off during summer months and deterioration of soil fertility over the years due to runoff of floods through fields as well as non-judicious use of fertilizers coupled by the less adoption of improved irrigation methods due to their own location/ situation specific problems. Further, the tail enders' effectiveness with better CYI is mainly due to the use of drip irrigation method as well as availability of alternative sources of irrigation in the form of canals, streams, tube wells and open wells that provided critical irrigations under crisis situations although the bore well water is of poor quality.

On an average, total sugarcane growers had (199.75) mean cropping intensity indicating almost double cropping is followed. Further, the head reach sugarcane growers have lesser mean cropping intensity with 179.58 whereas mid reach (204.84) and tail end (214.84) sugarcane growers possess better cropping intensity. The mid reach and tail end farmers have minimum of double cropping intensity compared to head reach farmers. Although the sugarcane crop is an annual crop and most of them followed wider row spacing which triggered farmers to grow various intercrops like maize, vegetables, pulses and tubers to get an additional income. The cropping intensity of head reach sugarcane growers was less because they usually grow the green manure crops to enhance soil fertility along with the maize for fodder purpose to cattle. Further, maize crop has been harvested before the maturity in order to earthing up of sugarcane

and some also due to fear of floods. But the mid reach farmers have grown the pulses, legumes and different vegetable crops based on the analysis of market prices and their conveniences. Tail end sugarcane growers have usually grown the vegetable crops as they have continuous touch with local markets as well as the knowledge about vegetable market as they involved in it from many years.

The benefit–cost ratio is an indicator used for analysis of costs and benefits that attempts to recapitulate the overall value for money. A BCR is the ratio of the benefits from sugarcane farming expressed in monetary terms in relation to the costs involved in its production. The higher BCR indicates the better returns to the investment. Keeping this in mind the BCR is used as indicator to measure the economic performance of sugarcane growers. Tail end sugarcane growers had better BCR (1:1.95) followed by mid reach (1:1.93) and head reach (1:1.79). On an average, the total sugarcane growers had (1:1.89) BCR. When we observe the results, the BCR is on increasing trend from head reach to tail end sugarcane growers. The probable reasons might be that the better management of water through drip irrigation during water shortage as well as diversification and growing of high value intercrops like vegetables, tubers and marigold. Similarly, gross income and net incomes of sugarcane growers was calculated for better understanding of economic performance of sugarcane growers. The results revealed that the head reach sugarcane growers possess better gross income than mid reach and tail end sugarcane growers. this was mainly due to the jaggery making that yields better prices than selling cane to factories. Further, the keen observations showed that cost of cultivation of head reach farmers is more because of their more investment in crisis management activities post crisis occurrence. In overall, sugarcane growers possess gross income of Rs. 1,20,788.98 per acre.

With respect to net income is concerned tail end sugarcane growers possess better net income than mid reach and head reach sugarcane growers. This was mainly because of the growing of multiple intercrops and knowledge about daily vegetable mandis which brought additional income. Although the gross income of head reach farmers was more but net income is less compared to the mid reach and tail enders because of their high expenditures on floods management and lesser returns from intercrops. In addition to this, better tonnage obtained in mid reach and tail end regions.

Table 16: Indicator wise overall economic performance of sugarcane growers.

SI. No.	Indicators	Head reach (n_1=80)	Mid reach (n_2=80)	Tail end (n_3=80)	Total (n=240)
1.	Mean Crop yield index	95.46	98.77	101.20	98.48
2.	Mean Cropping intensity	179.58	204.84	214.84	199.75
3.	B:C ratio per acre	1:1.79	1:1.93	1:1.95	1:1.89
4.	Gross income (Rs.)	122739.90	118097.48	121529.54	120788.98
5.	Net income (Rs.)	54209.77	57204.69	59319.22	56911.23

Table 17: Economic performance of sugarcane growers under crisis.

SI. No.	Indicators	Category	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
			f	%	f	%	f	%	f	%
3.1	Cropping intensity Mean: 199.75 SD: 44.02	Poor (<177.74)	32	40.00	11	13.75	10	12.50	53	22.08
		Moderate (177.74 to 221.76)	44	55.00	55	68.75	45	56.25	144	60.00
		Better (>221.76)	04	5.00	14	17.50	25	31.25	43	17.92
3.2	Crop yield index Mean: 98.48 SD: 19.93	Poor (<88.51)	33	41.25	13	16.25	15	18.75	61	25.42
		Moderate (88.51 to 108.44)	22	27.50	48	60.00	28	35.00	98	40.83
		Better (108.44)	25	31.25	19	23.75	37	46.25	81	33.75
3.3	B: C Ratio Mean: 2.03 SD: 0.36	Poor (<1.85)	40	50.00	19	23.75	15	18.75	74	30.83
		Moderate (1.85 to 2.20)	22	27.50	35	43.75	36	45.00	93	38.75
		Better (>2.20)	18	22.50	26	32.50	29	36.25	73	30.42

4.2.3 Distribution of sugarcane growers based on different indicators of economic performances.

The bird eye view of Table 17 indicated the distribution of head reach, mid reach and tail end sugarcane growers into different categories of economic performances. The farmers were categorized into three categories under each indicators using mean and standard deviation.

The results revealed that more than half of head reach sugarcane growers (55.00 %) belongs to the moderate cropping intensity category followed by poor (40.00 %) and better (5.00 %). The probable reasons might be that the head reach farmers cultivated maize along with green manure crops to enhance fertility as well as to conserve soil from erosion during runoff. Further, few farmers were not ready to grow intercrops because of their previous encounters with floods which caused crops failure. Hence, they decided not to burn their hands by unnecessary investments where there was no surety of returns. Whereas, more than two-third of mid reach (68.75 %) and more than half of tail end (56.25 %) sugarcane growers belongs to moderate cropping intensity category followed by better (17.50 % and 31.25 %) and poor category (13.75 % and 12.50 %) respectively. This trend of results was mainly due to the growing of multiple intercrops like legumes, pulses, vegetables and tubers based on their previous experiences of market with the hope of better returns. In case of poor prices for intercrops, they incorporate them into soil during earthing-up as a green manure to sugarcane crop. In nutshell, sixty per cent of the overall sugarcane growers belongs to the moderate cropping intensity category followed by poor (22.08 %) and better (17.92 %) categories respectively.

The other economic performance indicator used is the crop yield index. In this indicator, more than two-fifth of head reach (41.25 %) sugarcane growers belong to the poor CYI category followed by better CYI (31.25 %) and moderate CYI (27.50 %) category. This trend of results was due to their frequent exposure to dual crisis almost every year from highly severe to moderate extent affecting sugarcane yield as well as reducing sugar recovery. The farmers opined that during normal years they used to get almost equal to or more than state average sugarcane yield (40-45 tonnes per acre during normal years). Sixty per cent of mid reach sugarcane growers falls under the moderate CYI category followed by better CYI (23.75 %) and poor CYI (16.25 %) category. This trend of results might be due to the fact of better management of irrigation during critical crisis times as well as the soil properties in the area along with lesser severity of flood crisis. For drought crisis, situation specific/ suitable alternative irrigation facilities are contributing to the better tonnage of sugarcane. Whereas,

46.25 per cent of tail end sugarcane growers belongs to better CYI category followed by moderate CYI (35.00 %) and poor CYI (18.75 %). The possible reasons might be lesser severity of twin crisis namely floods and droughts with availability of alternative irrigation facilities from the canals, wells and streams with drip irrigation adoption are leading to the better acreage of sugarcane. In nutshell, more than two-fifth (40.83 %) of overall sugarcane growers belongs to the moderate CYI category followed by better CYI (33.75%) and poor CYI (25.42 %) categories of CYI respectively.

With respect to the BCR is concerned half of the head reach sugarcane growers falls under poor BCR category followed by moderate (27.50 %) and better (22.50 %) BCR category. The reasons might be due to the facts that head reach sugarcane growers spend more on recovery and rehabilitation activities post crisis occurrence and reduced yield was common due to crisis in head reach region. When we see the total returns, the head reach farmers have better returns than the tail end and mid reach farmers as they focused on jaggery making to earn extra around Rs. 300-400 for each tonne of sugarcane with good recovery. The rejection of flood affected cane by factories was a blessing in disguise for head reach farmers. Whereas more than two-fifth of mid reach (43.75%) and tail end (45.00%) sugarcane growers belongs to the moderate BCR category followed by better (mid reach-32.50%), (tail end-36.25 %) and poor BCR (mid reach-23.75 %) (tail end-18.75 %) categories respectively. This might be due to their better tonnage as well as the mid reach and tail end farmers have lesser expenses in recovery and rehabilitation activities of crisis has put them ahead of head reach farmers in BCR. Although the jaggery making brings good profits, the mid reach and tail end farmers usually not preferred to prepare jaggery because of poor recovery, labour scarcity and tedious works as expressed by jaggery makers. Further, to make jaggery the crop must be of minimum of 11 months old to attain full maturity. But they even send their cane for factory at 9^{th} or 10^{th} month which helped them in better management of drought conditions and also earns more returns in the form of good tonnage than matured cane. In nutshell, less than two-fifth (38.75%) of overall sugarcane growers belongs to the moderate BCR category followed by poor (30.83 %) and better (30.42 %) BCR categories respectively. The overall BCR of sugarcane growers was still low when compared with the BCR of other areas of Karnataka during normal years of sugarcane production. Hence, conclusively the crises have influenced the economic performance of sugarcane farmers in all aspects of sugarcane production. But they are overcoming those all obstacles by taking various adaptations by investing more and unknowing the consequences.

4.3 Adoption of crisis mitigation mechanisms by sugarcane growers to reduce the effect of crisis.

4. 3. 1. Overall adoption of crisis mitigation mechanisms by sugarcane growers.

The Table 18 and Fig. 7 depicted the overall adoption of crisis mitigation mechanisms by head reach, mid reach and tail end sugarcane growers. The results revealed that less than two-fifth of head reach (38.75 %) sugarcane growers belongs to medium crisis mitigation mechanisms adoption category followed by high (33.75 %) and low (27.50 %) crisis mitigation mechanisms adoption category. The probable reasons might be the severity of major crisis they faced i.e., floods which caused the damage irrespective of the adoption of crisis mitigation mechanisms in earlier years has added the further financial burden on them. Hence, farmers opined that the only no cost or low-cost mechanisms were adopted using locally available resources by sugarcane farmers mainly during the post crisis management activities to recover from the damage and reduce the losses. Farmers also expressed that the nature and severity of floods was unpredictable over the years on crops as well as on human lives and made to evacuate them within no time. The damaged electric lanes due to floods caused the water shortage for irrigation and problem for drinking water. Under such circumstances farmers responded by not depending on any governmental bodies as most of them resides in fields by carrying water from nearby filter points installed at different centers as well as from bore wells. The farmers also opined that they took care of lives of family members and domestic animals and other essentials which they are capable of shifting in short period of time. They also expressed that it was hard to shift some assets because of its heaviness, non-availability of vehicles to carry immediately and time shortage caused heavy losses to farmers. Further, the deep black soil helped the farmers in irrigation postponement as the well aerated black soil retains moisture up to one and half months. This indicates that with one or two critical irrigations they can overcome the drought period of three months (summer). The head reach farmers were not eager to receive the temporary donations like food packets, clothes, etc. which indicates their self-esteem as they indicated that standing in que for whole day by leaving their regular work was not in their cup of coffee.

Whereas, more than half of mid reach (52.50 %) and 37.50 per cent of tail end sugarcane growers belongs to high crisis mitigation mechanisms adoption category followed by medium (mid reach- 27.50%, tail end- 35.00%) and low (mid reach-20.00%, tail end- 27.50%) crisis mitigation mechanisms adoption category. The probable reasons might be the lesser or moderate severity of floods and better management of irrigation through drip installation during the drought. The better rate of success of adaptations made them to adopt the new crisis

mitigation mechanisms. They were also opined that shifting of family members, animals and valuable assets were made based on the severity. Further, the rehabilitation materials were distributed among themselves based on the need and mutual understanding like food, clothes, tadpoles, seeds, fodder for animals etc. Also, during droughts, the local panchayat arranged the basic amenities like drinking water, food materials, polythene sheets supplied through fair price shops, medical facilities, seeds and inputs if needed for planned cropping etc in consultation with concerned development departments. The involvement of panchayat with respect to addressing people is benefitting farmers in adoption of mitigation mechanisms.

Table 18: Overall adoption of crisis mitigation mechanisms by sugarcane growers.

SI. No.	Category	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f	%	f	%	f	%	f	%
1	Low (6.77)	22	27.50	16	20.00	22	27.50	60	25.00
2	Medium (6.77 to 8.83)	31	38.75	22	27.50	28	35.00	81	33.75
3	High (>8.83)	27	33.75	42	52.50	30	37.50	99	41.25

Mean: 7.8042 **SD: 2.0613**

X^2 = 10.82* : * Significant at 5 per cent

In general, more than two-fourth of total sugarcane growers (41.25 %) belongs to high adoption of crisis mitigation mechanisms category followed by medium and low categories with 33.75 per cent and 25.00 per cent respectively. The chi-square test results also indicated that significant difference exists in adoption of crisis mitigation mechanisms at five per cent significance level.

4. 3. 2. Statement wise adoption of crisis mitigation mechanisms by sugarcane growers.

The observations from Table 19 depicted the statement wise adoption of crisis mitigation mechanisms by head reach, mid reach and tail end sugarcane growers. From the results of head reach sugarcane growers, it is observed that majority of them have adopted the storing the food grains and fuel (88.75%), followed by shifting of family members and animals to safe places (82.50%) and storing fodder to use in crisis period (77.50%). The probable reasons might be that farmers were usually growing commercial crops, they brought and preserved the food grains for consumption as well as for the cattle, sheep and goat feed. Further, they preserved the firewood and dry cobs of maize for use during rainy season as well as preserve the thrash residue for using as fuel for jaggery units and bedding material for cattle. They obviously shifted the animals and family members for the safety by leaving one person at the residence to take care of their valuable belongings. Further, head reach farmers opined that

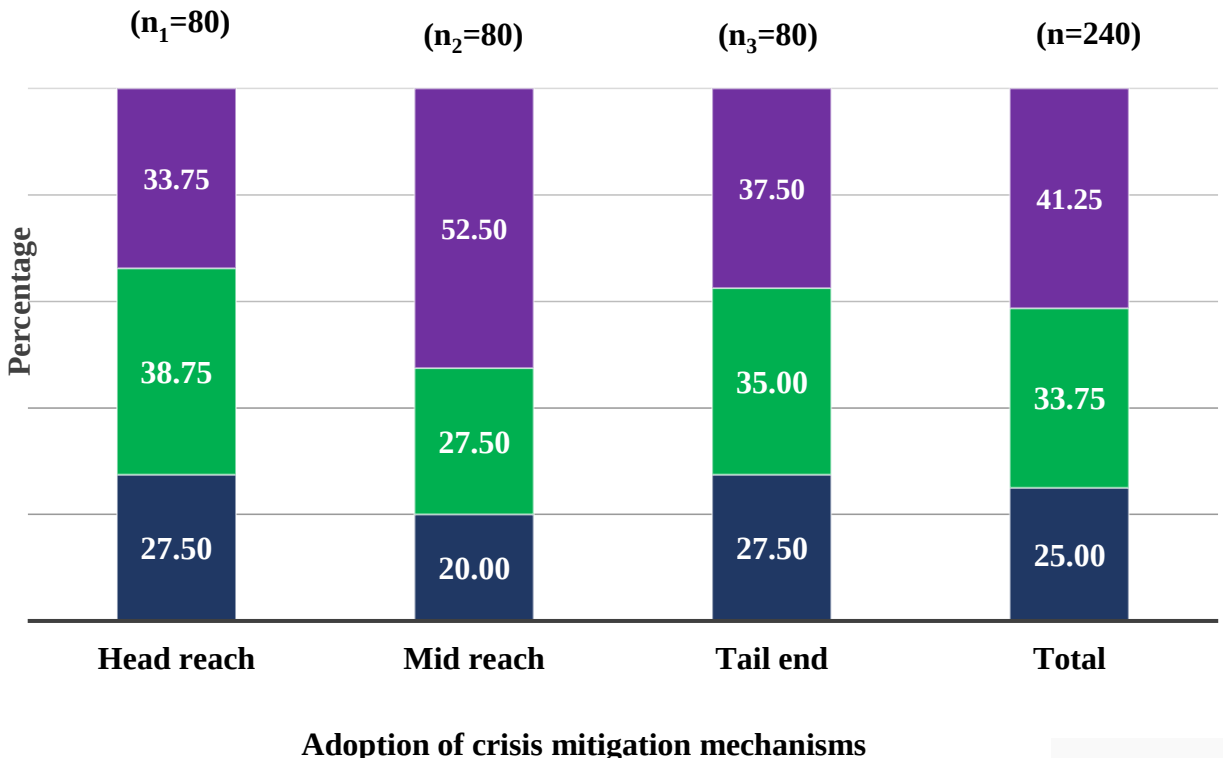

Fig. 7.: Overall distribution of head reach, mid reach, tail end total sugarcane growers into different adoption categories of crisis mitigation mechanisms

it was difficult to get the fodder during crisis hence, stored fodder for use during crisis. If fodder was not stored/preserved, they purchased from the fellow farmers as well as chopped dry fodder from the factory. The least adopted crisis mitigation mechanisms were safeguarding the seed material required for the next seasons (30.00 %), soil test-based application of fertilizers to crops (28.75%) and use of drip irrigation (23.75%). The probable reasons might be the availability of seeding material from the agriculture department at all the times for intercrops. With respect to cane setts either they purchased from the tail end farmers or seedlings from the nursery as the cane fields were affected by crisis to some extent in head reach and mid reach areas. Farmers were not at all tested the soil and they applied fertilizers based on their experience by observing color of the leaves. The farmers expressed that regular occurrence of floods to some extent has led to variation in fertility status as the reason for not testing the soil and are also not aware of the importance of soil testing. Although they faced water shortage during summer months as well as post flood occurrence, they did not adopt the drip irrigation because of blockage of the filter and if farmers digged farm ponds which requires new electric lanes and purchase of new electric motors. The farmers are not ready to invest more on it.

The glimpses on Table 19 indicated that among mid reach farmers, majority of the mid reach sugarcane growers have adopted crisis mitigation mechanisms like receiving temporary relief materials from govt, NGOs, individual donors (73.75 %), storing fodder to use in crisis period (72.50%) and shifting of family members and animals to safe places (66.25%). The reasons for receiving of relief materials were that the relief materials were collected by local leaders and distributed to all the farmers while delivering the rations and other government relief materials. They usually store the fodder for the animals especially dry maize and jowar for cattle to use during crisis as milch animals were major sources of their daily essentials during the crisis period. The least adopted crisis mitigation mechanisms were disposal of carcass (37.50%), restarted the traditional jaggery production (37.50%) and soil test-based application of fertilizers to crops (36.25%). The reasons might be that farmers are conscious about pollution caused by carcass and dumped it into the soil. Farmers expressed that jaggery production units requires huge investments and few have started in association with the friends. Further, the recovery from mid reach and tail end sugarcane growers was less compared to the head reach farmers as they harvest early. Farmers applied fertilizers by traditional broadcast method without testing the soil. Farmers applied urea after six months can also be a reason for the poor recovery as it increases the tenderness of cane.

Majority of tail end sugarcane growers were adopted the crisis mitigation mechanisms like practiced the mixed farming to reduce risks (68.75%), storing fodder to use in crisis period (68.75%), adjusting cropping pattern and planting time (63.75%) and use of drip irrigation (60.00%). As the farming is the sole source of income farmers have practiced mixed farming by growing multiple intercrops in sugarcane and adjusted the cropping to manage crisis period by early planting and growing other commercial horticulture crops in piece of the farm. They also used the drip irrigation system to irrigate the fields using bore-wells and stored water from open wells. The least adopted crisis mitigation mechanisms were soil test-based application

Table 19: Statement wise adoption of crisis mitigation mechanisms by sugarcane growers to reduce the effect of crisis.

SI. No.	Mitigation mechanism	Head reach (n_1=80)				Mid reach (n_2=80)				Tail end (n_3=80)				Total (n=240)			
		Adopted		Not adopted		Adopted		Not adopted		Adopted		Not adopted		Adopted		Not adopted	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1.	Shifting of family members and animals to safe places	66	82.50	14	17.50	53	66.25	27	33.75	37	46.25	43	53.75	156	65.00	84	35.00
2.	Receiving temporary relief materials from govt, NGOs, individual donors (food packets, water, clothes etc.)	53	66.25	27	33.75	59	73.75	21	26.25	47	58.75	33	41.25	159	66.25	81	33.75
3.	Practicing proper health and sanitation measures	29	36.25	51	63.75	37	46.25	43	53.75	34	42.50	46	57.50	100	41.67	140	58.33
4.	Disposal of carcass	31	38.75	49	61.25	30	37.50	50	62.50	40	50.00	40	50.00	101	42.08	139	57.92
5.	Safeguarding the seed material required for the next seasons	24	30.00	56	70.00	32	40.00	48	60.00	41	51.25	39	48.75	97	40.42	143	59.58
6.	Better access to critical inputs	51	63.75	29	36.25	46	57.50	34	42.50	47	58.75	33	41.25	144	60.00	96	40.00
7.	Practiced the mixed farming to reduce risks	34	42.50	46	57.50	32	40.00	48	60.00	55	68.75	25	31.25	121	50.42	119	49.58
8.	Adjusting cropping pattern	32	40.00	48	60.00	48	60.00	32	40.00	51	63.75	29	36.25	131	54.58	109	45.42
9.	Availing crop insurance to minimize the risk	26	32.50	54	67.50	39	48.75	41	51.25	28	35.00	52	65.00	93	38.75	147	61.25
10.	Storing the food grains and fuel	71	88.75	9	11.25	51	63.75	29	36.25	47	58.75	33	41.25	169	70.42	71	29.58
11.	Storing fodder to use in crisis period	62	77.50	18	22.50	58	72.50	22	27.50	55	68.75	25	31.25	175	72.92	65	27.08
12.	Availing cattle insurance	28	35.00	52	65.00	37	46.25	43	53.75	33	41.25	47	58.75	98	40.83	142	59.17
13.	Soil test-based application of fertilizers to crops	23	28.75	57	71.25	29	36.25	51	63.75	30	37.50	50	62.50	82	34.17	158	65.83
14.	Use of drip irrigation	19	23.75	61	76.25	41	51.25	39	48.75	48	60.00	34	32.00	108	45.00	134	55.83
15.	Restarted the traditional jaggery production	37	46.25	43	53.75	30	37.50	50	62.50	26	32.50	54	67.50	93	38.75	147	61.25

of fertilizers to crops (37.50%), availing crop insurance to minimize the risk (35.00%) and restarted the traditional jaggery production (32.50%). The farmers have not tested the soil but agriculture department and sugar factories collected some samples and recommended the fertilizer dosages without the soil health cards. Farmers follow it along with using their own experience in farming as well as recommendations from input shop owners. The farmers who took loans from banks are only paid the premium for crop insurance and came to know about its advantage as some received their insured amount to their bank account. Others did not pay because of their poor vision and also said that for damaged crops as government will provide the compensation amount and why to pay extra although it's a meagre amount.

In a nutshell, majority of overall sugarcane growers were adopted the crisis mitigation mechanisms were storing fodder to use in crisis period (72.92%), storing the food grains and fuel (70.42%), receiving temporary relief materials from govt, NGOs, Individual donors (66.25%), and shifting of family members and animals to safe places (65.00%). The probable reasons were discussed in detail at individual farmers' category level. But the overall observations show that the crisis mitigations mechanisms were adopted by sugarcane growers based on their severity of the crisis and their vulnerability to the crises.

4.4 Awareness about the crisis and its management in agriculture and sugarcane farming

4. 4.1. Awareness about the crisis and its management in agriculture.

4.4.1.1. Statement wise awareness of head reach, mid reach and tail end sugarcane growers about crisis and its management in agriculture.

The Table 20 represented the statement wise awareness of head reach, mid reach and tail end sugarcane growers about crisis and its management in agriculture. The results of head reach sugarcane growers revealed that more than one-third of respondents expressed that crisis management means activities taken during crisis occurrence followed by 30.00 per cent of them opined that crisis management means prior planning along with activities taken during crisis occurrence and aftermath rehabilitation measures. The probable reason is that their exposure to crisis was comparatively more mainly to floods and further they believed that activities carried out during floods as the crisis management activity. Two-fifth of the respondents opined that crisis management is an activity of concern of government followed by less than one-fourth of them (23.75 %) expressed that it is a concern of community. The probable reason as expressed by respondents was that the effects of crisis cannot be overcome by individuals alone and it

requires government's involvement to recover quickly. More than one-fourth of the respondents (28.75 %) expressed that television (TV) was major sources of information about crisis followed by neighbours & friends (22.50 %). The probable reason is that respondents have a habit of regularly watching TV to get information about crisis and the same is disseminated to other fellow farmers. Critical notice has showed that NGOs are the major sources than newspaper because very few/none had access and subscribed to newspaper and NGOs are providing information about crisis management. With the penetration of smart phones into rural areas, sugarcane growers have no idea about how to access the crisis related information as the most of them are using them for entertainment purpose due to their poor awareness about the sources providing information. More than one-fourth of the respondents (26.25 %) equally opined that providing relief by government agencies and insuring crops, contingency crop planning, relief and compensation for crop losses are major measures to manage crisis effectively in agriculture followed by insuring crops (20.00 %). This might be due to the reason that farmers expect relief measures from government as they invested more in crop production which includes investments for critical inputs and expect government to carry out rehabilitation measures as well as contingency crop planning. Nearly one-third of the respondents (35.00 %) expressed that shifting of cattle to safer and food accessible places, keeping buffer stocks of medicines & concentrated feed, storing adequate fodder and insuring cattle are major livestock management measures during crisis period followed by shifting cattle to safer and food accessible places (32.50 %) and storing adequate fodder (18.75 %). As per the discussion with farmers it was found that based on their previous experiences, they take precautions to protect livestock during crisis period. Further, significant percentage of respondents irrespective of head reach, mid reach and tail end are not aware about crisis management measures with respect to livestock enterprises. More than one-fourth of respondents expressed that creating awareness and providing technical assistance (28.75 %) followed by prior planning of farming systems (26.25 %) are the major roles of government to manage crisis effectively. The reasons quoted by farmers were that they will be deprived of government compensations because of poor awareness and lack of knowledge about taking situation specific measures immediately to save crop.

With respect to mid reach sugarcane growers from Table 20, it can be observed that more than two-fifth of the respondents (43.75 %) opined that crisis management means taking aftermath rehabilitation measures followed by more than one-fourth of them (26.25 %) expressed that it is an activity taken during crisis occurrence. The probable reason is that the severity of crisis faced by them is relatively low and as a result, they believe that crisis

management means aftermath rehabilitation measures. More than two-fifth of respondents (42.50 %) are aware about crisis management is a concern of government followed all stakeholders like government, community, individual and NGOs (22.50 %). This might be due to reasons that government involvement in crisis management along with local communities enhances their coping capacity to crisis and take appropriate measures more effectively. More than one-fourth of the respondents (26.25 %) opined that television is the major source of crisis information followed by neighbours & friends (23.75 %). This is due to the fact that they watch the television regularly related to weather and rainfall updates along with entertainment and disseminate the same among peer farmers to take activities and also consult their neighbours and friends to get crisis information. More than one-fourth of respondents (27.50 %) were aware that contingency crop planning is the major agriculture crisis management measure followed by relief by government agencies (23.75 %). The reason is that the cropping intensity of these farmers was more compared to head reach farmers and they are conscious about the planning for crops based on prevailing situation. Less than one-third of respondents opined that storing of adequate fodder is the livestock management measure during crisis followed by more than one-fourth of them (26.25 %) expressed that shifting of cattle to safer and food accessible places, keeping buffer stocks of medicines & concentrated feed, storing adequate fodder and insuring cattle are livestock management measures during crisis period. This might be due to fact that they traditionally store dry fodder of maize and brought chaffed fodder from Yadav ad factory to use during crisis. With respect to role of government in agriculture crisis management, more than one-fourth of respondents (28.75 %) opined that government should create awareness & provide technical help during crisis period followed by timely relief measures and prior planning of farming systems equally (22.50 %). This is due to their poor awareness and deprived of government facilities.

With respect to mid reach farmers, awareness about meaning of crisis, major source of information and crisis management measures significant farmers are not aware about this. Hence efforts should be made by concerned organizations to create awareness among sugarcane growers. With respect to major source of information about crisis and its management, none of the respondents indicated radio as major source of information about crisis irrespective of head reach, mid reach and tail end sugarcane growers. The possible reason for non-use of radio could be the easy accessibility to the television, smart phones and web-based platforms penetration into the rural areas. Apart from this interesting thing is that majority of farmers opined that they don’t know about the crop and livestock insurances. This was mainly due to the fact that the farmers are even not aware about the cattle insurance except very few and the people who

know about the crop insurance are mainly due to their loans in the banks where farmers have been informed about that by bank officials.

With respect to tail end sugarcane growers, from Table 20 it is observed that more than one-third of respondents (33.75 %) opined that crisis management means aftermath rehabilitation and nearly one-third of them (32.50 %) expressed it as prior planning, activities during crisis occurrences & post crisis rehabilitation activities collectively. This might be due to their less exposure to crisis, good literacy and good extension contacts. In general, significant proportion of them do not possesses adequate knowledge about crisis and its management along with roles to be played by government agencies. One-third of respondents (33.75 %) expressed that crisis management is an activity of concern of government followed by community (26.25 %). This might be due to their poor exposure to natural crisis and if any damage occurs, the government came forward to help the farmers and some saints in the area inspired locals to provide basic facilities to the flood victims which initiated community action. Less than one-fourth of respondents (22.50 %) expressed that television was major source of crisis information followed by neighbours and friends (20.00 %) and local government agencies (17.50 %) & other sources like mobiles, social media (17.50 %). More than one-fourth of respondents (27.50 %) opined that providing relief by government agencies is a crisis management strategy in agriculture followed by insuring crops (26.25 %). This might be due to reason that the farmers believe strongly that whatever assistance provided was the governments' duty and further literate farmers contacted the extension personnel to grow alternate crops in case the earlier crop failed due to crisis. More than one-third of respondents expressed that storing of adequate fodder was livestock crisis management measure followed by shifting cattle to safe and food accessible places, keeping stocks of medicines, storing adequate fodder and insuring cattle (23.75 %). This might be due to the reasons that most of the tail end farmers grow maize as livestock feed after turmeric harvest and they store it as dry fodder to use in crisis and rainy seasons. More than one-third of respondents (33.75 %) opined that government's role is to provide timely relief measures followed by creating awareness & providing technical help (32.50 %). This might be due to the fact that government relief amount was released lately to victims and few victims could not get government assistance due to their poor knowledge about submitting documents in time and use of crop survey app at appropriate time and difficulty of its operation.

