KNOWLEDGE AND ADOPTION OF DROUGHT MITIGATING TECHNOLOGIES FOLLOWED BY FARMERS OF GADAG DISTRICT

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By

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CERTIFICATE

This is to certify that the thesis entitled "KNOWLEDGE AND ADOPTION OF DROUGHT MITIGATING TECHNOLOGIES FOLLOWED BY FARMERS OF GADAG DISTRICT" submitted by Miss VIJAYLAXMI B. SOMANATTI for the degree of MASTER OF SCIENCE (AGRICULTURE) in AGRICULTURAL EXTENSION EDUCATION to the University of Agricultural Sciences, Dharwad is a record of research work carried out by her during the period of her study in this university, under my guidance and supervision, and the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar titles.

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1. INTRODUCTION

Drought is a climatic anomaly, characterized by deficient supply of moisture resulting either from sub-normal rainfall, erratic rainfall distribution, higher water need or a combination of all the three factors. Among all the natural hazards, drought ranks first in terms of the number of people directly affected. Drought is a creeping phenomenon, difficult to understand and define due to differences in hydro meteorological variables and socio-economic factors along with the stochastic nature of water demand in various regions of the world.

The usual impact of agricultural drought is in terms of loss of crops, malnutrition of human beings and livestock, land degradation, spread of diseases and migration of people. Droughts result in crop losses of different magnitude, depending on their geographic incidence, intensity and duration. The droughts not only adversely affect the food security at the farm level but also the national economy and overall food security as well.

Holistic development of the rain-fed areas is one of the prime concerns of the Government of India. About 60 per cent of total arable land (142 million ha) in the country is rain-fed, characterized by low productivity, low income, low employment with high incidence of poverty and a bulk of fragile and marginal land. These areas witness acute moisture stress during critical stages of crop production, which makes agriculture production vulnerable to pre and post production risks. Management of natural resources on large scale produce multiple benefits in terms of increasing food production, improving livelihoods, protecting environment, addressing gender and equity issues along with biodiversity concerns (Rockstorm *et al*. 2007). It is also recommended as the best option to upgrade rain-fed agriculture to meet the growing food demand globally.

Drought mitigation is one of the most trusted and eco-friendly approaches to manage rainwater and other natural resources, which has paid rich dividends in the rain-fed areas and is capable of addressing many natural, social and environmental intricacies. The goal of drought mitigation and preparedness is to reduce drought vulnerability and foster drought-resilient societies. “Drought Mitigation” can be defined as ‘Actions that may be taken before or at the beginning of drought to

reduce the impact of drought'. The basic objective of drought mitigation is to minimize possible adverse outcomes within the constraints of the costs involved. The effective management of drought is therefore a matter of concern not only to those countries subject to significant climate uncertainty, but to the international community as a whole. Effective drought mitigation and preparedness planning are based on established policies and institutional capacity.

Drought impacts and losses can be substantially reduced if authorities, individuals and communities are well-prepared, ready to act, and equipped with the knowledge and capacities for effective drought management. It should be recognized that mitigation and preparedness have a greater impact on reducing the scale and effects of drought disasters than ad-hoc emergency. So the development of appropriate policies and strengthening of institutional mechanisms for drought preparedness and mitigation need to be accompanied by concrete programmes to promote sustainable livelihoods, as well as build safety net to protect lives and livelihoods in the event of major drought episodes.

The incidence and impact of droughts in the country's food and agriculture sector is increasing. But, comprehensive long-term action plans to prepare for and mitigate droughts are lacking. Even when there is advance warning of droughts, most small farmers especially those in arid and semi-arid regions do not know what to do or do not have the resources to undertake mitigating measures or suffer owing to ineffective measures undertaken.

Farmers, businessman, corporate and governments have been reluctant to invest in rain fed drought-prone areas. Considering the increase in frequency of droughts in different parts of the country, what is urgently needed is a shift in public policy from drought management to drought preparedness and drought mitigation measures.

INDIAN SCENARIO

Drought and famines have occurred in India for centuries and have even been mentioned in folklore. No precise data of these events are available, however. Since the establishment of the India Meteorological Department in 1875 and systematic data generation, it has been possible to demarcate areas affected by droughts in each year. About two thirds of the geographic area of India receives low rainfall (less than 1000 mm), which is also characterized by uneven and erratic distributions. Out of net sown area of 140 million hectares about 68% is reported to be vulnerable to drought conditions and about 50% of such vulnerable area is classified as sever, where frequency of drought is almost regular.

The major drought years in India were 1877, 1899, 1918, 1972, 1987 and 2002. The drought-prone areas of the country are confined to peninsular and western India (Maharashtra, Karnataka and Andhra Pradesh) –primarily arid, semi-arid and sub-humid regions.

Recently in the year 2013-14, India experienced a normal south west monsoon rainfall (June-September) but taking country as a whole, it received 936.7 mm of rainfall against normal rainfall of 886.9 mm. Out of 622 districts for which rainfall data were available, 264 districts (42%) received normal rainfall, 156 districts (25%) received deficient rainfall and 18 districts (3%) received scanty rainfall (Department of Agriculture and Cooperation, MoA. GoI, 2014.)

SCENARIO OF DROUGHT IN KARNATAKA

Karnataka stands on second place after Rajasthan; in terms of total geographical area prone to drought. Nearly 90 % of the population in this semi-arid region is dependent on agriculture for their livelihood and 18 out of 30 districts experience drought in the state.

In 2002, Karnataka experienced a severe drought for three consecutive years (2001-02, 2002-03 and 2003-04) and 159 taluks/blocks were listed as drought affected. During these periods, the state received 23 per cent less rainfall. The agricultural production declined to 6.4 m tones against the target of 10.4 m tones and the availability of crop residues for livestock was substantially low. During 2013-14, Government of Karnataka declared drought in 22 districts on 16.11.2013 and hailstorm occurred in 14 districts of the state which lead to the substantial yield loss.

The State government declared 64 taluks of 22 districts as drought affected, excluding the irrigated command areas. According to a press release from the government, this decision has been taken after taking into consideration two indicators - rainfall deficiency and moisture adequacy index during 2013-14.

The number of taluks hit by drought in different districts are as follows: Bangalore Urban-3 taluks, Ramanagaram-1, Kolar-6, Chikballapur-1, Tumkur-5, Chitradurga-5, Davangere-1, Chamarajanagar-1, Mysore-4, Mandya-4, Bellary-6, Koppal-1, Gulbarga-2, Yadgir-1, Belgaum-9, Bagalkot-4, Bijapur-1, Gadag-2, Haveri-1, Dharwad-1, Hassan-2 and Uttara Kannada-1.

Measures, like MGNREGA works under employment schemes to landless labourers, supply of drinking water, fodder, livestock protection were taken up by the government as a relief measures (Department of Agriculture and Cooperation, MoA. GoI, 2014).

As far as the productivity of land is concerned, there is a lot of scope for increasing the production and profit through adoption of the improved drought mitigation technologies in drought prone areas. Therefore, a study of this nature was very much required to understand and obtain suitable feedback which will be useful to dry land farmers, extension workers, scientists, administrators and planners. Hence, the study was conducted with the following objectives -

1. To assess knowledge and adoption of recommended drought mitigating technologies
2. To document the indigenous technical know-hows (ITKs) of drought mitigation
3. To enlist the community approaches of drought mitigation
4. To elicit reasons for non-adoption of recommended drought mitigating technologies

SCOPE OF THE STUDY

The present study explores the status of knowledge and adoption of drought mitigating technologies by the farmers. The study also throws light on the ITKs followed by farmers over a period of time. Documentation of ITKs helps the research organizations to rationalize the greater application of ITKs. The aspects in the study will be of immense help in providing feedback to extension machineries for reorientation of existing delivery system and technology development which are feasible to the farming community. The study also helps to take appropriate measures to overcome practical difficulties in drought mitigation.

LIMITATIONS OF THE STUDY

Though, all the possible efforts were made to make the study objective and precise, certain limitations did remain in the present study, being part of the master's degree programme. The normal limitation of time, funds and other facilities are commonly faced by student researcher. These limitations led to the purposive selection of only one district as the locale of the study. Generalisations made based on the finding of the study may not be directly applicable to the other areas.

2. REVIEW OF LITERATURE

A brief review of previous researches relating to the various dimensions of the present study has been made and presented in this chapter. The review is presented below under various subsections in accordance with the objectives set for the study.

2.1 Socio-economic characteristics of the farmers

2.2 Knowledge of farmers about drought mitigation technologies

2.3 Adoption of drought mitigation technologies

2.4 ITKs for drought mitigation

2.5 Community level drought mitigation practices in study area

2.6 Reasons for non adoption of drought mitigation practices.

2.1 Socio-economic characteristics of the farmers

2.1.1 Age

Nithyashree and Angadi (2001) in a study on knowledge and adoption of IPM practices among cotton growers in Raichur district revealed that fifty per cent of the respondents belonged to middle age group followed by young age group (33%) and old age group (17%).

Sunil Kumar (2004) from his study on knowledge and adoption of production and post-harvest technology in tomato crops of Belgaum district of Karnataka state indicated that majority of the tomato growers (53.30%) belonged to middle aged group.

Chandracharan (2005) while studying profile of sujala watershed project beneficiary farmers in Dharwad district revealed that 46.00 per cent of the respondents were middle aged, 24.67 per cent were young and 29.33 per cent were old.

Nirban (2006) conducted a study on indigenous technology about rice cultivation and bovine health management practices in Konkan region of Maharashtra and reported that, majority of the respondents belonged middle aged group.

Nagadev and Venkataramaiah (2007) while studying the characteristics of integrated pest management (IPM) of trained dry paddy farmers in Maharashtra state reported that majority (66.00%) of respondents were middle aged, followed by old (19.33%) and young (14.67%), respectively.

Suresh Kumar (2009) in his study on technological gap in adoption of the improved cultivation practices by soybean growers reported that 62.00 per cent of respondents were found to be in middle age category, 30.00 per cent belonged to young age category and 8.00 per cent belonged to old age category.

Kikon (2010) in a study on adoption gap in groundnut production in northern transition zone of Karnataka reported that majority (83.33%) of the demonstrator farmers were middle aged, Whereas 10.00 and 6.67 per cent of them belonged to old age and young age, respectively.

Jamadar (2012) conducted study on farmers awareness of climate change and their adaptations indicated that 49.33 per cent of the respondents belonged to middle age, whereas 34.67 and 16.00 per cent belonged to old age and young age, respectively.

Sabi (2012) in a study on knowledge and technological gap in wheat production revealed that 58.33 per cent of the respondents belonged to middle age, followed by 22.51 per cent and 19.16 per cent belonged to old age category and young age category, respectively.

Santhosh (2013) in a study on perception of national horticulture mission and its impact on crop diversification among the beneficiaries in Dharwad district reported that majority of farmers belong to middle age group (54.16%) followed by old and young age.

Sowjanya (2014) in a study on management efficiency of dairy farm women revealed that majority of the respondents (65.00%) were middle aged, followed by young (18.33%) and old aged (16.64%), respectively.

It could be apprehended from the above studies that majority of the respondents belonged to middle age group.

2.1.2 Education

Nithyashree and Angadi (2001) revealed that 28.00 per cent of the respondents were illiterates followed by 30.00 per cent of the respondents had received high school education. While, 30.00 per cent had primary to middle school education and only 12.00 per cent had college education.

Sunil Kumar (2004) reported that 14.16 per cent were illiterate, 15.75 per cent of the respondents had received education up to middle age school whereas, 22.50 per cent of them received education up to high school while, 10.80 and 10.00 per cent of the respondents received education up to PUC and graduation level respectively.

Chandracharan (2005) noticed that 28.00 per cent of the respondents were educated upto high school, 27.00 per cent upto middle school, 14.67 per cent upto primary school, 11.33 per cent could read and write, 8.00 per cent had college education and degree.

Nirban (2006) indicated that majority of the farmers (66.20%) were educated upto or below middle school. Whereas, 21.13 per cent of the respondents were illiterate, followed by primary (40.85%), middle school (23.35%) and only (2.82% and 8.45%) of the respondents had studied high school and pre-university level education.

Swami (2006) in a study on technological gap and constraints of bidi tobacco cultivation in Belgaum district reported that 55.33 per cent of the respondents were having secondary school education, 26.00 per cent were having primary school education followed by 8.00 per cent having college education, whereas the percentage of illiterate farmers observed was only 10.67 per cent.

Chandrashekhar (2007) from a analysis of onion production and marketing behavior of the farmers in Gadag district of Karnataka revealed that, 43.33 per cent of the respondents had high school level of education, followed by 26.67 per cent upto middle, 13.33 per cent upto primary, 7.50 per cent illiterate, 1.67 per cent of the respondents can read and write category and 0.83 per cent fall in post graduate category.

Madhu (2010) conducted a study on technological gap in turmeric production practices in Belgaum district reported that, 38.60 per cent were illiterates, 28.60 per cent of respondents had primary education followed by 10.70 per cent having middle school education.

Kikon (2010) reported that more than half the number of the demonstrator farmers (56.67%) studied up to high school level which was just 10.00 per cent in case of fellow farmers. While 16.66 per cent of demonstrator farmers were graduates, none of the fellow farmers was graduate.

Gamannavar (2011) in a study on impact of sujala watershed development programme in Dharwad revealed that, higher proportion of beneficiary farmers were educated upto pre-university level (31.67%). Whereas, only 20.00 per cent of farmers were educated upto middle school and primary school level. One-tenth of the beneficiary farmers were illiterate. On the other hand, very less per cent of beneficiary farmers were found with graduation and above level of education (4.17%).

Jamadar (2012) showed that 41.33 per cent of the farmers were illiterates, while 17.33 per cent and 16 per cent farmers studied up to primary school and high school, respectively. About 12.66 per cent of the respondents were graduates and 6.00 and 4.66 per cent farmers studied up to middle school and high school, respectively.

Sabi (2012) revealed that 28.33 per cent of the respondents had high school education while, 13.33 per cent were illiterate. The other respondents were educated upto middle school (21.66%), PUC (17.52%), primary school (14.16%) and graduate level (05.00%), respectively.

Huded (2013) in his study on perceived attributes of IPM technologies as perceived by Bt cotton growers revealed that 26.67 per cent of the farmers studied upto high school while 24.00 per cent of the farmers studied upto middle school and 18.00 per cent were illiterates.

From the above studies it was noticed that majority of the respondents studied upto high school level.

2.1.3. Land holding:

Nithyashree and Angadi (2001) revealed that 36.00 per cent were marginal farmers and 15.00 per cent were big farmers.

Nagaraja *et al.* (2004) focused a study on Impact of drought on agriculture in Koppal and Raichur districts of Karnataka noticed that around 70.00 per cent of the farmers of drought affected regions of Karnataka are characterized by very small size of land holdings.

Chandracharan (2005) found that majority (30.00%) of the respondents belonged to medium land holding category.

Patil (2005) in a study on knowledge, extent of participation and benefits derived by participant farmers of the watershed development programme in Raichur district of Karnataka found that comparatively more number of farmers (64.00%) belonged to semi medium land holding category, followed by 22.00 per cent in medium category.

Sidram (2008) conducted a study on analysis of organic farming practices in pigeon pea in Gulbarga district of Karnataka state and observed that big land holders category occupied the highest percentage (60.83%), while 23.33 and 15.83 per cent of the respondents were in medium and small land holders categories.