4.4.1.2 Statement wise awareness of total sugarcane growers about crisis and its management in agriculture.

The Table 20 also indicated the statement wise awareness of total sugarcane growers about crisis and its management in agriculture. Nearly one-third of respondents opined that crisis management means aftermath rehabilitation activities followed by more than one-fourth of them (27.50 %) expressed that crisis management includes prior planning, activities during crisis occurrences & post crisis rehabilitation activities. Nearly two-fifth of respondents (38.75 %) expressed that crisis management is the concern of government followed by community (22.50 %) and nearly one fifth of them expressed as it is a concern of individual, community, NGOs and government (19.17%). More than one-fourth of respondents expressed television as major source of crisis information followed by neighbours and friends (22.08 %) and local government bodies (18.75 %). Interestingly nobody has identified radio as source of crisis information because almost no farmer has been using radio now days with the penetration of electronic gadgets like smart phones/ cell phones with vast options of entertainment along with memory cards. More than one-fourth of respondents (25.83 %) expressed that crisis management in agriculture is providing relief by government agencies followed by 22.50 per cent of them expressed it as insuring crops, contingency crop planning, relief and compensation to crop losses.

More than one-fourth (28.33 %) of respondents were equally aware about storing adequate fodder and shifting cattle to safe and food accessible places, keeping stocks of medicines, storing adequate fodder & insuring cattle as major crisis management measures in livestock. With respect to role of government during agriculture crisis period, less than one-third of respondents (30.00 %) expressed that government should provide timely relief measures followed by creating awareness and providing technical help (26.67 %) and prior planning of farming systems (20.83 %). The overall sugarcane growers' awareness about crisis and its management in agriculture are in congruence with the findings of Aravind (2011) and Meludu (2011).

Table 20: Statement wise awareness of crisis and its management in agriculture among the sugarcane growers.

SI. No	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f	%	f	%	f	%	f	%
1	**Crisis management means**								
a	Prior planning	12	15.00	08	10.00	15	18.75	35	14.58
b	Activities during crisis occurrence	27	33.75	21	26.25	12	15.00	60	25.00
c	Aftermath rehabilitation measures	17	21.25	35	43.75	27	33.75	79	32.92
d	All the above	24	30.00	16	20.00	26	32.50	66	27.50
2	**Crisis management is an activity of concern to**								
a	Individual	11	13.75	08	10.00	09	11.25	28	11.67
b	Community	19	23.75	14	17.50	21	26.25	54	22.50
c	Government	32	40.00	34	42.50	27	33.75	93	38.75
d	NGOs	06	07.50	06	07.50	07	08.75	19	07.91
e	All of them	12	15.00	18	22.50	16	20.00	46	19.17
3	**Major source of information about crisis is**								
a	Radio	0	0	0	0	00	00.00	0	0
b	Television	23	28.75	21	26.25	18	22.50	62	25.83
c	Newspapers	06	7.50	08	10.00	10	12.50	24	10.00
d	Government agencies	15	18.75	16	20.00	14	17.50	45	18.75
e	NGOs	08	10.00	05	06.25	08	10.00	21	08.75
f	Neighbours and friends	18	22.50	19	23.75	16	20.00	53	22.08
g	Others (Mobiles & social media)	10	12.50	11	13.75	14	17.50	35	14.58
4	**Crisis management in agriculture according to your opinion is**								
a	Contingency crop planning	13	16.25	22	27.50	12	15.00	47	19.58
b	Relief by government agencies	21	26.25	19	23.75	22	27.50	62	25.83
c	Insuring crops	16	20.00	04	05.00	21	26.25	41	17.08
d	Compensation for crop loss	09	11.25	15	18.75	12	15.00	36	15.00
e	All the above	21	26.25	20	25.00	13	16.25	54	22.50
5	**Crisis management measures in livestock according to you opinion is,**								
a	Shifting cattle to safe and food accessible places immediately	26	32.50	16	20.00	18	22.50	60	25.00
b	Keeping buffer stock of medicines & concentrated feeds	08	10.00	09	11.25	11	13.75	28	11.67
c	Storing adequate fodder	15	18.75	25	31.25	28	35.00	68	28.33
d	Insuring cattle	03	03.75	09	11.25	04	05.00	16	6.67
e	All the above	28	35.00	21	26.25	19	23.75	68	28.33
6	**The role of government in crisis management in agriculture is**								
a	Kept stock of all inputs for sowing post crisis	13	16.25	09	11.25	07	08.75	29	12.08
b	Prior planning of farming systems	21	26.25	18	22.50	11	11.25	50	20.83
c	Creating awareness & providing technical assistance	23	28.75	23	28.75	26	32.50	72	30.00
d	Providing timely relief measures	18	22.5	19	22.50	27	33.75	64	26.67
e	Training farmers about crisis management activities	05	6.25	11	13.75	09	11.25	25	10.00

4.4.2.1 Statement wise awareness of head reach, mid reach and tail end sugarcane growers about crisis and its management in sugarcane.

Table 21 represents the statement wise awareness of head reach, mid reach and tail end sugarcane growers about crisis and its management in sugarcane farming. In the head reach region, more than half of the sugarcane growers expressed that flood is the major type of crisis faced in sugarcane farming followed by price crisis (28.75 %). This is mainly because of the reasons that sugarcane growers are the frequent victims of floods and sugarcane arrears in the area. Two-fifth of respondents opined that delayed in payment is the major reason for price crisis in sugarcane farming followed by one-fifth of them expressed that they are not getting fixed prices for sugarcane. This was due to the fact that farmers were not receiving their payments for years from factories which in turn made the farmers to be in debt at bank as well as money lenders to carry out their farm activities. More than one-third of respondents (36.25 %) expressed that planned planting to reach advanced growth stage before flood occurrence is the major flood management strategy in sugarcane farming followed by draining out water from field to avoid crop loss (22.50 %). Based on their previous experiences about floods and droughts most of the farmers prefer to plant in October/November so that by monsoon season crop will be six to eight months old which can tolerate water stagnation as well as drought condition. With respect to reasons for lower productivity of sugarcane crop nearly one-third of growers (32.50 %) opined that acute shortage of water at critical stages is the main reason followed by imbalanced use of fertilizers (21.25 %) and improper selection of inter crops (16.25 %). This was mainly because of reason that drying up off rivers during summer as river was their major sources of irrigation. If they get good monsoons also it has led to floods and in-turn it reduced the yield. In order to balance yield, farmers are using more than recommended fertilizers. With respect to role of government in sugarcane crisis period, less than half of respondents (45.00 %) expressed that government should fix uniform prices for sugarcane like minimum support price instead of fair and remunerative prices followed by taking strict actions against factory for delayed payments (33.75 %).

With respect to mid reach sugarcane growers, from Table 21 it is observed that more than two-fifth of respondents (41.25 %) expressed that price crisis is the major crisis faced by tail end sugarcane growers followed by floods (38.75 %) and drought (11.25 %). Most of these farmers' dependent mainly on factories and they were also exposed to floods. With respect to price crisis in sugarcane farming, more than one-fourth of mid reach farmers (28.75 %) opined that over production, delayed payments, no fixed prices & weighing fluctuations were major

reasons for price crisis in sugarcane farming followed by delay in payments (26.25 %). Nearly one-third of respondents (32.50 %) expressed that planned planting to reach advanced growth stage before flood occurrence was the major flood management strategy in sugarcane farming followed by taking actions based on severity of floods (28.75 %). This might be due to their previous experiences of gambling with monsoons farmers prefer to take actions based on severity otherwise it will be burden for farmers. More than one-fourth of respondents expressed that acute shortage of water during critical stages (28.75 %) and imbalanced use of fertilizers (26.25 %) are the major causes for lower productivity in sugarcane farming. With respect to role of government during sugarcane crisis period, less than half of respondents (45.00 %) expressed that government should take strict actions against factory for delayed payments followed by fixing uniform prices for sugarcane (32.50 %) to manage sugarcane crisis effectively. This might be due to the burden they faced because of delayed payments and farmers observed price fluctuations in factories where farmers get better prices in cooperative factories compared to private factories of same taluk.

With respect to tail end sugarcane growers, from Table 21 it is observed that less than two-fifth of respondents (38.75 %) expressed that price crisis is the major crisis faced in sugarcane farming followed by floods and drought equally with 23.75 per cent. Because of their high dependency on sugarcane and political attachment to leaders made them to send their cane to private factories owned by politicians. As a result, they are not getting good prices for their produce. More than one-third of respondents (36.25 %) expressed that delay in payments is the major reason for price crisis in sugarcane farming followed by 21.25 per cent of them opined that they are not getting fixed prices for sugarcane. More than one-third of respondents (33.75 %) expressed that draining out flooded water from field was the major flood management measure in sugarcane farming followed by conserving soil from erosion (26.25 %). This might be due to their experience in farming and least exposure to severe floods. Based on their experience due to heavy rains/ overflow of stream into field, the water accumulated was drained out to avoid crop damage. With respect to lower productivity of sugarcane, more than one-third of growers (33.75 %) expressed that imbalanced use of fertilizers is the reason for lower sugarcane productivity followed by acute shortage of water during critical growth stages (21.25 %). The main reason is that most of the farmers extensively use fertilizers to get higher yield as they were cultivating more than three crops at a time believing that it requires more inputs. Further, they also use micro irrigation especially drip which reduced their water shortage in tail end areas. With respect to governments role during crisis period, more than two-fifth of tail end sugarcane growers (41.25 %) were opined that government should take strict actions against

factory for delayed payments followed by fixing uniform prices for sugarcane (27.50 %) and should frame proper policies for sugarcane (26.25 %) production.

Table 21: Distribution of respondents based on their awareness about crisis and its management in sugarcane farming.

SI. No	Statements	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f	%	f	%	f	%	f	%
1	**Major type of crisis in sugarcane faced by you is**								
a	Price crisis	23	28.75	33	41.25	31	38.75	87	36.25
b	Drought	06	7.50	09	11.25	19	23.75	34	14.17
c	Floods	43	53.75	31	38.75	22	27.50	96	40.00
d	Pest and disease outbreak	03	3.75	04	5.00	08	10.00	15	6.25
e	Others (Salinity, wetlands formation)	05	6.25	03	3.75	00	0.00	08	3.33
2	**Price crisis in sugarcane is due to**								
a	Over production	09	11.25	13	16.25	10	12.50	32	13.33
b	Delay in payments	32	40.00	21	26.25	29	36.25	82	34.16
c	No fixed prices	16	20.00	04	05.00	17	21.25	37	15.42
d	Fluctuations in weighing at factory	11	13.75	19	23.75	13	16.25	43	17.92
e	All the above	12	15.00	23	28.75	11	13.75	46	19.17
3	**Flood management in sugarcane is mainly concerned with**								
a	Conserving the soil from erosion	09	11.25	11	13.75	21	26.25	41	17.08
b	Drain out water from field to avoid crop loss	18	22.50	15	18.75	27	33.75	60	25.00
c	Slashed the crop to allow ratooning if damage was severe	11	13.75	05	6.25	03	3.75	19	07.92
d	Taking actions based on severity of floods	13	16.25	23	28.75	17	21.25	53	22.08
e	Planned planting to reach advanced growth stage before flood occurrence	29	36.25	26	32.5	12	15.00	67	27.92
4	**Lower productivity of sugarcane is caused by**								
a	Acute shortage of water	26	32.50	23	28.75	17	21.25	66	27.50
b	Frequent & faulty irrigation scheduling	12	15.00	10	12.50	08	10.00	30	12.50
c	Imbalanced application of fertilizers	17	21.25	21	26.25	27	33.75	65	27.08
d	Improper selection of inter-crops	13	16.25	16	20.00	15	18.75	44	18.33
e	All the above	12	15.00	10	12.50	13	16.25	35	14.58
5	**The role of government in crisis management in sugarcane is to**								
a.	Take strict actions against factory for delayed payments	27	33.75	36	45.00	33	41.25	96	40.00
b.	Fixing uniform prices for sugarcane (MSP instead of FRP)	36	45.00	26	32.50	22	27.50	84	35.00
c.	Framing of proper policies for sugarcane (Export, import etc)	13	16.25	16	20.00	21	26.25	50	20.83
d.	All the above	04	05.00	02	2.50	04	5.00	10	04.17

4.4.2.2 Statement wise awareness of overall sugarcane growers about crisis and its management in sugarcane.

The Table 21 indicated the distribution of total sugarcane growers based on their awareness about crisis and its management in sugarcane. It is observed that two-fifth of respondents (40.00 %) expressed that flood was major crisis faced in sugarcane farming followed by price crisis (36.25%). With respect to price crisis in sugarcane, more than one-third of the respondents (34.17 %) expressed that price crisis in sugarcane is due to delay in payments followed by over production, no fixed prices and fluctuations in weighing at factories (19.17%). More than one-fourth of sugarcane growers opined that flood management in sugarcane farming involves planned planting to reach advanced growth stage before flood occurrence (27.92 %) followed by drain out flooded water from field (25.00 %). With respect to lower productivity, more than one-fourth of the respondents expressed that acute shortage of water (27.50 %) and imbalanced use of fertilizers (27.08 %) were major causes for lower productivity in sugarcane farming followed by improper selection of inter crops (18.33 %). With respect role of government in sugarcane crisis management, two-fifth of the respondents expressed that government should take strict actions against factory for delayed payments and more than two-third of them expressed to fix uniform prices for sugarcane like minimum support price instead of fair and remunerative prices (35.00 %).

4. 4. 3. Overall awareness of sugarcane growers about crisis and its management.

The Table 22 and Fig. 8 represented the overall awareness of sugarcane growers about the crisis and its management in sugarcane farming. With respect to head reach sugarcane growers less than half of the respondents (47.50 %) belongs to moderate awareness category followed by poor (30.00 %) and better (22.50 %) awareness categories. Similarly, among mid reach sugarcane growers it was noticed that less than two-fifth of respondents (38.75 %) belongs to moderate awareness category followed by poor and better awareness categories with 33.75 per cent and 27.50 per cent respectively. Among tail end sugarcane growers, 36.25 per cent of sugarcane growers belongs to the good awareness category followed by poor and better awareness category with 33.75 per cent and 30.00 per cent respectively. In total, significant percentage of sugarcane growers belongs to the moderate awareness category with 40.83 per cent followed by poor and better awareness category with 30.42 per cent and 28.75 per cent respectively. The results are in congruence with the findings of Aravind (2011).

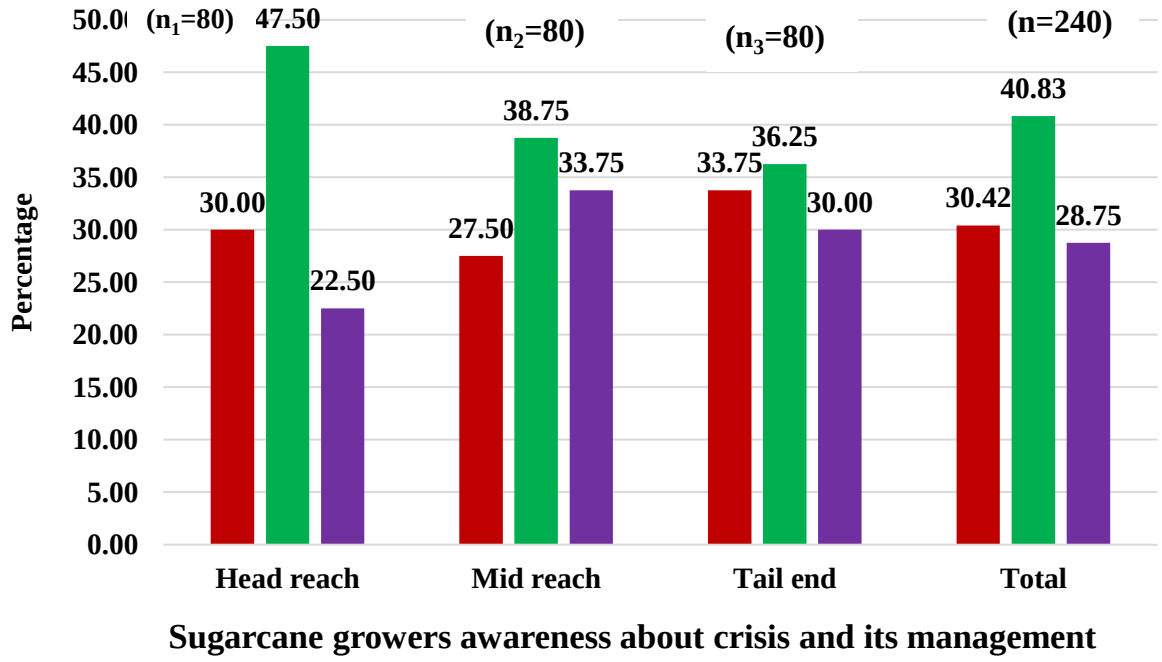

Fig. 8: Overall distribution of head reach, mid reach, tail end and total sugarcane growers into different categories of awareness about crisis and its management

From the results it can be interpreted than four-sixth (69.58 %) of the sugarcane growers belongs to moderate to better awareness levels about crisis and its management which was mainly due to the fact that farmers based on their knowing took the crisis management actions based on their exposure, severity and frequency of crisis in their condition. Crisis cannot be controlled/ prevented but it can be managed effectively if sugarcane growers aware about the crisis and its management. Hence, there is a need for improving the awareness level of sugarcane growers about crisis management by adopting suitable extension strategies during crisis period. It is imperative to devise suitable extension interventions like awareness campaigns, training to enhance coping capacities of sugarcane growers, planning farming systems, demonstrations, simulation exercises, etc., for updating their knowledge and create awareness about crisis management activities to facilitate better and holistic management of crisis to reduce its impact and faster recovery from its losses, rather than taking measures after crisis occurrence. In addition to that the chi-square test value indicates that the significant difference exists in the awareness level of sugarcane growers at one per cent of significance.

Table 22: Overall awareness of sugarcane growers about crisis and its management.

SI. No	Category	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f	%	f	%	f	%	f	%
1	Poor (<13.92)	24	30.00	22	27.50	27	33.75	73	30.42
2	Moderate (13.92 to 18.50)	38	47.50	31	38.75	29	36.25	98	40.83
3	Better (>18.50)	18	22.50	27	33.75	24	30.00	69	28.75

Mean=16.21 SD: 4.59

X^2 =12.79* : *Significant at 1 per cent

4.5 Awareness about the benefits received by sugarcane growers during crisis and its management.

4.5.1 Overall awareness of sugarcane growers about the benefits received by sugarcane growers during crisis and its management.

The Table 23 indicated the distribution of sugarcane growers into different categories of the awareness about the benefits received. The results revealed that more than two-fifth (43.75 %) of sugarcane growers belongs to moderate awareness category followed by the better awareness category with 34.58 per cent and poor awareness category with 21.67 per cent. This trend of result was mainly due to the reasons that most of the sugarcane farmers were aware of the help they received but don't aware about the exact source of assistance. Hence, they fall into the moderate awareness category. Further, they were concerned only with taking benefits no matter where it comes from as expressed by them. This tendency is mainly due to heavy burden of crises on farmers and their livelihoods making farmers highly vulnerable to crises.

Table 23: Overall awareness of sugarcane growers about benefits received during crisis and its management at different phases. (n=240)

SI. No.	Category	Sugarcane growers	
		f	%
1	Poor (<24.93)	52	21.67
2	Moderate (24.94 to28.73)	105	43.75
3	Better (>28.74)	83	34.58

Mean: 26.83 Standard Deviation:3.81

4.5.2 Item wise awareness about the benefits received by sugarcane growers during crisis and its management.

The glimpses on Table 24 depicted the awareness about the benefits received during crisis and its management by sugarcane growers. The awareness activities were ranked based on the mean score obtained for each awareness activity at different crisis management phases. The top ranked awareness statements in before crisis occurrence phase were storing adequate fodder for crisis time (Rank I), storing of seed and input material in advance in case of crop failures (Rank II) and crop insurance (Rank III). These might be due to the fact that farmers experienced the extreme shortage of fodder during their previous exposure to crisis and hence they preferred to store fodder and during shortage the local political leaders provided the sugarcane crop as fodder to cattle by paying to farmers for cane. Similarly, most of them were

aware of storing and preservation of seed material because of their traditional knowledge. Preserved the required seeds in ash with neem leaves and some used the chemicals for seed preservation. They were also aware of the crop insurance as earlier they borrowed from the banks where crop insurance was compulsory helped them to gain knowledge about crop insurance. The last ranked statement was simulation exercises like evacuation, swimming camps, building tents, group activity etc. (XII rank) prior to that keeping buffer stock of medicines for humans as well as animals (XI Rank. The reasons might be that as farmers were learnt about swimming from family members as they reside in river basin area as well as in open wells. With respect to activities like evacuation in emergency, building tents, group activity nobody has attended and aware of activities which necessitates the need for conducting simulation training on these aspects. The training of local people prepares them to respond quickly to crisis rather than waiting for rescue teams to carryout activities.

Similarly, during crisis occurrence phase the top mean score obtained benefits received by farmers were 'search and rescue' operations (Rank I), providing relief materials (food, water, sanitation, medicines etc.) (Rank II) and health and sanitation (Rank III) in and around schools and village roads. The reasons might be that the sugarcane growers' farmers were aware of search and rescue operations as they were involved directly with farmers during 2019 floods upsurged suddenly and at that time farmers were also received the basic necessities from individuals, organizations and government Ganji Kendra's. Since the floods have affected farmers severely, they have resided in rehabilitation camps for at least 15 days. During that period the government undertook the sanitation activities as well as regular health checkups of old people, woman and children were taken care in the camps.

Table 24: Statement wise awareness of the sugarcane growers about the benefits received during crisis and its management. (n=240)

SI. No.	Statements	Fully aware		Partly aware		Not Aware		Total awareness	
		f	%	f	%	f	%	Mean	Rank
	I. Before crisis:								
1	Storing adequate fodder for crisis time	94	39.17	103	42.92	43	17.92	1.21	I
2	Storing of seed and input material in advance in case of crop failures	83	34.58	120	50.00	37	15.42	1.19	II
3	Crop insurance	68	28.33	120	50.00	52	21.67	1.07	III
4	Early warning	66	27.50	122	50.83	52	21.67	1.06	IV
5	Cattle insurance	71	29.58	111	46.25	58	24.17	1.05	V
6	Drainage clear and spraying against mosquitos	70	29.17	101	42.08	69	28.75	1.04	VI
7	Training about coping mechanisms	77	32.08	88	36.67	75	31.25	1.01	VII
8	Evacuation of livestock	78	32.50	84	35.00	78	32.50	1.00	VIII
9	Prior contingency crop planning of farming systems	65	27.08	103	42.92	72	30.00	0.97	IX
10	Evacuation of human beings	63	26.25	105	43.75	72	30.00	0.96	X
11	Keeping buffer stocks of medicines	69	28.75	81	33.75	90	37.50	0.91	XI
12	Simulation exercises like evacuation, swimming camps, building tents, group activity etc	65	27.08	59	24.58	116	48.33	0.79	XII
	II. During crisis:								
13	Search and rescue	87	36.25	114	47.5	39	16.25	1.2	I
14	Providing relief materials (food, water, sanitation, medicines etc.)	94	39.17	86	35.83	60	25	1.14	II
15	Health and sanitation	77	32.08	104	43.33	59	24.58	1.08	III
16	Shifting cattle to safe places	82	34.17	90	37.5	68	28.33	1.06	IV
17	Needs and damage assessment	78	32.5	85	35.42	77	32.08	1.01	V
18	Shifting to shelters	68	28.33	103	42.92	69	28.75	1	VI
19	Disposal of carcass	52	21.67	98	40.83	90	37.5	0.84	VII
	III. After crisis:								
20	Soil reclamation	96	40	110	45.83	34	14.17	1.26	I
21	Resumption of transport facilities	77	32.08	102	42.5	61	25.42	1.07	II
22	Reconstruction of damaged houses	64	26.67	109	45.42	67	27.92	0.99	III
23	Resumption of communication facilities	52	21.67	107	44.58	81	33.75	0.88	IV
24	Restoration of livelihoods	42	17.5	116	48.33	82	34.17	0.83	V
25	Saving the standing crops	43	17.92	93	38.75	104	43.33	0.75	VI
26	Offering compensation	28	11.67	108	45	104	43.33	0.68	VII

Further, in the last phase of crisis management the top rank obtained benefits received were the soil reclamation (Rank I), resumption of transport facilities (Rank II) and reconstruction of damaged houses (Rank III). The farmers were aware about these type of assistance as they were cultivating green manure crops to enhance soil fertility, sheep and goat pica / litters, FYM and applied fertilizers based on the recommendations of local vendors' post floods and also based on their farming experience by observing leaf color. Further for salinity opened the drainage and installed the filtration pipes for fields and applied the gypsum sulphate for early dry off of saline soils. The transportation facilities information was gathered immediately through fellow farmers, tv, mobile and Tata ace drivers etc., because the farmers wanted to visit the vendors' shops and discuss about corrective measures and also to visit their other regular purposes along with documents generation for getting compensations.

4.6 Personal, socioeconomic, organizational and psychological characteristics

In this section, the profile characteristics of the respondents were presented. For easy and better understanding, the profile characteristics of sugarcane growers were classified into personal, socio-economic, organizational and psychological characteristics.

4.6.1 Personal characteristics of sugarcane growers

4.6.1.1 Age

It was evident from the Table 25 that forty per cent of the sugarcane growers were middle aged in head reach region followed by young (33.75 %) and old (26.50 %). In case of mid reach region, equal proportion of 33.75 per cent of respondents were in both middle and young age followed by 32.50 per cent of old age category. Where as in the tail end region 43.75 per cent were middle aged followed by young age (28.75 %) and old age (27.50 %). On the whole, 39.17 per cent respondents were belonged to middle age followed by young (32.08 %) and old age (28.75 %) category respectively.

4.6.1.2 Education

It was observed from the Table 25 that, among the sugarcane growers 26.25 per cent in head reach, 30.00 in mid reach and 33.75 per cent in tail end region were completed their matriculation. On a whole, 30.00 per cent were completed their matriculation followed by ITI/PUC/diploma (16.66 %), primary school (14.58 %), middle school (13.33 %), higher primary (11.25 %), graduates (7.08 %), illiterates (5.00 %) and only 2.08 per cent of farmers were completed their post-graduation.

4.6.1.3 Farming experience

It was shown in the Table 25 that in the head reach region, 42.50 per cent of respondents belonged to medium farming experience in sugar cane followed by high (37.50 %) and low (20.00 %) farming experience. In mid reach region 38.75 per cent of respondents were having high farming experience followed by low (31.25 %) and medium (30.00 %) farming experience. Whereas in tail end region 41.25 per cent of respondents having medium farming experience followed by high (33.75 %) and low (25.00 %) farming experience. In total 37.92 per cent of respondents were belonged to the medium category of sugarcane farming experience followed by high (36.67 %) and low (25.41 %) sugarcane farming experience respectively.

4.6.1.3 Prior exposure to crisis

It was observed from the Table 25 that irrespective of the regions nearly half of the respondents' fit into the medium category of prior exposure to crisis i.e., head reach (41.25 %), mid reach (47.50 %) and tail end (45.00 %) respectively. Whereas, among overall sugarcane growers 44.58 per cent respondents had falls in to medium category of prior exposure to crisis followed by 34.17 per cent were had low exposure and 21.25 per cent were comes under high prior exposure to crisis.

4.6.1.4 Family size

From the Table 25 observed that, in head reach region 47.50 per cent of respondents were belonged to large family size followed by 33.75 per cent medium family size and 18.75 per cent were belonged to the small family size. In mid reach region, 43.75 per cent were belonged to medium category followed by large (43.75 %) and small (15.00 %) family size. Whereas in tail end region 41.25 per cent of respondents were belonged to medium followed by large (36.25 %) and small (22.50 %) family size respectively. In total 41.67 per cent were belonged to large family size followed by medium (39.58 %) and low (18.75 %) category family size respectively.

Table 25: Personal characteristics of sugarcane growers of Northern Karnataka.

Sl. No.	Characteristics	Category	Sugarcane growers							
			Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
			f	%	f	%	f	%	f	%
1	Age	Young (up to 35 years)	27	33.75	27	33.75	23	28.75	77	32.08
		Middle (36-50 years)	32	40.00	27	33.75	35	43.75	94	39.17
		Old (>50 years)	21	26.25	26	32.50	22	27.50	69	28.75
2.	Education	Illiterate	4	5.00	5	6.25	3	3.75	12	5.00
		Can read and write	9	11.25	13	16.25	5	6.25	27	11.25
		Primary School	16	20.00	10	12.50	9	11.25	35	14.58
		Middle School	11	13.75	11	13.75	10	12.50	32	13.33
		Matriculation	21	26.25	24	30.00	27	33.75	72	30.00
		ITI/PUC/Diploma	11	13.75	10	12.50	19	23.75	40	16.66
		Graduate	5	6.25	5	6.25	7	8.75	17	7.08
		Post graduate	3	3.75	2	2.50	0	0.00	5	2.08
3	Farming experience in sugarcane	Low (0-5 years)	16	20.00	25	31.25	20	25.00	61	25.41
		Medium (5-10 years)	34	42.50	24	30.00	33	41.25	91	37.92
		High (>10 years)	30	37.50	31	38.75	27	33.75	88	36.67
4	Prior exposure to crisis	Low (Up to 5 times)	18	22.50	29	36.25	35	43.75	82	34.17
		Medium (5-10 times)	33	41.25	38	47.50	36	45.00	107	44.58
		High (>10 times)	29	36.25	13	16.25	9	11.25	51	21.25
5	Family size	Small (up to 4 members)	15	18.75	12	15.00	18	22.50	45	18.75
		Medium (5-7 members)	27	33.75	35	43.75	33	41.25	95	39.58
		Large ($\geq$ 8 members)	38	47.50	33	41.25	29	36.25	100	41.67

4.6.2 Socio-economic characteristics of sugarcane growers

4.6.2.1 Land holding

Nearly two-fifth of the farmers were belonged to the medium land holding category 31.25 per cent in head reach region followed by 40.00 per cent in mid reach region and 46.25 per cent in tail end region. As a whole, 39.17 per cent of farmers were medium farmers, 28.33 per cent were small farmers, 19.17 per cent were large farmers and 13.33 per cent were marginal farmers respectively (Table 26).