Naik (2009) in his study on knowledge and adoption of *Bacillus thuringiensis* (Bt) cotton practices followed by farmers in Haveri district revealed that that big land holders formed nearly half (48.00%) of the respondents, while 28.67 per cent of them were in medium category, followed by 16.00and 7.33 per cent in small and medium land holding categories, respectively.

Suresh Kumar (2009) found that majority of the farmers (45.33%) belonged to medium land holding category, 22.67 per cent of them belonged to semi-medium land holding category, whereas 16.67 per cent of them were small farmers, 10.66 per cent were marginal farmers and 4.67 per cent belonged to big landholding capacity.

Gamannavar (2011) showed that high per cent of beneficiary farmers were found in medium land holding category (30.80%) followed by marginal land holding category (25.00%). Less than 20.00 per cent of farmers were found in semi-medium (19.20%) and small land holding category (14.20%).

Jamadar (2012) inferred that thirty six per cent of the respondents belonged to medium land holding category, followed by Big (24%) and semi medium farmers (18.66 %).Whereas 16.66 and 4.66 per cent of the farmers belonged to small and marginal farmers, respectively.

Sabi (2012) revealed that revealed that, 35.83 per cent of farmers belonged medium land holding category while 23.33 per cent of them belonged to small land holding category.

Huded (2013) revealed that 56.67 per cent of farmers belong to semi-medium land holding category followed by medium farmers (29.33%), small farmers (11.33%) and marginal farmers (2.00%).

It can be observed from the above studies that majority of the respondents belonged to medium and semi-medium land holding categories.

2.1.4. Farming Experience

Nayak (2007) in a study on management practices of pineapple growers in Karnataka reported that, the majority (70.00%) of the respondents belonged to medium farming experience.

Sidram (2008) reported that nearly one third farmers (30.83%) had high experience in farming whereas majority (69.17%) had low experience.

Suresh Kumar (2009) revealed that majority (58.67%) of the respondents had medium farming experience (10 to 20 years), while (30.66%) of the respondents had high farming experience (more than 20 years) and 10.66 per cent of respondents had low farming experience.

Kikon (2010) reported that majority (48.33%) of the fellow farmers had medium experience in groundnut cultivation, 26.67 per cent and 25.00 per cent had low and medium experience in groundnut cultivation.

Madhu (2010) observed that majority of respondents (39.30%) had medium level of experience followed by 34.28 and 26.42 per cent of high and low level of experience, respectively.

Jamadar (2012) showed that nearly 38 per cent of the respondents had low farming experience whereas 35.33 per cent of the respondents had high farming experience followed by 26.66 per cent of the respondents had medium farming experience in agriculture.

Sabi (2012) revealed that more than half number (53.33%) of the respondents had medium farming experience, while 41.67 per cent of the respondents had high farming experience and 5.00 per cent of respondents had low farming experience.

Maraddi *et al.* (2014) in a study on extent of adoption of improved technologies by groundnut farmers and constraints analysis revealed that half of the respondents (49.17%) possessed low experience followed by medium experience (31.67%) and high experience (19.17%) category.

Pawar (2014) in a study on technological gap in pepper cultivation in Uttara Kannada district noticed that 37.78 per cent of the respondents had medium farming experience while 32.22 per cent of the respondents had high farming experience followed by low farming experience (30.00%).

It can be inferred from the above studies that majority of the respondents belonged to medium farming experience category.

2.1.5. Livestock possession:

Chandracharan (2005) revealed that majority (88.00%) of the respondents possessed bullocks, followed by cows (54.00%), buffaloes (48.00%), poultry birds (23.33%) and sheeps/goats (12%).

Khin Mar Oo (2005) found that 7.50 per cent of dairy women possessed one cross bred cow, followed by 2 crossbred cows (4.16 %) and 3 and above cross bred cows (0.83 %), whereas 1 local cow (19.16%) and 2 and above (9.16 %). While up to 1 buffaloes (32.50 %), 2 buffaloes (34.16%) and 3 and above (5.83 %), respectively.

Patil (2005) reported that majority of the respondents (86.00%) possessed cows, followed by buffaloes (80.66%), bullocks 74.66%), sheeps/goats (26.66%) and only 3.33 per cent of them had poultry birds.

Gamannavar (2011) found that high majority of the beneficiary farmers possessed buffaloes (95.83%) followed by cows (79.17%). Whereas, the percentage of beneficiaries possessing bullocks, sheeps and goats was 56.67 and 40.83 per cent, respectively.

Sowjanya (2014) revealed that majority of dairy farm women (24.16%) possessed up to 3 local cows, whereas 11.66 per cent of dairy farm women possessed 4 to 6 local cows and only 2.50 percent of dairy farm women possessed above 7 local cows.

2.1.6. Farm implements possession

Chandracharan (2005) reported that 96.67 per cent of the respondents were having a seed drill followed by 68.00 per cent having wooden plough, 27.33 per cent having sprayer or duster and 36.00 per cent were possessed iron plough. Only 5.53 per cent of the respondents were in possession of tractor.

Patil (2005) revealed that almost all of farmers (92.00%) possessed wooden plough, followed by iron plough (74.66%), seedrill (70.66%), seed cum fertilizer drill (46.66%), sprayed /duster (48.00%) and tractors (12.66%), respectively.

Swami (2006) revealed that 96.67 per cent of the respondents possessed seed drill followed by 68.00 per cent possessed wooden plough, 27.33 per cent possessed sprayer or duster and 36.00 per cent were possessed iron plough. Only 5.53 per cent of the respondents possessed tractor.

Gamannavar (2011) observed that majority of the beneficiary farmers possessed wooden plough (74.17%) followed by seed drill (72.50%) and television (62.50%). Whereas, less per cent of beneficiaries possessed tractor (21.67%) and gobar gas plant (11.67%), respectively.

Sowmya (2014) in study on analysis of change in cropping system in northern transitional zone of Dharwad district revealed that majority of the farmers possessed seed drill (87.77%), wooden plough (85.55%), cultivators (75.00%), hoes (70.00%), harrow (65.00%) and iron plough (60.00%).

2.1.7. Extension contact

Sunil Kumar (2004) revealed that 40.83 per cent of the respondents belonged to medium extension contact category followed by 30.00 and 29.16 per cent belonging to high and low categories of extension contact, respectively.

Chandracharan (2005) found that 30.64 per cent of the farmers regularly contacted AAs, while 38.66 and 30.67 per cent of the farmers occasionally and never contacted AAs, respectively.

Swami (2006) revealed that 30.67 per cent of respondents contacted Agricultural Assistants regularly while Assistant Agricultural Officer (50.00%) and Private Company Staff (40.67%) were occasionally contacted by the farmers.

Chetan (2011) conducted a study on knowledge and adoption of cardamom cultivation practices by the farmers of Chikmagalur district reported that as high as 48.66 per cent of the cardamom growers had medium level of extension contact, followed by 22.66 and 18.66 per cent of respondents had low and high level of extension contact respectively.

Jamadar (2012) showed that 71.33 per cent of the farmers had medium level extension contact followed by low (14.16%) and high (14.00%) contact with extension agency.

Maraddi *et al.* (2014) revealed that around 32 per cent of the respondents were found to contact AAO whenever problem arises followed by once in a year (20.00%) and once in a month (9.17%).

Sowmya (2014) revealed that nearly half (45.56%) of the respondents had medium level of extension contact followed by high (29.44%) and low (25.00%) level of contact extension agency.

It can be observed from the above studies that majority of the respondents belonged to medium level of extension contact.

2.1.8. Cropping system

Satish (2010) in his study on farmers' perceptions, preferences and utilization of sri and traditional paddy straw for livestock more than half (56.66%) of the respondents grew paddy alone in kharif. Paddy, ragi and maize were grown in this season by 11.66 per cent of the respondents. Almost same per cent (10.00%) of them mentioned that they grew paddy and maize; 5 per cent grew paddy and ragi in kharif. In Rabi season paddy alone was taken up by 59.66 per cent respondents. Paddy and sunflower were grown by 17.5 per cent respondents.

Gamannavar (2011) revealed that more than half number of the beneficiaries followed maize-chickpea as a major cropping pattern (56.67%), followed by paddy-pulses (53.30%) and cotton-chilli-onion (51.67%). Whereas, more than thirty per cent of beneficiaries followed soybean-*rabi* sorghum (32.50%) as a cropping pattern.

Sabi (2012) indicated that the crops grown by farmers on kharif season in the order of priority were; maize (88.33%), cotton (85.00%), groundnut (76.67%), green gram (64.16%), onion (42.50%), chilli (30.00%) and sunflower (26.67%).

Sowmya (2014) revealed that in rabi season large majority of the respondents cultivated rabi sorghum (98.88%), bengalgram (95.55%) and wheat (85.55%), whereas only 27.77 per cent of the respondents cultivated safflower.

2.1.9. Risk orientation

Nithyashree and Angadi (2001) revealed that majority (71.00%) of the respondents had high risk bearing ability.

Shashidhara (2004) in his study on influencing factors and constraints in drip irrigation by horticulture farmers of Bijapur district revealed that majority of farmers (70.83%) had medium risk bearing ability while 15.00 per cent of respondents had low level of risk orientation.

Chandracharan (2005) revealed that considerable per cent of the respondents (58.00%) belonged to medium risk orientation category, followed by high (24.00%) and low (18.00%) risk orientation categories, respectively.

Patil (2005) reported that 56.00 per cent belonged to medium risk orientation category, followed by high 28 per cent and low 19.33 per cent risk orientation categories respectively.

Sidram (2008) noticed that majority of the respondents (46.67%) belonged to low level of risk orientation, while 29.17 and 24.17 per cent of respondents belonged to medium and high risk orientation category, respectively.

Suresh Kumar (2009) witnessed that majority (58.67%) of respondents belonged to medium level of risk orientation category, followed by high (20.00%) and low (21.33%) level of risk orientation.

Jamadar (2012) indicated that in their behaviour of taking risk 46.00 per cent of the respondents had high level of risk taking ability followed by low (37.33%) and medium (16.66%) level of risk orientation.

Maraddi *et al.* (2014) in a study on extent of adoption of improved technologies by groundnut farmers and constraints analysis revealed that low level of risk orientation was noticed in (45.00%), While medium risk orientation was 35.00 per cent followed by high risk orientation (20.00%) category.

From the above literature, it can be observed that majority of the respondents belonged to medium level of risk orientation.

2.1.10. Scientific Orientation:

Nithyashree and Angadi (2001) revealed that majority of the respondents had obtained high scientific orientation score with 30 per cent of the respondents coming in the score group 7-8 and 40 per cent of the respondents coming in the score group 9-10 while only 13 per cent of the respondents had low scientific orientation.

Karamtol (2006) in his study on impact of trainings conducted on vermicompost by krishi vigyan Kendra, Bijapur revealed that nearly an equal per cent (43.33%) of the trained and untrained respondents were found in medium scientific orientation category. While, 35.00 per cent of trained and 28.33 per cent of untrained respondents belonged to high scientific orientation category. Whereas 21.67 per cent and 28.33 per cent of the trained and untrained respondents were found in low scientific orientation.

Raghavendra (2010) an impact study on farmer's knowledge and adoption level of sunflower frontline demonstrations in Bijapur district of Karnataka revealed that majority (40.00%) of participant farmers belongs to medium scientific orientation category, while 31.67 and 28.33 per cent respondents belonged to low and high scientific orientation category, respectively. But 58.33, 35.00 and 6.67 per cent of non-participant farmers belongs to low, medium and high scientific orientation category, respectively.

Jamadar (2012) indicated that forty four per cent of the respondents had medium scientific orientation, whereas, 35.33 per cent and 20.66 per cent of them had low and high scientific orientation, respectively.

Maraddi *et al.* (2014) revealed that nearly half number of the respondents possessed lower level of scientific orientation (50.83%) followed by medium (36.67%) and high (12.50%) scientific orientation category.

It can be observed from the above studies that majority of the respondents belonged to medium level of scientific orientation.

2.1.11. Mass Media Participation

Nithyashree and Angadi (2001) revealed that 40 per cent of the respondents had low mass media participation while 32 per cent of the respondents had medium mass media participation score and 24 per cent of the respondents had high mass media participation score.

Shasidhara (2003) reported that 41.11 per cent of the respondents belonged to medium level of mass media participation, followed by low (35.56%) and high level (23.33%) mass media participation.

Sunil Kumar (2004) reported that 59.17 per cent of respondents were occasionally listening agricultural programmes in radio, Whereas, 30.00 per cent of them viewed agricultural programmes in television occasionally. While, 70.83 and 85.00 per cent of the respondents never read the newspapers and farm magazines respectively.

Patil (2005) revealed that radio sets were possessed by 80.00 per cent of the farmers. Of which 90.00 and 22.00 per cent of them listened to general and agricultural programmes regularly. Further, 28.00 and 16.00 per cent of the farmers occasionally listened the general and agricultural programmes. On the other hand 54.00 and 50.00 per cent of the farmers never listened to these programmes.

Karamtol (2006) revealed that 36.66 per cent of the trained respondents belonged to high mass media participation category. While, an equal per cent (31.66%) of farmers belonged to high and low mass media participation categories. Whereas, 38.33, 33.33 and 28.33 per cent of untrained respondents

were found to be in high, low and medium massmedia participation category respectively.

Sowmya (2014) revealed that more than half (56.11%) of the respondents belonged to medium mass media utilization category followed by high (23.89%) and low (20.00%) mass media utilization categories.

It can be observed from the above studies that majority of the respondents belonged to medium level of mass media utilization.

2.1.12. Intensity of drought:

Rathore (2004) in a study on state level analysis of drought policies and impacts in Rajasthan revealed that the chance of occurrence of a meteorological drought in the state was 47.00 per cent and the number of severe and very severe drought years was larger in the Western and Southern districts of Rajasthan.

Devappa *et al.* (2009) in a study on meteorological drought events revealed that during the period (1961 to 2008) of analysis most part of the district experienced severe drought conditions. The occurrence of drought in the district was quite high ranging from 50 to 65 per cent. Most of the taluks were affected by drought about more than 50per cent during the period considered for analysis.

Gore *et al.* (2010) concluded that in most parts of India, probabilities of moderate drought were in the range 11 to 20 per cent. Major parts of India show probabilities of severe drought in the range 1 to 5 per cent. In some West Central, Central Northeast and Northeast region of India, no severe drought was experienced.

Anonymous (2011) identified about 120 million ha of the country's area, covering 185 districts in 13 states as drought-prone. Based on the historical records, about 130 droughts/famines have been reported in one or other part of the country between 1991 and 2009. During the 20th century alone, droughts of varied intensities occurred during 28 years in India.

Puspendra and Ajay (2013) in their study on assessment of meteorological drought in Satna district of Madhya Pradesh revealed that Number of drought years which received above the normal average rainfall were 49.18 per cent. Number of years of different intensities of drought are 42.62 per cent. Within 10 years 3 to 4 years face good rain (no drought) and 4 to 5 years are faces normal / near normal rain (Mild drought) and 1 to 2 year face Severe to extreme drought.

Puspendra and Ajay (2014) in a study on assessment of environmental stress as meteorological drought due to rainfall variability revealed that maximum years have no drought (49%) to mild drought condition (21%). Moderate drought was less and found once in 14 years, severe drought was more and found once in 2 years which was a normal natural cycle.

It can be concluded from the above reviews that India experienced varied intensity of drought.