4.6.2.2 Annual income

With respect to the annual income significant percentage of the farmers belonged to the medium level of annual income in tail end region (45.00 %) followed by mid reach (42.50 %) and head reach region (37.50 %). In total 41.67 per cent farmers were belonged to medium level followed by 37.50 per cent were low level and 20.83 per cent were belonged to high level of annual income category respectively (Table 26).

4.6.2.3 Cosmopoliteness

From the Table 26 it was evident, that more than half of the respondents were belonged to the medium cosmopoliteness category in head reach region (52.50 %) and mid reach region (50.00 %). Whereas in tail end region, 37.50 per cent respondents were belonged to the low cosmopoliteness. On the whole, 46.25 per cent were belonged to medium cosmopoliteness category followed by high (27.50 %) and low (26.25 %) cosmopoliteness category respectively.

4.6.2.4 Mass media exposure

More than half of the head reach region (60.00 %) and mid reach (55.00 %) farmers belongs to the medium category of mass media exposure. Similarly, 43.75 per cent of tail end sugarcane growers also falls into the medium mass media exposure category. In nutshell, more than half (52.92 %) of overall sugarcane growers' belonged to medium category of mass media exposure followed by high (25.00 %) and low (22.08 %) category of mass media exposure (Table 26).

Table 26: Socio-economic characteristics of sugarcane growers of Northern Karnataka.

Sl. No.	Characteristics	Category	Sugarcane growers							
			Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
			f	%	f	%	f	%	f	%
6	Land holding	Marginal farmer (up to 2.5 acres)	9	11.25	13	16.25	10	12.50	32	13.33
		Small farmer (up to 2.51-5.0 acres)	24	30.00	22	27.50	22	27.50	68	28.33
		Medium farmer (> 5.0-10.0 acres)	25	31.25	32	40.00	37	46.25	94	39.17
		Large farmer (> 10.0 acres)	22	27.50	13	16.25	11	13.75	46	19.17
7	Annual income Mean:4.831 lakhs SD: 3.345 lakhs	Low (<3.16 lakhs)	27	33.75	31	38.75	32	40.00	90	37.50
		Medium (3.16 to 6.5 lakhs)	30	37.50	34	42.50	36	45.00	100	41.67
		High (> 6.50 lakhs)	23	28.75	15	18.75	12	15.00	50	20.83
8	Cosmopoliteness Mean: 4.5083 SD: 1.6279	Low (<3.69)	12	15.00	21	26.25	30	37.50	63	26.25
		Medium (3.69 to 5.32)	42	52.50	40	50.00	29	36.25	111	46.25
		High (>5.32)	26	32.50	19	23.75	21	26.25	66	27.50
9	Mass media exposure Mean: 9.0375 SD:2.1915	Low (<7.94)	8	10.00	15	18.75	30	37.50	53	22.08
		Medium (7.94 to 10.13)	48	60.00	44	55.00	35	43.75	127	52.92
		High (>10.13)	24	30.00	21	26.25	15	18.75	60	25.00
10	Innovative proneness Mean: 12.0125 SD: 2.9895	Low (<10.51)	14	17.50	28	35.00	33	41.25	75	31.25
		Medium (10.51 to 13.51)	27	33.75	30	37.50	40	50.00	97	40.42
		High (>13.51)	39	48.75	22	27.50	07	08.75	68	28.33

4.6.2.5 Innovative proneness

In head reach region, less than half (48.75 %) of the sugarcane growers were having high innovative proneness followed by medium (33.75 %) and low (17.50 %). In mid reach region, 37.50 were belonged to medium followed by low (35.00 %) and high (27.50 %) innovativeness categories. Whereas in tail end region, half of the sugarcane farmers belonged to medium category followed by low (41.25 %) and high (8.75 %) innovative proneness. On a whole, 40.42 per cent of the farmers belonged to medium innovative proneness category followed by low (31.25 %) and high (28.33 %) innovative proneness category respectively (Table 26).

4.6.3 Organizational characteristics of sugarcane growers.

4.6.3.1 Extension support

Nearly forty per cent of the head reach (38.75 %) and more than two-fifth of mid reach (41.25 %) sugarcane growers belonged to low extension support category. Whereas, more than two-fifth (43.75 %) of tail end sugarcane cultivators belongs to medium extension support category. On a whole, slightly less than two-fifth (39.17 %) of overall sugarcane growers belonged to medium extension support followed by low (33.75 %) and high (27.08%) extension support category (Table 27).

4.6.3.2 Production input support

Nearly half of the farmers belonged to moderate production input support category in tail end region (48.75 %) followed by head reach (46.25 %) and mid reach region (45.00 %). In total, less than half (46.66 %) of the sugarcane growers belonged to moderate production input support and equal proportion of (26.67 %) of growers were belonged to both poor and good production input support categories (Table 27).

4.6.3.3 Credit support

With respect to the credit support, two fifth (40.00%) of head reach received medium credit support category and 43.75 per cent of mi-reach sugarcane farmers comes under low credit support category. Whereas, 43.75 per cent of tail enders were belongs to high credit support category. In total, 34.17 per cent of total sugarcane farmers received high credit support followed by 33.33 per cent low and 32.50 per cent were received medium credit support (Table 27).

Table 27: Organizational characteristics of sugarcane growers of Northern Karnataka.

Sl. No.	Characteristics	Category	Sugarcane growers							
			Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
			f	%	f	%	f	%	f	%
11	Extension support Mean: 32.700 SD: 4.743	Low (<30.33)	31	38.75	33	41.25	17	21.25	81	33.75
		Medium (30.34 to 35.06)	29	36.25	30	37.50	35	43.75	94	39.17
		High (>35.07)	20	25.00	17	21.25	28	35.00	65	27.08
12	Production input support Mean: 15.9458 SD: 2.9695	Poor (<14.46)	17	21.25	32	40.00	15	18.75	64	26.67
		Moderate (14.47 to 17.42)	37	46.25	36	45.00	39	48.75	112	46.66
		Good (>17.43)	26	32.50	12	15.00	26	32.50	64	26.67
13	Credit support Mean: 12.4625 SD: 2.3019	Low (<11.311)	22	27.50	35	43.75	23	28.75	80	33.33
		Medium (11.32 to 13.61)	32	40.00	24	30.00	22	27.50	78	32.50
		High (>13.62)	26	32.50	21	26.25	35	43.75	82	34.17
14	Crisis management trainings needed Mean: 22.7958 SD: 4.7815	Low (<20.40)	20	25.00	35	43.75	26	32.50	81	33.75
		Medium (20.41 to 25.18)	31	38.75	23	28.75	29	36.25	83	34.58
		High (>25.19)	29	36.25	22	27.50	25	31.25	76	31.67

4.6.3.4 Crisis management trainings needed

From the Table 27 it was observed that, about 38.75 per cent of head reach sugarcane farmers are in medium crisis management trainings needed category followed by high (36.25 %) and low (25.00 %) categories. In mid reach region, 43.75 per cent farmers needed low training followed by 28.75 per cent were needed medium training and 27.75 per cent were in high category of crisis management training needed. Where as in tail end region, 36.25 per cent were needed medium training followed by 32.50 per cent low and 31.25 per cent were needed high training. In total, 34.58 per cent of farmers were needed medium crisis management trainings followed by 33.75 per cent needed low training and 31.67 per cent farmers needed high training needed category regarding crisis management.

4.6.4 Psychological characteristics of sugarcane growers

4.6.4.1 Scientific orientation

From the Table 28, it is observed that 37.50 per cent of farmers in head reach region and 55.00 per cent in mid reach region were belonged to medium category of scientific orientation. Whereas, in tail end region 37.50 per cent of farmers were belongs to high category of scientific orientation. In total, more than two fifth (41.67%) of total farmers belonged to medium category followed by high (31.67 %) and low (26.66 %) category of scientific orientation.

4.6.4.2 Farming commitment

Less than half (46.25 %) of sugarcane farmers in head reach region and more than two-fifth (41.25 %) per cent of sugarcane farmers in tail end region were belongs to low category of farming commitment. While in mid reach region more than two-fifth (42.50 %) of sugarcane farmers belonged to medium farming commitment. In total, 37.50 per cent of farmers have medium farming commitment followed by less (36.67 %) and high (25.83 %) categories of farming commitment (Table 28).

4.6.4.3 Deferred gratification

In Table 28, more than two-fifth (43.75%) in head reach and less than half (47.50 %) in mid reach farmers were belongs to medium deferred gratification category. While in tail end region 38.75 per cent of farmers belonged to high deferred gratification. On a whole, more than

two-fifth (40.42 %) of overall sugarcane farmers belonged to medium deferred gratification category followed by high (35.00 %) and low (24.58 %) deferred gratification group.

4.6.4.4 Risk orientation

With respect to risk orientation, most of the sugarcane growers belonged to the medium risk orientation category in head reach (40.00 %), mid reach (58.75 %) and tail end region (46.25 %). On a whole, less than half (48.33 %) of the sugarcane growers were belongs to medium category followed by high (31.25 %) and low (20.42 %) risk orientation categories respectively (Table 28).

4.6.4.5 Achievement motivation

Significant percentage of the sugarcane growers belonged to the medium category of achievement motivation in head reach (41.25 %), mid reach (37.50 %) and tail end region (40.00 %) respectively. In total, 39.58 per cent of sugarcane farmers belonged to medium achievement motivation category followed by high (36.25 %) and low (24.17 %) achievement motivation category (Table 28).

4.6.4.6 Perception towards crisis

Most of the sugarcane growers belonged to moderate perception towards crisis in head reach (43.75 %), mid reach (42.50 %) and tail end region (47.50 %) respectively. In total, 44.58 per cent of sugarcane farmers were belonged to moderate perception followed by good (30.42 %) and poor (25.00 %) perception towards crisis (Table 28).

4.6.4.7 Attitude towards crisis management

With respect to the attitude towards crisis management, irrespective of the region, nearly two-fifth of sugarcane farmers possesses the favourable attitude viz., head reach (40.00 %), mid reach (42.50 %) and tail end region (38.75 %) respectively. Almost equal percentage of sugarcane growers had neutral (30.42 %) and unfavourable (29.16 %) attitude towards crisis management (Table 28).

Table 28: Psychological characteristics of sugarcane growers of Northern Karnataka.

Sl. No.	Characteristics	Category	Sugarcane growers							
			Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
			f	%	f	%	f	%	f	%
15	Scientific orientation Mean: 12.1417 SD: 2.6086	Low (<10.83)	23	28.75	17	21.25	24	30.00	64	26.66
		Medium (10.84 to 13.44)	30	37.50	44	55.00	26	32.50	100	41.67
		High (>13.45)	27	33.75	19	23.75	30	37.50	76	31.67
16	farming commitment Mean:20.3042 SD:3.9638	Low (<18.32	37	46.25	18	22.50	33	41.25	88	36.67
		Medium (18.33 to 22.28)	24	30.00	34	42.50	32	40.00	90	37.50
		High (>22.29)	19	23.75	28	35.00	15	18.75	62	25.83
17	Deferred gratification Mean:26.4375 SD:5.0088	Low (< 23.93)	15	18.75	19	23.75	25	31.25	59	24.58
		Medium (23.93 to 28.94)	35	43.75	38	47.50	24	30.00	97	40.42
		High (>28.95)	30	37.50	23	28.75	31	38.75	84	35.00
18	Risk orientation Mean:16.2333 SD:2.5223	Low (< 14.97)	19	23.75	9	11.25	21	26.25	49	20.42
		Medium (14.98 to 17.49)	32	40.00	47	58.75	37	46.25	116	48.33
		High (>17.49)	29	36.25	24	30.00	22	27.50	75	31.25
19	Achievement motivation Mean: 12.0292 SD:2.3512	Low (10.85)	19	23.75	21	26.25	18	22.50	58	24.17
		Medium (10.86 to 13.20	33	41.25	30	37.50	32	40.00	95	39.58
		High (>13.21)	28	35.00	29	36.25	30	37.50	87	36.25
20	Perception towards crisis Mean: 22.6125 SD:3.8832	Poor (<20.67)	20	25.00	18	22.50	22	27.50	60	25.00
		Moderate (20.67 to 24.55)	35	43.75	34	42.50	38	47.50	107	44.58
		Good (>24.56)	25	31.25	28	35.00	20	25.00	73	30.42
21	Attitude towards crisis management Mean: 28.5558 SD:4.6687	Unfavourable (<26.22)	23	28.75	28	35.00	19	23.75	70	29.16
		Neutral (26.23 to 30.88)	25	31.25	18	22.50	30	37.50	73	30.42
		Favourable (>30.89)	32	40.00	34	42.50	31	38.75	97	40.42
22	Knowledge Mean: 18.5583 SD:2.5043	Low (<17.30)	19	23.75	33	41.25	20	25.00	72	30.00
		Medium (17.31 to 19.81)	31	38.75	22	27.50	32	40.00	85	35.42
		High (>19.82)	30	37.50	25	31.25	28	35.00	83	34.58
23	Adoption Mean: 13.0125 SD:2.5075	Low (<11.75)	17	21.25	24	30.00	25	31.25	66	27.50
		Medium (11.76 to 14.26)	39	48.75	33	41.25	38	47.50	110	45.83
		High (>14.27)	24	30.00	23	28.75	17	21.25	64	26.67

4.6.4.8 Knowledge

About 38.75 per cent in head reach and 40.00 per cent in tail end region were possessing medium knowledge. While in mid reach region 41.25 per cent were belonged to low knowledge category. In total, 35.42 per cent were belonged to medium knowledge followed by high (34.58 %) and low (30.00 %) knowledge category (Table 28).

4.6.4.9 Adoption

Most of the sugarcane growers belonged to the medium adoption category in head reach (48.75 %), mid reach (41.25 %) and tail end region (47.50 %). In total, 45.83 per cent of the overall sugarcane farmers belongs to medium adoption category followed by low (27.50 %) and high (26.67 %) adoption categories respectively (Table 28).

4.7 Association of personal, socioeconomic, organizational and psychological characteristics with the crisis management behaviour of the sugarcane growers.

4.7.1 Association of personal characteristics with the crisis management behaviour of sugarcane growers.

The results from Table 29 depicted the association between the personal characteristics indicating variables of sugarcane growers with their crisis management behaviour in sugarcane farming. The results revealed that among the five personal variables only two variables namely education and prior exposure to the crisis are associated with their crisis management behaviour at one per cent level of significance positively. The experience in sugarcane farming was significantly associated at 0.05 significance level whereas remaining personal variables were found non-significant at 5 per cent level of significance. These findings are in association with the findings of Jyothi (2000). Let us discuss about these variables' association with crisis management behaviour of sugarcane growers.

4.7.1.1 Age with crisis management behaviour

The data in the Table 29 showed that chi square value worked out between age and crisis management behaviour was less than critical value indicating that age and the crisis management behaviour of sugarcane growers were not associated significantly at five per cent significance level.

Age is an uncontrolled irreversible biological process. In the aging process, an individual moulds his actions by engaging himself with external physical and social environments around him which is central for any substantial changes observed among the individuals. Some persons achieve certain things as age advances against others who complete their tenure of life without any productive achievements. Therefore, age itself does not contribute significantly at various times for individual actions and attainments. Although it provides foundation for other personality characters to be established on it. Also, the assumption of aging corresponds to improved level of experience and skills due to increased interaction are questionable. In view of modernization of social systems, the attainment or acquisition of something which would have taken several years in the past, require a few years now. With the advancement of technologies and smart ICT interventions, the persons who good amount of knowledge and access to these advancements irrespective of their age can manage the crises. As a consequent of this causal influence of farmers age on crisis management is not very prominent.

4.7.1.2 Education with crisis management behaviour

An observation of the Table 29 showed that chi square value computed between education and crisis management behaviour was found to be significant at 0.01 level of significance. Thus, the personal variable education of sugarcane growers was observed to be associated positively with their crisis management behaviour. The results are in line with the findings of Vinay (2015).

Education is a basic element and important step towards human development. Education was found to have significant influence on rational decision making by farmers. Also, it was reported that education had higher pay off in a technological dynamic economy where the scope for exercise of discretionary abilities, adaptability and decision-making ability were higher. Therefore, education influences the selection of alternative actions i.e., decisions and judicious use of locally available low-cost resources.

4.7.1.3 Farming experience in sugarcane with crisis management behaviour

The computed chi square value between farming experience in sugarcane with crisis management behaviour of sugarcane farmers in Table 29 showed that farming experience is associated significantly with the crisis management behaviour at five per cent level of significance.

Logically, accumulated experience in sugarcane farming among the farmers with self-driven urge for new learning with the acceptance of new challenges posed by crises and their management with effective interventions like mitigation mechanisms, crisis situation specific adaptations etc. which in-turn will result in higher crisis management behaviour. Internalized routine experience among the individuals make them to accept the change in the existing psychomotor skills which would have been introduced through acceptance of new technological advances in their situation. Also, this perfect conditioning of an individual with the old experiences, make them primitive in thinking that leads to observable changes in their crisis management behaviour.

Table 29: Association between personal characteristics with the overall crisis management behaviour of total sugarcane growers. (n=240)

Sl. No.	Personal variables	Chi -square value
1.	Age	2.36^{NS}
2.	Education	26.87 **
3.	Farming experience in sugarcane	7.80*
4.	Prior exposure to crisis	23.22 **
5.	Family size	3.40^{NS}

NS= non-significant, *=Significant at 5%, **= Significant at 1%

4.7.1.4 Prior exposure to crises with crisis management behaviour

The results in the Table 29 depicts that there was significant association exists between sugarcane growers' prior exposure to crisis and their crisis management behaviour levels with the computed 'X^{2}' value of 23.22, which was found to be significant at 0.01 level of probability.

Number of times or frequency of crises faced and their severity is termed as prior exposure to crisis situation. This exposure provides learning opportunity where the sugarcane growers make changes in their behavioural actions through the practice and experience of success / failure of crisis management interventions. In this process, the actions which are successful were further strengthened and used more often than the unsuccessful actions. Also, crisis exposure leads to make efforts and also to gather more information for complete and better understanding of crisis situation before taking actions. Further, prior exposures to crises helped the sugarcane growers to evaluate their coping strategies in sugarcane farming, family/home and also to choose the appropriate strategies to mitigate the negative impact of crises on sugarcane. Thus, the results are quite expected to be associated with each other as previous experiences and exposures provide basis for advanced learning and development.

4.7.1.5 Family size with crisis management behaviour

The results of the Table 29 revealed that 'X^2' value computed between family size and crisis management behaviour was observed to be non-significant at 0.05 level by concluding that the family size and crisis management behaviour levels were not associated.

If the family size is large, then higher would be the expenditure on household. The decreased landholding due to bifurcations of family over years and increased expenditures on social issues. Increased frequency of crises with higher severity and uncertainty of monsoons made the sugarcane growers more vulnerable to the living. The decreased landholding, increased crisis vulnerability and reduced income might have influenced them to have an ideal family size in such way to afford the expenses even under the crisis years. This is also coupled with the government initiatives of family planning. Under decreased land size and to get sustainable income under crisis situations through judicious decision making, selection of wise adaptive strategies, increasing crop yield and maximizing profit per unit investment. The farm mechanization has further made the farmers to less worrisome for almost all activities in farming. Further, the shifting of people during crisis was also difficult. Hence the farmers are of opinion that based on the farm size and regular incomes one should decide the family size keeping national interest in mind. Although the presence of large family does not help them because of their residences in working cities and their own commitments.

4.7.2 Association of sugarcane growers' socioeconomic characteristics with the crisis management behaviour of sugarcane growers.

The glimpses on Table 30 depicted the association between the socioeconomic indicating variables of sugarcane growers with their crisis management behaviour levels in sugarcane farming. The results revealed that out of five socioeconomic variables mass media exposure was found to be significantly associated with crisis management behaviour at one per cent level whereas cosmopoliteness and innovative proneness were found to be significantly associated at five per cent level. The findings are in congruence with Gohil *et al.* (2016). But the land holding is not associated with the crisis management behaviour five per cent significance level.

4.7.2.1 Landholding with crisis management behaviour

The observation of Table 30 revealed that the 'X^2'value calculated was lesser than table value at 0.05 level, indicating non-significant association between land holding and crisis

management behaviour level of sugarcane farmers. Although there is belief that large land-holdings provide farmers with an opportunity to think of many alternative courses of actions and also higher resource possession attached to higher holdings aid farmers to take appropriate actions at right time. But the prevailing crisis conditions especially floods and drought has affected the all kinds of sugarcane farmers irrespective of their operational holdings. The preparatory, mitigation mechanisms, behavioural survival actions, rehabilitation and recovery activities involve the equal investments that varies simultaneously with the landholdings. Hence, the mid reach and tail farmers were of the opinion that the based on the severity of crises only decided to invest on crisis management as they previously burned their hands by investing in it. The head reach farmers were majorly focused on post crisis and during crisis activities rather than pre-crisis activities as floods have damaged their previously adapted strategies as precautions except early planting. Instead of going for multiple crops farmers preferred to cultivate sugarcane as it is stress tolerant crop compared to other short duration crops and it also requires low farm labours except at initial stages and final harvesting. In addition, to that most of the farmers have received the credit from banks but did not paid on time and remained as debtors in banks. Hence banks were not coming forward to lend loans during crisis as well as normal agriculture loans except very few or rare farmers who cleared debts on time. Further, the belief of farm loan waive-off has made farmers lazy and even they won't bother about the remaining loans in banks.

4.7.2.2 Annual income with crisis management behaviour

The observations made from Table 30 revealed that there was non-significant association existed between annual income and crisis management behaviour of the sugarcane farmers at 0.05 per cent level.

It is proven fact that high annual income leads farmers to invest on productive purposes and greater access to information sources. The natural crises like floods, droughts, soil erosion due to flooding, aberrant rainfall etc. are not in the farmers control to full extent. Hence farmers preferred to save the extra earnings of normal years to use during crisis recovery in future rather than immediate spending on farm development fully except the extremely felt critical needs in farming. Further, the farmers used some faulty agronomic practices in head reach and mid reach area like growing exhaustive crops as intercrops as well as following faulty irrigations using streams' saline water during acute water shortage has reduced the main crop yield as well as deteriorated the soil health. Further, sand mining in river basin areas was affecting the agricultural land. All these factors have made the farmer to be conservative in attainment and

investing in farm activities based on their annual income. But in contrast these farmers have focused mainly on the low cost and less capital intensive as well as additional income generating or cost cutting crisis management activities in their farm.

4.7.2.3 Cosmopoliteness with crisis management behaviour

The cosmopoliteness of farmers was recorded to be associated significantly with their crisis management levels as evident from Table 30 at 0.05 significance level. It is well accepted that cosmopoliteness of farmer increases his contact with outside world where an individual will be exposed to new ideas and experiences of diverse people. This interaction provides him a benefit of vicarious experience thereby affecting decision-making ability and application of new ideas by the individuals that will effectively leads to better management of crisis situations in sugarcane. Also, the cosmopoliteness help to expose sugarcane growers to developmental opportunities like credit or government subsidy programmes to undertake suitable flood combating permanent measures and other government programmes like solar pump sets, pipelines establishment under ganga kalyana Yojana etc. Hence the association between cosmopoliteness and crisis management was logically seeming true.

4.7.2.4 Mass media exposure with crisis management behaviour

The chi-square cross tabulation between mass media exposure and crisis management behaviour of sugarcane farmers was found to be associated significantly at 1 per cent level (Table 30). The outcomes could be accredited to vital role played by the mass media. The mass media 'accumulate and distribute information around the concerned events in the environment' (outside and inside) of any particular region/situation/society. Also, they provide interpreted information about the environment and precipitation for conduct which adds further dimension of thinking to farmers. The three common functions of mass media in general includes watchman, decision-making and teaching. As mass media contributes to the decision-making process by making the necessary information available at required time with all advanced updates and creates awareness among large mass of sugarcane growers. Thus, influencing the decision-making ability of sugarcane growers. Besides the manifest function of mass media, the latent function is that mass media possession became sources of information authority and entertainment of individuals and groups. Further, the mass media bring about cognitive, effective and behavioral effects in addition to reinforcing the existing beliefs. Therefore, in purview of this broad functional role of mass media the sugarcane growers' exposure to mass media would acquire information regarding advanced sugarcane farming practices with

varieties, cattle management and improved breeds, integrated farming opportunities, value addition, demands for different products of sugarcane etc., besides knowing about various developmental programmes. Thus, assisting in their decision- making under crisis situations and help to stabilize their returns. Therefore, the observed significant association between mass media exposure with sugarcane farmers' crisis management behavior levels is logically seems true to the prevailed condition.

4.7.2.5 Innovative proneness with crisis management behaviour

The results of the chi-square test between innovative proneness with crisis management behaviour indicates the significant association at 0.05 per cent level of significance (Table 30). Logically, advanced and innovative technologies at village/ societal level creates the conducive climate for development. This could beneficially by ignite the sugarcane farmers to be innovative to undertake and overcome crisis vulnerabilities. Thus, it is indirectly individual effort which tells upon ones' management of a situation. Also, innovative proneness indicates a capital-intensive farming having high labour employment potential. As a consequent of this, particularly small and marginal farmers might have sought labour employment throughout the year. This continuous availability of employment is just not sufficient to feed their families. Such conditions might not have made them to recognize the need for permanent crisis proofing activities involving long-run strategies related to land development or acceptance of multiple enterprises to earn more income as well as stabilizing the farm income. Moreover, the weak community bondage is seen in the progressive rural societies might be acting as a serious barrier for group efforts required to mobilize human and material resources for establishing or maintaining community assets like infrastructure, inside roads development, drinking water tank development etc to bring down the negative effects of crises on humans. In view of the above observations, the innovative proneness of the village shows significant relationship with crisis management level of farmers.

Table 30: Association between socio-economic characteristics with the overall crisis management behaviour of total sugarcane growers. (n=240)

Sl. No.	Socio-economic variables	Chi -square value
1.	Land holding	3.631 ^{NS}
2.	Annual income	4.530 ^{NS}
3.	Cosmopoliteness	6.681 *
4.	Mass media exposure	27.89 **
5.	Innovative proneness	10.04 *

NS= non-significant, *=Significant at 5%, **= Significant at 1%

4.7.3 Association of organizational characteristics with the crisis management behaviour of sugarcane growers.

The results in the table 31 indicated the association between the organizational characteristics indicating variables of sugarcane growers with their crisis management behaviour levels in sugarcane farming. The results revealed that out of four organizational characteristics three variables were found to be significantly associated with crisis management behaviour at one per cent significance level namely extension orientation, production input support and credit support. Participation in crisis management trainings was found non-significant association at 5 per cent level of significance. These findings are in congruence with Vinay Kumar (2015).

4.7.3.1 Extension orientation with crisis management behaviour

The results in the Table 31 showed that the chi-square cross tabulation value computed between the extension orientation and crisis management behaviour of sugarcane growers was found to be associated significantly at 0.01 level. Extension advice foster clear understanding of the farmers' position, alerts them to changes occurring over years based on analysis and promote informed decision making and adaptations. Also, provide facts and probabilities to sound decision-making after well thought evaluation. Further, extension guidance of line departments, private consultancy and para extensionists would also help sugarcane farmers to explore the development and crisis management opportunities available from different programmes like farm ponds, micro irrigation, solar pump sets, etc. In addition to information support, the material support such as seedlings / setts, seeds, fertilizers, micronutrients like boron, zinc etc., offered by extension organizations helped farmers to undertake crisis management and mitigation strategies for long run or short run nature. Thus, crucial roles of identification of felt needs through need arousal, development related information, seedling nurseries linking with farmers and materials supports comprising extension personnel support might be helping for better management of crisis by sugarcane farmers.

4.7.3.2 Production input support with crisis management behaviour

The data presented in the Table 31 presented the results of chi-square test computed value emerged to be significantly at 0.01 level of probability signifying that production input support and crisis management behaviour levels of sugarcane farmers were significantly associated. Production inputs support include availability of seeds/seedling, fertilizers, plant

protection chemicals, micronutrients, contingency crop seeds etc., should be available at nearest places to sugarcane cultivators with specific required brands availability of inputs at needed time in sufficient quantities. Production input support plays a key role in agricultural production when their availability is timed with the sync of normal climate and weather as the farm operations run parallel to the monsoons. Further, the farm related communication efforts of line departments may not cause concrete impact on farm economy without adequate support by the production inputs availability. The local availability of agricultural inputs and equipment's are essential to put the technology into practice. Efficient and timely production inputs supply with other requisites of crisis management supports are the fundamental pre-requisite in the shift from traditional to commercial cultivation. Thus, the significant relationship between these variables has emerged.

4.7.3.3 Credit support with crisis management behaviour

The credit support received by the farmers depicted a highly significant association with the sugarcane grower's crisis management behaviour as revealed by chi-square test at 0.01 significance level (Table 31).