2.2 Knowledge of farmers about drought mitigation technologies

Kumar and Singh (1995) in a study on fertilizer use in dryland noticed that majority (70.45%) farmers had poor knowledge about fertilizer use.

Prasad and Mahipal (1995) found that majority of participants (68.24%) were found in the medium level of knowledge gain in the alternate land use systems. Whereas, the minimum knowledge gain (64.29%) was in case of crop planning and cropping system under rainfed conditions.

Prasad (1995) in a study on adoption of dry land agricultural technologies by farmers revealed that 46.33 per cent of the respondents possessed medium level of knowledge while 27.00 and 26.67 per cent of respondents had low and high levels of knowledge about dry land agricultural technologies, respectively.

Desai *et al.* (2000) conducted a study on adoption of recommended technology for rainfed cotton NHH-44 concluded that the overall knowledge level about recommended rainfed cotton production technology of NHH- 44 was observed to be medium in case of 67.00 per cent of cotton growers, while 33.00 per cent of them had high level of knowledge.

Govindagowda *et al.* (2000) conducted a study on knowledge of farmers on dryland farming practices in groundnut cultivation found that majority (72.00%) of the groundnut farmers belonged to medium knowledge level about dryland farming practices.

Sriram and Palaniswami (2000) in a study on extent of awareness about eco-friendly agricultural practices in cotton observed that 59.16 per cent of cotton growers had medium level of awareness followed by high (25.84%) and low level (15.00%). Eco-friendly agricultural production practices like summer ploughing was known to cent per cent of farmers followed by variety selection, season in cotton cultivation.

Bheemappa (2001) found that majority (38.00%) of migrant farmers had knowledge about choosing right varieties, spacing, use of recommended dose of fertilizers and plant protection chemicals whereas 62.00 per cent of non-migrant farmers had knowledge about the choosing right varieties, use of herbicides, recommended dose of fertilizers with respect to cotton crops.

Kadam *et al.* (2001) reported that majority of the beneficiaries had knowledge about the practices namely dividing the fields with small bunds (82.00%) and small earthen bunds (76.66%). More than two-fifth of the beneficiaries had knowledge about the practices namely stubble and agro waste plucking (46.00%), drains per trenches (43.33%) and intercropping (42.00%).

Nagabhushanam and Nanjaiyan (2001) conducted a study in Karnataka state on knowledge of eco-friendly practices among watershed farmers indicated that majority of the respondents (71.11%) possessed the medium level of knowledge on eco-friendly practices followed by 16.11 per cent of respondents in low level of knowledge. The percentage of respondents having high level of knowledge was found to be still less i.e., 12.78 per cent.

Nithyashree and Angadi (2001) revealed that 58.00 per cent of the respondents had low knowledge level while 34.00 per cent of the respondents had medium knowledge about the IPM practices.

Sridhara (2002) in his evaluative study of watershed programme in Pavagada taluk of Tumkur district in Karnataka reveal that knowledge about soil and water conservation practices more than 50.00 per cent changes was observed in case of contour bunds (53.94%), ploughing across the slope (58.00%), strengthening of existing bunds (56.66%) and water ways (57.33%).

Chandracharan (2005) reported that majority (45.34%) of the respondents belonged to medium level of knowledge about watershed practices. Whereas, 31.33 and 23.33 per cent of respondents belonged to high and low knowledge levels, respectively.

Raghavendra (2005) conducted a study on knowledge and adoption of recommended cultivation practices of Cauliflower growers in Belgaum district of Karnataka and found that 61.66 per cent of the respondents possessed medium level of knowledge followed by 22.50 per cent and 15.84 per cent fell under low and high categories, respectively.

Patil (2005) revealed that majority (72.67%) of the respondents belonged to medium knowledge level category while 14.00 per cent of the respondents belonged to high knowledge level category.

Kharamtol (2006) found that majority of trained farmers (70.00%) and only 16.67 per cent of untrained farmers perceived correctly that use of vermicompost loosen the soil there by increase availability of water to the crop and easy movement of air in the soil. While, 65.00 per cent and 13.33 per cent of trained and untrained farmers respectively had correct knowledge that use of vermicompost improves availability of micro and major nutrients to the crop.

Sidram (2008) reported that 63.33 per cent of the respondents had medium knowledge on organic farming practices of pigeonpea. While, 23.33 and 13.33 per cent of them had high and low knowledge level, respectively.

Naik (2009) revealed that 53.33 per cent of the respondents had medium level of knowledge, whereas 24.67 and 22.00 per cent of respondents had high and low knowledge, respectively.

Modi (2010) in his study on knowledge and adoption of post-harvest management practices among the mango growers observed that medium level of knowledge was noticed with 45.00 per cent of respondents, while 33.33 per cent had low knowledge level. However, high level of knowledge was noticed with 21.67 per cent of respondents.

Naik *et al.* (2010) studied knowledge and adoption level of integrated crop management practices by the participants of farmers field school on maize in Bellary district of Karnataka state reported that majority of the respondents(94.00%) had correct knowledge of methods of irrigation(alternate furrow irrigation) followed by advantage of land leveling(84.00%).

Sabi (2012) revealed that majority of the respondents (49.17%) had medium level of knowledge about recommended cultivation practices of wheat followed by high (28.33%) and low (22.50%) knowledge level categories, respectively.

Kulashreshta *et al.* (2014) conducted a study on technological knowledge level about watershed practices revealed that regard to soil conservation practices, a huge majority 73.00 per cent of the respondents had low knowledge followed by 17.00 per cent and 10.00 per cent respondents had medium and high level of knowledge respectively.

The above reviews reveal that majority of the respondents had medium knowledge about drought mitigation practices.

2.3 Adoption of drought mitigation technologies

Khatik (1993) in a study on adoption of soil and water conservation technologies reported that majority (90.00%) of the farmers adopted contour farming followed by 88 per cent of the farmers adopted intercropping and 16 per cent of the farmers adopted green leaf manuring.

Naik and Jayaramaiah (1997) conducted a study on adoption of watershed management practices and productivity levels attained by farmers in mittemari watershed reported that except big farmers none of the marginal and small farmers adopted non-arable land development and alternate land use system.

Prasad *et al.* (2000) conducted study on adoption pattern of dry land agricultural technologies by farmers of Andhra pradesh revealed that there was increased rate of adoption in case of contour cultivation over period of time, while it was declining lately in case of off season tillage and soil bunding.

Vekaria *et al.* (2000) in a study on knowledge and adoption behavior of rainfed groundnut growers in Saurashtra region of Gujarat revealed that majority (69.05%) of the groundnut growers were medium adopters followed by low adopters (15.71%) and high adopters (15.24%).

Shinde *et al.* (2000) revealed that cent per cent of the respondents adopted crop rotation, seed treatment (90%) with cow urine and dung slurry, East-West sowing in kharif and north-south in rabi season, intercropping (56.67%) under rainfed conditions.

Bagadi *et al.* (2001) in their study noticed that majority of the respondents (80%) adopted intercropping practices and 64 per cent of them practiced summer ploughing. Gully ploughing, mulching and leveling their field were the other soil and water conservation practices being adopted by the farmers.

Waghmore and Ingle (2001) revealed that selection as per fertility of land was adopted by 75.67 per cent followed by boundary bunds (44.59%) and brush wood dams (43.59%). Cent per cent of the respondents adopted the practices like harrowing for leveling and intercropping.

Manjunatha *et al.* (2002) conducted a study on adoption pattern of sustainable water management practices by sugarcane farmers observed that majority (75.50%) of the sugarcane farmers had irrigated the crop grown in red soils once in 5-8 days as recommended, while 18 per cent and 6.5 per cent of them had not adopted.

Bhagwat and Gohad (2003) carried out a study on adoption of dry land cotton cultivation technology by the farmers in Amaravati district of Maharashtra state and reported that 53.33 per cent of the respondents were medium adopters of dry land cotton cultivation technology, whereas 26.00 and 20.66 per cent respondents were found in low and high adopter categories, respectively.

Karamtol (2006) revealed that 45.00 per cent of belonged to high adoption level category while 40.00 per cent belonged to medium adoption level whereas 15.00 per cent of the had low adoption level, respectively.

Sidram (2008) found that 69.17 per cent of respondents belonged to medium adoption category. While, 20.00 and 10.83 per cent of respondents belonged to high and low adoption categories, respectively.

Benal *et al.* (2010) conducted study on adoption of dryland technologies noticed that majority of the respondents adopted practices like use of chemical fertilizers (90%), summer ploughing (87.50%) and use of nitrogen in soyabean+ maize intercrop (85%).

Gamannavar (2011) revealed that large majority of beneficiary farmers adopted the practices like ploughing across the slope (77.50%), field bund (72.50%) and intercropping (70.83%). The practices like strengthening of existing bunds, intercultivation were practiced by 60.00 and 47.50 per cent of beneficiaries, respectively. Whereas, very less per cent of beneficiaries (14.17%, 10.00%, 10.00% and 6.67%) adopted rubble filled check, farm pond, check dam and waste weir, respectively.

Shashidhara (2012) in a study on adoption of eco-friendly technologies by cotton growers revealed that more than two third (68.75%) of the respondents belonged to medium adoption category. Whereas, 16.88 and 14.37 per cent were in high and low adoption category of ecofriendly technologies, respectively.

Jagadale *et al.* (2013) in a study on knowledge and adoption of dryland technology for rabi jowar reported that large proportion of respondents belonged medium adoption index that is 48.21 per cent, respectively.

Maraddi *et al.* (2014) revealed that more than half number of the respondents are noticed in partial to full adoption categories in simple and low cost technologies, Where as lower adoption was observed in IDM and IPM technologies in addition to seed treatment with bio-agents, organic manure and fertilizer management.

From the above reviews it can be concluded that majority of the respondents belonged to medium adoption category.

2.4 ITKs practiced by the farmers

Ranganath (2002) in a study on identification of indigenous farm practices followed by Soliga tribals reported that great majority (80-90%) of the tribals expressed the errection of small section bunds and digging against slope was relatively advantageous and compatibile while 25 per cent of them had expressed that it was complex process.

Jirli and Kumari (2005) in a study on documentation and validation of convectional seed storage methods noticed that majority (93%) of the respondents practiced mixing pulse with oil before storage followed by storing of seeds in wheat straw (92%), using container coated with paste of neem leaf (85%) and plastering the floor and room in which the seeds are stored with cow dung (60%).

Lal and Verma (2006) conducted a study on indigenous technological knowledge on soil and water management reported that villagers often harvest rain water by by small water storage ponds, spring water is broadcasted for weed control. Soil crust breaking and making soil more porous by conserving the rainwater.

Kalaskar *et al.* (2007) in a study on knowledge and adoption of indigenous technologies about agriculture and allied fields by tribal farmers noticed that majority (78.12%) of the respondents had followed practices like application of khanduchakka bark paste to cure animal fractures, storage of pulses by mixing with ash (75.00%), ploughing and sowing across the slope (74.38%), respectively.

Mohapatra *et al.* (2007) in a study on storage of cowpea and hill arhar through indigenous technical knowledge reported that a minimum spoilage occurred for storage of hill arhar (10%) with an application of wood ash and salt (10:1) and cowpea dal (18.5%) with an application of mahua oil (3%) in earthen pots suitable plastering with mud after harvesting and proper sun drying.

Moulasab (2007) in a study on established ITKs practices for weather forecast and seed germination reported that most common indigenous methods of predicting rainfall used by the Karnataka tribal are, if the rain bird lays at the ground level, then there will less rain, however if the eggs are laid at the higher elevations, it's the indication of more rain and cucurbits seeds are kept embedded in fresh cowdung ball ,which are then buried dep in soil for better germination.

Patil *et al.* (2007) in a study on documentation of ITKs and their use pattern in plantation crops in Davanagere District reported that ITKs most popularly used were incorporation of neem, arka, pongamia, glyrcidia leaves in soils before planting, beejamrutha for seed treatment, jeevamrutha for disease resistance.

Patil and Mahadik (2007) studied established indigenous knowledge in forestry crops noticed that more than eighty per cent respondents followed application of black oil, cow dung and coalter to their wooden material, for pest control respondents were found using leaves of Neem and Ailanthus.

Chhetry and Belbahri (2009) in a study on indigenous pest and disease management practices in traditional farming systems in north east India noticed that indigenous people have rich store house of traditional beliefs which may sound as agricultural practices. These beliefs include that seeds collected and thrashed on new moon day (Amawasia) for sowing in the next season are usually not infested by pest and pathogens, plant diseases are caused by halo around the sun, sowing seeds should be sprinkle first with gold water etc.

Muthuraman and Meera (2011) conducted a study on indigenous technical knowledge in rice cultivation revealed that *Vasambu* (*Acotus calamus*) powder and cow urine are mixed in the water that has been boiled and cooled over night and the seeds are soaked in the solution. The floating seeds are removed. The remaining seeds are used for sowing. This serves the dual purpose of seed selection and treatment of seed borne disease.

2.5 Community level drought mitigation practices

Sumitra (1991) reported that the better intensification and implementation of agro forestry required the formation and promotion of farmer's organizations, the provision of fertilizers, pesticides and seed of improved varieties of food crops, the improvement in credit facilities and the promotion of soil and water conservation measures.

Ito Kasumi *et al.* (2001) in a study on NGO involvement in bilateral aid projects for community forestry revealed that, grass root activities to support community forestry extension are implemented by NGO's and they are becoming a fundamental organization for CF. Additional influence and impact of NGO's involvement to develop efficient methods of such involvement in community forestry aid projects is essential.

Satyanarayana (2002) in his study on evaluation of watershed programme in Tumkur district reported that, majority of the beneficiaries received higher income and all of them were employed after the development programme.

Sharma (2003) in his study on rethinking watershed development in india: strategy for the twenty-first century revealed that many watershed projects have basic design flaws and implementation problems. Better-performing projects have been based on promoting communities' traditional water harvesting and conservation practices. These have good community participation and low implementation costs. They have benefited a larger number of people and are usually based on promoting equity and ecological principles.

Rao *et al.* (2004) in his study on a comparative analysis of performance of watershed development programme observed that, the watershed structures were more likely to be maintained when more ground water recharge was created and in watersheds implemented by NGOs.

Lakshminarayan *et al.* (2005) in a study on people's participation in the conservation and development of forests noticed that more than one lakh man days were generated by the FDA for providing employment to local people in aforestation and plantation areas are being protected with social fencing by the beneficiaries.

Hulagur (2006) in his study on watershed development –NABARD initiatives revealed that IGWDP made efforts to create basic potential like conservation of soil fertility, recharge of ground water, increase in fodder availability etc. through effective soil and moisture – conservation measures. There was remarkable improvement in groundwater table and vegetative

treatments and also proved that comprehensive watershed development with people's participation is a feasible proposition .

Ghosh *et al.* (2007) in a study on institutional arrangements and linkage mechanism for water management in Orissa's agriculture reported that vertical linkages are more prominent as compared to horizontal linkage at present institutional arrangements, pani panchayat since mid nineties has diverted larger flow of information towards it and organizational change has been showing a favorable effect on policy dimensions such as water pricing and cost recovery.

Prabhakar and Shaw (2007) studied climate change adaptation implications for drought risk mitigation and reported that most notable climate change implications for the drought vulnerable India are the enhanced preparedness with due emphasis to the community based preparedness planning, reviewing the existing monsoon and drought prediction methodologies and establishing drought monitoring and early warning systems in association with a matching preparedness at the input level.

Aher and Pawar (2013) in their study on socio-economic and environmental impact of participatory watershed management programme reported that the project resulted in increase in livestock population, per capita income, agricultural productivity, and drinking and irrigation water availability. Besides these impacts reduction in debt, workload of women, migration, and runoff also observed. The project influenced the cropping intensity, crop diversification, land use pattern etc. in favor of environmental improvement and ensured further sustainable development in the area.

Dolli *et al.* (2013) in a study on community ownership building through participation and contribution in natural resource management noticed that the immediate benefits observed were improved ground water table (80.00%), reduction in soil erosion (72.65%), water conservation (57.50%), increase in yield(36%) and good crop stand during dry spell (5%) due to moisture retention.

Eshwarappa and Doddamani (2013) in a study on impact of irrigation tanks rehabilitation on livelihood of farmers reported that majority (82.55%) of the farmers expressed tank silt applied had doubled the crop yield, de-siltation had impact on escalating storage capacity (75%) and after de-siltation of tanks and spreading the silt on the field has enhanced the profit in the crops (54.72%).

Tripathi and Sharada (2014) conducted study on mitigation of impact of climate change through watershed management revealed that watershed management practices, though very effective mitigation options under adverse climatic conditions are likely to be more expensive. To overcome the increasing cost of soil and water conservation measures, appropriate cost effective bio-engineering measures need to be evolved.

It can be concluded from the above reviews that need was felt to develop and promote community based drought mitigation practices region wise.

2.6 Reasons for adoption /non adoption of drought mitigation practices.

Datta and Dayal (2000) studied the farm level constraints facing farmers in their effort to manage water and soil quality problems reported that inadequate and untimely availability of good quality water was the main constraint followed by non-availability of salt tolerant high yielding varieties of crops, non-availability of organic manures and non-availability of soil amendments like gypsum.

Prasad *et al.* (2000) revealed that technologies related to silvi-pastoral and agroforestry systems were not at all adopted. Reasons attributed were non-awareness and non-applicability of the technologies.

Kadam *et al.* (2001) through their study reported that lack of information/guidance was reported by almost all the non-adopters in respect of each practice as reason for non adoption. The second important reason for non-adoption of the recommended soil and water conservation practices was non-availability of inputs, material/labor etc. In case of many of the practices, difficulty in crop cultivation, difficulty in maintenance and lack of skill were the important reasons for non-adoption.

Nithyashree and Angadi (2001) indicated major constraint of IPM practice was lack of proper knowledge (75%) followed by lack of proper guidance (70%), non- availability of the required material (62%), lack of training (60%) and requires lot of skill (40%).

Sridhara (2002) in an evaluative study of watershed programme reported that the major constraints in soil and water conservation practices faced by farmers were loss of cultivable area, water stagnation near bunded area and time consuming operations. In case of crop production practices the constraints faced by farmers were non availability of labour, lack of finance, heavy risk due to failure of monsoon and costly chemicals.

Nirmala (2003) in her study on impact of watershed development programme on socio-economic dimensions of beneficiaries revealed that, the productivity obtained under watershed area was found higher as compared to those in non-watershed area in all the crops both in *kharif* and *rabi* seasons.

Chandracharan (2005) revealed that majority of the farmers expressed time consuming operation (74.67%), fragmentation of land into unconvenient shape (70.67%). Whereas, 49.33 per cent of respondents expressed that there is water stagnation near bunded area and obstruction for cultural operations (39.33%).

Kulshrestha *et al.* (2010) in his study on impact of kheri nala watershed in Madhya Pradesh revealed that lack of capital (65.00%), completion of land procedures (62.50%), high cost of fertilizer and seed (61.25%), lack of training (57.50%), lack of transport facilities (46.25%) and lack of irrigation facilities were perceived as major constraints in adoption of watershed technologies.

Shashidhara (2012) in a study on adoption of eco-friendly technologies by cotton growers revealed that technologies involving low/no cost were adopted by majority of the respondents. Whereas, the technology involving complex knowledge, skill, high cost and inadequate availability of input were found to be adopted by relatively lesser proportion of the respondents.

Gamannavar and Halakatti (2013) in a study on benefits and constraints of sujala watershed development programme revealed that more than 30 per cent of the beneficiaries expressed that soil and water conservation practices helped them to increase groundwater recharge (36.67%) and reduction in soil and water erosion (35.00%).

Maraddi *et al.* (2014) revealed that full adoption of technologies might be due to the fact that they are simple and involve very low cost practices followed by no adoption was due to lack of timely advisory services about pest and diseases particularly integrated pest management and integrated disease management in collaboration with low cost technologies in addition to various bio-rational solution.

3. METHODOLOGY

The study was conducted during the year 2014-15 in Gadag district of Karnataka state. In this chapter, the general typology and description of the research methods and procedures followed in the present investigation are presented under the following sub-headings.

3.1 Research design

3.2 Locale of the study

3.3 Description of the study area

3.4 Selection of taluks and villages

3.5 Selection of respondents

3.6 Variables for the study

3.7 Operationalization and measurement of variables

3.8 Procedure for data collection

3.9 Statistical tools employed

3.1 Research Design

The research design adopted for this study was ex-post-facto technique, since the phenomenon has already occurred and the design was considered appropriate. Ex-post-facto research is the most systematic empirical enquiry in which the researcher does not have control over independent variables as their manifestation has already occurred.

3.2 Locale of the Study

The study was conducted in Gadag district of Karnataka during the year 2014-15 (Fig. 1). Gadag district was purposively selected for the study, as it was “drought prone district” and also covered under watershed activities by Department of watershed. It covers five taluks *viz.,* Gadag, Ron, Shirahatti,

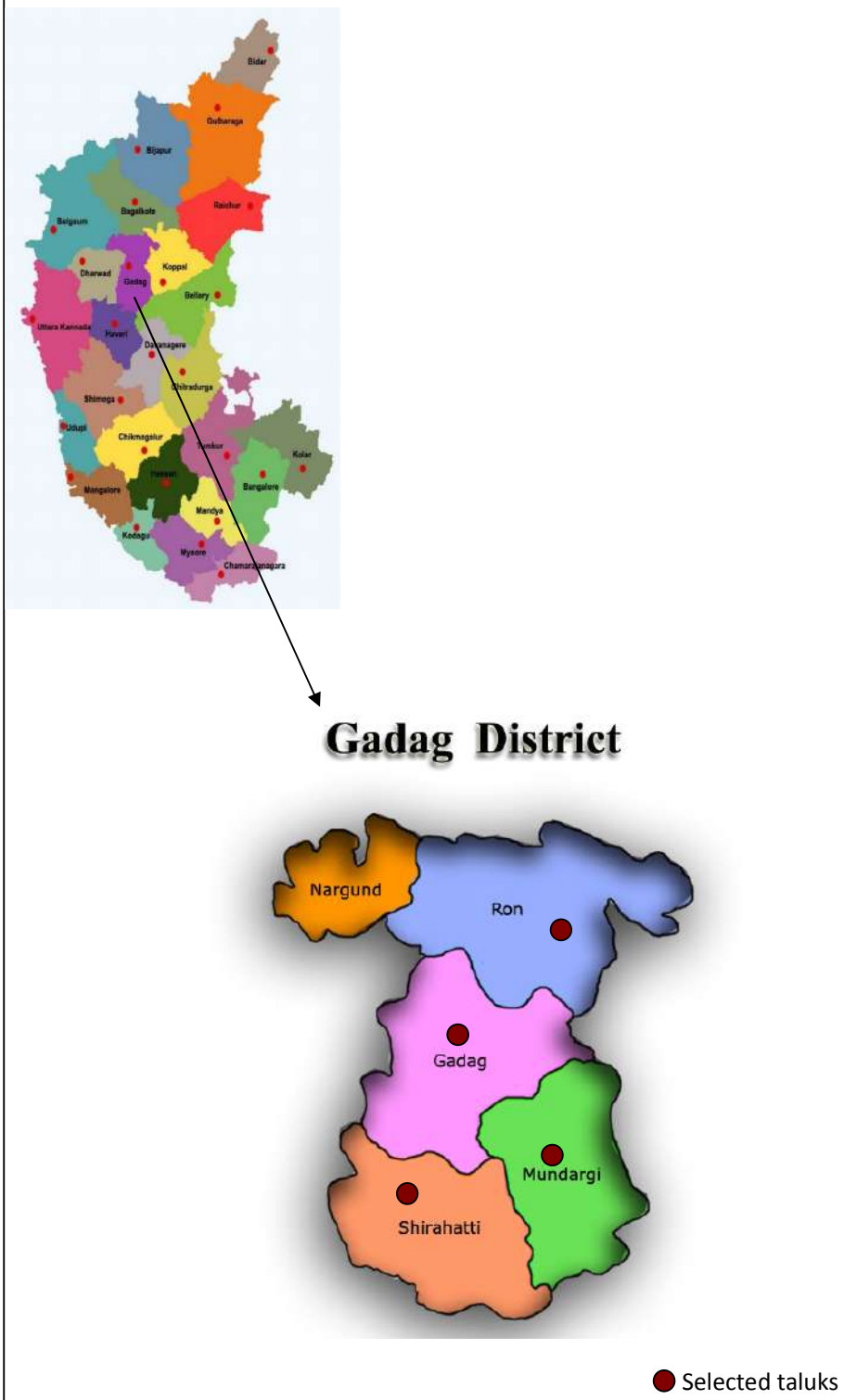

Fig. 1. Map showing study area

Mundaragi and Naragund. The study area covers four taluks namely Gadag, Ron, Shirahatti and Mundaragi based on the watershed area covered.

3.3 Description of the Study Area

Location:

Gadag district was created on 1-11-1997, bifurcating Gadag, Mundargi, Nargund, Ron, Shirhatti taluks from the old Dharwad district. Gadag district is located in northern part of Karnataka and situated between north latitudes of 15° 15’ and 15°45’ and east longitudes of 75°20’ and 75°47’. Gadag district is bounded by Koppal district on east, Bagalkote district on north, Haveri district on south and Dharwad district on west.

The district falls in the semi arid tracts of Karnataka. It lies to the east of the Western Ghats in the rain – shadow region. Hence receives low rainfall and generally drought prone. Gadag district is a part of Krishna basin, divided into two sub basins namely Malaprabha and Tungabhadra.

Climate

The average temperature observed ranges between 18°C (minimum) to 44°C (maximum) with an average rainfall of 613 mm.

Soil

The soils in Gadag district are broadly classified as medium to deep black cotton soils, red loamy soils and sandy loam soils.

Crops

The major crops of the district are: greengram, hybrid jowar and groundnut which are grown in kharif followed by wheat, maize, rabi jowar, bengalgram and sunflower in rabi. besides these, during kharif, onion and chilies are transplanted and cotton are grown as mixed crop. Normally, in command areas of the district, crops like sugarcane, maize, jowar, wheat, gram, paddy and pulses are grown while in non command areas sunflower, groundnut, chillies, millet and pulses are grown.

3.4 Selection of the taluks and villages

Four taluks were selected from the district namely Gadag, Ron, Shirahatti and Mundaragi. From each taluk, three villages were selected at random from the list of villages covered by watershed department.

3.5 Selection of the respondents

From each village, ten farmers were selected randomly. Thus, a total of 120 farmers constituted sample for the study.

Details of the sample

Taluks	Villages	Selected respondents
a) Gadag	Chikoppa	10
	Hirekoppa	10
	Huilgol	10
b) Ron	Lakkalakatti	10
	Dindoor	10
	Nagendragada	10
c)Mundaragi	Bagewadi	10
	Muradi	10
	Jyalawadgi	10
d)Shirahatti	Magadi	10
	Parasapur	10
	Shirahatti	10
Total		120

3.6 Variables under study

Sl. No.	Variable	Measurement tools
1	Dependent variables	
	a) Knowledge	Followed by Naik (2009)
	b)Adoption	Followed by Naik (2009)
2	Independent variables	
	a)Age	Followed by Mavinakatti (2013)
	b) Education	Followed by Mavinakatti (2013)
	c) Land holding	Followed by Mavinakatti (2013)
	d) Farm experience	Followed by Sabi (2012)
	e) Livestock possession	followed by Gamannavar (2011) with suitable modifications
	f) Farm implements possession	Followed by Sowmya (2014) with suitable modifications
	g) Extension contact	Followed by Sabi(2012)
	h) Cropping system	Followed by Gamannavar (2011)
	i) Risk orientation	Followed by Dange (2012)
	j) Scientific orientation	Followed by Raghavendra (2010)
	k) Mass media utilization	Followed by Mavinakatti (2013)
	l) Intensity of drought	Procedure developed for study

3.7 Operationalization and measurement of variables

3.7.1 Dependent variables:

3.7.1.1 Knowledge of drought mitigation practices

Knowledge of farmers about drought mitigation technologies is referred to as body of information aware and retained by respondents about drought mitigating practices. A teacher made test as suggested by Anastasi

(1961) was employed with little modifications to measure the knowledge level of the respondents about drought mitigation practices.

The questions were carefully framed by referring to the book “Drought proofing and Contingent crop planning in Northern Karnataka” published by the University of Agricultural Sciences, Dharwad and district watershed development authority of Gadag district . The answers elicited from the farmers were quantified by giving “1” score to known and “0” to not known answers.

The knowledge level was quantified by using frequency and percentage. Based on the total score, the respondents were classified into three categories namely, ‘low’, ‘medium’ and ‘high’ using mean and standard deviation as a measure of check.

Category	Score
Low	Less than (mean – 0.425SD)
Medium	In Between (mean±0.425SD)
High	More than(mean+0.425SD)

The above procedure was followed by Naik (2009).

3.7.1.2. Adoption

Adoption is operationally defined use of adoption of selected recommended drought mitigation practices.

The procedure followed by Sengupta (1967) was used to measure the general adoption level of the respondents. Respondents were asked questions to know whether they have adopted practices or not. The answers elicited from the farmers were quantified by giving “1” score to adoption and “0” to non-adoption.

Depending on the total score obtained by each respondent, they were grouped into three categories with mean and standard deviation as a measure of check.

Category	Score
Low	Less than (mean – 0.425 SD)
Medium	In Between (mean ± 0.425 SD)
High	More than (mean + 0.425 SD)

The above procedure was followed by Naik (2009).

3.7.1.3 Indigenous technical knowledge:

Indigenous technical Knowledge refers to the unique, traditional, local knowledge existing within a society and developed around the specific conditions of people indigenous to a particular geographic area. The ITKs followed by farmers are documented and the results were expressed in frequency, percentages.

3.7.1.4 Community based drought mitigation practices

Community based drought mitigation structures such as Bunding, Wasteweir, Check Dams and Nala Bunds were constructed in the study area. The details such as year of construction, area covered under particular practice and number of beneficiaries were collected from Watershed Department of the Gadag district for three consecutive years from 2011-14.

3.7.2 Measurement of independent variables:

3.7.2.1 Age

Age was operationalised as the chronological age of the respondent in completed years at the time of investigation. The age of the respondent was recorded as mentioned in completed years . The respondents were classified into three categories viz, young, middle and old as found in Government of India census report and the procedure followed by Mavinakatti (2013).

Category	Age (years)
Young	18-30
Middle	31-50
Old	51 and above

3.7.2.2 Education

It is operationalized as the number of years of formal education the person/ respondent has completed. For each category of schooling, a score from 0-5 was given, the respondents were grouped into different categories based on the score and procedure followed by Mavinakatti (2013).