Essentially, sugarcane growers are in need of credit support mainly for long-term solutions like new jaggery unit construction or to modify the existing production unit into semi-automatic units, soil salinity reclamation, irrigation pipelines from river basin, digging wells or bore wells, reclamation of sand mined fields, waterlogged areas etc., requires huge investments. Few farmers who paid their loan dues received the loans regularly without any hassles but other farmers are unable to get credit support from institutional sources because of their long-term debts. But they have carried out these development activities by borrowing from private money lenders in sufficient and timely manner. Further, the adoption of better agricultural management practices like land leveling, shaping, bunding and adoption of improved crop technology again and again due to crisis are normally being capital intensive. The sugarcane growers having low economic ability cannot come up with the sufficient money for such high-cost developmental activities on their own. The permanent flood proofing also requires much higher capital. Further, the availability of capital influences the decisions of sugarcane growers and thereby their income and economic performance. Therefore, credit is considered as turpitude for agricultural development in crisis prone areas to manage the crises well. Also, the survival in the agricultural economy of the future will depend largely upon the individual farmers' management ability and whether he has sufficient credit of right type at right time and credit is needed at the early transitional stages of agricultural development. Well organized

credit system that functions effectively whether private, cooperative or governmental or combination of these greatly facilitates the development as well as abilities of crisis management in a better way.

4.7.3.4 Crisis management trainings needed with crisis management behaviour

The results from Table 31 indicated that there is no significant association between crisis management trainings needed and crisis management behaviour at 0.05 level of significance.

The crisis management behaviour should have to be associated with crisis trainings needed logically. But the development departments were majorly focused on programmes that normally provide material benefits (incentive) besides information benefits to sugarcane farmers. They neglected the identification of key needs of sugarcane growers for better crisis management and rarely / no trainings were organized specifically on crisis management. But regularly conducted the trainings which normally focuses on increasing productivity rather than finding alternatives for price crisis, floods, droughts, etc. This makes farmers to become lazy as well as adapting less effective measures which they know rather than finding most effective scientific mechanisms. Instead of those developmental programmes, concerned departments should have to concentrate on capacity development in sugarcane crisis coping. Hence, this may be the reason for this kind of non-association with crisis management behaviour of farmers.

Table 31: Association between organizational characteristics with the overall crisis management behaviour of total sugarcane growers. (n=240)

Sl. No.	Organizational variables	Chi -square value
6.	Extension orientation	36.55 **
7.	Production input support	25.03 **
8.	Credit support	24.55 **
9.	Crisis management trainings needed	5.29 ^{NS}

NS= non-significant, *=Significant at 5%, **= Significant at 1%

4.7.4 Association of organizational characteristics with the crisis management behaviour of sugarcane growers.

The Table 32 shows the association between the psychological characteristics indicating variables with the crisis management behaviour of sugarcane growers in farming. From the results it is observed that all the psychological variables were found to be significantly associated with crisis management behaviour either at one or five per cent level of significance. The variables deferred gratification and risk orientation were found significant at five per cent level of significance remaining were found significant at one per cent level of significance. The

findings are in similarity with the findings of (Rame Gowda 1991) and Vinay Kumar (2015). Let us discuss about these variables in detail.

4.7.4.1 Scientific orientation with crisis management behaviour

The Table 32 showed the chi-square cross tabulation computed between scientific orientation and crisis management behaviour revealed the significant association between scientific orientation and the crisis management behaviour levels of sugarcane growers. The credible reason might be that, farmers with scientific orientation could be more receptive to the latest technologies, employ scientific methods in making the decisions as well as acquired and adopted efficient adaptations of management of agriculture and sugarcane crisis. This ultimately reflects on their higher level of crisis management which helps to have a significant association of sugarcane growers' scientific orientation with the crisis management behaviour levels.

4.7.4.2 Farming commitment with crisis management behaviour

The chi-square test value computed between farming commitment and crisis management behaviour of sugarcane growers was found the significant association at 1 per cent significance level (Table 32). This might be because of the fact that farmers who are dedicated to farming and have strong desire to stay in sugarcane farming because of high returns in normal years as well as less labour intensive compared to other crops. Further the support in scientific view would extract more hard work on crisis management from sugarcane growers. Also, the maintenance of substitute farm enterprises and intercrops will complement their earnings. These divergent efforts with the scientific agricultural methods in sugarcane and crisis management practices would perhaps enhance the crisis management behaviour of sugarcane farmers.

4.7.4.3 Deferred gratification participation with crisis management behaviour

The deferred gratification of sugarcane growers was found to be associated significantly with their crisis management behaviour at 0.05 level of probability as observed from the Table 32. It could be disputable but fact that the postponement of instant satisfaction during normal years by sugarcane growers increase their savings as well as accumulation of capital which they further use during the crisis periods. Under the crisis situation the sugarcane farmer will be in a better situation to make fitting and suitable choice of strategies to diminish the adverse impact

of crises on sugarcane growers and thereby stabilizing the outcomes. Therefore, the results recorded are in complying with the crises prevailing in situation.

4.7.4.4 Risk orientation with crisis management behaviour

The chi-square cross tabulation value computed between crisis management behaviour and risk orientation scores of sugarcane growers was found to be significant at 5 per cent level indicating significant association with each other as observed from Table 32**.** Risk taking is an important quality of innovators, progressive farmers and the agripreneurs. The risks are always involved in farming but under crisis situation it gets multiplied because of higher uncertainties and cannot be controlled. The calculated risks or well evaluated decisions taken in sugarcane farming gives better yield and profits thereby stabilizing the returns under crisis. As gambling monsoons and natural calamities coupled with human greed for over development are all involving the risks and making agriculture riskier. In this sense that anticipation of profits is a necessary stimulus for risk taking. Therefore, in farming during crisis situations those who take a calculated risk at any rate performed better than the other farmers and are in line with those that moderate risk takers are high achievers.

4.7.4.5 Achievement motivation with crisis management behaviour

The results reported in the Table 32 revealed that there was significant association exists between the achievement motivation and crisis management behaviour of sugarcane growers at 1 per cent level of significance. The ‘achievement motivation’ as a 'mental virus' that leads aspirations to prove oneself superior than others, which is necessary factor to change individuals of society and seems to influence task or goal-oriented behaviour. Motivation contributes positively for performance. Existence of dissonance creates psychological tension or discomfort that will motivate the person to reduce dissonance and achieve consonance. Thus, the psychologists have proved the significance of achievement in individual performance. A farmer with high achievement motivation will definitely conceive the crisis mitigating strategies better than an individual with low achievement motivation. Motivation built up in an individual also influences other variables which lead to better crisis management behaviour. Hence, the crisis management behaviour showed a significant association with achievement motivation.

4.7.4.6 Perception towards crises with crisis management behaviour

The results from Table 32 revealed that perception towards crisis and crisis management behaviour of sugarcane growers was found to be significantly associated at 0.01 level. A theory of stress and coping revealed that cognitive appraisal are central elements of human actions. The appraisal of threat is viewed as an intervening variable between the stimulus situation, the threat and stress reaction. It is this appraisal which helps to explain marked individual reactions to stimulus situations. It was also argued that motives, belief systems, and ability to withstand environmental pressures that shape reactions and ways in which the situation is appraised. Lazarus (1966) maintains that cognitive appraisal is of primary importance in determining the strategies for dealing with the threat. The specific objective factors in one's personal history may also influence the perceived severity of the stimulus condition. For instance, the level of threat perceived by a wealthy person whose income is suddenly reduced to that of the basic wage may differ markedly by level of threat perceived by another whose income never exceed the basic wage. Also, observed that positive feedback occurring in perception will lead to seeking more and more intense stimulation and experience. Further, it was argued that the adoption and implementation of policies to mitigate the risk of environmental extremes by individuals influenced by perception and interpretation that the people have and make about the crisis risks. The probability of crisis risk adjustment increases a positive function of crisis perception, through the mediating effect that perceived crisis risk has the variables of image of damage and perceived benefits. Therefore, perception is prerequisite for crisis management and the observable significant association between these is as expected.

During a crisis situation, most of the farmers were unable to take decisions as they were in a desperate situation to bear the losses. This behaviour naturally restrained them to reach higher level of management orientation. Hence, the sugarcane growers came up with alternatives adaptations to different crisis conditions. Some of the farmers were chosen to grow vegetables in the sugarcane fields due to frequent crisis based on their experience and advice of the crop experts, instead of growing the exhaustive crops as others followed. During fallow period post heavy floods farmers have grown the fruit crop majorly watermelon and vegetables like cauliflower, cabbage, carrot and brinjal post crisis which yielded them good returns. These efforts were proved successful as the farmer realized substantial income from cultivation of vegetables. Thus, decision-making at right time, effectual planning and execution with available capitals were the proven key issues in effective crisis management indicated by Vinay Kumar (2015).

4.7.4.7 Attitude towards crisis with crisis management behaviour

The results from Table 32 showed that the attitude towards crisis was significantly associated with the crisis management behaviour of sugarcane growers at 1 per cent level of significance.

Attitudes were mental and neutral states of individuals. Attitudes are those internal factors those influence judgement by the individuals. The rate at which increase / decrease in sugarcane production is affected or not. But sugarcane growers feel that an increase/ decrease in production on his farm is really affected by crisis. It is affected by his willingness to try different methods of protection and productivity. It is also affected by attributes of family with respect to their living. If he, his wife and their children really want a better life and believe they can achieve it through the proven interventions and incentives to increase production are much greater than their attitude is a fatalistic acceptance of their present fate or feeling that any change will have to be brought by someone else. The unfavourable attitude towards crisis made farmers to prepare for stabilizing their income by incorporating intercrops as well as various adaptations to protect and receive minimum stabilized output to lead their daily livings. Further, favourable attitude towards farming by sugarcane growers is very much important in the crisis affected and crisis prone areas. Unfavourable attitude and farming commitment of farmers indicates their adaptations and wise decision making for better crisis management and favourable attitude act as a factor for selection of mixed enterprises to stabilize the farm income, in addition to the achievement of increased input efficiency and higher rate of return. Thus, obviously, attitude of farmers towards crisis and crisis management behaviour were associated significantly.

Table 32: Association between psychological characteristics with the overall crisis management behaviour of total sugarcane growers. (n=240)

Sl. No.	Characteristics	Chi -square value
1.	Scientific orientation	26.16 **
2.	Farming commitment	17.83 **
3.	Deferred gratification	6.95 *
4.	Risk orientation	7.97 *
5.	Achievement motivation	43.34 **
6.	Perception towards crisis	25.91 **
7.	Attitude towards crisis	19.87 **
8.	Knowledge	21.01 **
9.	Adoption	13.63 **

NS= non-significant, *=Significant at 5%, **= Significant at 1%

4.7.4.8 Knowledge with crisis management behaviour

Table 32 displayed the chi-square cross tabulation value computed between knowledge and crisis management behaviour of farmers was found to be significantly associated at 1 per cent level of significance. The possession of correct knowledge about the improved sugarcane cultivation as well as crisis management practices identified by experts and good communication contacts with the sources of information assisted the sugarcane farmers in identifying the best alternative options. In simple words the correct knowledge helped the sugarcane growers in conscious decision-making for better handling of crisis and also in taking conscious adaptations based on the severity, frequency of crisis prevailing in the area. Thereby it helps to get consistent returns even during crisis. Further, the correct knowledge also prevented the unnecessary trial and error in taking survival actions and also unnecessary expenditures on it by direct adopting of suitable and expert suggested practice. Hence, the strong association between knowledge and crisis management behaviour is observed.

4.7.4.9 Adoption with crisis management behaviour

The results from Table 32 depicted that the chi-square cross tabulation value computed between knowledge and crisis management behaviour of farmers was found to be significantly associated at 1 per cent level of significance. Logically the correct knowledge and mental evaluation of any adaptations and improved production methods leads to the adoption of them by farmer community because of their visible results to others. Further, the attitude and perceptions towards the crisis and its management makes the farmers to adopt the crisis management activities (decision making, adaptations and alternative/ supplementary sources of income) as well as improved cultivation practices in sugarcane farming as it was the major source of livelihood for most of the sugarcane growers. Hence, the association between the crisis management behaviour with adoption is expected.

4.8 Stepwise regression analysis to understand relative importance of various independent variables in explanation of crisis management behaviour of sugarcane farmers.

The stepwise regression analysis was carried out to find the influence of the independent / exogenous variables on crisis management behaviour of sugarcane growers. The stepwise regression was applied so that the specification bias of the model does not occur. The results are presented in the Table 33. The systematic analysis of the table showed that the fitted model is adequate in explaining the variation in crisis management behaviour of sugarcane growers as shown by a high and significant coefficient of multiple/ several determinations with R^2 value

of 0.807. In other words, 80.70 per cent of the variation in crisis management behaviour is explained and influenced by the independent / exogenous variables included in the model.

The standardized regression coefficient has been computed for personal socioeconomic, organizational and psychological variables with crisis management behaviour of sugarcane growers. The standardized regression coefficient has been computed from the original 'b' coefficients, so that they can be compared across the independent variables to assess the magnitude of their effects on crisis management behaviour.

It could be observed from the Table 33 that among the personal variables namely education (0.850) and prior exposure to crisis (0.257) had the powerful effect on the sugarcane grower's crisis management behaviour in positive and significant manner. The education level of the sugarcane growers was found to be positive and significant effect on crisis management behaviour of sugarcane growers. This might be due to the reasons that educated people have better contacts, ideas and information sources than uneducated farmers who kept quite till intimated by others about different crisis management, mitigation and adaptive activities. Further, the variable prior exposure to crisis had positive effect attributable to past experience equipped farmers for better manipulation of the crisis situations, needed information as well as material supports assistance from development departments.

Among the socio-economic variables the mass media exposure, innovative proneness and cosmopoliteness were influenced the crisis management behaviour positively and significantly among the sugarcane growers. The mass media had significant effect on crisis management behaviour of sugarcane growers as it provides the crisis and its management related information to the sugarcane growers. In the various TV channels special programmes with focus on farm innovations and technologies like 'Annadata' have made sugarcane farmers to gain knowledge about the latest varieties developed along with their special characteristics, information about Farmers fairs, trainings and other related information shared through the passive or active means helped farmers to manage crisis in an effective way Further farmers also came to know about different forms of information on crisis forecasts and live updates during crisis period which helped them to make instantaneous decisions to reduce the vulnerability on the family, livestock and crops to possible extent. Further, mass media exposure helped farmers to know about the different schemes and compensations announced by the governments that help in better crisis management as it assists the sugarcane farmers in undertaking rehabilitation and recovery works faster. Hence, the mass media has significant effect on crisis management behaviour of sugarcane growers in decision making, taking

survival actions, mitigation measures, preparedness, recovery, rehabilitation and stabilizing livelihoods to lead a normal life.

The innovative proneness had significant effect on crisis management behaviour because most of the farmers were not ready to invest in the crisis management capital intensive technologies rather, they invented/discovered their won low-cost technologies or modified the technologies which assist in managing crisis to significant level but not completely. The next variable that has significant effect on crisis management behaviour was cosmopoliteness. This might be due to the reasons that the higher cosmopoliteness with the external environment has increased contacts with farmers of different areas as well as scientists of the different institutions like KVK, SAU's, ARS, etc. as well as about the progressive farmers. All these are assisting in crisis management with increased knowledge, awareness about the better production practices and management of the farm. Hence, the cosmopoliteness is directly assisting sugarcane growers to learn by observations, learn from visiting and seeing and to get information from scientific trusted sources which leads to make better and conscious efforts towards crisis management through decision making, to undertake suitable adaptations and crops selection.

Table 33: Stepwise regression analysis showing relative importance of various independent variables in explanation of crisis management behaviour. (n=240)

SI. No.	Independent Variables	Beta	Regression coefficients	't' value
1	Cosmopoliteness	0.31	2.23	5.66***
2	Innovative proneness	0.45	1.72	9.35***
3	Production input support	0.40	1.49	7.11***
4	Adoption	0.25	1.09	4.92***
5	Mass media exposure	0.18	0.93	3.24***
6	Education	0.12	0.85	3.46***
7	Knowledge	0.16	0.73	2.87***
8	Extension orientation	0.30	0.72	5.45**
9	Perception towards crisis	0.24	0.70	5.62***
10	Farming commitment	0.28	0.59	6.80***
11	Attitude towards crisis	0.19	0.49	3.80**
12	Crisis management trainings needed	0.14	0.33	2.66**
13	Prior exposure to crisis	0.80	0.26	4.64***
14	Deferred gratification	0.09	0.20	2.50*
15	Risk orientation	0.12	0.08	1.69*

R^2=0.807; f value = 190.905 (14348.076)

* Significant at 10%; **Significant @ 5%; ***Significant @ 1%

The organizational variables namely production input support, extension orientation, crisis management trainings needed variables were influenced the crisis management behaviour of sugarcane farmers positively and significantly. The production input support had a significant effect on crisis management behaviour as the farmers were receiving all the required inputs from the development departments, private extension personnel and SAU's in the form of seeds of intercrops, alternative crop planning and assistance in getting government benefits like crop failure compensation as well as advisory from scientists. Similarly, the extension orientation had positive effect attributable for equipping farmers for better manipulation of the situation through participation in extension events like farmers' fairs, exhibitions etc and information supply along with the material supports extended by development departments respectively. Essentially, the crisis management trainings needed variable is significantly affecting the crisis management behaviour in positive way probably because of non-orientation of sugarcane growers specifically to drought and flood problems and simulation exercises under such crisis situation has created negative attitude as well as most of the trainings organized by different line departments mainly focused on increased productivity rather than addressing crises directly.

Among the psychological variables namely knowledge, farming commitment, perception, adoption, attitude, deferred gratification and risk orientation had the powerful effect and influenced the sugarcane growers' crisis management behaviour in positive direction. The knowledge about crisis management and improved sugarcane cultivation and their adoption at the different phases of crisis management was influencing greatly their crisis management behaviour positively. This might be due to the fact the sugarcane growers were keen in acquiring the new technologies and their adoption with regular contacts with extension personnel as well as line departments. Next influencing psychological variable was farming commitment which was perhaps due to the availability of vast irrigation opportunities and requires less labour post earthing up to harvesting. Least/ minor works were there in sugarcane cultivation for around six months except irrigation and fertilizer application as well as the tolerance by sugarcane especially floods and bulk returns made the farmers to stay in the sugarcane farming. Also, the increased labour scarcity prevented the farmers from diverting to the other commercial cum labour intensive crops. Further, sugarcane growers have no other options other than the faming as well as their attachment to land as ancestral property with scientifically exploitation cause significant effect in short run but it may affect negatively in long run as we witnessed the price arrears increasing year by year due to overproduction. Nevertheless, the negative influence of farming commitment is masked by other variables.

Further, perception and attitude especially with finding crisis as an opportunity for improvement and it also changed perception of few sugarcane farmers about the crisis as most of them were human induced and necessitating the need for the reduction of human interferences into natural balance of ecosystem. Further negative perception and attitude about crisis threats has made the farmers to prepare and to adapt accordingly to the different crises to maintain the stabilized returns. Thus, perception and attitude of sugarcane growers were affecting the crisis management behaviour positively through forcing sugarcane growers to undertake decisions at right time and timely adaptations to stabilize farm income and enhance farming efficiency under crisis situations.

The deferred gratification is significantly affecting the crisis management behaviour. This is because of higher capital saving and investment behaviour resulting from deferred gratification contributing to increased crisis management (Rame Gowda, 1993). The returns obtained during normal years were saved for future instead of immediate spending. Essentially, risk orientation of the sugarcane farmers to venture in innovative and risky enterprises. It also induces entrepreneurial behaviour among sugarcane growers for acceptance of multiple complementary and supplementary intercrops and subsidiary enterprises which combined adequately with off farm income earning avenues. Thus, risk orientation has emerged as a significant factor influencing crisis management behaviour level of farmers.

4.9 Case studies related to crisis management in sugarcane farming

<u>Case Study – 1</u>: A successful case of tail end sugarcane grower in crisis management–Sri Vittal Patil

Profile: -

- Name: Sri Vittal Patil
- Village: Rajapur
- Taluk: Gokak
- District: Belagavi
- Age- 38
- Education – B. Com. MBA
- Family details: Nuclear Family; (Father, Wife, 2 sons and 1 daughter) (Total = 06 members).
- Land holding: 06 acres
- Occupation: Farming and Jaggery production unit
- Farming experience: 17 years

Background:

Sri Vittal Patil has around 18 crores of annual turnover every year. He has earning around 2.64 crore annually from the jaggery production itself. Around 6.07 lakh is earned from his farm as net profit from just six acres of land. Although with his education he is capable to get the job but he left it and modified his grandparents jaggery production unit which was the first jaggery unit established in his region. There are two reasons behind the running of jaggery production unit as indicated by the Vittal Patil. The first reason was to continue the legacy of his family of helping farmers under difficult conditions and the next reason was to protect himself from crisis and taking care of his family as he was the only son. Hence, he modified it into the modern semiautomatic jaggery unit with the crushing capacity of 30 tons per day. The principle of him is to 'rise in your area with your people instead of working for others'. He used to produce the pure jaggery in initial days but later started to produce sugar mixed jaggery because of the high returns from that than the normal pure jaggery production. To overcome the labour crisis, he made an agreement with his friend to bring the minimum of 15 workers on every working day for making jaggery moulds, blocks and their packaging and sealing. The packed jaggery was supplied to the different jaggery markets like Hyderabad, Mumbai, Kolhapur, Vijayawada, etc., based on the consumer demands (size, shape, color, quantity and jaggery type).

Plate 7: Glimpses of activities undertaken by successful sugarcane grower in crisis management – by Sri Vittal Patil., Rajapur, Gokak, Belagavi.

Crisis Management interventions in his field and assistance to the farmers in crisis management:

1. **Decision making ability:** Instant decision making about varietal selection before the planting in consultation with Sugarcane Research Station, Sankeshwar. Intercrops were selected based on the analysis of costs, returns and their requirements namely soya bean, tomato, okra and onion as he followed five feet spacing between rows. He sold his sugarcane for the setts purpose mainly for those who supply sugarcane to his crushing unit as its recovery is good.

2. **Adaptations to crisis situations:**

- ✓ **Floods:** Selected the sugarcane variety tolerant to both water stagnation and drought-**Nayana variety** to cultivate in four acres. Newly developed eight months' duration (SNK-09211) variety of Sankeshwar was also planted in 2 acres of farm.
- ✓ **Acute water shortage or droughts management:** Drip irrigation for all the six acres. Digged three borewells and one open well / deep farm pond to store water and irrigate during droughts. One bore-well for jaggery unit.
- ✓ **Soil and water/moisture conservation:** Adopted the dry mulching after harvesting of intercrops. Applied the poultry manure to the sugarcane crop before earthing up. Bund's formation to increase water retention and planted across the slope to reduce the flow of water to down area.
- ✓ **Production:** He adopted the sea weed extracts application and culture based organic formulations like sugarcane special, netsurf NPK, grow more, stim rich, etc.
- ✓ **Price crisis:** Jaggery produced commercially based on market demand in various forms like cubes, moulds, 200 grams blocks, 500 grams blocks, 1 kg and 2 kg blocks as well as designer jaggery like lamps, candle shaped etc which fetches higher rate than normal jaggery.
- ✓ **Financial management:** With respect to the financial adjustment is concerned, he took the complete assistance from the Canara bank initially and later seeing his progress and credibility of returning loans in time. The bank was ready to offer & approve loan for him at any time and any amount.

3. Economic performance of Sri Vittal Patil.

Table 34: Details of economic performance of Sri Vittal Patil under crisis situations.

SI. No.	Component	Production	Cost of Production (Rs.)	Gross income (Rs.)	Net income (Rs.)	BC Ratio
1	Sugarcane (45 tons /acre)	270 (6 acres)	4,18,800.00	10,26,000.00 (3800/qtl)	6,07,200.00	1:2.45
2	Jaggery production rent	1,89,000+1,01,50,000+ 2,780*50,000+700*2,700) = **15,12,29,000.00** (Electricity + Labour wage+ Sugar + Sugarcane)		**17,76,25,000.00**	**2,63,96,000.00**	1:1.17

Conclusion:

Sri Vittal Patil is not only successful in managing crisis in his sugarcane farm. But he is the successful entrepreneur in jaggery production by identifying opportunities with more than 17.5 crores of annual turnover. Despite that he provided the employment to minimum of 15-20 people almost eight months of the year. His net income was more than 2.50 crores from jaggery unit and more than 6 lakhs from sugarcane production.

<u>Case Study – 2</u>: A successful case of head reach sugarcane grower in crisis management – by Sri Basavaraj. R. H.

Profile: -

- Name: Sri Basavaraj. R. H.
- Village: Udagatti (Near Cross)
- Taluk: Gokak,
- District: Belagavi.
- Age- 47
- Education – 10^{th} passed
- Family details: Joint Family; (Wife, 3 sons, brother and his wife, 3 nephews, 1 niece and Widow sister) (Total = 12 members).
- Land holding: 18 Acres
- Subsidiary: Jaggery production unit
- Farming Experience: 32 years

Background:

Sri Basavaraj started the farming journey at the age of 16 as he was the elder son in family due to family problems. He started farming with three acres of own land and two acres of leased land. The land was leased at the rate of 45 blocks of jaggery weighing 20 kg each block per acre. Later due to the clashes with some close relatives and nearby farmers, he leased out his land and went to purchase four acres of land later that has grown into 18 acres of owned land leaving his ancestral property. To purchase the lands, he organized the finances from the jaggery trader of Sangli market with the agreement to send the produced jaggery to them. In order to produce jaggery he started his own small scale traditional jaggery unit in order to avoid the paying of around two lakhs of rent to jaggery makers during every crushing season. As a result, he is earning the rents for jaggery making after crushing his cane. Due to the emergence of factories, he faced the hiccups in getting regular supply of sugarcane as well as the labours availability/scarcity. Hence, he crushed his own cultivated cane for few years. Later due to the price arrears, farmers came forward again to make jaggery instead sending to factories. But during 2019 floods his jaggery unit was completely vanished which affected him badly. In addition to that his sugarcane fields were affected badly by floods and no factories came forward to purchase it initially. As his jaggery unit was damaged and become dysfunctional he thought of making jaggery using his flood affected sugarcane. He crushed his sugarcane in the semi-automatic jaggery production unit located in nearby village Chigadolli. For which he paid

around 5.42 lakhs of rent for crushing his 18 acres of sugarcane. Although he got reduced yield due to floods but due to the use of semi-automatic crushing machine the recovery from sugarcane was increased by 10-20 kilograms on an average for each ton of sugarcane. This has triggered him to start the semi-automatic jaggery production unit. From which he has earned minimum of six lakhs except crushing of his own sugarcane for last two years. In his words, he earns around 10-11 lakhs by just crushing for 5-6 months per year including crushing of his sugarcane. The crisis situations faced by him in sugarcane farming as expressed by him were floods, droughts, soil fertility reduction, financial problems, labour shortage, price arrears, faulty weighing and raw material for firing.

Crisis management interventions of Sri Basavaraj. R. H.

1. **Decision Making ability:** One of the key important characteristics of this farmer is rational decision making with the practical evaluation of situation by seeing others and doing what they know rather than trying new thing. Immediate application of the planned activities irrespective of investments. The important decisions taken by him in order to overcome the crisis in his sugarcane production were:

- ✓ Established the semiautomatic jaggery production unit with crushing capacity of 20 tons per day (due to collapse of the traditional jaggery production unit) – to overcome the price arrears as well as to crush the flood affected sugarcane which was rejected by factories.
- ✓ He also converted diesel operated crushing unit into electric crushing with mechanical bagasse drier and carrier to overcome labour shortage. This has saved almost three to five labour requirements.
- ✓ Mechanized the farm operations as well as used the own bulls for inter-cultivation, dethrashing and weeding time to save cost of weeding as well as to overcome labour crisis.
- ✓ Obtained the financial assistance from Sangli jaggery trader Mr. Mosali over institutional sources with moral and ethical concern over him as he helped him to purchase the land.



Plate 8: Successful crisis management case of head reach sugarcane grower Sri Basavaraj. R. H., Udagatti cross, Gokak, Belagavi.

2. Adaptations to different crisis in his field.

- ✓ **Floods:** Early planted the sugarcane crop so that it can tolerate the water stagnation. Planted Bhima (Co-8371) a flood tolerant variety for first time after 2019 floods. Earlier to that Nayana (Co-86032) was cultivated which was drought tolerant and waterlogging to some extent as well as red rot tolerant.
- ✓ **Acute water shortage/droughts management:** Alternate furrow wetting and left dethrashed leaves between the rows as mulch. Foliar spraying of KNO_3 if crop is in reachable stage of growth. Critical irrigation provided by digging temporary borewells in dried river itself. Installed two motors for lift irrigation from river. During load shedding used the 62 cavet generator for lifting water.
- ✓ **Soil fertility and moisture conservation:** Green mulching of crotalaria juncea initially and later dry mulching with dethrashed leaves. Tank silt and soil from other fields was applied. Further, sheep and goats were stalled in field before planting to enhance soil fertility through its litters/ fecal matter. Used the molasses waste generated by jaggery unit as manure to field.
- ✓ **Financial management:** Consulted the jaggery trader or goldsmith for bulk amounts/ investments. For small amounts managed with the borrowings from friends and crop loans from Union bank and PACS.
- ✓ **Price crisis:** Jaggery production as the best alternative solution but also sold for setts purpose to the fellow farmers. Prepared the jaggery based on demand from the buyers in cubes, moulds, blocks of 1 to 5 kgs during peak labours availability but during labours scarcity 10 kg and 20 kg blocks were prepared and sold.
- ✓ **Labour crisis:** Mechanization of farm activities as well as automatization of all possible activities. Labours were paid in advance without interest so that they can come when called. Involved family members in farm activities during peak working days.
- ✓ **Other crisis management:** Thrash was collected and used as firing material or biofuel for jaggery making. He also suggested for providing information about ethanol production at field level.
- ✓ **Faulty practices:** Grown maize as intercrop with sugarcane. Poor or no management of records.

3. Economic performances:

Table 35: Details of economic performance of Sri Basavaraj. R. H. under crisis situations.