Education	Score
Illiterate	0
Primary school(1^{st}- 4^{th} std)	1
Middle school (5^{th}-7^{th} std)	2
High school (8^{th} -10^{th})	3
Pre-university	4
Graduation	5

3.7.2.3 Land holding

It is the actual land owned by the family of farmer in acres. The criterion prescribed by Ministry of Rural Development, Government of India vides circular No.280-12/16/19 RD-III (Vol- II) dated 15th November 1991 (Anonymous, 1992) was used. Accordingly, one acre of irrigated or garden land was equivalent to three acres of dryland. The respondents were categorized based on the procedure followed by Mavinakatti (2013).

Category	Land holding
Marginal farmer	Upto 2.50 acres
Small farmer	2.51 to 5.00 acres
Semi-medium farmer	5.01 to 10.00 acres
Medium farmer	10.01 to 25.00 acres
Big farmer	More than 25.00 acres

3.7.2.4. Farming Experience

It refers to total number of years of experience in cultivation by the farmer. The experience of the farmer in completed years at the time of investigation was considered. The scoring pattern followed by Chandaragi (1996) was used in the study with suitable modification and the procedure followed by Sabi (2012).

Category	Farming experience (years)
Low	<10
Medium	10 to 20
High	>20

3.7.2.5. Farm implements possession:

It refers to the respondents ownership of farm equipments and farm power possessed .To quantify this variable, the procedure following by Sowmya (2014) was used with suitable modifications.

Implements	No	Score
Wooden plough	1	2
Iron plough	1	2
Harrow	1	2
Sparyer	1	2
Bullock cart	1	2
Tractor	1	3
Pumpset	1	2
Seed cum fertiliser drill	1	2
Any other	1	2

Based on the total scores, the respondents were classified into three categories such as ‘low’, ‘medium’ and ‘high’ by considering mean and standard deviation.

Category	Score
Low	Less than (mean- 0.425SD)
Medium	In between(mean ± 0.425SD)
High	More than (mean+ 0.425SD)

3.7.2.6. Livestock Possession:

Livestock possession refers to the number of animals possessed by the respondents such as cows, buffaloes, bullocks, sheep and goats. The results were expressed in frequency and percentages. Procedure followed by Gamangatti (2011) was adopted for the study.

3.7.2.7. Cropping system:

Cropping system is defined as the order in which the crops are cultivated on a piece of land over fixed period of time.

In the present investigation the cropping system was studied by asking the respondents regarding crops grown in all the seasons of previous year. The respondents were classified based on crops grown by using frequency and percentages.

3.7.2.8. Extension contact

The frequency of contact of a respondent with extension agency during the previous year was taken into consideration. The variable was quantified by using the procedure followed by Sabi (2013). The score of an individual respondent was the summation of scores for all the extension personnel contacted by the respondent.

Sl. No	Frequency of contact	Score
1	Contacted once in week	4
2	Contacted once in fortnight	3
3	Contacted once in month	2
4	Contacted when problem arises	1
5	Never	0

Based on the total scores of extension contact, the respondents were classified into three categories such as ‘low’, ‘medium’ and ‘high’ using Mean and Standard Deviation as a measure of check.

Category	Score
Low	Less than (mean – 0.425 SD)
Medium	In Between (mean ± 0.425 SD)
High	More than (mean + 0.425 SD)

3.7.2.9. Risk orientation

It is operationalized as the degree to which a farmer is oriented towards risk and uncertainty and has courage to face the various risks involved in farming. Risk orientation was measured with help of risk orientation scale developed by Supe (1969). The scale consisted of six statements, of which first and fifth statements were negative and all others were positive. The items were rated on a three point continuum ranging from "Agree' "Undecided" and Disagree" with weightages of 2, 1 and 0 for positive statements and 0, 1 and 2, for negative statements, respectively.

Category	A	UD	DA
Score for positive statement	3	2	1
Score for negative statement	1	2	3

A- Agree, UD- Undecided, DA- Disagree

Based on the total scores, the respondents were grouped into three categories by using mean and standard deviation as a measure of check.

Category	Score
Low	Less than (Mean-0.425 SD)
Medium	In Between (Mean ±0.425 SD)
High	More than (Mean+ 0.425 SD)

3.7.2.10. Scientific orientation

Scientific orientation is operationalized as the degree to which farmer is oriented towards the use of scientific methods in farming. The scale consisted

of six statements among which the second statement was negative. The items were rated on a three point continuum ranging from “Agree” “Undecided” and “Disagree” with weightages of 2, 1 and 0 for positive statements and 0, 1, and 2 for negative statements respectively. Higher score indicated better orientation towards scientific farming. Respondents were grouped into different categories on the basis of mean and standard deviation.

Category	Scores
Low	Less than (Mean-0.425 SD)
Medium	In Between (Mean ±0.425 SD)
High	More than (Mean+0.425 SD)

3.7.2.11. Mass media utilization

It refers to the frequency of using mass media such as newspapers, farm magazines, radio, television and ICT tools by the respondents. The respondents were asked to indicate their degree of participation in terms of listening habit, viewing habit and reading habit. The variable was quantified on the basis of procedure followed by Mavinakatti (2013).

Subscription/ownership	Score
Subscriber/owner	1
Non- Subscriber/ non-owner	0
Behavior of listening/reading/viewing	Score
Regular	2
Occasional	1
Never	0

Based on the total score obtained by the respondents on mass media utilization they were grouped into three categories, keeping the mean and standard deviation as check.

Category	Score
Low	Less than (mean- 0.425SD)
Medium	In between (mean ± 0.425SD)
High	More than (mean + 0.425SD)

3.7.2.12. Intensity of drought:

Intensity of drought is operationally defined as strength with which the drought occurs. In the present study it is calculated by the considering the rainy months during the cropping period i.e from June to October using the below formula which is expressed in percentage.

$$\text{Intensity of drought} = \frac{\text{Total number of drought months in year}}{12} \times 100$$

Based on the score obtained intensity of drought is classified as below,

Sl. No.	Intensity of drought	Range
1	Mild	11 to 25 %
2	Moderate	26 to 50%
3	Severe	>50%

(Source : IMD, Pune.)

3.8 Procedure for data collection

Keeping in the view the objectives and variables of the study, a structured interview schedule was developed by consulting experts and referring to the relevant literature. Pretesting of the schedule was carried out in the non-sample area for its practicability and relevancy. The final schedule was prepared by making necessary corrections based on pre-testing results. The final format of the interview schedule is given in Appendix-II.

The data was collected from the respondents through personal interview method in an informal atmosphere and the data for community based drought mitigation practices was collected from watershed department of Gadag district.

3.9 Statistical tools employed

The following statistical tools were used to analyze the data.

Mean: The arithmetic mean is the sum of the scores divided by total number of items. This measure was used to categorize the dependent and independent variables into low, medium and high categories.

Frequency: This measure was used to know the distribution pattern of respondents variable wise and to categorize the problems perceived by respondents in order of importance.

Percentage: This measure was used for simple comparisons.

Standard deviation: This measure was used to categorize the dependent and independent variables into low, medium and high categories.

Chi-square test: Chi-square test was used to find out the relationship/association between dependent variables and independent variables using the following formula.

$$\chi^2 = \Sigma \left(\frac{(f_o - f_e)^2}{fe} \right)$$

Where:

χ^2 = Chi-square value.

fo = Observed frequencies

fe = Expected frequencies.

$\sum$= Summation.

4. RESULTS

The results of the study are presented in this chapter under the following sub headings.

4.1 Socio-economic characteristics of the farmers

4.2 Knowledge of farmers about drought mitigation technologies

4.3 Adoption of drought mitigation technologies

4.4 Association between dependent and independent variables

4.5 ITKs practices by farmers

4.6 Community level drought mitigation practices in study area

4.7 Reasons for non –adoption of drought mitigation technologies

4.1 Socio-economic characteristics of the respondents

4.1.1 Age

An insight into Table 1 and Fig.2 revealed that, 42.50 per cent of the respondents belonged to middle age followed by young age (30.83%) and old age category (26.66%).

4.1.2 Education

The results showed that 25.00 per cent of the farmers studied up to high school, while 20.00 per cent and 19.16 per cent farmers studied up to PUC and graduation respectively. About eighteen per cent of the farmers studied up to primary school and 17.50 per cent of farmers belonged to middle school category.

4.1.3 Land holding

The data revealed that, 30.00 per cent of farmers belonged to medium land holding category (10–25.0 acres) while, 22.50 per cent of them belonged to semi medium land holding category (2.51–5.0 acres). Only 19.16 per cent of them were

Table 1: Personal and socio– economic characteristics of the respondents

n=120

Sl. No.	Characteristics	Number
I	Age	
1	Young (18-30 years)	37 (30.83)
2	Middle (31-50)	51 (42.50)
3	Old (>50)	32 (26.67)
II	Education	
1	Illiterate	00 (0.00)
2	Primary school	22 (18.33)
3	Middle school	21 (17.50)
4	High school	30 (25.00)
5	Pre university	24 (20.00)
6	Graduate and above	23 (19.16)
III	Land holding	
1	Marginal (up to 2.5 acres)	22 (18.33)
2	Small (2.51-5.00 acres)	23 (19.17)
3	Semi medium (5.01-10 acres)	27 (22.50)
4	Medium (10.01-25 acres)	36 (30.00)
5	Big (>25 acres)	12 (10.00)
IV	Farming experience	
1	Low (<10)	21 (17.50)
2	Medium (10-20)	54 (45.00)
3	High (>20)	45 (37.50)
V	Livestock possession*	
1	Bullock	90 (75.00)
2	Cow	105 (87.50)
3	Buffalo	75 (62.50)
4	Goat	28 (23.33)
5	Sheep	9 (7.50)
6	Poultry	5 (4.16)

Figures in parentheses indicate percentage
***Multiple responses obtained**

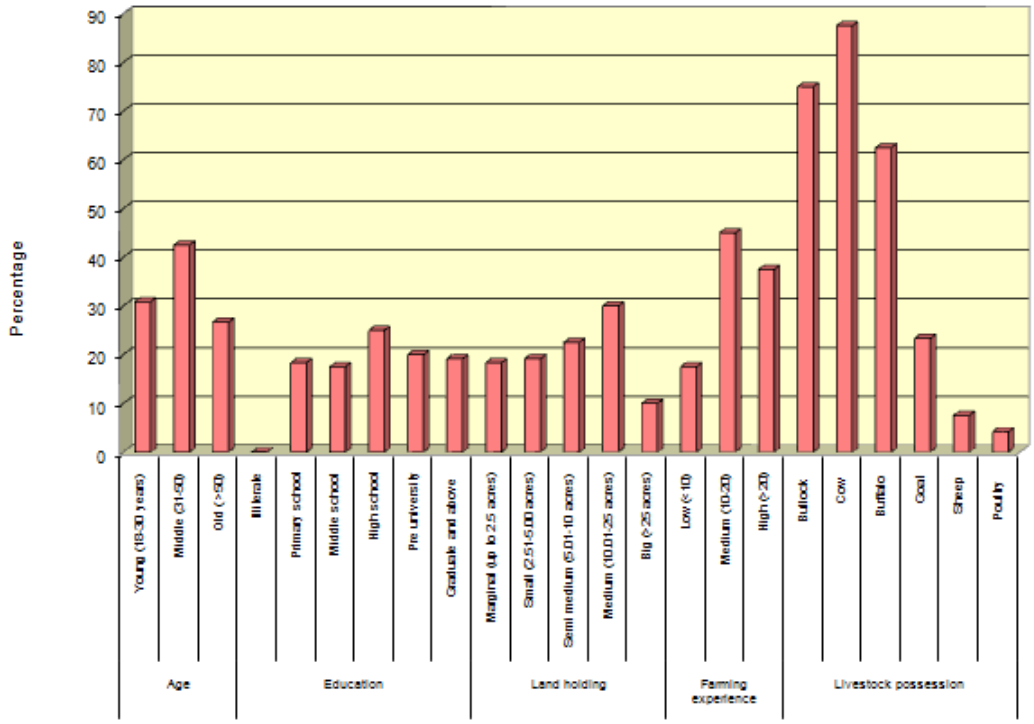

Fig. 2. Personal and socio– economic characteristics of the respondents

small farmers (5.01–10.0 acres), 18.33 per cent were marginal farmers (<2.5 acres) and 10.00 per cent belonged to big land holding category (>25 acres).

4.1.4 Farming experience

The results pertaining to farming experience revealed that, 45.00 per cent of the respondents had medium farming experience followed by high (37.50%) and low farming experience (17.50%).

4.1.5 Livestock possession

High majority of the farmers possessed cows (87.50%) followed by bullocks (75.00%) and buffaloes (62.50%). Whereas, the percentage of respondents possessing goats, sheep and poultry was 23.33, 7.50 and 4.16, respectively.

4.1.6 Farm implements possession

The look into Table 2 and Fig.3 revealed that, large percentage of the farmers possessed sprayer (83.33%), harrow (79.16%) and wooden plough (76.66%). Whereas, 70.00 per cent of the respondents possessed iron plough followed by bullock cart (66.66%), pump set (56.66%), seed cum fertilizer drill (53.33%). Forty eight per cent of the respondents possessed tractor.

It was also clear from the Table 2.1 that, 36.67 per cent of the respondents belonged to medium farm implements possession category followed by low (33.33%) and high (30.00%) farm implements possession categories.

4.1.7 Extension contact

It was evident from the results in Table 3 and Fig.4 that 36.67 per cent of the respondents had medium extension contact, while equal proportion of the respondents (31.67%) had high and medium extension contact.

The results presented indicated that, 57.83 per cent of the respondents contacted Assistant Agriculture Officers once in a month. Nearly fifty per cent of the farmers contacted Agricultural Officers and Scientists of KVK when problem arised. While, larger percentage of the farmers never contacted any extension personnel.

Table 2: Farm implements possessed by the respondents

n=120

Sl. No.	Farm implements	Frequency
1	Wooden plough	92 (76.66)
2	Iron plough	84 (70.00)
3	Harrow	95 (79.16)
4	Sprayer	100 (83.33)
5	Cart	80 (66.66)
6	Tractor	48 (40.00)
7	Pumpset	68 (56.66)
8	Seed cum fertilizer drill	64 (53.33)
9	Others	16 (13.33)

Figures in parentheses indicate percentage

Table 2.1: Distribution of respondents based on farm implements possession

n=120

Sl. No	Category	Respondents	
		Frequency	Percentage
1	Low (<9.34)	40	33.33
2	Medium (9.34-13.38)	44	36.67
3	High (>13.34)	36	30.00

Mean = 11.36 SD=4.7

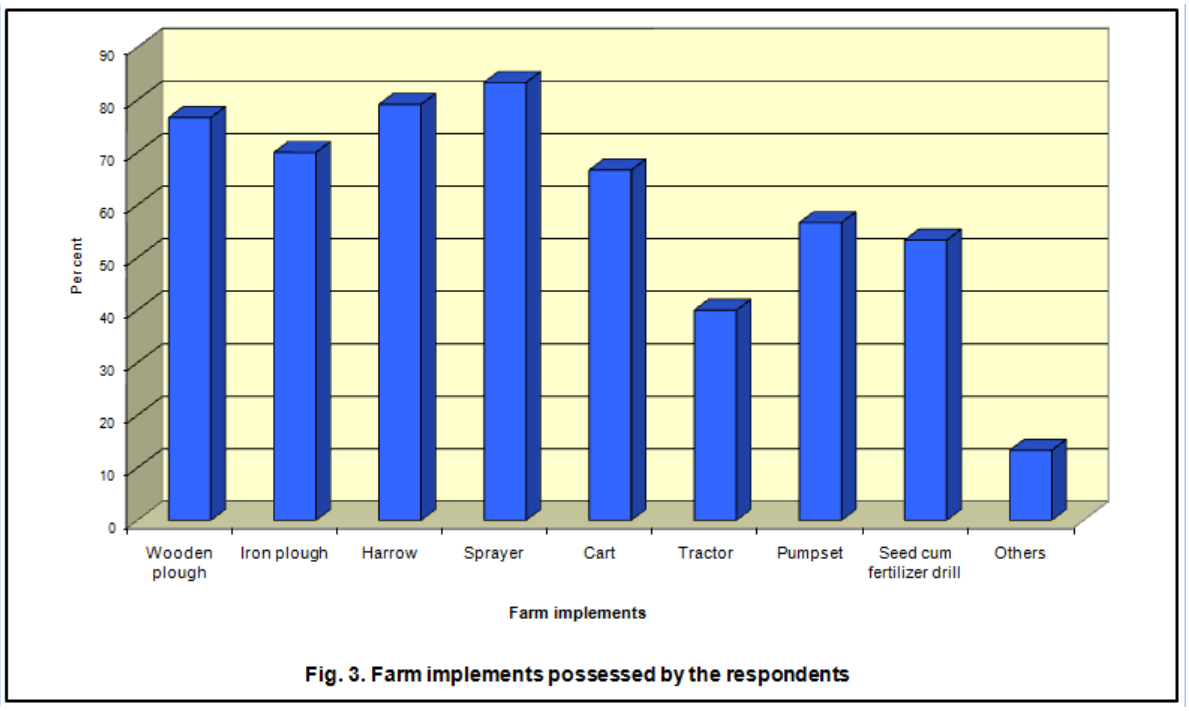

Fig. 3. Farm implements possessed by the respondents

Table 3: Extension contact by the respondents

n=120

Sl. No.	Extension personnel	Once in fortnight		Once in month		When problem arises		Never	
		F	%	F	%	F	%	F	%
1	AAO	36	30	67	57.83	17	14.66	0	0
2	AO	4	3.33	40	33.33	56	46.66	20	16.67
3	Scientists of KVK	0	0	1	0.83	63	52.50	56	46.67
4	Agril. Field officers of bank	0	0	0	0	48	40.00	72	60.00
5	Relevant extension personnel	0	0	8	6.66	64	53.33	48	40.00
6	Others	0	0	0	0	40	33.33	80	66.67

Table 3.1: Distribution of respondents according to extension contact

n=120

Sl. No.	Category	Respondents	
		Frequency	Percentage
1	Low (<4.61)	38	31.67
2	Medium(4.61-6.03)	44	36.67
3	High (>6.03)	38	31.66

Mean = 5.32 SD=1.67

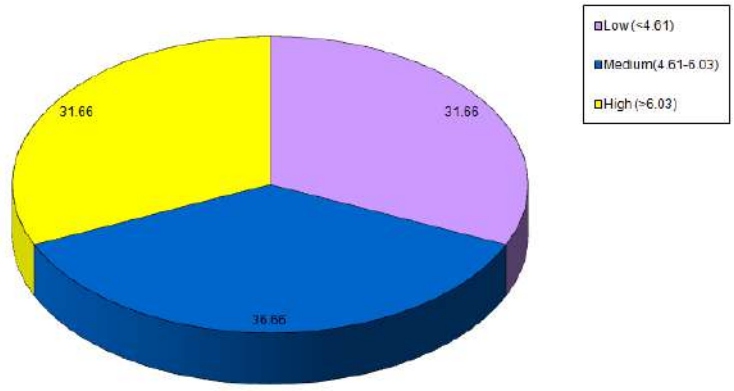

Fig. 4. Distribution of respondents according to extension contact

4.1.8 Cropping system

The data presented in Table 4 revealed that, majority of the respondents practiced Cotton-Chilli-Onion cropping system (89.16%), followed by Maize–Chickpea (43.33%) and Groundnut-Rabi Sorghum (39.16%). Less than twenty per cent of respondents followed Sunflower-Rabi Sorghum (18.33%) followed by Sugarcane-Sugarcane (15.00%) cropping system. However, least per cent (4.16%) of respondents followed Soyabean-Rabi Sorghum cropping system.

4.1.9 Risk orientation

The data from Table.5 and Fig.5 revealed that 38.33 per cent of respondents had medium level of risk orientation while 37.50 per cent and 24.17 per cent of farmers belonged to low and high risk orientation categories.

4.1.10 Scientific orientation

The data presented in Table 6 and Fig.5 revealed that 38.33 per cent of farmers had medium level of scientific orientation followed by equal proportion of the farmers (30.38%) had low and high level of scientific orientation.

4.1.11 Mass media utilization

It is interesting to note from Table 7 revealed that, most of the farmers (83.33%) possessed Television followed by News paper (66.66%) and Radio (60.00%). Only 46.66 per cent of the farmers subscribed farm magazines and even lesser percentage (33.33%) of them possessed ICT tools.

The table also revealed that 40.00 per cent of the respondents never listened to Radio. The other 20.00 per cent and 16.66 per cent of the respondents listened to general and agricultural programmes in radio occasionally, respectively.

Table 4: Major cropping system followed by the farmers

n=120

Sl. No.	Crops	Respondents	
		Frequency*	Percentage
Major			
1	Cotton-chilli-onion	107	89.16
2	Groundnut-Rabi sorghum	47	39.16
3	Maize – Chickpea	52	43.33
4	Sunflower-Chickpea	22	18.33
5	Sugarcane-Sugarcane	18	15.00
6	Soybean-Rabi sorghum	5	4.16
Others			
1	Vegetables	30	25.00
2	Horticultural crops	6	5.00

*multiple responses obtained

Table 5: Distribution of respondents according to risk orientation

n=120

Sl. No.	Category	Respondents	
		Frequency	Percentage
1	Low (<11.85)	45	37.50
2	Medium (11.85-13.06)	46	38.33
3	High (>13.06)	29	24.17

Mean = 12.45 SD=1.43

Table 6: Distribution of respondents according to scientific orientation

n=120

Sl. No.	Category	Respondents	
		Frequency	Percentage
1	Low (<11.42)	37	30.83
2	Medium(11.42-12.40)	46	38.33
3	High(>12.40)	37	30.84

Mean =11.91 SD=1.15

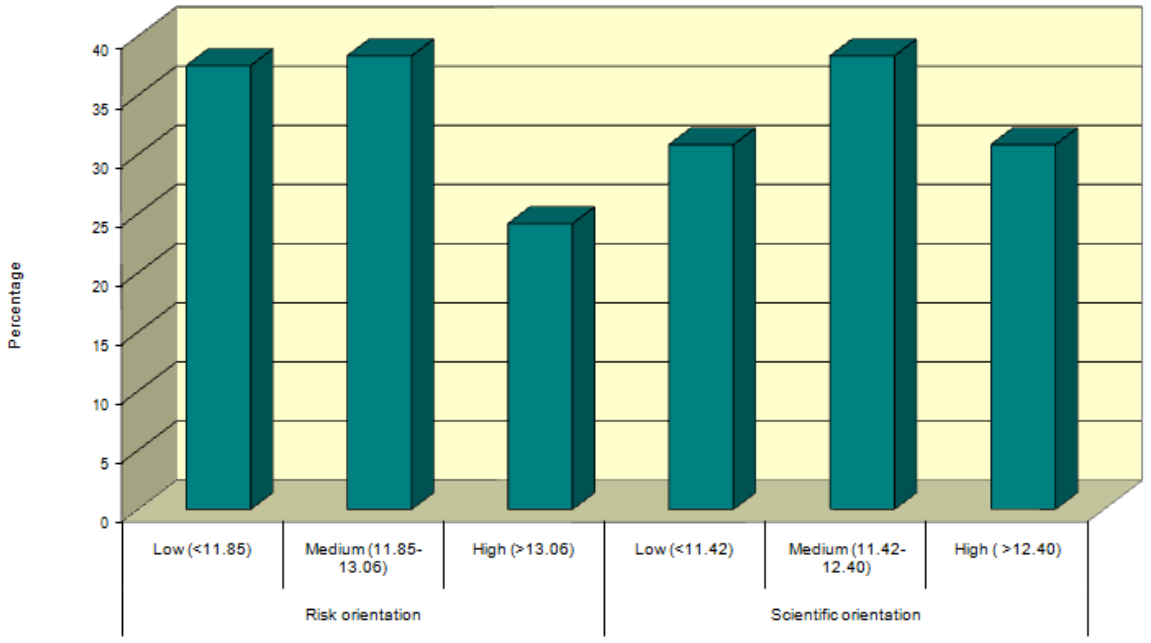

Fig. 5. Distribution of respondents according to risk orientation and scientific orientation

Table 7: Extent of utilization of mass media by the respondents

n=120

Sl. No.	Mass media source	Subscription/ Possession		Programmes	Frequency of use					
					Regular		Occasionally		Never	
		F	%		F	%	F	%	F	%
1	Radio	72	60.0	General	18	15.00	24	20.00	28	23.33
				Agriculture	10	8.33	20	16.66	20	16.66
2	Television	100	83.33	General	66	55.00	2	1.66	0	0
				Agriculture	50	41.66	2	1.66	0	0
3	Newspaper	80	66.66	General	38	31.66	20	16.66	32	26.66
				Agriculture	10	8.33	12	10.00	8	6.66
4	Farm magazine	56	46.66	General	3	2.50	2	1.66	18	15.00
				Agriculture	40	33.33	10	8.33	47	39.16
5	ICT tools	40	33.33	General	10	8.33	15	12.50	40	33.33
				Agriculture	5	4.16	10	8.33	40	33.33

Table 7.1: Distribution of respondents based on mass media utilization

n=120

Sl. No	Category	Respondents	
		Frequency	Percentage
1	Low (<9.17)	35	29.16
2	Medium (9.17-12.40)	44	36.67
3	High (>12.40)	41	34.17

Mean =10.81 SD=3.85

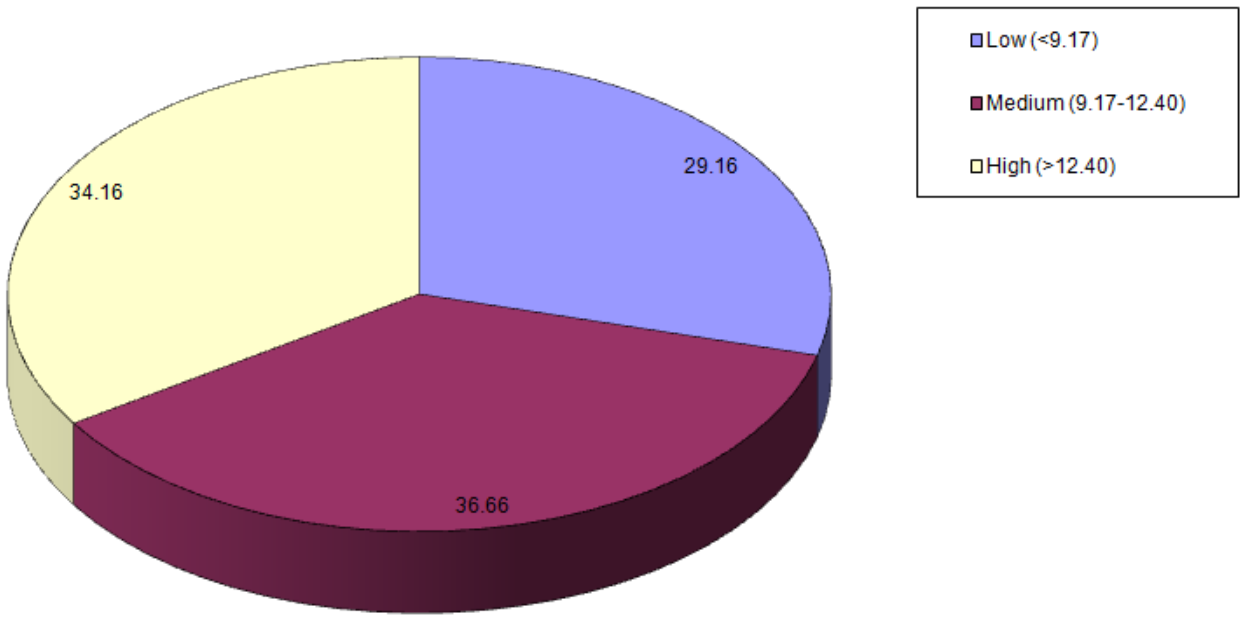

Fig. 6. Distribution of respondents based on mass media utilization

As high as 55.00 per cent of the respondents regularly watch general programmes in television. It was also found that 41.66 per cent of the farmers regularly watch agricultural programmes in television.

The data also revealed that 33.33 per cent of the respondents never read newspaper. Whereas, 31.66 per cent of the respondents read general news regularly and 8.33 per cent of them read agricultural news regularly.

Majority of the respondents (54.16%) never read farm magazines. It can also be seen that 33.33 per cent of the respondents read farm magazine regularly for agricultural articles followed by 8.33 per cent of them read agricultural articles occasionally.

It was found that nearly 65.00 per cent of the respondents never accessed ICT tools. It was also noticed that a very less percentage of respondents (8.33% and 4.16%) accessed ICT tools regularly for general and agricultural news, respectively.

Table 7.1 and Fig. 6 clearly showed that, 36.67 per cent of the respondents had medium mass media utilization while 34.17 per cent and 29.16 per cent of the respondents belonged to high and low mass media utilization categories, respectively.

4.1.12 Intensity of drought

Table 8 and Fig.7 clearly showed that, majority of the respondents (68.33%) were of the opinion that intensity of drought was very mild the previous year followed by 31.67 per cent opined that it was mild.

4.2 Knowledge of farmers about drought mitigation technologies.

An perusal of Table 9.1 and Fig.8 revealed that 40.83 per cent of the respondents belonged to medium level of knowledge about drought mitigation practices followed by low (30.00%) and high (29.16%) knowledge categories.

Table 8: Distribution of farmers based on intensity of drought

n=120

Sl. No.	Intensity	Respondents	
		Frequency	Percentage
1	Very mild (16.66%)	82	68.33
2	Mild (25%)	38	31.67
3	Moderate (26-50%)	00	00.00

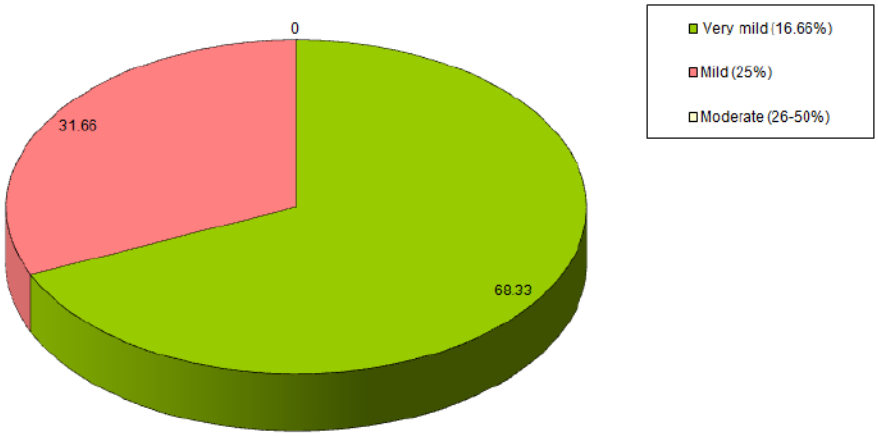

Fig. 7. Distribution of farmers based on intensity of drought

4.2.1 Knowledge of individual drought mitigation technologies by farmers

4.2.1.1 Pre-sowing arrangements

The data from Table.9 revealed that cent per cent of the respondents were aware of organic matter incorporation followed by seed treatment (96.66%) and use of drought resistant varieties (66.66%). Less than fifty per cent of the farmers were aware of contingent crop plans (46.66%).