SI. No.	Component	Yield	Cost of Production (Rs.)	Gross income (Rs.)	Net income (Rs.)	B:C Ratio
1	Sugarcane (18 acres)	748 tonnes	11,15,280.00	22,44,000.00 (3000/ton)	11,28,720.00	1:2.02
2	Maize	90 qtls	37,800.00	1,26,000.00	88,200.00	1:3.33
3	Jaggery production rent	6,86,000.00 (Electricity + Labour wage) + 2,50,000 (Depreciation per year) =9,36,000.00		12,74,000.00 (980X1300*) + 1,05,000 (30 tons X 3500) =13,79,000.00 (*Rent charges per tonne) + Molasses	4,43,000.00	1:1.47

Conclusion:

Sri Basavaraj. R. H. was successful in managing the different crises faced by him compared to his previous years. The net income earned by him was more than 11 lakhs from his sugarcane and almost 4.50 lakhs from the jaggery making unit by crushing others jaggery. In Basavaraj's words the establishment of sugarcane crushing unit, not only helped him to overcome the price arrears but also to generate continuous income for almost six months with providing employment to 6-8 members on regular basis. It has taken care of the family expenses as well as the farm expenses without depending on the returns of the crops.

Case Study – 3: A successful case of mid reach sugarcane grower in crisis management by Sri Adivesh. S. Korbu.

Profile: -

- Name: Sri Adivesh. S. Korbu.
- Village: Paramandawadi
- Taluk: Raibag
- District: Belagavi
- Age- 38
- Education – PUC failed
- Family details: Joint Family; (Father and Mother, Wife, Brother and his wife, 2 Sons, 1 daughter) (Total = 09 members).
- Land holding: 8 Acres
- Farming Experience: 23 years

Background:

The frequent floods on the Krishna River bank have led to the damage of the pipeline, motors and lanes. As a consequence, there was acute water shortage during post floods due to delayed installation of electric lanes as well as during the summer. Hence, he thought of alternative sources of water, one fine day during his visit to 2018 Krishi mela Dharwad taken by Agriculture Department. He came to know about the solar panel installation and its usage in lifting ground water. He decided to install it with the help of subsidy under ganga kalyana yojana as well as Surya Raitha project of Government of Karnataka. This also helped him to install the drip irrigation system for his field. Around 4.50 lakh rupees was spent on the 5 hp submersible solar water panel installation after subsidy. Advantage for him is the presence of entire land in single place. Apart from this he faced various crisis in sugarcane farming like other farmers. The crisis situations faced by Sri Adivesh Korbu in sugarcane farming as expressed by him were price arrears, floods and droughts induced irrigation water crisis, soil fertility reduction, financial problems and labour shortage.

Crisis interventions:

1. **Decision Making ability:** Seeks continuous advice from the line department officials related to his problems in sugarcane farming as well as crisis management. Contracted with the sugar factories by taking advance to supply certain quantity of sugarcane to the factory using his own tractor which helped him to overcome the price arrears in most of the times.

Because he supplied the sugarcane to the factory at earliest taking the advantage of early payments to the first suppliers of cane to attract the other farmers to supply their cane.

2. **Adaptations:**

- **Flood:** He took the flood management activities based on the severity as his land is located at steep place.
- **Acute water shortage/droughts management:** He installed the solar submersible water lifting system. Later, he transformed his flooding method of irrigation to the drip irrigation.
- **Price crisis:** Firstly, he contracted with sugar factories with his tractor to supply the cane. Further, he chose the intercrops wisely based on suggestions of the extension professionals i.e., onion and vegetables like beetroot, tomato which helped him to get minimum 50 per cent of investments on his crop production. The advances borrowed from factories were also helping him to come up with the financial management.
- **Labour crisis:** Lend in advance to the labours and used the younger people of his relatives like sister's sons (Niece/Nephew) and maternal son in laws in farm activities during peak periods of work.
- **Thrash management:** Baled and raked the sugarcane residue. It was sold to the jaggery makers at 18 rupees per bale.

3. Economic performances:

Table 36: Details of economic performance of Sri Adivesh S Korbu under crisis situations.

SI. No.	Component	Yield	Cost of Production (Rs.)	Gross income (Rs.)	Net income (Rs.)	B:C Ratio
1	Sugarcane before solar pumpset (8 acres)	378 tonnes	6,92,890.00	10,20,600.00 (2700/ton)	3,27,710.00	1:1.47
	Sugarcane after solar pumpset	472 tonnes	7,37,890.00	12,74,400.00 (2700/ton)	5,36,510.00	1:1.72
2	Sugarcane bales	800 bales	8*800 =6400.00	18*800 =14,400.00	8,000.00	1:2.25
3	Intercrops Vegetables (Sold to wholesaler)		3200*11 =35,200.00	15,000*11 =1,20,000.00	84,800.00	1:3.41

Conclusion:

Sri Adivesh Korbu has overcome all the obstacles of water shortage by installing the solar pump set. Further, the installation of the drip irrigation system helped him to get the expected yields from sugarcane. Almost more than two lakhs of increase in net income was observed after installation of solar pump set and the drip irrigation system.

Plate 9: Successful crisis management case of Sri Adivesh S. Korbu of Raibag taluk in sugarcane crisis management by adapting solar submersible water pump set.

<u>Case Study – 4</u>: A Successful case of tail end sugarcane grower in crisis management by - Sri Dhareppa Byakood.

Profile: -

- Name: Sri Dhareppa Byakood
- Village: Mahalingapur
- Taluk: Mudhol
- District: Bagalkot
- Age- 62
- Education – High school
- Family details: Joint Family; (2 Sons and their wives, 4 grandsons, 2 granddaughter) (Total = 11 members).
- Land holding: 9 Acres 32 guntas
- Farming Experience: 46 years

Background:

Sri Dhareppa started the farming from the high school days. In initial days, he used to grow the sugarcane solely. But, later he visited the Maharashtra farmers' fields with the friends and followed wide row planting with 5 feet between rows. In first year, he got the same yield that of the closed row spacing which brought confidence in him. But he was worried about the weeding between the wide spaced rows. Hence, he thought of planting broad leafy plants like soyabean, mung bean, tomato or high-density crops like menthe, coriander, jeera, fenugreek, etc with minimum two acres of guards along with sugarcane crop. Further, he diverted the entire sugarcane farm to 5 acres of sugarcane, 2 acres of turmeric, one-acre maize followed by cabbage, watermelon and capsicum crop which is transported to the major cities like Mumbai, Kolhapur, Belagavi etc and one acre of pudina which generates regular income. This made his farm into the integrated farm with adoption of various crops at varying time of harvests that helps to get continuous income despite the bulk returns from sugarcane and turmeric crops.

The different crisis situations he faced were the price crisis, erratic rainfall, prolonged drought spells and labour shortage.

Crisis interventions to manage the crisis in sugarcane farming:

1. **Decision making ability:** Sri Dhareppa was the practical oriented decision maker by seeking the correct information from the agriculture department, friends and successful farmers in his locality. Planted the Nayana and Meera varieties of sugarcane based on the suggestions of development department extension professionals.
2. **Adaptations:**

- **Price crisis:** In fact, the price arrears existed but he does not feel about it because he diverted few acres of land to regular income generating crops for continuous income generation from different crops with varying harvest times.
- **Erratic rainfall:** The major effect of sugarcane on him was the erratic rainfall which mainly affected his vegetable crops that generates the continuous income. Hence, he adopted greenhouse net in half acre of land to grow watermelon, capsicum and cherry tomato.
- **Soil erosion and soil fertility:** Due to the presence of stony soil which is more prone to soil erosion and also loss of soil fertility. He adopted the stone structures at the exit points that infiltrates and lets only water to flow out of field. The accumulated soil is disbursed across the field for every three years after removing sugarcane crop along with the molasses of the factories.
- **Prolonged drought spells:** This condition arises only when the canal water stopped for more than three months because of ground water table reduction dries off bore wells. For which, he adopted with deepening of the existing borewell and storage of water in open wells. Further, he adopted the drip irrigation for sugarcane and other crops that helps in better management of water. Sometimes lifted the water from streams in extreme crisis.
- **Financial management:** The plan of planting different crops was such that minimum of returns from each crop by end of two months that helped to get continuous returns to carry out all the farm activities as well as household needs.
- **Labour shortage:** All the family members are involved in the farming activities as well as the relatives from his sister's family will help in peak harvesting days. Further, they have fixed the 10 female labours for carrying out the farm activities by lending in advance as well as helping them financially in carrying out their family functions.
- **Governmental adaptations:** Adaptations suggested by him to government despite he has no problems for delayed payment is to strictly disburse payments within a month after procuring sugarcane, uniform prices for sugarcane at least for each state and make availability of improved and new varieties of sugarcane setts.

3. **Economic performance:**

Plate 10: Successful crisis management case of Sri Dhareppa Byakood, Mirji village, Mudhol taluk, Bagalkot in sugarcane crisis management.

Table 37: Details of economic performance of Sri Dhareppa Byakood under crisis situations.

SI. No.	Component	Yield	CoP (Rs.)	Gross income (Rs.)	Net income (Rs.)	B:C Ratio
1	Sugarcane (5 Acres)	227 tons	5*57300 =2,86,500.00	227*2650 =6,01,550.00	3,15,050.00	1:2.10
2	Turmeric (2 Acres- dry turmeric)	56 qtls	2*76,000 =1,52,000.00	56*5,200 =2,91,200.00	1,39,200.00	1:1.92
3	Maize (qtls) + Cabbage + Watermelon (tonnes) (1 acre)	22 qtl 12 tons 52 tons	9200*2 =18,400.00 2*35,000 =70,000.00 2*51000 =102000.00	22*1600 =35,200.00 21*9200 =1,93,000.00 52*5300 =275000.00	16,800 1,23,000 1,73,000 =312800.00	1:1.91 1:2.76 1:2.70

Conclusion:

Sri Dhareppa adapted to the sugarcane crisis by diverting part of his farm to the turmeric and vegetable crops. He earned the net income of 3.15 lakh from sugarcane, 1.39 lakhs from turmeric and 3.13 lakhs from vegetables and fruits. Further, he adapted to the crisis of water shortage by storing water in open wells and use of canal water through drip irrigation.

<u>Case Study – 5</u>: A successful case of mid reach sugarcane grower in crisis management by - Sri Hanamant Kamble.

Profile: -

- Name: Sri Hanamant Kamble
- Village: Tubachi
- Taluk: Jamakhandi
- District: Bagalkot
- Age- 53
- Education – PUC
- Family details: Nuclear family; (Wife and 2 Sons) (Total = 04 members).
- Land holding: 4 acres
- Farming Experience: 23 years

Background:

The Tubachi is one such a village of Jamakhandi taluk of Bagalkot that is highly flood prone because of lying in low land areas but has got highly fertile black soil which is suitable for sugarcane. The frequent floods from the Krishna River and its tributaries had led to damage of the pipeline, motors and electric lanes. Due to lowland area, there was accumulation of silt into the field. Further, during the drought this area has been affected mostly due to non-stagnation of the river water and no barrages for storing river water. The price arrears, financial management and livestock crisis and labour shortage were the other crises faced by him.

Crisis interventions:

1. **Decision making ability:** He is capable of taking conscious decisions and received the flood tolerant variety of sugarcane from factory. Close interaction with the line departments to get subsidy and other government projects benefits. He rotated the crops as he kept only 2 acres for sugarcane. Remaining used for the other commercial crops like turmeric in one acre and 1 acre with maize and later he cultivated the watermelon crop with plastic mulching and drip irrigation. Further, to overcome the filtration problem in drip irrigation system he used the big sand-based metal filter.

Plate 11: Successful crisis management case of Sri Hanamant Kamble, Tubachi village, Jamakhandi taluk, Bagalkot unloading chopped fodder and stored thrash bales.

2. **Adaptations:**

- **Flood:** He planted the sugarcane in September/October so that crop reaches the grand growth phase and least effect on the sugarcane crop due to floods. He further stated that he did not dethrashed the lower leaves of sugarcane because to reduce the silt load on cane and if anything stored will be washed off during the rains and slashing. Further, interesting thing noted from his observation was if the floods was of less severe then it helped to enhance the soil fertility. He also took the flood management activities based on the severity and time such as inter-cultivation.

- **Drought:** He used the generator to lift the water from river basin and if river was dried off then temporary farm pond in river was digged using the JCB for water accumulation which was later lifted through pumps. Apart from that he uses the drip irrigation based on the water availability.

- **Price crisis:** Firstly, he did not much bother about the price crisis as he sent either to factory or to the Jaggery makers based on the sugarcane rates. Further he reduced the area under sugarcane diverted to other crops like turmeric, maize watermelon, cabbage and cauliflower looking into the market demands and suggestions from private field officers.

- **Labour crisis:** Used the herbicides for weed control and sold cane on wholesale basis to jaggery makers reduced his responsibility of slashing, loading, unloading. If sent to factories, then mechanical harvester was used for cane cutting.

- **Thrash management:** Burnt in the field with the intention of burning will make the field heat as it was affected by floods.

- **Livestock crisis management:** Planted 5 guntas of grasses on river side as it reduces the soil erosion as well as provides fodder to animals. Only two cattle were kept for domestic consumption purpose. Increased the number of goats as well as rams in his farm. As they can be sold based on needs.

- **Government institutional adaptations:** Correct regulation of water release from dams. Uniform prices for all sugarcane across the country.

3. Economic performances:

Table 38: Details of economic performance of Sri Hanamant Kamble under crisis situations.

SI. No.	Component	Yield	CoP (Rs.)	Gross income (Rs.)	Net income (Rs.)	B:C Ratio
1	Sugarcane (2 acres)	89 tonnes	2*62640 =1,25,280.00	2,35,850.00 (2650/tonne)	1,22,570.00	1:1.88
2	Turmeric (1 acre)	28 qtls	53,000.00	1,56,800.00	1,03,800.00	1:2.96
3	Watermelon (1 acre)	40 tons	72,000.00	40*4800 =1,92,000.00	1,20,000.00	1:2.66
4	Maize in one acre (qtls)	6+8+12 = 26	4000+8600 =12,600.00	26*1350 =36,400.00	23,800.00	1:2.89

Conclusion:

Sri Hanamant Kamble adapted to the sugarcane crisis by diverting the half of his farm to the other crops like maize, turmeric and watermelon. Through which, he earned the net income of 1.23 lakhs from sugarcane, 1.04 lakhs turmeric and 1.20 lakhs from watermelon and around 23,000 from maize grains along with fodder for the cattle.

4.10 Constraints experienced by head reach, mid reach and tail end sugarcane growers at different phases of crisis management.

In this section, the constraints faced at different phases of crisis management by head reach, mid reach and tail end sugarcane growers were presented using percentage and rank (Table 39).

The major constraints faced in first phase of crisis management i.e., before crisis phase were delay in disbursement of FRP bonus was the first ranked constraint as expressed by sugarcane growers irrespective of their category followed by lack of trainings related to crisis management in agriculture (Rank II) and lack of crisis warning related to agriculture on regular basis to farmers (Rank III). The similar trend of results has been observed with respect to head reach and mid reach sugarcane growers. Whereas in tail end region, the major constraints were poor infrastructure to prepare for agricultural crisis management in advance (Rank II) and lack of crisis warning related to agriculture on regular basis to farmers (Rank III).

During crisis occurrence phase, the major constraints faced by the sugarcane growers were load shedding during the summer (96.67 %), poor availability of clean drinking water for farmers (91.25 %) and poor quality and connectivity of roads to nearby villages as main roads were closed due to floods (86.67 %). Two major constraints faced by the mid reach and tail end sugarcane growers were load shedding during the summer (Rank I) and poor availability of clean drinking water for farmers (Rank II). But mid reach farmers ranked poor quality and connectivity of roads to nearby villages as main roads were closed due to floods third constraint which was ranked fourth by tail enders. The tail end farmers third ranked constraint was river dry-off during summer which was ranked fifth by mid reach farmers. Whereas, the head reach farmers ranked the constraint poor quality and connectivity of roads to nearby villages as main roads were closed due to floods as first followed by load shedding during the summer (Rank II) and poor availability of clean drinking water for farmers (Rank III).

In the third phase of crisis i.e., post crisis phase, the major constraints faced by sugarcane growers were disconnection of electricity for long duration led to crop losses (89.58 %) followed by crop failure compensation amount given by government is too less (87.50 %), delay in disbursement of compensation amount declared by government (75.00 %), poor availability of clean drinking water for farmers and animals, (72.50 %) increased illness among the members of farm family (66.25 %) improper selection of beneficiaries under compensation scheme due to local politics (64.58 %). The similar trend of results was observed among tail

end farmers. The major constraints of head reach farmers were delay in disbursement of compensation amount declared by government (Rank I), improper selection of beneficiaries under compensation scheme due to local politics (Rank II) and crop failure compensation amount given by government is too less (Rank III). Whereas, the major constraints of mid reach sugarcane growers were disconnection of electricity for long duration led to crop loss (Rank I), crop failure compensation amount given by government is too less (Rank II) and increased illness among the members of farm family (Rank III).

The delay in disbursement of FRP bonus was due to the reasons that sugarcane farmers most of the time did not receive their second payment of FRP bonus because of single payment provided by cooperative mills i.e., fifty to hundred rupees more than the fixed rate of sugarcane per tonnes considering farmers' suggestions in annual meeting. Apart from that private mills have offered the FRP based on the sugar recovery. The flood affected canes have reduced recovery percentage of sugar that does not crossed the FRP criteria recovery as explained by cane development officer. The lack of trainings related to crisis management in agriculture was due to the facts that programmes and trainings organized in the study areas by the development departments were mainly concerned with the agronomic practices and focused towards increasing production and productivity of cane rather than the focusing on other crisis management aspects in sugarcane especially floods and droughts as expressed by farmers. The lack of crisis warning related to agriculture on regular basis to farmers and poor infrastructure to prepare for agricultural crisis management in advance was mainly because of the reasons that the information related to crisis was provided through mass media i.e., television, social media and friends only during the crisis occurrence but did not provided the warning in advance which hindered their preparation activities related to crisis management. Further, the announcements made through local bodies at specific times when most of the farmers were busy in fields activities. Apart from this, the farmers were not informed continuously about the release of water from dams in advance. This can be overcome by registering the farmers by line departments to the concerned portals like KSNDMC portal, KVK SMS services, orientation trainings on installation and operation of smart applications, expert systems, crop survey, insurances advantages etc. which provides the regular information on various crisis related updates like short weather predictions, activities to be taken and other management related recommendations.

The major reason attributed towards load shedding during the summer was to make the water available for drinking to all specially to reach the periphery farmers during the summer,

thus the electricity supply was reduced to 5-6 hours per day in summer whereas everyday minimum 8 hours of electricity was supplied for agriculture purpose during normal seasons. The in-depth thought behind the move was preventing river dry off for longer period. In addition to that shortage of electricity as most of the electricity generated was through hydro power and supply of regular electricity to industrial works like cottage, factories etc. This has affected the sugarcane growers as sugarcane is the high-water requiring crop. Hence, farmers feel that minimum of eight hours of electricity should be supplied for agriculture purposes only and in order prevent river dry off, regulation of water release should be done properly. The poor quality and connectivity of roads to nearby villages as main roads were closed due to floods was notable constraint as expressed by sugarcane growers because of surrounding of water around the villages during floods has closed the main roads and evacuated the residing places during nights. The kuccha roads connectivity was poor due to the irregular use coupled with negligence by the local leaders and spread of bushes on the roads. The continuous rains and sudden rise of water in river and flooding into houses has no other option other than the kuccha roads. The travel on these kuccha roads has costed the loss of calves, animals as well as human lives which made farmers to turn unfelt need for small roads into felt need for emergency exits during floods and stressed for the road development. The poor availability of clean drinking water for victims and river dry off during summer was due to the fact that the river was major source of water for domestic, livestock and agriculture purpose irrespective of the seasons and farmers' category but during the summer, river dry off has created the shortage of water as well as during floods the drinking water structures were damaged and polluted water flow with mixture of several wastes like carcass, animal wastes, human wastes etc.

The delay in disbursement of compensation amount declared by government and the disconnection of electricity for long duration led to crop losses were very prominent as the farmers have been affected seriously because of frequent floods which damaged houses of most of the farmers. The survey has been conducted by panchayat development officer with the consultation of the local elected members. Most of the farmers expressed that there was bias in selection of damaged households as the really damaged houses were kept in the C category whereas the least damaged houses of closest people were kept in A and B categories while conducting the survey. The complicated procedures and poor awareness about documents to be submitted to access the benefits. Further, the elected members were asking the bribe by convincing farmers to include their house in A and B category instead of C category which fetches the higher compensation. As the crises have created havoc and further exploitation by the elected members should be prevented by lodging the complaint against corrupted

Table 39: Constraints experienced by head reach, mid reach and tail end sugarcane growers at different phases of crisis management.

Sl. No.	Constraints*	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f (%)	Rank	f (%)	Rank	f (%)	Rank	f (%)	Rank
	Before crisis								
1.	Delay in disbursement of FRP bonus	67 (83.75)	I	72 (90.00)	I	72 (90.00)	I	211 (87.92)	I
2.	Lack of trainings related to crisis management in agriculture	58 (72.50)	II	66 (82.50)	II	57 (71.25)	III	181 (75.42)	II
3.	Lack of crisis warning related to agriculture on regular basis to farmers	53 (66.25)	III	61 (76.25)	III	49 (61.25)	IV	163 (67.92)	III
4.	Poor infrastructure to prepare for agricultural crisis management in advance	44 (55.00)	IV	53 (66.25)	IV	63 (78.75)	II	160 (66.67)	IV
	During crisis								
5.	Load shedding during the summer	74 (92.50)	II	78 (97.50)	I	80 (100)	I	232 (96.67)	I
6.	Poor availability of clean drinking water for farmers	69 (86.25)	III	73 (91.25)	II	77 (96.25)	II	219 (91.25)	II
7.	Poor quality and connectivity of roads to nearby villages as main roads were closed due to floods	77 (96.25)	I	70 (87.50)	III	61 (76.25)	IV	208 (86.67)	III
8.	River dry-off during summer	46 (57.50)	VII	56 (70.00)	V	62 (77.50)	III	164 (68.33)	IV
9.	Poor management of Ganji Kendra's during floods	66 (82.50)	IV	59 (73.75)	IV	32 (40.00)	VI	157 (65.42)	V
10.	Increased number of thefts and robbery in vacated houses during floods	58 (72.50)	V	45 (56.25)	VI	33 (41.25)	V	136 (56.67)	VI
11.	Accumulation of weeds and silt load into fields during flood	49 (61.25)	VI	33 (41.25)	VII	16 (20.00)	VII	98 (40.83)	VII
	Post crisis								
12.	Disconnection of electricity for long duration led to crop loss	66 (82.50)	IV	73 (91.25)	I	76 (95.00)	I	215 (89.58)	I
13.	Crop failure compensation amount given by government is too less	67 (83.75)	III	72 (90.00)	II	71 (88.75)	II	210 (87.50)	II
14.	Delay in disbursement of compensation amount declared by government	75 (93.75)	I	56 (70.00)	V	49 (61.25)	III	180 (75.00)	III
15.	Poor availability of clean drinking water for farmers and animals	64 (80.00)	V	63 (78.75)	IV	47 (58.75)	IV	174 (72.50)	IV
16.	Increased illness among the members of farm family	53 (66.25)	VI	65 (81.25)	III	41 (51.25)	V	159 (66.25)	V
17.	Improper selection of beneficiaries under compensation scheme due to local politics	70 (87.50)	II	49 (61.25)	VI	36 (45.00)	VI	155 (64.58)	VI

*Multiple responses

representatives and officials by farmers. Floods have also led to the destruction of the electric lanes. The installation of damaged electric lanes takes minimum of two to three months because of wet fields and long lanes. The crop failure compensation amount given by government is too less was mainly because of the fact that crop compensation for damage/loss caused due to crisis was very low because only 10,000/- per hectare was provided to farmers in irrigated areas and 8000/- for dryland area. This amount was very low as it is not enough to purchase even the setts for planting in the field per acre. Further, this amount was fixed based on whether the area is under irrigated or rainfed category. With the advancement of the irrigation facilities through installation of pipelines most of the dryland area has converted into irrigated area. Hence, there is a need for upgradation of land records. The increased illness among the members of farm family was attributed to the change in quality of drinking water, sudden change of the weather, drinking of long stored (for weeks) unfiltered water and stagnation of water around the houses as well as increased mosquitoes. Further, the drinking of rain harvested water without filter which is hard and unfit for drinking has also caused the illness among family members.

4.11 Suggestions given by the sugarcane growers to overcome the constraints faced by them in managing crisis.

The Table 40 indicated the suggestions offered by head reach, mid reach and tail end sugarcane growers to overcome the constraints faced by them during all the three phases of crisis management.

In the before crisis phase, the major suggestions offered by sugarcane growers were FRP and sugarcane price should be disbursed immediately without delay (98.33 %), training and simulation exercises should be conducted on regular basis through intimation to farmers (85.00 %), proper infrastructure should be established at the crisis affected areas to take initiatives of crisis management all time (70.83 %) and crisis related warnings should be disseminated through messages and through Public address system / gramasevak (60.42 %). The similar trend of results has been observed among the head reach and tail end sugarcane growers. Except mid reach farmers who ranked the suggestion crisis related warnings should be disseminated through messages and through PAS/ gramasevak as third and fourth ranked suggestion was proper infrastructure should be established at the crisis affected areas to take initiatives of crisis management all time.

The FRP and sugarcane payments should be disbursed immediately without delay was suggested because of the quite clear reasons that farmers were invested in agriculture by borrowing from others or from his savings with hope of good returns, which also derive their livelihood from agriculture and allied activities, non-familiarity of other jobs apart from agriculture. The interest rates of loans borrowed were very high hence in order to pay them and to start fresh cultivation activities, farmers are in need of immediate payments. Further, entering into new vocation has caused failures during crisis hence farmers come to conclusion that instead of trying unknown work it's better to continue in known field i.e., agriculture. Hence, sugarcane growers were in need of immediate payments as it acts as basis for next crop as well as to repay the earlier borrowings. The immediate payment for sugarcane helped the farmers indirectly in reducing their interest rates on borrowed amount and to build credibility from funders for next loan.

Another suggestion was training and simulation exercises should be conducted on regular basis through intimation to farmers, because of the fact that most of the trainings, demonstrations, exhibitions and exposure visits conducted by line departments and other concerned institutes were focused on increasing the production and productivity but neglected on stabilizing the yields and returns during crisis. Hence, the farmers suggested to conduct the trainings and other extension activities related to crisis management so that they can reduce their vulnerability to crisis and enhance the crisis management capacities as well as their living conditions. They further pointed out that the information related to the trainings organized by line departments was not reaching them in time.

The proper infrastructure should be established at the crisis affected areas to take initiatives of crisis management all time and crisis related warnings should be disseminated through messages and through PAS / gramasevak were suggested by sugarcane growers mainly because of the poor diagnosis and forecasting weather uncertainties and delayed dissemination of forecasted information by concerned institutions/personals. Further, farmers felt that the survey conducted should be more transparent and specific instead of selection of beneficiaries/ victims based on suggestions of talawars (gramasevak) and for upgradation of land records one should have to visit the Bailahongal where land map records exist. But mid reach farmers stressed for dissemination of crisis related, weather forecast and price forecast information through messages. This indicates that extension initiatives mainly to create the awareness about the registration process for existing forecast sources, Krishi Maratha vahini, APMC messages, e-NAM etc. is much needed by line departments.

During crisis phase, the major suggestions given by sugarcane growers were government should provide at least eight hours regular supply of electricity for irrigation purpose (98.75 %), proper arrangements should be made by local authorities to provide drinking water, food, transportation, shelter and health facilities during crisis (88.33 %), proper management of outflow of water from dams should be ensured to continuous water flow in river (85.00 %), alternate road connectivity should be ensured to nearby villages as main roads were blocked due to floods (78.33 %) and proper management of Ganji Kendra's with all facilities should be ensured by local authorities (70.00 %). The similar trend of results has been observed with respect to mid reach farmers. The major suggestions given by head reach farmers were government should provide at least eight hours regular supply of electricity for irrigation purpose (Rank I), proper arrangements should be made by local authorities to provide drinking water, food, transportation, shelter and health facilities during crisis (Rank II), alternate road connectivity should be ensured to nearby villages as main roads were blocked due to floods (Rank III), proper management of Ganji Kendra's with all facilities should be ensured by local authorities (Rank IV) and proper management of outflow of water from dams should be ensured to continuous water flow in river (Rank V). Whereas, the major suggestions of tail end farmers were government should provide at least eight hours regular supply of electricity for irrigation purpose (Rank I), proper management of outflow of water from dams should be ensured to continuous water flow in river (Rank II), proper arrangements should be made by local authorities to provide drinking water, food, transportation, shelter and health facilities during crisis (Rank III), alternate road connectivity should be ensured to nearby villages as main roads were blocked due to floods (Rank IV) and proper management of Ganji Kendra's with all facilities should be ensured by local authorities (Rank V).

In the second phase i.e., during crisis occurrence phase major suggestion given by majority of the sugarcane growers was that government should provide at least eight hours' regular supply of electricity for irrigation purpose. This was due to the fact that during summer the double phase electricity has been supplied for only four to six hours which affected irrigation capacity of the fields sufficiently. The other reasons were that for lifting water through pipeline it takes almost 20 to 40 minutes based on the distance from river basin and capacity of motors used. Electricity supply for irrigation purposes in split hours at early morning and late night consumed almost one hour. Further, the taps installed by the people from pipelines for domestic use reduced the irrigation potential and lifting capacity to some extent. Finally, only five hours is left for irrigation purpose with reduced capacity to lift. Hence, farmers were demanding to provide the irrigation electricity on continuous basis and at least for eight hours.