4.2.1.2 Land grading and conservation of natural resources

It is evident from the data that 97.50 per cent of the farmers were aware of live bunds followed by mulching (96.66%), contour bunding (83.33%), compartment bunding (73.33%) and farm pond (50.83%). Only 32.50 per cent of the respondents were aware of conservation furrows at 15-20 cm.

4.2.1.3 Tillage operations and planting geometry

It was found that 93.33 per cent of the farmers were aware of secondary tillage/hoeing followed by off season tillage (88.33%) and deep ploughing (72.50%). Whereas, 50.00 per cent of the respondents were aware of wider row spacing followed by protective irrigation from farm pond (49.16%) and paired row spacing (34.16%).

4.1.2.4 Diversification of agriculture

The results revealed that, cent per cent of the farmers were aware of animal husbandry. While, 78.33 per cent and 53.33 per cent of the respondents were aware of vermi-compost and vegetable cultivation, respectively as a supplementary activities in diversified agriculture. Less than fifty per cent of the respondents were aware of horticulture (45.00%) and poultry (40.83%).

4.1.2.5 Alternate land use systems

It was found that 70.83 per cent of the respondents were aware of agro horti system followed by agri-forestry system (54.16%). Only 38.33 per cent of the respondents were aware of agri-pastoral systems.

Table 9: Knowledge of individual drought mitigation practices by farmers

n =120

Sl. No.	Practices	Aware	
		Frequency	Percentage
1.	Pre –sowing arrangements		
a)	Organic matter incorporation	120	100
b)	Use of drought resistant varieties	80	66.66
c)	Seed treatment	116	96.66
d)	Contingent crop plans	56	46.66
2.	Land grading and conservation of natural resources		
a)	Contour bunding	100	83.33
b)	Conservation furrows at 15-20cm	39	32.50
c)	Compartment bunding	88	73.33
d)	Mulching	116	96.66
e)	Live bunds	117	97.50
f)	Farm ponds	61	50.83
3.	Tillage operations and planting geometry		
a)	Off season tillage	106	88.33
b)	Secondary tillage/hoeing	112	93.33
c)	Deep ploughing	87	72.50
d)	Wider row spacing	60	50.00
e)	Paired row spacing	41	34.16
f)	Protective irrigation from farm pond	59	49.16
4	Diversification of agriculture		
a)	Animal husbandry	120	100
b)	Horticulture	54	45.00
c)	Poultry	49	40.83
d)	Vegetable cultivation	64	53.33
e)	Vermin-compost	94	78.33
5	Alternate land use systems		
a)	Agroforestry	65	54.16
b)	Agri-horti systems	85	70.83
c)	Agri-pastoral systems	46	38.33
6.	Nutrient management		
a)	Green leaf manuring	105	87.50
b)	Tank silt application	61	50.83
c)	Recommended dose of fertilizers	118	98.33

Table 9.1: Distribution of respondents according to their knowledge

n=120

Sl. No.	Category	Respondents	
		Frequency	Percentage
1	Low (<17.23)	36	30.00
2	Medium (17.23-19.76)	49	40.83
3	High (>19.76)	35	29.16

Mean= 18.50 SD=2.9

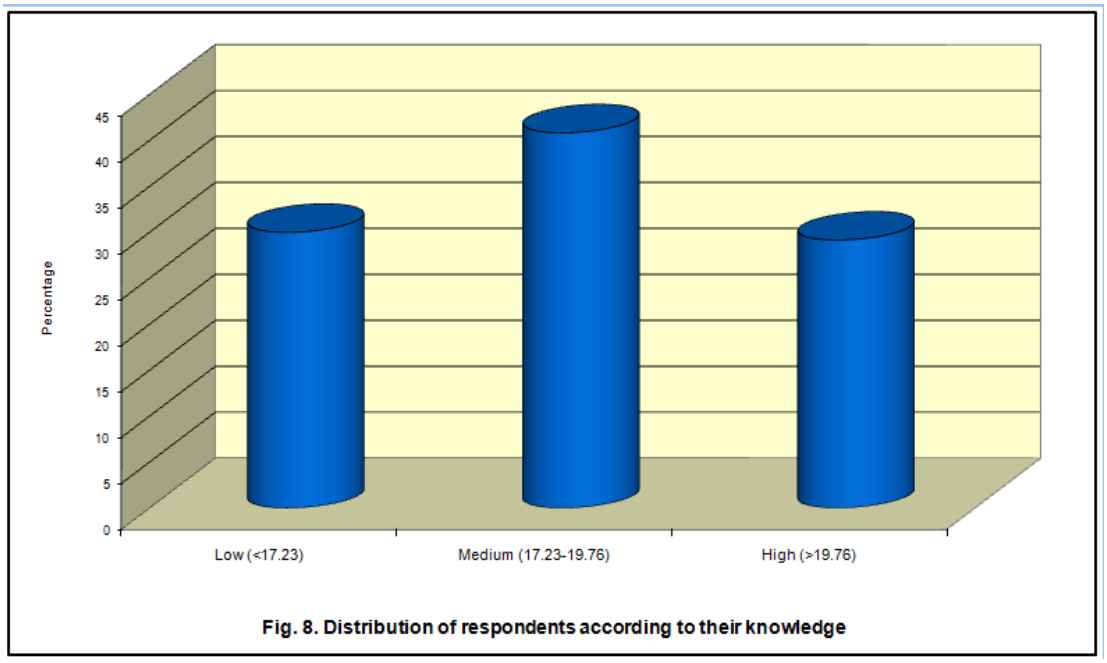

Fig. 8. Distribution of respondents according to their knowledge

4.1.2.6 Nutrient management

It is evident from the data that, 87.50 per cent of the farmers were aware of green leaf manuring followed by tank silt application (50.83%).

4.3 Adoption of drought mitigation technologies.

The results presented in Table 10.1 and Fig.9 revealed that, 38.33 per cent of the respondents belonged to medium adoption category of drought mitigation practices followed by high (32.50%) and low (29.16%) adoption categories.

4.3.1 Adoption of individual drought mitigation technologies by farmers.

4.3.1.1 Pre-sowing arrangements

The data from Table.10 indicated that 85.00 per cent of the respondents adopted organic matter incorporation followed by seed treatment (60.83%). In case of use of drought resistant varieties 30.00 per cent of the farmers belonged to adoption category. Less than thirty per cent of the respondents (21.66%) adopted contingent crop plan.

4.3.1.2 Land grading and conservation of natural resources

Nearly sixty per cent of the farmers adopted live bunds and farm ponds. Majority of the farmers (53.33%) were adopters of mulching. In case of conservation furrow formation less than ten per cent of the respondents were adopters. Regarding compartment bunding and contour bunding 41.66 per cent and 44.16 per cent of the farmers belonged to adoption category, respectively.

4.3.1.3 Tillage operations and planting geometry

It was clear from the data that, majority of the respondents (61.66%) adopted off season tillage. Sixty five per cent of the farmers were adopters of secondary tillage /hoeing. With respect to deep ploughing, 43.33 per cent of the respondents were adopters. Regarding wider row spacing and paired row cultivation very less percentage of the respondents (15.00% and 13.33%) were adopters, respectively. Only 46.66 per cent of the respondents were adopters in case of protective irrigation from farm pond.

Table 10: Adoption of individual drought mitigation practices by farmers

n =120

Sl. No.	Practices	Adoption level	
		Adoption	Non adoption
1.	Pre-sowing arrangements		
a)	Organic matter incorporation	102 (85.00)	18 (15.00)
b)	Use of drought resistant varieties	36 (30.00)	86 (70.00)
c)	Seed treatment	73 (60.83)	47 (39.17)
d)	Contigent crop plans	26 (21.67)	94 (78.33)
2.	Land grading and conservation of natural resources		
a)	Contour bunding	53 (44.16)	67 (55.84)
b)	Conservation furrows at 15-20cm	11 (9.16)	109 (90.84)
c)	Compartment bunding	50 (41.66)	70 (58.34)
d)	Mulching	74 (61.66)	46 (38.34)
e)	Live bunds	88 (73.33)	32 (26.67)
f)	Farm pond	70 (58.33)	50 (41.67)
3.	Tillage operations and planting geometry		
a)	Off season tillage	74 (61.66)	46 (38.34)
b)	Secondary tillage/hoeing	78 (65.00)	42 (35.00)
c)	Deep ploughing	52 (43.33)	68 (56.67)
d)	Wider row spacing	18 (15.00)	102 (85.00)
e)	Paired row spacing	16 (13.33)	104 (86.67)
f)	Protective irrigation from farm pond	56 (46.66)	64 (53.34)

Sl. No.	Practices	Adoption level	
		Adoption	Non adoption
4	Diversification of agriculture		
a)	Animal husbandry	92 (76.66)	28 (23.34)
b)	Horticulture	23 (19.66)	97 (80.84)
c)	Poultry	8 (6.66)	112 (93.37)
d)	Vegetable cultivation	30 (25.00)	90 (75.00)
e)	Vermi-compost	64 (53.33)	56 (46.67)
5	Alternate land use systems		
a)	Agroforestry	29 (24.16)	91 (75.84)
b)	Agri-horti systems	38 (31.66)	82 (68.34)
c)	Agri-pastoral systems	32 (26.66)	88 (73.34)
6.	Nutrient management		
a)	Green leaf manuring	57 (47.50)	63 (52.50)
b)	Tank silt application	18 (15.00)	102 (85.00)

Figures in parentheses indicate percentage

Table 10.1: Distribution of respondents according to adoption level

n=120

Sl. No.	Category	Adoption level	
		Frequency	Percentage
1	Low (<10.71)	35	29.17
2	Medium (10.71-12.75)	46	38.33
3	High (>12.75)	39	32.50

Mean = 11.73 SD=2.39

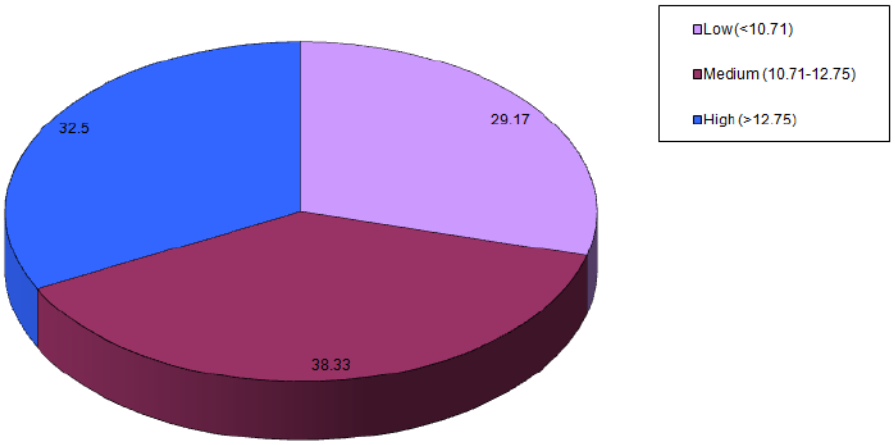

Fig. 9. Distribution of respondents according to adoption level

4.3.1.4 Diversification of agriculture

It was found that 76.66 per cent of the respondents adopted animal husbandry. Only 19.66 per cent, 6.66 per cent and 25.00 per cent of the respondents adopted horticulture, poultry and vegetables cultivation, respectively as component of diversified agriculture. Vermi-composting was adopted by 36.66 per cent of the respondents.

4.3.1.5 Alternate land use systems

Regarding agro forestry, agri-horti system and agri-pastoral system less than thirty five per cent of the respondents (24.16%, 31.66% and 26.66%) were adopters, respectively.

4.3.1.6 Nutrient management

It was seen that 47.50 per cent of the respondents adopted green leaf manuring. Fifteen per cent of the respondents adopted tank silt application.

4.4 Association between dependent and independent variables

4.4.1 Association between knowledge level and independent variables

To find out the association between knowledge of drought mitigation practices with independent variables, the data was subjected to chi-square test and the results are presented in Table 11.

Age, education, farming experience, extension contact were having significant association with knowledge at 0.05 level of significance and mass media utilization was having significant association with knowledge at 0.01 level of significance. Whereas, land holding, farm implements, risk orientation and scientific orientation were not having significant association with the knowledge of the respondents.

Table 11: Association between independent variables and their knowledge level

Sl. No.	Variable	Chi-square value
1	Age	10.59*
2	Education	18.35*
3	Land holding	4.90 NS
4	Farming experience	9.97*
5	Farm implements	3.97 NS
6	Extension contact	12.03*
7	Mass media utilization	14.86**
8	Risk orientation	2.67 NS
9	Scientific orientation	3.82 NS

*** Significant at 5% ** Significant at 1% NS – Non-significant**

4.4.2 Association between adoption level and independent variables

To find out the association between adoption of drought mitigation practices with independent variables, the data was subjected to chi-square test and results are presented in Table 12.

Age, education, farming experience, extension contact, mass media utilisation and scientific orientation were having significant association with adoption at 0.05 level of significance. Whereas, land holding, farm implement and risk orientation were not having significant association with the adoption of the drought mitigation practices.

4.5 ITKs practiced by farmers

Table 13 brings to the light that majority of the respondents (68.33%) practiced cow dung slurry treatment for seed treatment followed by cow urine treatment (31.66%).

With respect to tillage operations, 60.83 per cent of the farmers practiced zero tillage followed by dead furrow formation to reduce soil and water erosion (55.00%).

Forty five per cent of the farmers followed broadcasting of soaked seeds followed by sowing of seeds embedded in cow dung (37.50%).

As high as 70.83 per cent of the farmers practiced sheep and goat penning for manuring followed by 30.00 per cent of the respondents who follow use of press mud and poultry waste.

With respect to pest and disease control, 76.66 per cent of the respondents grew catch crops followed by panchgavya application (53.33%) and puffed rice application (47.50%).

It can also be seen that 74.16 per cent of the farmers used burning of slashed waste for weed control followed by mulching (60.00%).