The second ranked suggestion of head reach, mid reach as well as third ranked suggestion of tail end sugarcane growers was proper arrangements should be made by local authorities to provide drinking water, food, transportation, shelter and health facilities during crisis (Table 40). This kind of suggestion expected due to the difficulties faced by farmers during 2019, 2020 and 2021 floods when they evacuated their residences without planning and went to the hilly areas where no basic facilities were there. This insists that before evacuation of villages, the planning is necessary for rehabilitation camps keeping to provide minimum basic facilities to victims. Another major suggestion was proper management of outflow of water from dams should be ensured to continuous water flow in river (Table 40) because of the facts that during the summer the water was stored for longer use for main cities and river basin people keeping the droughts and their consequences in mind without considering agricultural interests of farmers by providing only for drinking purposes. That storage of water has few times turned into bane with early onset of monsoons in Maharashtra, Koyna dam and Hidakal dam catchment areas which resulted in heavy discharge of water without any consent to farmers resulted in havoc in the farmers lives. Farmers complained about improper regulation of dam water. This was evident from several reports which claims that floods were due to the man-made mismanagements and mis-regulations with the rationale of storing water to supply for prolonged summer and droughts with aim to provide drinking water to major cities. The third ranked suggestion of head reach sugarcane growers was alternate road connectivity should be ensured to nearby villages as main roads were blocked due to floods (Table 40). This was strongly suggested by farmers because the main roads were blocked during floods. Hence, they took alternative kuccha roads which have not been renovated for years and heavy puddled muds with the spread of thorny bushes. This indicates that although they are kuccha roads but they became saviors' when all main exit points were blocked. Hence, there is need for keeping the kuccha roads in good conditions.

In the last phase of crisis management i.e., post crisis phase, the major suggestions given were measures should be taken for faster installation of electricity lanes to start water supply (95.00 %), strict adherences by officials to deliver compensation to victims firstly (85.00 %) political biases should be avoided by the officials during providing compensation amount to farmers (82.08 %), health and food kits should be disbursed to all victims of crisis (76.25 %) and proper basic facilities should be ensured post crisis till rehabilitation (70.42 %). The similar trend of results has been observed among the head reach and mid reach sugarcane growers. Whereas, the tail end farmers' other suggestions were political biases should be avoided by the

officials during providing compensation amount to farmers (Rank II) and strict adherences by officials to deliver compensation to victims firstly (Rank III).

The measures should be taken for faster installation of electricity lanes to start water supply was major suggestion by the growers because of the problem faced was real and its effect on sugarcane crop was huge. The acute water shortage caused due to destruction of electric lanes as well as submergence of electric motors and damage of pipelines on or near river basin due to frequent and severe floods was severely affecting the standing crops. This destruction has led to the acute water shortage in monsoon season and full river flow time which is also affected because of lack of rains after floods. Sugarcane was one of the heavy water requiring crop for development of cane and better yield. Further, they also admitted that it was impossible to install the electric lanes till drying off of flooded area to bring heavy electric poles and high-tension wires in vehicles due to wetted mud roads causing delay in installation. In addition to that, large scale destruction of electric lanes along the river basin might also be caused the delay in installation of electric lanes. Apart from that the water shortage during the summer due to river dry off was also causing the water shortage which affects the crop yield.

The strict adherences by officials to deliver compensation to victims firstly was suggested by sugarcane growers based on their observations about mis-happenings in villages and favouring by elected representatives to few villagers with respect to the allocation of compensations of crop losses, PACS loans, allocation of rations, seeds, other, inputs etc. Hence, farmers expressed that without the intervention of elected representatives, the officials should deliver compensations to the real victims rather than allocating based on the suggestions of elected representatives. Because the elected persons provided compensations to their close ones without considering real victims of the crisis. Further, the survey should be conducted by officials from external agency and should consider the severity of affected people and their lives. This prevailing condition has led farmers to offer this specific suggestion.

The political biases should be avoided by the officials during providing compensation amount to farmers was suggested due to the reasons that biases of local leaders in selection of victims by taking consideration of caste groups, those who voted them and personal clashes by locally elected people. Further, these local leaders involved and made officials to select the suggested victims only without considering whether they are the real victims of crises and extent of losses, severity caused by crises to the real victims lives. This has led to false impression on officials partly also. Further, the growers opined that elected representatives were asking for bribe to include the victims house into A or B category to get higher compensation amount.

Table 40: Suggestions given by sugarcane growers to overcome the constraints faced during crisis and its management.

Sl. No	Suggestions*	Head reach (n_1=80)		Mid reach (n_2=80)		Tail end (n_3=80)		Total (n=240)	
		f (%)	Rank	f (%)	Rank	f (%)	Rank	f (%)	Rank
	Before crisis								
1.	FRP and sugarcane payments should be disbursed immediately without delay	76 (95.00)	I	80 (100.00)	I	80 (100.00)	I	236 (98.33)	I
2.	Training and simulation exercises should be conducted on regular basis through intimation to farmers.	67 (83.75)	II	71 (88.75)	II	66 (82.50)	II	204 (85.00)	II
3.	Proper infrastructure should be established at the crisis affected areas to take initiatives of crisis management all time	57 (71.25)	III	51 (63.75)	IV	62 (77.50)	III	170 (70.83)	III
4.	Crisis related warnings should be disseminated through messages and through PAS/ gramasevak.	49 (61.25)	IV	55 (68.75)	III	41 (51.25)	IV	145 (60.42)	IV
	During crisis								
5.	Government should provide at least 8 hours regular supply of electricity for irrigation purpose	80 (100.00)	I	77 (96.25)	I	80 (100.00)	I	237 (98.75)	I
6.	Proper arrangements should be made by local authorities to provide drinking water, food, transportation, shelter and health facilities during crisis	76 (95.00)	II	68 (85.00)	II	68 (85.00)	III	212 (88.33)	II
7.	Proper management of outflow of water from dams should be ensured to continuous waterflow in river	68 (85.00)	V	63 (78.75)	III	73 (91.25)	II	204 (85.00)	III
8.	Alternate road connectivity should be ensured to nearby villages as main roads were blocked due to floods.	75 (93.75)	III	59 (73.75)	IV	54 (67.50)	IV	188 (78.33)	IV
9.	Proper management of Ganji Kendra's with all facilities should be ensured by local authorities	72 (90.00)	IV	57 (71.25)	V	39 (48.75)	V	168 (70.00)	V
	Post crisis								
10.	Measures should be taken for faster installation of electricity lanes to start water supply	80 (100.00)	I	80 (100.0)	I	68 (85.00)	I	228 (95.00)	I
11.	Strict adherences by officials to deliver compensation to victims firstly	78 (97.50)	II	67 (83.75)	II	59 (73.75)	III	204 (85.00)	II
12.	Political biases should be avoided by the officials during providing compensation amount to farmers	73 (91.25)	III	61 (76.25)	III	63 (78.75)	II	197 (82.08)	III
13.	Health and food kits should be disbursed to all victims of crisis	69 (86.25)	IV	58 (72.50)	IV	56 (70.00)	IV	183 (76.25)	IV
14.	Proper basic facilities should be ensured post crisis till rehabilitation	65 (81.25)	V	52 (65.00)	V	52 (65.00)	V	169 (70.42)	V

*Multiple response

V SUMMARY

The sugarcane productivity of Karnataka is diminishing over the years from 105-110 tonnes/ha (2006-07) to 90-95 tonnes/ha (2020-21). The protests against the sugarcane price arrears across the major sugarcane cultivating states of India making the news headlines every year. Along with that sugarcane farmers are facing various crisis situations like floods, droughts, hikes in input cost, pest and disease outbreaks, severe usage of chemical fertilizers & prolonged irrigation has led to the decrease in cane yield and problems with export policies. The varying degrees of crisis were affected the farming community mentally, financially, socially and their coping capacities. As a testimony to these crises, farmers' suicides were more in the sugarcane growing areas like Belagavi and Mandya. The crisis cannot be prevented but their adverse impacts on humans, livestock and crops sector can be minimized by undertaking crisis management measures at all phases. Therefore, in spirit, the imminent threats of crisis situations in sugarcane farming could be managed scientifically by integrating the efforts of sugarcane growers, governmental agencies and farm scientists. With the growing apprehension over crisis affected areas, hardly studies carried out to document sugarcane growers' adjustments/adaptations to crisis situations, which offers useful lessons for planners and administrators. Sugarcane growers' crisis adaptation practices should be documented to provide the basis for designing pragmatic research, extension and development programmes for better managing of crisis in sugarcane areas. Keeping all this in view, the present contemporary study was planned with the below-mentioned specific objectives:

1) To develop and standardize the crisis management behaviour scale to analyze the crisis management behaviour of sugarcane growers.
2) To know the adoption of crisis mitigation mechanisms by sugarcane growers to reduce crisis effect.
3) To understand the awareness level of sugarcane growers about the crisis and its management in sugarcane farming and to know the benefits received during crisis and its management.
4) To study the personal, socio-economic, organizational and psychological characteristics and to know their association with the crisis management behaviour of sugarcane growers.
5) To document success stories of crisis management in sugarcane farming.
6) To document constraints experienced by sugarcane growers in managing crisis and to enlist the suggestions given by them to overcome the crisis.

The contemporary study was carried out in two purposively selected districts of Northern Karnataka region namely Belagavi and Bagalkot districts as these two districts are major sugarcane growing districts in Karnataka with contribution of 45.67 per cent to total Karnataka's sugarcane production and 48.56 per cent of Karnataka's total sugarcane area. Further, more yield gap, nearly 21 per cent in sugarcane production was observed in Belagavi and Bagalkot districts. Ex-post facto research design was used in the present study as crisis was already experienced by farmers as the event has already happened. Simple random sampling technique was used in the study. From each district, two Taluks were selected based on maximum area under sugarcane and crisis prevalence. From each block two head reach (0-4 Km), two mid reach (4-8Km) and two tail end (8-12 km) villages were carefully chosen based on their distance from river basin. From each village ten sugarcane growing farmers were randomly selected thus constituting a total sample of 240. The sugarcane growing farmers' responses were documented through personal-interview method using the structured pre-tested interview schedule. The data collected were analyzed with descriptive statistics, percentage, frequency, mean, standard deviation, chi-square test and stepwise regression analysis.

The salient findings of the current research study are abridged as below:

1. With regard to overall crisis management behaviour, little more than two-fifth (40.42 %) of total sugarcane growers belongs to the moderate crisis management behaviour category followed by better (30.41 %) and poor (29.17 %) crisis management behaviour categories respectively.

2. More than two fifth (41.25 %) of the head reach sugarcane growers belongs to the better crisis management behaviour category followed by moderate and poor crisis management category with 37.50 percent and 21.25 per cent respectively. Less than two-fifth (38.75 %) of mid reach sugarcane growers belongs to the moderate crisis management behaviour category followed by better (32.50 %) and poor (28.75 %) crisis management categories respectively. More than two fifth (45.00 %) of tail end sugarcane growers belongs to the moderate crisis management behaviour category followed by poor (37.50 %) and better (17.50 %) crisis management behaviour categories respectively.

3. In overall decision-making ability, more one-third of total sugarcane growers belongs to the moderate (36.25 %) and better (33.75 %) decision-making ability categories respectively followed by poor decision-making ability category with 30.00 per cent.

4. With respect to head reach sugarcane growers more than two fifth (42.50 %) of them belongs to the better decision-making ability category followed by poor (33.75 %) and moderate (23.75 %) decision-making ability categories respectively. Similarly, two-fifth (40.00 %) of mid reach sugarcane growers belongs to the moderate decision-making ability category followed by better (36.25 %) and poor (23.75 %) categories respectively. Whereas, less than half (45.00 %) of tail end sugarcane growers belongs to the moderate decision-making ability category followed by poor (32.50 %) and better (22.50 %) categories respectively.

5. Less than two-fifth of total sugarcane growers belongs to the moderate (37.92 %) adaptability category followed by better (31.25 %) and poor (30.83 %) adaptability categories respectively.

6. The distribution of sugarcane farmers based on their adaptability scores showed that more than two-fifth (42.50 %) of head reach sugarcane growers belongs to the moderate adaptability category followed by better (38.75 %) and poor (18.75 %) adaptability categories respectively. More than one-third (35.00 %) of mid reach sugarcane growers belongs to the moderate adaptability category followed by better and poor adaptability categories with 32.50 per cent equally. Contrastingly, more than two-fifth (41.25 %) of the tail end sugarcane growers belongs to the poor adaptability category followed by moderate (36.25 %) and better (22.50 %) adaptability categories respectively.

7. Majority (71.25 %) of sugarcane growers are under the moderate to poor economic performance categories followed by better (28.75 %). Similar tendency of findings was observed among the mid reach and tail end farmers but significant percentage of head reach farmers belongs to poor economic performances category.

8. The distribution of sugarcane growers based on their economic performance scores indicated that less than two-fifth (38.75 %) of head reach sugarcane growers belongs to the poor economic performance category followed by moderate (32.50 %) and better (28.75 %) economic performance categories respectively. But, two-fifth of mid reach and less than half

(48.75 %) of tail end sugarcane growers belongs to the moderate economic performance category.

9. With regard to statement wise analysis of decision making ability, the sugarcane growers' ranked first the statement 'decision on development of contingency crop plans prior to crisis occurrence' followed by 'decision on selection of the irrigation methods based on the water availability' (Rank II), 'decision to access finance from formal/ informal sources of credit to cope with crisis' (Rank III), and 'decision on selling sugarcane to jaggery makers or factories based on cost and returns analysis to overcome delayed payment' (Rank IV).

10. The sugarcane growers opined that 'carrying out proper ratoon management practices like stubble shaving and gap filling' as major adaptation measure to production crisis management in sugarcane which is ranked first followed by the statement 'to control white grub- stagnation of water for 48 hrs. /drenching imidacloprid / chlorpyriphos @ 1 liter per acre' (Rank II) and 'to control wooly aphid- Spray 2ml chlorpyriphos 20 E.C. or dimethoate @ 1.7ml per liter of water (requires 300-liter solution per acre)' (Rank III).

11. The sugarcane growers ranked first the statement 'followed green / dry mulching by growing green manure crops and thrash residues' as the adaptation measure to soil and moisture conservation followed by 'application of farm yard manure and tank silt to enhance soil fertility and water holding capacity of the soil' (Rank II) and 'followed water saving irrigation methods like alternate furrow wetting and drip irrigation methods' (Rank III) and 'followed crop rotation to retain soil fertility after three harvests' (Rank IV).

12. With respect to the flood management, the major adaptation measures of sugarcane growers were 'drain out the flooded water from the field as soon as possible' (Rank I), 'early sowing of sugarcane to reach that growth stage which has minimum damage and effects on cane yield' (Rank II) 'field is cleared immediately and grown short duration crops like maize/wheat after flood occurrence' (Rank III), 'slashing of severely damaged cane to promote ratooning' (Rank IV), and 'construction of stone or sandbag structures to avoid water and silt load into field' (Rank V).

13. The sugarcane growers stated that 'the stripped lower leaves and thrash residue of sugarcane is useful as mulching to conserve soil moisture' was ranked first adaptation measure to the

drought management in sugarcane farming followed by 'the temporary farm pond/bore well in river or deepened the existing bore wells to provide critical irrigations using improved irrigation methods' (Rank II) 'increased use of organic manure with gradual reduction of chemical fertilizers' (Rank III) and 'earthing-up in main sugarcane and ratoon crop helps in soil and moisture conservation and to remove excess water' (Rank IV).

14. To overcome the price crisis irrespective of sugarcane growing farmers' category ranked the statement 'wholesale-based selling of sugarcane to the jaggery makers' as first adaptation measure to price crisis management followed by 'jaggery production to overcome delayed payment' (II Rank) and 'sold sugarcane for setts/seed purpose' (III Rank) and 'sold sugarcane to locals for juice/aesthetics purpose' (Rank IV).

15. Adaptations of sugarcane growers to financial crisis management in sugarcane farming were 'saved money during normal year to utilize the same during crisis period' (Rank I), 'mortgaged valuable assets like gold/home to meet capital needs' (Rank II) 'borrowed loan from non-institutional sources like money lenders' (Rank III) and 'cultivated maize/sweet corn as intercrops over recommended intercrops in sugarcane to get additional income' (Rank IV).

16. Labour crisis management adaptation measures of sugarcane growers were 'lending loan to labours in advance' (Rank I), 'hiring labours from nearby villages by providing transportation facilities to them' (Rank II), 'involvement of family members in farm activities during peak work by suspending their regular work' (Rank III) and 'use of herbicides and weedicides for weed management' (Rank IV).

17. Major livestock management adaptation measures of sugarcane growers under crisis conditions were 'growing fodder in a piece of irrigated land with forage trees/crops' (Rank I), 'increased small animals like sheep/ goat and decreased the voracious feeding animals during crisis time' (Rank II), 'increased the supplementary feeding to livestock' (Rank III), and 'purchased the fodder from fodder bank / other farmers on debt during crisis' (Rank IV).

18. With regard to the thrash residue management sugarcane growers ranked 'mulching of sugarcane thrash residue in alternate rows' as first adaptation measure followed by 'thrash can be used as firing material / biofuel in jaggery production' (Rank II) 'thrash can be baled and

raked to sell it to biorefineries and jaggery units' (Rank III) and collected thrash is used as bedding material for livestock' (Rank IV).

19. With regard to the adaptations needed from government for comprehensive sugarcane crisis management plan, irrespective of their category the sugarcane growers ranked the statement 'government should frame rigid laws and take actions against the factory owners for delayed payment' as first major adaptation followed by 'uniform price for sugarcane across the country' (Rank II), 'government should replace fair and remunerative price with MSP' (Rank III) and 'immediate and adequate responses from line departments to help farmers at all stages of sugarcane crisis management' (Rank IV).

20. With respect to the economic performance, the mean crop yield index (CYI) of head reach (95.46) and mid reach (98.77) sugarcane growers was lesser than tail end growers (101.20). The head reach sugarcane growers have lesser mean cropping intensity with 179.58 whereas mid reach (204.84) and tail end (214.84) sugarcane growers possess better cropping intensity. The results revealed that the benefit cost ratio of head reach (1:1.79), mid reach (1:1.93) and tail end (1:1.95) sugarcane growers was better. With respect to net income and B:C ratio is concerned tail end sugarcane growers possess better net income and B:C ratio than mid reach and head reach sugarcane growers.

21. The results of crisis mitigation mechanisms adoption revealed that less than two-fifth of head reach (38.75 %) sugarcane growers belongs to medium crisis mitigation mechanisms adoption category followed by high (33.75 %) and low (27.50 %) crisis mitigation mechanisms adoption category. Whereas, more than half of mid reach (52.50 %) and 37.50 per cent of tail end sugarcane growers belongs to high crisis mitigation mechanisms adoption category followed by medium (mid reach- 27.50%, tail end- 35.00%) and low (mid reach-20.00%, tail end-27.50%) crisis mitigation mechanisms adoption category. In general, more than two-fourth of total sugarcane growers (41.25 %) belongs to high adoption of crisis mitigation mechanisms category followed by medium and low categories with 33.75 per cent and 25.00 per cent respectively.

22. With respect to head reach sugarcane growers less than half of the respondents (47.50 %) belongs to moderate awareness category about crisis and its management followed by poor (30.00 %) and better (22.50 %) awareness categories. Similarly, among mid reach sugarcane

growers it was noticed that less than two-fifth of them (38.75 %) belongs to moderate awareness category about crisis and its management followed by poor and better awareness categories with 33.75 per cent and 27.50 per cent respectively. Among tail end sugarcane growers, 36.25 per cent of sugarcane growers belongs to the moderate awareness category about crisis and its management followed by poor and better awareness category with 33.75 per cent and 30.00 per cent respectively. In total, significant percentage of sugarcane growers belongs to the moderate awareness category about crisis and its management with 40.83 per cent followed by poor and better awareness category with 30.42 per cent and 28.75 per cent respectively.

23. With regard to awareness about the benefits received, more than two-fifth of sugarcane growers belongs to moderate awareness category followed by the better awareness category with 34.58 per cent and poor awareness category with 21.67 per cent.

24. The variables namely education, prior exposure to the crisis, mass media participation, extension orientation, production input support, credit support, scientific orientation, farming commitment, achievement motivation, perception towards crisis, attitude towards crisis, knowledge and adoption were found to be associated at one per cent level of significance whereas experience in sugarcane farming, cosmopoliteness, innovative proneness, deferred gratification and risk orientation were significantly associated at five per cent significance level.

25. The stepwise regression analysis results explained that the variation in crisis management behaviour of sugarcane growers was high and significant as shown by a coefficient of multiple determinations with R^2 value of 0.807. In other words, 80.70 per cent of the variation in crisis management behaviour is explained and influenced by the independent / exogeneous variables included in the model. The major independent variables influencing the crisis management behaviour are education, prior exposure to crisis, mass media exposure, innovative proneness, cosmopoliteness, production input support, extension support, crisis management trainings needed, knowledge, farming commitment, perception towards crisis, adoption, attitude towards crisis, deferred gratification and risk orientation.

26. The major constraint faced by the sugarcane growers before crisis phase were ‘delay in disbursement of FRP bonus’ which was the ranked first followed by ‘lack of trainings related

to crisis management in agriculture' (Rank II) and 'lack of crisis warning related to agriculture on regular basis to farmers' (Rank III).

27. In the crisis occurrence phase the major constraints of sugarcane growers were 'load shedding during the summer' (96.67 %), 'poor availability of clean drinking water for farmers' (91.25 %) and 'poor quality and connectivity of roads to nearby villages as main roads were closed due to floods' (86.67 %).

28. During post crisis phase, the major constraints confronted by sugarcane growers were 'disconnection of electricity for long duration led to crop losses' (89.58 %) followed by 'crop failure compensation amount given by government is too less' (87.50 %) and 'delay in disbursement of compensation amount declared by government' (75.00 %), 'poor availability of clean drinking water for farmers and animals', (72.50 %) 'increased illness among the members of farm family'(66.25 %) 'improper selection of beneficiaries under compensation scheme due to local politics' (64.58 %).

29. In the before crisis phase, the major suggestions offered by total sugarcane growers were 'FRP and sugarcane price should be disbursed immediately without delay' (98.33 %), 'training and simulation exercises should be conducted on regular basis through intimation to farmers' (85.00 %), 'proper infrastructure should be established at the crisis affected areas to take initiatives of crisis management all time' (70.83 %) and 'crisis related warnings should be disseminated through messages and through PAS/ gramasevak' (60.42 %). The similar tendency of results has been observed among the head reach and tail end sugarcane growers. Except mid reach farmers who third ranked the suggestion 'crisis related warnings should be disseminated through messages and through PAS/ gramasevak' and fourth ranked suggestion statement 'proper infrastructure should be established at the crisis affected areas to take initiatives of crisis management all time'.

30. During the crisis phase, the major suggestion given by sugarcane growers were 'government should provide at least 8 hours regular supply of electricity for irrigation purpose' (98.75 %), 'proper arrangements should be made by local authorities to provide drinking water, food, transportation, shelter and health facilities during crisis' (88.33 %), 'proper management of outflow of water from dams should be ensured to continuous water flow in river' (85.00 %), 'alternate road connectivity should be ensured to nearby villages as main roads were blocked

due to floods' (78.33 %) and 'proper management of Ganji Kendra's with all facilities should be ensured by local authorities' (70.00 %).

31. In the post crisis phase the major suggestions of sugarcane growers were 'measures should be taken for faster installation of electricity lanes to start water supply (95.00 %), 'strict adherences by officials to deliver compensation to victims firstly' (85.00 %) 'political biases should be avoided by the officials during providing compensation amount to farmers' (82.08 %), 'health and food kits should be disbursed to all victims of crisis' (76.25 %) and 'proper basic facilities should be ensured post crisis till rehabilitation (70.42 %).

Implications and recommendations:

Based on the findings of the present study and discussions held with the sugarcane growing farmers, cane development officers, extension personnel, bureaucrats and expert scientists during the study period, the following recommendations are made for effective sugarcane crisis management.

1. The prevailing major twin crisis situations namely flood and drought are affecting the sugarcane growers of Belagavi and Bagalkot districts of Northern Karnataka badly by affecting their yields largely and causing soil erosion continuously. Hence, the specific strategies to divert these crises negative impact on sugarcane growers should be framed and disseminated to the sugarcane growers by the developmental departments. To overcome the acute water shortage caused by these two crisis situations, the sugarcane growers should be made aware to use the subsidized solar pump sets scheme for lifting the irrigation water from borewells, open wells as well as river.

2. Price crisis is another major crisis which is affecting the sugarcane growers which is mainly due to the overproduction of the sugarcane. Hence, the proper extension strategies should be framed to convenience the sugarcane growers to undertake other commercial crops. Further, the government programmes to divert the sugarcane growers towards jaggery and ethanol production from sugarcane should be promoted. The main concern towards these, is conversion of agricultural land to non-agricultural land to avail loans for the construction/establishment of production/processing units. Further, there is a need to develop the proper guidelines by the concerned departments about ethanol and jaggery production process, procurement centers for

ethanol, selling of produced ethanol and jaggery, markets information with all the producers, wholesalers, traders, buyers and list of processing units should be prepared and distributed among sugarcane cultivators.

3. The sugarcane growers were striving hard to get the inputs especially required sugarcane varieties. Hence, proper arrangements should be made to supply the required varieties and quality setts / seedlings either by the factories, State Agricultural Universities and concerned line departments at minimal costs.

4. Findings exposed various thought-provoking adaptation strategies of sugarcane growers to reduce the vulnerability and overcome the ill effects like early planting of sugarcane, practicing of exhaustive intercrops, contingency crop planning, soil and moisture conservation practices, ratoon management, price and financial crisis management, labour and livestock management etc. Hence, the extension workers have to identify the successful practical mitigation and adaptation strategies and promote them to reduce growers' vulnerability to crisis in sugarcane farming. Further, most of the adaptations followed were of low cost/ no cost adaptations which are temporary solutions. Hence, line departments should make necessary arrangements to help farmers in finding long-term and semi-permanent solutions like desalination and infiltration systems to overcome the salinity and wetland restoration.

5. There is a need for improving the awareness level of sugarcane growers about crisis management by adopting suitable extension strategies during crisis period. It is imperative to devise suitable extension interventions like awareness campaigns, training to enhance coping capacities of sugarcane growers, planning farming systems, demonstrations, simulation exercises, etc., for updating their knowledge and create awareness about crisis management activities to facilitate better and holistic management of crisis to reduce its impact and faster recovery from its losses, rather than taking measures after crisis occurrence.

6. The adoption of crisis mitigation mechanisms by sugarcane growers recommended for the deep involvement of line departments to create awareness, enhance knowledge and encourage farmers to adopt the crisis mitigation mechanisms by using suitable extension interventions like training, demonstrations, exposure visits, timely information through ICTs specifically on crisis management along with production aspects and linking farmers to crisis management cells.

7. Disaster and crisis management related institutions and policy makers should prepare the crop, region and crisis specific guidelines for better management of crisis situations instead of generalized and single crisis-oriented plans by government.

8. The developmental departments and its programmes should have to be more emphasized on enhancing the thirteen identified independent variables which are influencing the crisis management behaviour of sugarcane growers for better management of crisis.

9. Constraints expressed at different phases of crisis management by sugarcane growers like delay in 'fair and remunerative prices' disbursement, poor road connectivity to small roads for emergency exits and load shedding have been affecting the sugarcane farmers at different phases to mitigate crisis and its effects. These constraints have to be taken seriously by government and concerned developmental departments to take suitable measures to manage crisis more effectively.

10. The look into suggestions indicated the legal enforcement of laws and actions against the factories and concerned persons for delayed payment.

11. The look into case studies indicated that the orienting and preparing farmers to get financial assistance from banks along with governmental subsidy programmes would help the farmers to take up the crisis adaptations in better way like solar pump sets, reclamation activities like infiltration for wet and saline lands etc. will help the farmers in better management of crises and making sugarcane farming profitable. Further, regulation and monitoring of chemicals used in jaggery preparation especially in sugar mixed jaggery making should be regulated.

12. The promotion and establishment of the Farmers Produce Organizations in the study areas will be helpful in addressing many of these crises in sugarcane farming.

13. The startups related to sugarcane production system and its marketing should be promoted for addressing the production, marketing, financial, price and climate change related crises.

Suggestions for future research

1. The evolved scale to measure the crisis management behaviour of sugarcane growers has to be tested in diverse locations for its reliability (consistency) and also, applicability under different sugarcane growing areas.

2. The adaptations identified in sugarcane crisis management have to be analyzed from financial side, that would provide evident support to sugarcane farmers to select correct adaptation strategies.

3. The study has been conducted only in two districts of northern Karnataka, the similar kind of study in other sugarcane growing areas can be carried out to have better picture of sugarcane crisis management.

4. The documentation of the case studies of sugarcane growers in management of different crisis conditions at different locations has got great scope because it provides the better insights into micro-aspects of crisis management.

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INTERVIEW SCHEDULE
for
DATA COLLECTION
on
"CRISIS MANAGEMENT BY SUGARCANE GROWERS OF NORTHERN KARNATAKA- AN ANALYSIS"

PART-A

Respondent No:_____

Date: _____

District:_____

Taluk: _____

Village: _____

I. General information

a. Name of the respondent: _____

b. Occupation i) Main : _____

ii) Subsidiary: _____

I. Personal factors

1. Age: _____ years

2. Education level: Illiterate/ Can read and write/ Primary school/ Middle school/ High school/ PUC or Diploma/ Degree/ Post Graduation

3. Farming experience: Number of years engaged in sugarcane farming: _____ years

4. Prior exposure to crisis (In your sugarcane farming experience, how many years you have experienced crisis situations?)

Crisis Type	**Frequency**	**Damage to (**Property, Infrastructure, Crops, Livestock)	**Type of Damage**	**Value**
Flood				
Drought				
Price				
Pest and Disease Outbreak				
Others				

5. Family size: Please furnish the following details about your family

SI. No.	Relation	Number	Age	Studying	Works on Farm/ as Labour	In service	
1	Family Head						
2	Father						
3	Mother						
4	Son						
5	Daughter						
6	Others						

6. Land holdings

	Land holding(acres)			
	Dry land	**Wet land**	**Garden land**	**Total**
Owned				
Leased in				

7. Annual Income

SI.No.	Source of income	Income per month (Rs.)	Income per year (Rs.)
1	Agriculture		
2	Animal husbandry		
3	Subsidiary Enterprises		
4	Business		
5	Service		
6	Other		
	Total		

8. Cosmopoliteness

Please indicate the number of times you visit the nearest town and purpose of your visit?

SI. No.	Purpose	Response	Frequency of visits
1	Majority of the visit relating to agriculture and allied enterprises		
2	Some relating to agriculture and allied enterprises		
3	Personal domestic and entertainment		
4	No		

(Two or more times a week-5; Once per week-4; Once in fortnight-3; Once in a month-2; Occasionally-1; Never-0)

9. Mass media exposure

Sl. No.	Mass media	Read/ listen/ view	Discuss with others	Seek clarification with others	Read/ listen/ view about																				
					Soil conservation			Water conservation			Application of fertilizer			Sugarcane Crop management			Strategy on aberrant weather Management			Long range strategies to crisis			Entertainment/ General knowledge		
					R	O	N	R	O	N	R	O	N	R	O	N	R	O	N	R	O	N	R	O	N
1.	**Print media** **a**. Newspaper																								
	b. Agriculture publications																								
	c. Extension literature (leaf let, pamphlet etc.)																								
2	**Electronic media** **a.** Radio																								
	b. Television																								
	c. Film show																								
	d. social media																								

10. Innovative Proneness

Please indicate your response on four-point continuum to each of the statements indicating innovative proneness of the farmer.

Sl. No.	Statements	Response			
		Strongly agree	Agree	Undecided	Disagree
1	Try to keep myself up-to-date with information, on new farm practices, but that does not mean that I try out all the new methods on my farm				
2	I feel restless till I try out a new farm practice, I have heard about				
3	They talk of many farm practices these days, but who knows if they are better than the old ones.				
4	From time to time, I have heard of several new farm practices and I have tried out most of them in the last few years.				
5	I usually wait to see what results my neighbours obtain before I try out the new farm practices				
6	Somehow, I believe that a traditional way of farming is the best				
7	I am cautious about trying a new practice				
8	After all our fore fathers were wise in their farming practices and I don't see any reason for changing these old methods				
9	Often new farm practices are not successful however if they are promising, I would surely like to adopt them				

11. Extension Orientation

a. Access to information support

Sl. No.	Statements	Response			
		Very much	Much	Very little	Never
1.	The extent of advice received for conservation of soil (Bunding, inter bund management)				
2.	Extent of advice received for conservation of water				
3.	The level of assistance for selection of improved varieties, horticulture crops, animal breeds etc.				
4.	Extent of advice on different agronomic practices to be adopted after crops are sown during varying rainfall condition				
5.	Extent of information received in management of livestock to face crisis situation				
6.	Extent of guidance on drought relief activities				
7.	Extent of guidance on rural development programmes operated by state government				
8.	Extent of guidance on long term crisis management activities				
9.	Extent of guidance on price and financial crisis management activities				
10.	Extent of information on suitable combination of enterprises				
11.	Extent of guidance on fertilizer use efficiency				
12.	Extent of guidance on accessing good markets and prices				

b. Access to material support from different development departments

Sl. No.	Benefits	Department				
		Agriculture	Horticulture	Veterinary	Forestry	Fishery
1.	Supply of implements					
2.	Seeds					
3.	Planting material					
4.	Seedling supply					
5.	PP chemicals					
6.	Fodder supply					
7.	Soil conservation structures					
8.	Veterinary care					
9.	Improved Cow sheep piglets					
10.	Forest species planting material					
	Any other specify					

12. Production Input Support

a) Availability of production input (quantity and type) & Accessibility of inputs on time

Sl. No.	Input	Availability							Accessibility	
		Quantity					Type/brand/variety		Inputs	
		0	25	50	75	100	Available	Not available	Timely	Untimely
1	Setts/Seeds/ Seedlings									
2	Fertilizer									
3	Plant protection chemicals									
4	Feed concentrates									
	Others									

13. Access to Credit Support

a) Per cent credit facility available and time of availability

Sl. No.	Source	Availability					Timeliness		Type of loan
		0	25	50	75	100	Available	Untimely	
1	Formal source a. b. c.								Crop loan Collateral Developmental schemes Others
2	Informal source a. b. c.								

b) Special provisions given by development departments during crisis

Sl. No.	Provisions	Benefits	
		Received	Not received
	i. Formal source		
1	Postponement of installments		
2	Reduced interest rate		
3	Subsidized loan		
4	Immediate payment of PM-Samman nidhi		
	ii. Informal source		
1	Postponement of installments		
2	Reduced interest rate		
3	Reduced installment amount and increased number of installments		

14. Crisis management trainings needed

a) Involvement in crisis management programme i) Beneficiary ii) Non beneficiary

Sl. No.	Items	Response	
		Yes	No
1	Construction of bunds		
2	Received benefits of seeds and fertilizer		
3	Received agricultural implements on subsidy or free		
4	Received seedling of horticultural crops		
5	Received financial assistance to open farm pond		
6	Received forestry seedlings		
	If any others		

b) Participation in educational activities on development programmes

I. Regular: ---------- II. Occasional: ---------- III. Never: ----------

c) Training Needs:

SI. No.	Areas of training needed	Most Needed	Somewhat Needed	Not Needed
1.	IPM			
2.	INM			
3.	Entrepreneurship			
4.	Minor irrigation			
5.	Jaggery production			
6.	Jaggery marketing			
7.	Jaggery certification			
8.	Soil reclamation measures			
9.	Community disaster management			
10.	Organic farming			
11.	Others			

15. Scientific Orientation

Please indicate your choice for each of the following statements.

Sl. No.	Statement	Response category		
		Agree	Undecided	Disagree
1.	New methods of farming give better results to a farmer than the old methods			
2.	The way farmer's fore-fathers practiced agriculture is still the best way even today			
3.	Even a farmer with lot of experience should use new method in agriculture			
4.	Though, it takes time for a farmer to learn new methods in agriculture, it is worth the efforts			
5.	A good farmer experiments with new ideas in agriculture			

6.	Traditional methods in farming have to be changed in order to raise the level of living of a farmer			

16. Farming commitment

Sl. No.	Statement	Response			
		Strongly agree	Agree	Undecided	Disagree
1.	If I were given a job in city, I quit farming				
2.	I feel that people simply talk of farming problems they forget that everything depends on how they manage it				
3.	I am not willing to take a great deal of effort to develop my farm				
4.	I am proud that I am a farmer				
5.	I prepare to face any problem to stay permanently in agriculture				
6.	I wish my children to be government employee rather than a farmer like me				
7.	There is not much to be gained by sticking to farming permanently				
8.	For me farming is the best profession when compared to other occupations				
9.	I continue farming simply as it is not socially respected to sell away my ancestral property				
10.	I believe that agriculture vocation alone pays in long run				

17. Deferred gratification

Sl. No.	Statement	Response			
		Strongly agree	Agree	Undecided	Disagree
1.	I am good at saving money rather than spending it straight away				
2.	When I am in a market place, I tend to buy a lot which I had not planned to buy				
3.	I agree with the philosophy eat, drink and be merry for tomorrow we may be all dead				
4.	I often feel that it is worthwhile to wait and think over before deciding anything				
5.	I like to spend my money for family as soon as I get it				
6.	I am good at planning things well in advance				
7.	I do not save food grains to face future uncertainties				
8.	I somehow manage to keep at least a little fodder in reserve for future uncertain weather				
9.	I sell farm produce immediately without waiting for good price				

10.	I invest more on farm to expect handsome return in long run				

18. Risk orientation

Given are a set of statements about risk orientation of individuals who experienced crisis. Please express your feelings towards these statements by indicating degree of your agreement or disagreement on three-point continuum. (A- Agree, UD-Undecided and DA- Disagree)

SI No	Statements	A	UD	DA
1.	I take greater risks in farming than my fellow farmers to do financially better.			
2.	Trying an entirely new practice for managing crisis involves risk but it is worth.			
3.	A farmer should try new practices to manage crisis before other farmers have used with success			
4.	A farmer who takes risks in farming, his chances of success are fairly high			
5.	I feel risk taking is an important quality for a farmer to progress.			
6.	A farmer should take a chance in making a big profit in farming by adopting innovations without caring for their consequences			
7.	Foreseeing events and planning based on past experience is a must in farming			
8.	I feel going only for sure thing is the best way to get ahead			
9.	I usually try a new farm technology on a small scale before it is introduced on a larger area to avoid risk			

19. Achievement motivation

Please indicate your response of agreement to measure the achievement motivation. (A=Agree; UD = Undecided & DA = Disagree)

SI. No.	Statements	A	UD	DA
1	Success brings relief for the further determination and not just pleasant feeling			
2	I believe that all my efforts are directed towards my goals			
3	I always seek for opportunity to excel in given situation			
4	I hesitate to undertake something that might lead to the failure			
5	I can succeed in every sphere of doing at all times.			
6	Avoided the situations that exposed me to evaluation			

20. Perception towards crisis

Given are a set of statements about perception of individual farmer on selected crisis. Please express your feelings on these statements by indicating degree of your agreement on 3-point continuum: A-agree; UD-Undecided and DA-Disagree.

1	Crises are inherent in nature	A	UD	DA
2	Farmers can forecast the crises accurately in advance through ITK's			
3	Losses due to crisis cannot be recovered			
4	Farmers can overcome a crisis by adopting appropriate and timely practices			
5	Frequent exposure to crisis leads to emotional imbalance			
6	Exposure to crisis makes the farmer dare, devil			
7	Occurrence of crisis during crop period results in loss in agricultural yields			
8	Crisis contains within itself seeds of fortune also			
9	Crisis threatens the goals and objectives of the farmer			
10	Due to exposure to crisis the individual tends to develop better alternate ways of living			

21. Attitude towards crisis

Please express your level of agreement or disagreement to the statements mentioned below by ticking in the appropriate cell.

SI.No.	**Statement**	**SA**	**A**	**UD**	**D**	**SD**
1.	The environmental crisis is an outward manifestation of the crisis of mind and spirit					
2.	We should not run after gains at the cost of nature, rather should strive to restore its damaged majesty					
3.	The community has a larger role than Government in taking initiatives for effective management of disasters					
4.	All farmers should deploy sustainable production practices for maintaining ecological balance					
5.	Occurrence of floods is erratic and is beyond control hence there is little scope for human intervention					
6.	The environment is a low priority for me as compared to livelihood and other things in my life					
7.	There is nothing that I can do personally for preventing or managing disasters					
8.	It is the duty of the Government to take steps for preventing or handling any crisis					
9.						
10.						

22. Knowledge

SI. No.	Statements	Correct Knowledge	Incorrect Knowledge
1.	Which type of soil is suitable for sugarcane cultivation?		
2.	Which method of planting is suitable for sugarcane?		
3.	Name the recommended varieties for your area		
4.	Mention the duration of recommended varieties and time of planting		
5.	Mention seed/setts required for planting one acre		
6	Do you treat the setts before planting (If yes mention the method)		
7	Mention the age of setts selected for planting (Moths)		
8	Which portion of the plant is used as setts		
9	To what depth the sets are planted		
10	Recommended spacing		
11	Mention the recommended quantity of farm yard manure per acre		
12	Mention the time of application of FYM		
13	Do you follow green manuring? (If yes mention green manure crops: ------)		
14	Recommended dosage of fertilizers (NPK)		
15	How many top dressings should be given to sugarcane		
16	Name the important pests and their control in sugarcane		
17	Name the important diseases and their control in sugarcane		
18	Mention the weedicides used in sugarcane		
19	Mention interval between two irrigations in sugarcane		
20	Why inter-cultivation and earthing-up operations carried out in sugarcane?		
21	Number of ratoons obtained in sugarcane crop		
22	Mention recommended dosage of fertilizers for ratoon crop		
23	Burnt thrash immediately after harvest		
24	Mention the intercrops grown with sugarcane		
25	Mention proper stage of harvesting		

23. Adoption

SI. No.	Practices	Practice Adopted by farmers	As per Recommendation Yes/No.	Reasons for non-adoption	
				Partial	Non-adoption
1.	Planting time				
2.	Age of setts used for planting				
3.	Portion of cane used for planting				
4.	Recommended variety				
5.	Setts required per acre				
6.	Setts treatment				
7.	Spacing followed				
8.	Depth of planting setts				
9.	Quantity of FYM applied				
10.	Time of FYM application				
11.	Quantity of fertilizer applied a. During planting---------- b. First top dressing---------- c. Second top dressing---------- d. Third top dressing----------				
12.	Time of inter-cultivation and earthing up				
13.	Plant protection a. Disease control---------- b. Pest control----------				
14.	Weedicide use				
15.	Chemical fertilizer used for ratoon 1. 2. 3.				
16.	Plant protection adopted for ratoon 1. 2. 3.				
17.	Harvested period (Months)				
18.	Yield obtained (tonnes/acre)				

PART – B

1. CRISIS MANAGEMENT BEHAVIOR OF SUGARCANE GROWERS

I. Decision Making Ability

Table 1: Decision making ability of sugarcane growers to different crises management

SI.No.	Statements	SA	A	UD	DA	SDA
1.	Decision on selection of specific new varieties of sugarcane (Drought tolerant varieties, Submergence/flood tolerant varieties and Healthy setts)					
2.	Decision on selection of intercrops based on analysis of costs, benefits and returns					
3.	Decision on selection of the irrigation methods based on the water availability					
4.	Decision on selection of labour or mechanization based on prevailing situation					
5.	Decision on selection of adhoc advises during crisis from scientific community and peer groups					
6.	Decision on selection of farm activities based on weather forecasts to overcome uncertainties					
7.	Decision on development of contingency crops plans prior to crisis occurrence					
8.	Decision on use of institutional sources of information like price forecasting, input supply and advisory services					
9.	Decision to access finance from formal/ informal sources of credit to cope with crisis					
10.	Decision on value added products preparation based on market demand to overcome price crisis like jaggery and ethanol production					
11.	Decision on selling sugarcane to jaggery makers or factories based on cost and returns analysis to overcome delayed payment					

II. ADAPTABILITY:

Table 1: Adaptation patterns of sugarcane growers related to production crisis management

SI.No	Statements	SA	A	UD	DA	SDA	Adapted	Not Adapted
1.	Alteration in sowing dates to reduce the vulnerability of crisis on sugarcane							
2.	Reduced the tillers/ plant population of sugarcane during stress season							
3.	Wrapping and propping of canes to							

	prevent crop lodging							
4.	Grown fodder species as wind breakers on bunds to prevent crop lodging							
5.	Carrying out proper ratoon management practices like stubble shaving and gap filling							
6.	To control white grub- stagnation of water for 48 hrs /drenching imidacloprid / chloropyriphos @ 1 litre per acre							
7.	To control wooly aphid- Spray 2ml chlorophyripos 20 E.C. or dimethiate @ 1.7ml per litre of water (requires 300 litre solution per acre)							
8.	To control top and early shoot borer- trichogramma chilonis eggs @ 60000 / 5 times at 10 days interval after 4 weeks of planting / use of chloropyriphos @ 1.2 litre per acre							

Table 2: Adaptation patterns of sugarcane growers related to soil and water conservation in sugarcane crisis management

SI.No.	Statements	SA	A	UD	DA	SDA	Adapted	Not adapted
1.	Constructed bunds and stabilized with grasses to conserve soil and moisture							
2.	Constructed water ways along the slope for safe disposal of rain water to avoid soil loss							
3.	Levelled the land to promote uniform infiltration							
4.	Application of farm yard manure and tank silt to enhance soil fertility and water holding capacity of the soil							
5.	Followed water saving irrigation methods like alternate furrow wetting and drip irrigation methods							
6.	Followed green / dry mulching by growing green manure crops and thrash residues.							
7.	Followed crop rotation to retain soil fertility after three harvests							
8.	Constructed farm pond and percolation pits for rain water harvesting and ground water recharge							

Table 3: Adaptation pattern of sugarcane growers related to flood and drought management

SI. No.	Statements	SA	A	UD	DA	SDA	Adapted	Not adapted
	Flood							
1.	Construction of stone or sandbag structures to avoid water and silt load into field							
2.	Cultivating varieties tolerant/resistant to waterlogging and salinity							
3.	Draining out the flooded water in field as soon as possible							
4.	Use of hazard insurance for crops							
5.	Early sowing of sugarcane to reach that growth stage which has minimum damage and effects on cane yield due to flooding							
6.	Slashing of severely damaged cane to promote ratooning							
7.	Field is cleared immediately and grown short duration crops like maize/wheat after flood occurrence							
8.	Use of desalination systems in the sugarcane field (nanofilteration, microfilteration and solar energy)							
9.	Restoration of normal soil characteristics by wetland restoration practices							
	Drought							
1.	Cultivating drought tolerant and short duration varieties							
2.	Reducing the area under sugarcane in forthcoming years							
3.	Frequent inter-cultivation and hoeing to create dust mulch to conserve soil moisture							
4.	Earthing-up in sugarcane and ratoon crop helps in soil and moisture conservation and to remove excess water							
5.	The stripped lower leaves and thrash residue of sugarcane is useful as mulching to conserve soil moisture							
6.	Critical irrigations provided in alternate rows/drip irrigation method saves crop							
7.	Foliar spraying of 2.5% urea & 2.5% KNO_3 / anti-transpirents during water stress results in better crop growth and increases yield							

8.	Digging the borewell/tube well to overcome the water shortage during crisis period is advantageous							

Table 4: Adaptation pattern of sugarcane growers related to price crisis and financial crisis management

SI. No.	Statements	SA	A	UD	DA	SDA	Adapted	Not adapted
	Price							
1.	Jaggery production to overcome delayed payment							
2.	Sold sugarcane for setts/seed purpose							
3.	Sold sugarcane to locals for juice/aesthetics purpose							
4.	Wholesale based selling of sugarcane to the jaggery makers							
5.	Demand based value addition of sugarcane into powdered jaggery, liquid jaggery and flavored jaggery to get higher and immediate returns							
6.	Contract farming with jaggery makers and sugarcane factories							
	Financial							
1.	Borrowed loan from institutional credit sources 1. Commercial bank/ Primary land development bank (PLDB) for land development 2. Borrowed crop loan from PACS/SHGs/Banks							
2.	Saved money during normal year to utilize the same during crisis period							
3.	Borrowed loan from non-institutional sources (money lenders)							
4.	Mortgaged valuable assets like gold/home to meet capital needs							
5.	Cultivated maize/sweet corn as intercrops over recommended intercrops in sugarcane to get additional income							
6.	Rearing and selling of small livestock like sheep/goat to meet emergency financial needs							

Table 5: Adaptation pattern of sugarcane growers during labour crisis

SI. No.	Statements	SA	A	UD	DA	SDA	Adapted	Not adapted
1.	Use of implements/ equipments to carryout farm operations							
2.	Lending loan to labours in advance							

3.	Hiring labours from nearby villages by providing transportation facilities to them							
4.	Mutual understanding with friends and relatives in peak work seasons to help each other							
5.	Involvement of family members in farm activities during peak work by suspending their regular work							
6.	Use of herbicides and weedicides for weed management							

Table 6: Adaptation pattern of sugarcane growers related to livestock management during crisis

SI. No.	Statements	SA	A	UD	DA	SDA	Adapted	Not adapted
1.	Increased the supplementary feeding to livestock							
2.	Shifting animals to safe places before occurrence of flood and sent to goshalas during drought							
3.	Increased small animals like sheep/ goat and decreased the voracious feeding animals during crisis time							
4.	Purchased the fodder from fodder bank / other farmers on debt during crisis							
5.	Growing fodder in a piece of irrigated land with forage trees							
6.	Fodder preserved in the form of silage and hay for future							

Table 7: Adaptation patterns of sugarcane growers to thrash management

SI. No.	Statements	SA	A	UD	DA	SDA	Adapted	Not adapted
1.	Mulching of sugarcane thrash residue in alternate rows							
2.	Thrash is burnt in the field							
3.	Collected thrash can be used as bedding material for livestock							
4.	Collected thrash can be used as raw material for compost preparation							
5.	Thrash can be used as firing material / biofuel in jaggery production							
6.	Enriched thrash can be used as feed and fodder							
7.	Thrash can be baled and raked to sell it to biorefineries and jaggery units							

Table 8: Adaptations needed from institutions/govt at crisis period according to farmers

SI. No.	Statements	SA	A	UD	DA	SDA	Adapted	Not adapted
1.	Government should **replace** fair and remunerative price with MSP							
2.	Government should adopt single sugarcane pricing mechanism instead of double sugarcane pricing mechanism							
3.	Government should frame rigid laws and take actions against the factory owners for delayed payment							
4.	Immediate and adequate responses from line departments to help farmers at all stages of sugarcane crisis management							
5.	Uniform price for sugarcane across country							
6.	Cumbersome procedures should be made easy and immediate sanctioning of loans during crisis period							
7.	Separate development programmes for sugarcane byproducts promotion							

III. ECONOMIC PERFORMANCE

A. Cropping intensity of the farmers and Crop yield index:

Season / Crops grown	Owned		Leased		Total	
	Area	Production	Area	Production	Area	Production
Kharif						
1.						
2.						
3.						
Rabi						
4.						
5.						
6.						
Summer						
7						
8						
9.						

B. Benefit cost ratio:

a. Cost of cultivation

1. Crop: _____ 2. Acreage:_____ 3.Season:_____

4. Wage rate: **Men:**_____Rs. /man day. **Women**:_____Rs. /man day.

5. **Bullock labour**:_____Rs. /man day 6. **Machine labour:**_____Rs. /man day./___Rs/hrs.

7. If grown in leasing land, **land rent**_____Rs. /acre

Sl. No.	Operation	Material cost			Labour cost									Total cost
					Human labour (no.)			Bullock labour (no.)			Machinery labour (no.)			
		Qty	Unit value	Cost 1	Family	Hired	Cost 2	Family	Hired	Cost 3	Family	Hired	Cost 4	1+2+3+4
A	**Land preparation**													
1	Ploughing & harrowing													
2	Clod crushing													
3	Land levelling													
3	Inter-cultivation													
4	Earthing up													
B	**Inputs**													
1	Setts													
2	Setts transportation													
3	Setts planting													
4	FYM transport													
5	FYM application													
6	Fertilizer													
	N													
	P													
	K													
	Complex fertilizers													
	Biofertilizers													
	Growth promoters													
7	**PPC**													
	Insecticides a. b.													
	Pesticides a. b.													
	Herbicides a. b.													
8	Gap filling and stubble shaving													
9	Irrigation													
10	Weeding and dethrashing													
11	Wrapping and propping													
C	**Harvesting:**													
12	Slashing													
13	Loading and unloading													
14	Residue/straw removal													
15	Processing charges (if processed)													
	Others if any (mention)													

b. Output Production and Returns

SN	Particulars	Units	Quantity	Rate	Value	Remarks
1.	Main Product					
2.	By product					
	Gross Returns					
	Total Cost of Cultivation					
	Net Returns					

Part – C

2. Adoption of crisis mitigation mechanisms by Sugarcane Growers to reduce the effect of Crisis

SI.No.	Mitigation mechanism	Adopted	Not Adopted	Reasons
1.	Shifting to safe places			
2.	Receiving temporary relief materials (food packets, water, clothes etc.)			
3.	Health and sanitation measures			
4.	Disposal of carcass			
5.	Saving the seed			
6.	Storing the food grains and fuel			
7.	Input, seed supply			
8.	Mixed farming			
9.	Adjusting cropping pattern			
10.	Crop insurance			
11.	Shifting cattle to safe places			
12.	Storing fodder			
13.	Cattle insurance			
14.	Building insurance			
15.	Monetary compensation			
	Others if any			

Part- D

3. Awareness of sugarcane growers about crisis and its management

1	**Crisis management means**
	a. Prior planning
	b. Activity during crisis occurrence
	c. Aftermath measures
	d. All the above
2	**Crisis management is an activity of concern to**
	a. Individual
	b. Community

	c. Government
	d. NGOs
	e. All of them
3	**Major source of information about crisis is**
	a. Radio
	b. Television
	c. Newspapers
	d. Government agencies
	e. NGOs
	f. Neighbours and friends
	g. All of them
4	**Crisis management in agriculture in your opinion is**
	a. Contingency planning
	b. Relief by Govt. Agencies
	c. Alternate crop planning
	d. Crop insurance
5	**Crisis management measures in cattle in your opinion is,**
	a. Shifting cattle to shelter places immediately
	b. Keeping buffer stock of medicines
	c. Storing adequate fodder
	d. Animal insurance scheme
	e. All the above
6	**The role of government in crisis management in agriculture in your opinion is**
	a. Storing of seed and input material in advance in case of crop failures
	b. Prior planning of farming systems
	c. Ready technical help
	d. Timely relief measures

4. Awareness of the sugarcane growers about the type of help received from government at different phases of crisis management. (Are you aware of the type of help you received from the government before, during and after crisis?).

SI. No.	**Type of Assistance/help**	**Aware**	**Aware but not known the source**	**Not Aware**
	I. Before			
1	Early warning			
2	Evacuation of human beings			
3	Evacuation of livestock			
4	Crop insurance			
5	Cattle insurance			
6	Building insurance			
7	Storing of seed and input material in advance in case of crop failures			
8	Prior planning of farming systems			

9	Storing adequate fodder			
10	Keeping buffer stocks of medicines			
11	Training in coping mechanisms			
12	Simulation exercises			
13				
	II. During:			
14	Search and rescue			
15	Shifting to shelters			
16	Shifting cattle to safe places			
17	Needs and damage assessment			
18	Providing relief materials (food, water, sanitation, medicines etc.)			
19	Disposal of carcass			
20	Health and sanitation			
21				
	III. After:			
22	Reconstruction of houses			
23	Resumption of transport facilities			
24	Resumption of communication facilities			
24	Soil reclamation			
25	Saving the standing crops			
26	Offering compensation			
27	Restoration of livelihoods			

Part- E

Success stories of sugarcane growers focusing on successful management of sugarcane crisis:

Crisis conditions:

Interventions:

Benefits/Advantages:

Part-F

A) Please state the constraints faced by you (sugarcane growers) during different phases of crisis management

Sl. No.	Constraints
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

B) Please provide your suggestions to overcome the constraints faced during different phases of crisis management

Sl. No.	Suggestions
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

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Awareness of Crisis Management Among the Sugarcane Growers of Northern Karnataka

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ABSTRACT

The present study was conducted in Belagavi and Bagalkot districts of Karnataka during 2020-21 to know the awareness of sugarcane growers about crisis and crisis management. Data was elicited from 80 head reach, 80 mid reach and 80 tail end sugarcane growers constituting to a total sample size of 240. The results revealed that 47.50 per cent of head reach sugarcane growers belongs to good awareness category followed by poor (30.00 %) and better (22.50 %) awareness categories. Similarly, 38.75 per cent of mid reach sugarcane growers belongs to good awareness category followed by poor (33.75 %) and better (27.50 %). 36.25 per cent of tail end sugarcane growers belongs to good awareness category followed by poor (33.75 %) and better (30.00 %) awareness category. With respect to overall sugarcane growers' awareness, significant percentage of sugarcane growers belongs to good awareness category with 40.83 per cent followed by poor (30.42 %) and better (28.75 %) awareness categories. With respect to statement wise awareness of sugarcane growers about crisis and its management the results revealed that crisis management means aftermath rehabilitation (32.92 %), crisis management was a concern of government (38.75 %), Television was major source of crisis information (25.83 %), agricultural crisis management is concerned with providing relief by government agencies (25.83 %), storing adequate fodder for livestock crisis management (28.33 %) and creating awareness and providing technical help is role of government in crisis management (30.00 %). Floods was major crisis faced (40.00 %), delay in payments was cause of price crisis (34.17 %), planned planting of cane as flood management in sugarcane (27.92 %), acute water shortage was cause of lower sugarcane productivity (27.50 %) and governments role is to take actions against factories for delayed payments (40.00 %).

Keywords : Crisis, Crisis management, Awareness, Head reach, Mid reach and Tail end sugarcane growers

CRISIS is extremely harmful to people whose survival solely depends on agriculture and cause considerable loss to national economies. It is a highly familiar fact that today's crisis and disasters are often due to human activities (Anonymous, 2011) causing to change the natural balance of the universe. Agriculture is one of the sectors that was most affected by crisis. In agriculture, crisis is defined as an unforeseen situation that endangers the viability of agricultural holdings, in the form of low crop prices and low farm income, either at localized level/ whole sector of production / wider geographical level (Anonymous, 2005). It may be caused by natural disasters like floods, drought, diseases and pests, economic factors and unforeseeable disruption of market access caused. Agriculture underpins the livelihoods of over 2.5 billion people worldwide (Anonymous, 2021). With agriculture sector's innate interactions with the environment. Disasters and crisis don't just have immediate, short-term effects, they diminish livelihoods and national development gains that took years to build (Anonymous, 2016). In coastal area, shift in the timing of rainfall season is due to crisis of climate change (Vinaykumar and Shvamurthy, 2015). Crisis and disasters disrupt livelihoods and add risk, damage and stress of crisis to farmers' livelihoods (Anonymous, 2018). India's geo-climatic conditions as well as its high degree of socio-economic vulnerability, makes it one of the most crisis prone country in the world (Anonymous, 2011).

Sugarcane is an important commercial crop cultivated in around seventy-nine countries. Today sugarcane cultivation and sugar industry stand as supporting pillars

of Indian agriculture economy. India holds second position in both area and production of sugarcane with an area of 5.06 lakh hectare and 341.20 million tonnes of production with the productivity of 70 to 75 tonnes/ ha, only after Brazil followed by China, Pakistan and Thailand. Among 20 sugarcane cultivating states, Karnataka stands third position in both area and production with 3.70 lakh ha under sugarcane and 299.02 lakh tonnes of production with productivity of 95 tonnes/ha, only after Uttar Pradesh and Maharashtra (Anonymous, 2020). Belagavi is the leading producer of sugarcane in Karnataka with an area of 1,20,762 hectares and 90.67 lakh tonnes of production with productivity of 75.08 tonnes/ha followed by Bagalkot (58,913 ha; 45.90 lakh tonnes; 78.08 tonnes/ha), Mandya (28,847 ha: 14.47 lakh tonnes 110.30 tonnes/ha) and Vijayapur (22,734 lakh ha; 14.47 lakh tonnes; 63.60 tonnes/ha). Lack of awareness of farmers about environment friendly practice like carbon sequestration was also indirectly contributing to crisis (Suresh and Shivamurthy, 2017).

When we compare the productivity of Karnataka, it is observed that there was a decline in the productivity of the state from 105-110 tonnes/ha (2006-07) to 90-95 tonnes/ha (2020). In recent years, country has witnessed the price crisis across sugarcane growing states of India. Along with price crisis, sugarcane farmers are facing various crisis like floods, droughts, hike in input cost, pest and disease outbreak, severe usage of chemical fertilizers & other inputs, prolonged irrigation led to the decrease in cane yield, problems in export policy which have affected the farming community mentally, financially, socially and their coping capacities. As a testimony to these farmers suicides were more in the sugarcane growing areas like Belagavi and Mandya (Anonymous, 2019). By definition, crisis is unforeseen and may exceed individual coping capacity and significant negative impact on economic viability and livelihood security of whole communities. The growing frequency and intensity of crisis are jeopardizing production system. Thus, in order to reduce the vulnerability and negative effects of crisis on sugarcane growers' lives, understanding and awareness about crisis and crisis management in general agriculture and specifically in sugarcane farming is of utmost importance. Awareness about crisis and crisis management helps in improving crisis preparedness, mitigation, response and recovery through formulation of location specific and suitable strategies (Anonymous, 2021).Integrating agriculture, livelihoods and environmental issues into crisis management efforts and risk reduction strategies is particularly important for poor farming communities, which are at greatest risk of natural crisis. Therefore, it is imperative to know the awareness level of sugarcane growers. Keeping all this in view, the present study was planned to assess the awareness of sugarcane growers about crisis and crisis management in agriculture and sugarcane farming.

Methodology

The study was carried out in two purposively selected districts of northern Karnataka region namely Belagavi and Bagalkot districts as these two districts are major sugarcane growing districts in Karnataka with contribution of 45.67 per cent to total Karnataka's sugarcane production and 48.56 per cent of Karnataka's total sugarcane area. Further, more yield gap of nearly 21 per cent in sugarcane production was observed in Belagavi and Bagalkot districts. Ex-post facto research design was used in the present study as crises like drought, flood, price, production, financial, pest and disease outbreak and livestock were already experienced by farmers *i.e.,* the event has already happened. Simple random sampling technique was used in the study. From each district, two blocks were selected based on maximum area under sugarcane and crisis prevalence. From each block two head reach (0-4 km), two mid reach (4-8 km) and two tail end (8-12 km) villages were selected based on their distance from river basin as followed by Somashekhar (2010). From each village ten sugarcane growing farmers were randomly selected thus constituting a total sample of 240. A set of statements reflecting crisis and crisis management in agriculture and sugarcane farming were identified and developed into a structured schedule through thorough review of the literatures available. The sugarcane growing farmers' responses to the crisis management statements in sugarcane cultivation were documented through

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personal interview method using the structured pre-tested interview schedule. The collected data were analyzed with descriptive statistics, percentage, frequency, mean and standard deviation.

Results and Discussion

Statement Wise Awareness of Head Reach, Mid Reach and Tail End Sugarcane Growers about Crisis and Crisis Management in Agriculture

Table 1 represents the statement wise awareness of head reach, mid reach and tail end sugarcane growers about crisis and crisis management in agriculture. The results of head reach sugarcane growers revealed that more than one-third of respondents expressed that crisis management means activities taken during crisis occurrence followed by 30.00 per cent of them opined that crisis management means prior planning along with activities taken during crisis occurrence and aftermath rehabilitation measures. The probable reason is that their exposure to crisis was comparatively more mainly to floods and further they believed that activities carried out during floods as the crisis management activity. Two-fifth of the respondents opined that crisis management is an activity of concern of government followed by less than one-fourth of them (23.75 %) expressed that it is a concern of community. The probable reason as expressed by respondents was that the effects of crisis cannot be overcome by individuals alone and it requires government's involvement to

Table 1

Statement wise awareness of crisis and crisis management in agriculture among head reach, mid reach and tail end sugarcane growers.

Statements	Head rich (n=80)		Mid rich (n=80)		Tail end (n=80)	
	F	%	F	%	F	%
Crisis management means						
Prior planning	12	15.00	08	10.00	15	18.75
Activities during crisis occurrence	27	33.75	21	26.25	12	15.00
Aftermath rehabilitation measures	17	21.25	35	43.75	27	33.75
All the above	24	30.00	16	20.00	26	32.50
Crisis management is an activity of concern to						
Individual	11	13.75	08	10.00	09	11.25
Community	19	23.75	14	17.50	21	26.25
Government	32	40.00	34	42.50	27	33.75
NGOs	06	07.50	06	07.50	07	08.75
All of them	12	15.00	18	22.50	16	20.00
Major source of information about crisis is						
Radio	0	0	0	0	00	00.00
Television	23	28.75	21	26.25	18	22.50
Newspapers	06	7.50	08	10.00	10	12.50
Government agencies	15	18.75	16	20.00	14	17.50
NGOs	08	10.00	05	06.25	08	10.00
Neighbours and friends	18	22.50	19	23.75	16	20.00
Others (Mobiles & social media)	10	12.50	11	13.75	14	17.50
Crisis management in agriculture according to your opinion is						
Contingency crop planning	13	16.25	22	27.50	12	15.00
Relief by government agencies	21	26.25	19	23.75	22	27.50
Insuring crops	16	20.00	04	05.00	21	26.25
Compensation for crop loss	09	11.25	15	18.75	12	15.00
All the above	21	26.25	20	25.00	13	16.25
Crisis management measures in livestock according to your opinion is,						
Shifting cattle to safe and food accessible places immediately	26	32.50	16	20.00	18	22.50
Keeping buffer stock of medicines & concentrated feeds	08	10.00	09	11.25	11	13.75
Storing adequate fodder	15	18.75	25	31.25	28	35.00
Insuring cattle	03	03.75	09	11.25	04	05.00
All the above	28	35.00	21	26.25	19	23.75
The role of government in crisis management in agriculture is						
Kept stock of all inputs for sowing post crisis	13	16.25	09	11.25	07	08.75
Prior planning of farming systems	21	26.25	18	22.50	11	11.25
Creating awareness & providing technical assistance	23	28.75	23	28.75	26	32.50
Providing timely relief measures	18	22.5	19	22.50	27	33.75
Training farmers about crisis management activities	05	6.25	11	13.75	09	11.25

recover quickly. More than one-fourth of the respondents (28.75 %) expressed that television (TV) was major sources of information about crisis followed by neighbours and friends (22.50 %). The probable reason is that respondents have habit of regularly watching TV to get information about crisis and the same is disseminated to other fellow farmers. Critical notice has showed that NGOs are the major sources than newspaper because very few / none of the farmers (in some villages) had access and subscribed to newspapers and NGOs are providing information about crisis management. With the penetration of smart phones in to rural areas, sugarcane growers have no idea about how to access the crisis related information as most of them are using them for entertainment purpose due to their poor awareness about the sources providing information. More than one-fourth of the respondents (26.25 %) equally opined that providing relief by government agencies and insuring crops, contingency crop planning, relief and compensation for crop losses are major measures to manage crisis effectively in agriculture followed by insuring crops (20.00 %). This might be due to the reason that farmers expect relief measures from government as they invested more in crop production which includes investments for critical inputs and expect government to carry out rehabilitation measures as well as contigency crop planning. Nearly one-third of the respondents (32.50 %) expressed that shifting cattle to safer and food accessible places, keeping buffer stocks of medicines & concentrated feed, storing adequate fodder and insuring cattle are major livestock management measures during crisis period followed by shifting cattle to safer and food accessible places (18.75 %) and storing adequate fodder (18.00 %). As per the discussion with farmers it was found that based on their previous experiences, they take precautions to protect livestock during crisis period.Further, significant percentage of respondents irrespective of head reach, mid reach and tail end are not aware about crisis management measures with respect to livestock enterprises. More than one-fourth of respondents expressed that creating awareness and providing technical assistance (28.75 %) followed by prior planning of farming systems (26.25 %) are the major roles of government to manage crisis effectively. The reasons quoted by farmers were that they will be deprived of government compensations because of poor awareness and lack of knowledge about taking situation specific measures immediately to save crop.

With respect to mid reach sugarcane growers from Table 1, it can be observed that more than two-fifth of respondents (43.75 %) opined that crisis management means taking aftermath rehabilitation measures followed by more than one-fourth of them (26.25 %) expressed that it is an activity taken during crisis occurrence. The probable reason is that the severity of crisis faced by them is relatively low and as a result, they believe that crisis management means aftermath rehabilitation measures. More than two-fifth of respondents (42.50 %) are aware about crisis management is a concern of government followed by all stakeholders like government, community, individual and NGOs (22.50 %). This might be due to reasons that government involvement in crisis management along with local communities enhances their coping capacity to crisis and take appropriate measures more effectively. More than one-fourth of the respondents (26.25 %) opined that television is the major source of crisis information followed by neighbours & friends (23.75 %). This is due to the fact that they watch the television regularly related to weather and rainfall updates along with entertainment and disseminate the same among peer farmers to take activities and also consult their neighbours and friends to get crisis information. More than one-fourth of respondents (27.50 %) were aware that contingency crop planning is the major agriculture crisis management measure followed by relief by government agencies (23.75 %). The reason is that the cropping intensity of these farmers was more compared to head reach farmers and they are conscious about the planning for crops based on prevailing situation. Less than one-third (31.25 %) of respondents opined that storing of adequate fodder is the livestock management measure during crisis followed by more than one-fourth of them (26.25 %) expressed that shifting cattle to safer and food accessible places, keeping buffer stocks of medicines & concentrated feed, storing adequate

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fodder and insuring cattle are livestock management measures during crisis period. This might be due to fact that they traditionally store dry fodder of maize and brought chaffed fodder from Yadavad factory to use during crisis. With respect to role of government in agriculture crisis management, more than one-fourth of respondents (28.75 %) opined that government should create awareness & provide technical help during crisis period followed by timely relief measures and prior planning of farming systems equally (22.50 %). This is due to their poor awareness and they were deprived of government facilities. With respect to mid reach farmers, awareness about meaning of crisis, major source of information and crisis management measures significant farmers are not aware about this. Hence efforts should be made by concerned organizations to create awareness among sugarcane growers. With respect to major source of information about crisis and its management, none of the respondents indicated radio as major source of information about crisis irrespective of head reach, mid reach and tail end sugarcane growers. The possible reason for non-use of radio could be the easy accessibility to the television, smart phones and web-based platforms penetration into the rural areas. Apart from this interesting thing is that majority of farmers opined that they don't know about the crop and livestock insurances. This was mainly due to the fact that the farmers are even not aware about the cattle insurance except very few and the people who know about the crop insurance are mainly due to their loans in the banks where farmers have been informed about that by bank officials.

With respect to tail end sugarcane growers, from Table 1, it is observed that more than one-third of respondents (33.75 %) opined that crisis management means aftermath rehabilitation and nearly one-third of them (32.50 %) expressed it as prior planning, activities during crisis occurrences & post crisis rehabilitation activities collectively. This might be due to their less exposure to crisis, good literacy and good extension contacts. In general, significant proportion of them do not possesses adequate knowledge about crisis and its management along with roles to be played by government agencies. More than one-third of respondents (33.75 %) expressed that crisis management is an activity of concern of government followed by community (26.25 %). This might be due to their poor exposure to natural crisis and if any damage occurs, the government came forward to help the farmers and some saints in the area inspired locals to provide basic facilities to the flood victims which initiated community action. Less than one-fourth of respondents (22.50 %) expressed that television was major source of crisis information followed by neighbours and friends (20.00 %) and local government agencies (17.50 %) & other sources like mobiles, social media (17.50 %). More than one-fourth of respondents (27.50 %) opined that providing relief by government agencies is a crisis management strategy in agriculture followed by insuring crops (26.25 %). This might be due to reason that the farmers believe strongly that whatever assistance provided was the governments' duty and further literate farmers contacted the extension personnel to grow alternate crops in case the earlier crop failed due to crisis. More than one-third (35.00 %) of respondents expressed that storing of adequate fodder was livestock crisis management measure followed by shifting cattle to safe and food accessible places, keeping stocks of medicines, storing adequate fodder and insuring cattle (23.75 %). This might be due to the reasons that most of the tail end farmers grow maize as livestock feed after turmeric harvest and they store it as dry fodder to use in crisis and rainy seasons. More than one-third of respondents (33.75 %) opined that government's role is to provide timely relief measures followed by creating awareness & providing technical help (32.50 %). This might be due to the fact that government relief amount was released lately to victims and few victims could not get government assistance due to their poor knowledge about submitting documents in time and use of crop survey app at appropriate time and difficulty of its operation.

Statement wise Awareness of Overall Sugarcane Growers about Crisis and Crisis Management in Agriculture

Fig. 1 indicates the statement wise awareness of overall sugarcane growers about crisis and crisis

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management in agriculture. Nearly one-third of respondents opined that crisis management means aftermath rehabilitation activities followed by more than one-fourth of them (27.50 %) expressed that crisis management includes prior planning, activities during crisis occurrences & post crisis rehabilitation activities. Nearly two-fifth of respondents (38.75 %) expressed that crisis management is the concern of government followed by community (22.50 %) and nearly one-fifth of them expressed as it is a concern of individual, community, NGOs and government (19.17%). More than one-fourth of respondents expressed television as major source of crisis information followed by neighbours and friends (22.08 %) and local government bodies (18.75 %). Interestingly nobody has identified radio as source of crisis information because almost no farmer has been using radio now days with the penetration of electronic gadgets like smart phones/ cell phones with vast options of entertainment along with memory cards. More than one-fourth of respondents (25.83 %) expressed that crisis management in agriculture is providing relief by government agencies followed by 22.50 per cent of them expressed it as insuring crops, contingency crop planning, relief and compensation to crop losses.

More than one-fourth of respondents were equally aware about storing adequate fodder and shifting cattle to safe and food accessible places, keeping stocks of medicines, storing adequate fodder & insuring cattle as major crisis management measures in livestock. With respect to role of government during agriculture crisis period, less than one-third of respondents (30.00 %) expressed that government should provide timely relief measures followed by creating awareness and providing technical help (26.67 %) and prior planning of farming systems (20.83 %). The overall sugarcane growers awareness about crisis and its management in agriculture are in congruence with the findings of Aravind (2011) and Meludu (2011).

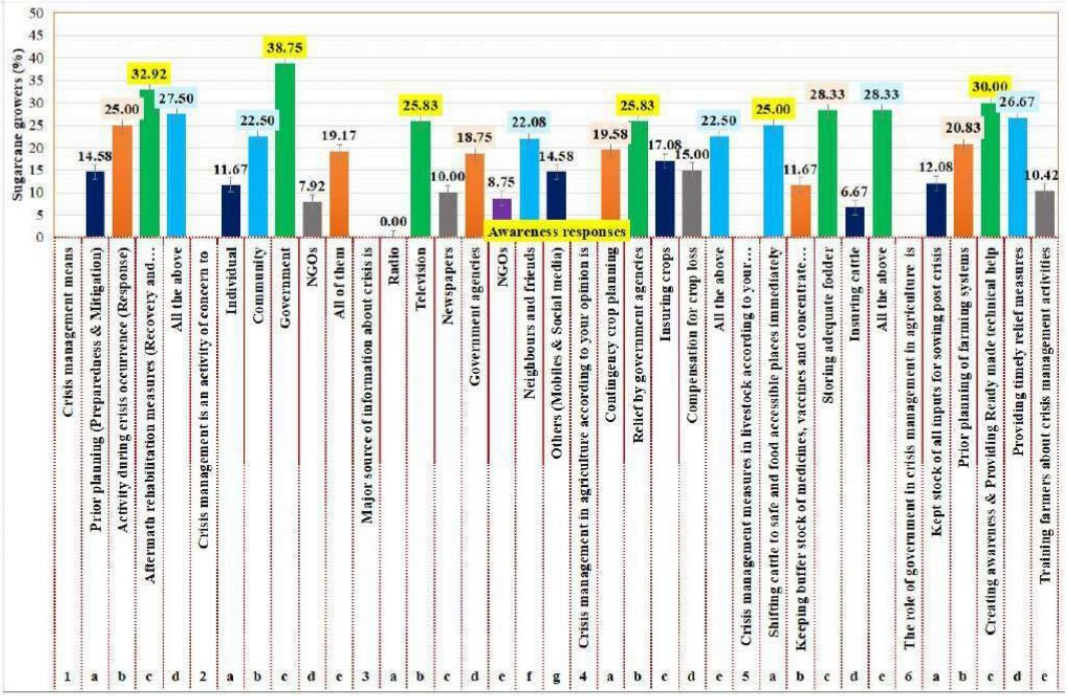

Fig. 1: Graphical representation of distribution of sugarcane growers based on their awareness about crisis and crisis management in agriculture (n=240)

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Statement wise Awareness of Head Reach, Mid Reach and Tail end Sugarcane Growers about Crisis and Crisis Management in Sugarcane

Table 2 represents the statement wise awareness of head reach, mid reach and tail end sugarcane growers about crisis and its management in sugarcane farming. With respect to head reach sugarcane growers, more than half of the head reach sugarcane growers expressed that flood is the major type of crisis faced in sugarcane farming followed by price crisis (28.75 %). This is mainly because of the reasons that sugarcane growers are the frequent victims of floods and sugarcane arrears in the area. Two-fifth of respondents opined that delayed in payment is the major reason for price crisis in sugarcane farming followed by one-fifth of them expressed that they are not getting fixed prices for sugarcane. This was due to the fact that farmers were not receiving their payments for years from factories which in turn made the farmers to be in debt at bank as well as money lenders to carry out their farm activities. More than one-third of respondents (36.25 %) expressed that planned planting to reach advanced growth stage before flood occurrence is the major flood management strategy in sugarcane farming followed by draining out water from field to avoid crop loss (22.50 %). Based on their previous experiences about floods and droughts most of the farmers prefer to plant in October/November so that by monsoon season crop will be six to eight months old which can tolerate water stagnation as well as drought condition. With respect to reasons for lower productivity of sugarcane crop nearly one-third of growers (32.50 %) opined that acute shortage of water at critical stages is the main reason followed by imbalanced use of fertilizers (21.25 %) and improper selection of inter crops (16.25 %). This was mainly because of reason that drying up off rivers during summer as river was their major sources of irrigation. If they get good monsoons also it has led to floods and in-turn it reduced the yield. In order to balance yield, farmers are using more than recommended fertilizers. With respect to role of government in sugarcane crisis period, less than half of respondents (45.00 %) expressed that government should fix uniform prices for sugarcane like minimum support price instead of

TABLE 2
Distribution of respondents based on their awareness about crisis and crisis management in sugarcane

Statements	Head rich (n=80)		Mid rich (n=80)		Tail end (n=80)	
	F	%	F	%	F	%
Major type of crisis in sugarcane faced by you is						
Price crisis	23	28.75	33	41.25	31	38.75
Drought	06	7.50	09	11.25	19	23.75
Floods	43	53.75	31	38.75	22	27.50
Pest and disease outbreak	03	3.75	04	5.00	08	10.00
Others (Salinity, wetlands formation)	05	6.25	03	3.75	00	0.00
Price crisis in sugarcane is due to						
Over production	09	11.25	13	16.25	10	12.50
Delay in payments	32	40.00	21	26.25	29	36.25
No fixed prices	16	20.00	04	05.00	17	21.25
Fluctuations in weighing at factory	11	13.75	19	23.75	13	16.25
All the above	12	15.00	23	28.75	11	13.75
Flood management in sugarcane is mainly concerned with						
Conserving the soil from erosion	09	11.25	11	13.75	21	26.25
Drain out water from field to avoid crop loss	18	22.50	15	18.75	27	33.75
Slashed the crop to allow ratooning if damage was severe	11	13.75	05	6.25	3	3.75
Taking actions based on severity of floods	13	16.25	23	28.75	17	21.25
Planned planting to reach advanced growth stage before flood occurrence	29	36.25	26	32.5	12	15.00
Lower productivity of sugarcane is caused by						
Acute shortage of water	26	32.50	23	28.75	17	21.25
Frequent &faulty irrigation scheduling	12	15.00	10	12.50	08	10.00
Imbalanced application of fertilizers	17	21.25	21	26.25	27	33.75
Improper selection of inter-crops	13	16.25	16	20.00	15	18.75
All the above	12	15.00	10	12.50	13	16.25
The role of government in crisis management in sugarcane is to						
Take strict actions against factory for delayed payments	27	33.75	36	45.00	33	41.25
Fixing uniform prices for sugarcane like MSP instead of FRP	36	45.00	26	32.50	22	27.50
Framing of proper policies for sugarcane (Export, import etc)	13	16.25	16	20.00	21	26.25
All the above	04	05.00	02	2.50	04	5.00

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fair and remunerative prices followed by taking strict actions against factory for delayed payments (33.75 %).

With respect to mid reach sugarcane growers, from Table 2 it is observed that more than two-fifth of respondents (41.25 %) expressed that price crisis is the major crisis faced by tail end sugarcane growers followed by floods (38.75 %) and drought (11.25 %). Most of these farmers dependent mainly on factories and they were also exposed to floods. With respect to price crisis in sugarcane farming, more than one-fourth of mid reach farmers (28.75 %) opined that over production, delayed payments, no fixed prices & weighing fluctuations were major reasons for price crisis in sugarcane farming followed by delay in payments (26.25 %). Nearly one third of respondents (32.50 %) expressed that planned planting to reach advanced growth stage before flood occurrence was the major flood management strategy in sugarcane farming followed by taking actions based on severity of floods (28.75 %). This might be due to their previous experiences of gambling with monsoons farmers prefer to take actions based on severity otherwise it will be burden for farmers. More than one-fourth of respondents expressed that acute shortage of water during critical stages (28.75 %) and imbalanced use of fertilizers (26.25 %) are the major causes for lower productivity in sugarcane farming. With respect to role of government during sugarcane crisis period, less than half of respondents (45.00 %) expressed that government should take strict actions against factory for delayed payments followed by fixing uniform prices for sugarcane (32.50 %) to manage sugarcane crisis effectively. This might be due to the burden they faced because of delayed payments and farmers observed price fluctuations in factories where farmers get better prices in cooperative factories compared to private factories of same taluk.

With respect to tail end sugarcane growers, from Table 2 it is observed that less than two-fifth of respondents (38.75 %) expressed that price crisis is the major crisis faced in sugarcane farming followed by floods and drought equally with 23.75 per cent. Because of their high dependency on sugarcane and political attachment to leaders made them to send their cane to private factories owned by politicians. As a result they are not getting good prices for their produce. More than one-third of respondents (36.25 %) expressed that delay in payments is the major reason for price crisis in sugarcane farming followed by 21.25 per cent of them opined that they are not getting fixed prices for sugarcane. More than one-third of respondents (33.75 %) expressed that draining out flooded water from field was the major flood management measure in sugarcane farming followed by conserving soil from erosion (26.25 %). This might be due to their experience in farming and least exposure to severe floods. Based on their experience due to heavy rains / overflow of stream into field, the water accumulated was drained out to avoid crop damage. With respect to lower productivity of sugarcane, more than one-third of growers (33.75 %) expressed that imbalanced use of fertilizers is the reason for lower sugarcane productivity followed by acute shortage of water during critical growth stages (21.25 %). The main reason is that most of the farmers extensively use fertilizers to get higher yield as they were cultivating more than three crops at a time believing that it requires more inputs. Further, they also use micro irrigation especially drip which reduced their water shortage in tail end areas. With respect to governments role during crisis period, more than two-fifth of tail end sugarcane growers (41.25 %) were opined that government should take strict actions against factory for delayed payments followed by fixing uniform prices for sugarcane (27.50 %) and should frame proper policies for sugarcane (26.25 %) production.

Statement Wise Awareness of Overall Sugarcane Growers about Crisis and Crisis Management in Sugarcane

Fig. 2 indicates the distribution of overall sugarcane growers based on their awareness about crisis and crisis management in sugarcane. It is observed that two-fifth of respondents (40.00 %) expressed that flood was major crisis faced in sugarcane farming followed by price crisis (36.25 %). With respect to price crisis in sugarcane, more than one-third of the

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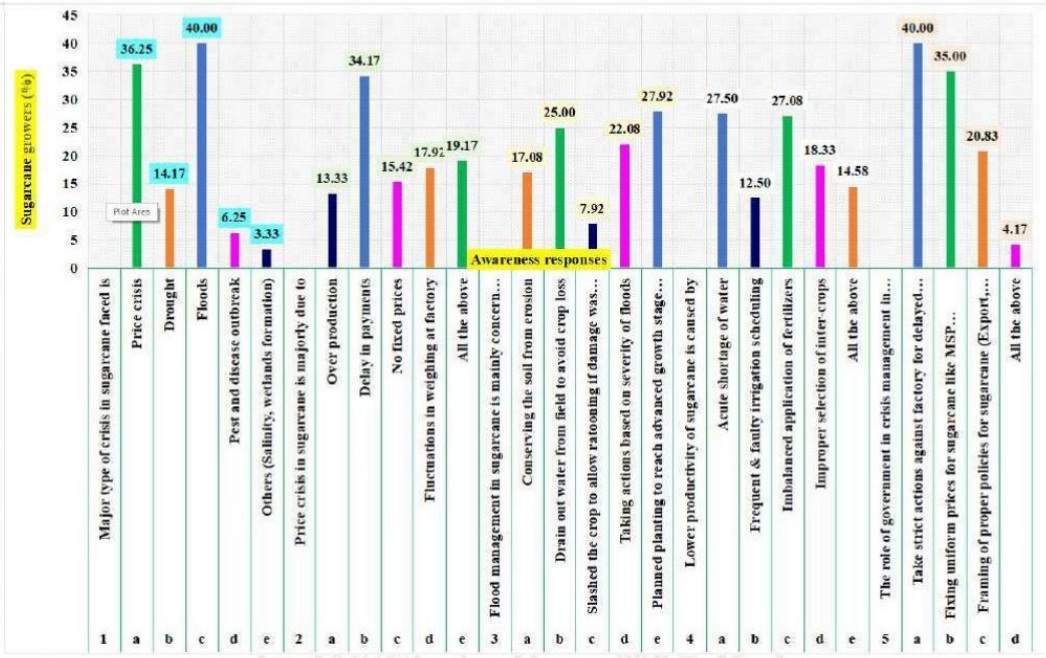

Fig. 2: Graphical representation of respondents based on their awareness about crisis and crisis management in sugarcane (n=240)

respondents (34.17 %) expressed that price crisis in sugarcane is due to delay in payments followed by over production, no fixed prices and fluctuations in weighing at factories (19.17%). More than one-fourth of sugarcane growers opined that flood management in sugarcane farming involves planned planting to reach advanced growth stage before flood occurrence (27.92 %) followed by drain out flooded water from field (25.00 %). With respect to lower productivity, more than one-fourth of the respondents expressed that acute shortage of water (27.50 %) and imbalanced use of fertilizers (27.08 %) were the major causes for lower productivity in sugarcane farming followed by improper selection of inter crops (18.33 %). With respect to role of government in sugarcane crisis management, two-fifth of the respondents expressed that government should take strict actions against factory for delayed payments and more than two-third of them expressed to fix uniform prices for sugarcane like minimum support price instead of fair and remunerative prices (35.00 %).

Overall Awareness of Sugarcane Growers about Crisis and Crisis Management

Table 3 represents the overall awareness of sugarcane growers about the crisis and its management in sugarcane farming. With respect to head reach sugarcane growers less than half of the respondents (47.50 %) belongs to average awareness category followed by poor (30.00 %) and better (22.50 %) awareness categories. Similarly, among mid reach sugarcane growers it was noticed that less than two-fifth of respondents (38.75 %) belongs to average awareness category followed by poor and better awareness categories with 33.75 per cent and 27.50 per cent, respectively. Among tail end sugarcane growers, 36.25 per cent of sugarcane growers belongs to the good awareness category followed by poor and better awareness category with 33.75 per cent and 30.00 per cent respectively. More tail end sugarcane growers belong to the better awareness category compared to head reach sugarcane growers because

TABLE 3

Overall awareness of sugarcane growers about crisis and crisis management

Statements	Head rich (n=80)		Mid rich (n=80)		Tail end (n=80)		Overall (n=240)	
	F	%	F	%	F	%	F	%
Poor (<13.92)	24	30.00	22	27.50	27	33.75	73	30.42
Average (13.92 to 18.50)	38	47.50	31	38.75	29	36.25	98	40.83
Better (>18.50)	18	22.50	27	33.75	24	30.00	69	28.75

Mean = 16.20833 SD : 4.5845

of the fact that tail end sugarcane growers possessed the good contacts with extension professionals and there was surety of getting returns if taken crisis management activities properly. Head reach farmers were mostly affected by the floods which cannot be prevented which in turn reduced their information seeking about the crisis management leading to poor awareness. In total, significant percentage of sugarcane growers belongs to the average awareness category with 40.83 per cent followed by poor and better awareness category with 30.42 per cent and 28.75 per cent respectively. The results are in congruence with the findings of Aravind (2011).

From the results it can be interpreted that most of the sugarcane growers belongs to average to better awareness category (69.58 %) and more than one fourth of them had poor awareness about crisis management which was mainly due to the fact that farmers what they know and take the crisis management actions based on their exposure, severity and frequency of crisis in their condition. Crisis cannot be controlled / prevented but it can be managed effectively if sugarcane growers aware about the crisis and its management. Hence, there is a need for improving the awareness level of sugarcane growers about crisis management by adopting suitable extension strategies during crisis period. It is imperative to devise suitable extension interventions like awareness campaigns, training to enhance coping capacities of sugarcane growers, planning farming systems, demonstrations, simulation exercises, etc., for updating their knowledge and create awareness about crisis management activities to facilitate better and holistic management of crisis to reduce its impact and faster recovery from its losses, rather than taking measures after crisis occurrence.

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