Table 12: Association between independent variables and their adoption level

Sl. No	Variable	Chi-square value
1	Age	10.43*
2	Education	17.82*
3	Land holding	5.66 NS
4	Farming experience	10.46*
5	Farm implements	3.81 NS
6	Extension contact	9.66*
7	Mass media utilization	10.37*
8	Risk orientation	1.14 NS
9	Scientific orientation	9.49*

*** Significant at 5% ** Significant at 1% NS – Non-significant**

Table 13: ITKs practiced by the farmers for drought mitigation

n=120

Sl. No.	Farm activity	ITK followed	Respondents	
			Frequency	Percentage
1	Seed treatment	1. Cow dung slurry treatment	82	68.33
		2. Cow urine treatments	38	31.66
2	Tillage operations	1. Zero tillage enhances microbial growth	73	60.83
		2. Dead furrow formation to reduce soil and water erosion	66	55.00
3	Sowing	1. Broadcasting of soaked seeds	54	45.00
		2. Sowing the seeds embedded in cow dung	45	37.50
4	Manuring	1. Sheep and goat penning	85	70.83
		2. Use of press mud and poultry waste	36	30.00
5	Pest and disease control	1. Catch crops	92	76.66
		2. Panchagavya application	64	53.33
		3. Puffed rice application	57	47.50
6	Weed control	1. Mulching removes unwanted weeds	72	60.00
		2. Burning of slashed wastes kill weed seeds	89	74.16
7	Harvesting	1. Early morning harvest to reduce the grain loss	96	80.00
8	Storage	1. Mixing with fire wood ash	65	54.16
		2. Mixing with Neem seeds and leaves	103	85.83
		3. Use of Nilgiri leaves	83	69.16
		4. Use of mud bins	32	26.66

Early morning harvest was practiced by 80.00 per cent of the respondents for harvesting.

As high as 85.83 per cent of the respondents follow mixing of seeds with fire wood ash for storage followed by use of nilgiri leaves (69.16%) and mixing with neem seeds and leaves. Only 26.66 per cent of the respondents followed use of mud bins for storage.

4.6 Community level drought mitigation practices in study area

Bunding and waste weir were the major practices taken up by the watershed department covering over 12,483 ha and 11,012 ha of area, respectively. Next important practice was forestry plantation on bunds of 384 ha and grass plantations of 384 ha. Nearly 220.4 ha of land was covered under horticulture plantations. Recently drought proof models are being introduced into farmers' field covering 23 ha but it is still on trail basis (Table.14).

In a span of three years (2011-14), 68 check dams (2785 farmers participated), 3 nala bunds (453 farmers participated) and 36 community tanks were built in the study area to reduce the impact of drought (Table. 14.1).

4.7 Reasons for non–adoption of drought mitigation practices

The reasons for non-adoption of drought mitigation practices are presented in Table 15.

4.7.1. Pre-sowing arrangements

With respect to the use of drought resistant varieties, 46.66 per cent of the farmers expressed non-availability of seeds as major reason for non-adoption. Nearly forty per cent of the farmers (39.16%) expressed lack of guidelines on proper seed treatment as reason for non adoption of seed treatment. Regarding contingent crop plan, 45.83 per cent of the farmers expressed lack of information support followed by difficulty in choosing right cropping system in short duration (35.00%). Regarding organic matter incorporation 10 per cent of the farmers expressed that it was labour intensive work.

Table 14: List of Community based drought mitigation practices

Sl. No.	Activity	Year	Area covered in ha	No. of beneficiaries
1	Bunding	2011-14	12,483	876
2	Waste weir	2011-14	11,012	652
3	Horticulture plantation	2011-14	220.4	134
4	Forestry plantation on bunds	2011-14	384	125
5	Grass plantation	2011-14	384	118
6	Drought proof models	2011-14	23	38

Table 14.1: List of Community based drought mitigation practices

Sl. No.	Activity	Year	Time span	Total number	Farmers participated
1	Check dam	2011-14	3 years	68	2785
2	Nala bunds	2011-14	3 years	3	453
3	Community tanks	2011-14	3 years	26	-

4.7.2 Land grading and conservation of natural resources

Majority of the farmers expressed that formation of conservation furrows at 15-20 cm involves high labour cost (50.88%). Forty per cent of farmers perceived it as an obstruction to other cultural operations. It was found that 30.00 per cent of farmers felt loss of cultivable land as a major constraint in contour bunding. Only 26.66 per cent of the farmers expressed high labour wages as one of the major problem in adoption of compartment bunding followed by time consuming operation and water logging. Regarding mulching, 38.33 per cent of the respondents expressed time consuming operation as the major reason for non adoption. In case of live bunds, 32.00 per cent of the respondents expressed maintenance problem. Thirty per cent of the respondents expressed risk of deficit rainfall as major reason for non adoption of farm pond.

4.7.3 Tillage operations and planting geometry

Regarding off season tillage and secondary tillage, 19.16 per cent of the respondents expressed labor problem as the important reasons for non adoption. Forty per cent of the respondents expressed increase in operational cost as major problem in deep ploughing. Sixty per cent of the respondents expressed that wider row spacing has slower ground cover. Majority of the respondents (59.16%) in case of paired row system expressed lack of knowledge about the benefits as the major problems in adoption. In case of protective irrigation from farm pond, 35.00 per cent of the respondents expressed lack of water storage due to temperature as the important reason.

4.7.4 Diversification of agriculture

It was found that, 28.00 per cent of the respondents expressed maintenance problem as a reason for non adoption of animal husbandry. In case of horticulture 44.16 per cent of the respondents expressed financial constraints. With respect to poultry, 46.66 of the respondents expressed maintenance problem as the major reason. Majority of the respondents expressed labour problem in vegetable cultivation and vermicomposting.

4.7.5 Alternate land use systems

It was seen that, 60.00 per cent of the farmers expressed fragmented land holding and damage to food crops as the important reasons for non adoption of agro-forestry. In case of agri-horti system and agri-pastoral system, 68.34 per cent and 73.34 per cent of farmers expressed fragmented land holding and use of dry fodder for animals as the reasons for non adoption, respectively.

4.7.6 Nutrient management

It can also be seen that, in green leaf manuring, 33.33 per cent of the farmers expressed it as time consuming operation. Majority of the respondents (63.33%) in tank silt application expressed it as labor intensive.

Table 15: Reasons for non-adoption of the drought mitigation practices by the respondents

n=120

Sl. No.	Practices	Reasons	Respondents	
			F	%
I	Pre-sowing arrangements			
1	Organic matter incorporation	Labour intensive	12	10.00
		High cost	6	5.00
2	Use of drought resistant varieties	Non- availability of seeds	56	46.66
		Lack of knowledge	18	15.00
		High Cost	12	10.00
3	Seed treatment	Lack of guidelines on proper seed treatments	47	39.16
4	Contigent crop plans	Difficulty in choosing right cropping system in short duration	42	35.00
		Lack of information support	55	45.83
II	Land grading and conservation of natural resources			
1	Contour bunding	Loss of cultivable land	36	30.00
		Labour intensive	17	14.16
		Lack of Technical support	14	11.66
2	Conservation furrows	Obstruction to other cultural operations	48	40.00
		High Labour cost	61	50.88
3	Compartment bunding	High labour wages	32	26.66
		Water logging	15	12.50
		Time consuming operation	23	19.16
4	Mulching	Time consuming operation	46	38.33
5	Live bunds	Maintainence problem	32	26.66
		Water logging near bunds		
6	Farm pond	Risk of deficit rainfall	36	30.00
		Loss of land	24	20.00
III	Tillage operations and planting geometry			
1	Off season tillage and secondary tillage	Labour problem	23	19.16
		Moisture loss	13	10.83
		Increase in operational cost	10	8.33
2	Deep ploughing	Loss of moisture	20	16.66
		Increase in operational cost	48	40.00

Sl. No.	Practices	Reasons	Respondents	
			F	%
3	Wider row spacing	Slower ground cover	72	60.00
		Increase in evaporation	12	10.00
		Increase in fertilizer dosage	18	15.00
4	Paired row spacing	Lack of knowledge about its benefits	71	59.16
		Spread of pest and disease	18	15.00
		Obstruction to cultural operation	15	12.50
5	Protective irrigation from farm pond	Lack of water storage due to temperature	42	35.00
		Seepage losses	22	18.33
IV	Diversification of agriculture			
1	Animal husbandry	Maintenance problem	28	23.33
2	Horticulture	Financial constaints	53	44.16
		Labour problem	44	36.66
3	Poultry	Maintenance problem	56	46.66
		Financial constraints	30	25.00
		Recent health issues	26	21.66
4	Vegetable cultivation	Labor problem	63	52.50
		Lack of Irrigation facilities	27	22.50
5	Vermi- compost	Time consuming operation	45	37.50
		Labour problem	21	17.50
V	Alternate land use systems			
1	Agro forestry	Fragmented land holding	72	60.00
		Damage to food crops	19	15.83
2	Agri-horti systems	Fragmented land holding	82	68.33
3	Agri-pastoral system	Use of dry fodder for animals	88	73.33
VI	Nutrient management			
1	Green leaf manuring	Time consuming operation	40	33.33
		Increase in pest and disease	13	10.83
		Decrease in soil moisture	10	8.33
2	Tank silt application	Labor intensive	76	63.33
		Additional operational cost	26	21.66

Plate 1. Water conservation structure developed by Watershed department in Nagendragada village

Plate2. Researcher interviewing the farmers of Hirekoppa village

Plate 3 Researcher with the progressive farmer of Muradi village

5. DISCUSSION

The discussion of the results of the study is made under the following headings

5.1 Socio-economic characteristics of the farmers

5.2 Knowledge of farmers about drought mitigation technologies

5.3 Adoption of drought mitigation technologies

5.4 Relationship between dependent and independent variables

5.5 ITKs followed by farmers

5.6 Community level drought mitigation practices in study area

5.7 Reasons for non –adoption of drought mitigation practices

5.1 Socio-economic characteristics of the farmers

5.1.1 Age

The results in Table.1 and Fig.2 revealed that, 42.50 per cent of the respondents belonged to middle age category followed by young age (30.83%) and old age categories (26.66%).Usually farmers of middle age are more enthusiastic and have more work efficiency. Middle aged persons have more physical vigour and feel more family responsibility than the young and old ones. This might be the reason to find majority of farmers in middle age group. These results are in agreement with the findings observed by Jamadar (2012) and Sabi (2012).

5.1.2 Education

The results showed that 25.00 per cent of the farmers studied up to high school, while 20.00 per cent and 19.16 per cent farmers studied up to PUC and graduation, respectively. In recent past changes are observed in education level of rural India due to availability of proper educational facilities and better economic

status. These results are in line with the findings of Amol (2006) and Chandrashekhar (2007).

5.1.3 Land holding

Thirty per cent of farmers belonged to medium land holding category, while 22.50 per cent of them belonged to semi medium land holding category

Increase in family members results in fragmentation of ancestors land leading to medium and semi-medium land holdings. The above mentioned results are in line with the findings of Jamadar (2012) and Sabi (2012).

5.1.4 Farming experience

The results pertaining to farming experience revealed that, 45.00 per cent of the respondents had medium farming experience followed by high (37.50%) and low farming experience (17.50%).

Majority of the respondents were middle aged and had high school education. After the formal schooling, they might have started practicing agriculture as their main occupation so the results show more number of farmers under medium farming experience. These results are supported by the findings of Kikon (2010) and Sabi (2012).

5.1.5 Livestock possession

High majority of the respondents possessed cows (87.50%) followed by bullocks (75.00%) and buffaloes (62.50%). Cows and buffaloes provide additional income to the family in terms of milk and manure, which were sold for money or used for their own consumption. The percentage of respondents possessing goats, sheep and poultry was 23.33, 7.50 and 4.16, respectively. Maintenance problem, non-availability of fodder, high cost of concentrates and smaller size of land holding might have made the farmers think twice before going for rearing goats/sheep and poultry birds.

5.1.6 Farm implements possession

High majority of the farmers possessed sprayer (83.33%), harrow (79.16%) and wooden plough (76.66%). Majority of the farmers possessed iron plough (70.00%), bullock cart (66.66%), pump set (56.66%), seed cum fertilizer drill (53.33%) and only 48 per cent of the respondents possessed tractor. (Table.2 and Fig.3)

These are necessary equipments required to carry out important farming activities like ploughing, sowing, spraying and irrigation etc. The possession of necessary equipments also helps to take up timely agricultural operations and can be repaired in the village itself with low cost. The present findings are in line with Chandracharan (2005) and Sowmya (2014).

5.1.7 Extension contact

It was evident from Table.3 and Fig.4 that 36.66 per cent of the respondents had medium extension contact, while equal proportion of the respondents (31.66%) had high and medium extension contact. Farmers need technical guidance to follow drought mitigation practices such as contour bunds, farm ponds, compartment bunds etc. Different subsidies provided under agricultural development programmes also attract farmers to be in touch with the extension official to avail various benefits. These results are in agreement with the findings of Jamadar (2012) and Sowmya (2014).

5.1.8 Cropping system

The data presented in Table.4 revealed that 89.16 per cent of the respondents followed cotton-chilli-onion cropping system, followed by maize–chickpea (43.33%) and 15 per cent of the farmers followed sugarcane-sugarcane cropping system.

Nowadays, farmers perceive agriculture as a commercial activity rather than traditional occupation. So, farmers are more intended towards cash crops such as cotton, chilli and onion. Recently maize is replacing many crops, because it can be easily grown and incidence of pest and disease is less. Further, the market price of

the maize is quite consistently high compared to other crops. Farmers with irrigation facilities in area like mundargi taluk grow sugarcane crop and most of the farmers have farm ponds built under ganga kalyan yojana. These results are in line with the findings of Gamannavar (2009).

5.1.9 Risk orientation

Table.5 and Fig.5 revealed that, 39.16 per cent of respondents had medium level of risk orientation followed by low (37.50%) and high (24.16%) levels of risk orientation. The possible reason could be the dry land nature of farming in the study area. Farmers in such areas tend to possess medium risk based on profits assumed. Farming in dry land involves production risk because of erratic rainfall pattern, smaller land holdings and labour problem. These results are in line with findings of Chandracharan (2005).

5.1.10 Scientific orientation

In their behavior of scientific orientation, 38.33 per cent of respondents had medium level of scientific orientation followed by equal per cent of low and high (30.83%) level of scientific orientation (Table.6 and Fig.5). This could be due to their level of education, and less use of mass media to educate themselves on new and emerging technologies. Besides even rural environment and traditional mind set might have also restricted them to have less orientation to try new scientific technologies. The results are contradictory with the findings of Nithyashree and Angadi (2001) were farmer's possessed high scientific orientation.

5.1.11 Mass media utilization

It was found that 36.66 per cent of the respondents had medium mass media utilization followed by high (34.16%) and low (29.16%) mass media utilization categories (Table.7.1 and Fig.6). The results indicated that mass media like television, radio, news paper and farm magazine are utilized by high percentage of the farmers. It might be due to educational level and sound economic status of the farmers.

The results pertaining to mass media utilization presented in Table 7 revealed that television was the most effective common media which was possessed by a large majority of the farmers (83.33%). Increasing popularity and economic value of television has dominated in its use over the other mass media.

The television viewing, news paper reading and radio listening were mainly for the purposes other than agricultural programmes. The less utility and lack of practicability of information and inconvenient timing of the agricultural programmes may be the reason that could be attributed.

With respect to ICT tools, majority (75.00%) of the respondents never accessed ICT tools because most of the farmers feel it is difficult to handle ICT tools such as smart phones, computers etc. These results are in line with findings of Sowmya (2014).

5.1.12 Intensity of drought

Table 8 and Fig.7 clearly showed that, majority of the respondents (68.33%) were of the opinion that intensity of drought was very mild the previous year followed by 31.66 per cent who opined that it was mild.

The normal rainfall during the cropping period in the study area should be 450 mm. The actual rainfall during the cropping period of 2013-14 was 427.2 mm which was less than 450 mm. This justifies the perception of mild drought in the study area.

5.2 Knowledge of farmers about drought mitigation technologies

The results in Table 9.1 and Fig.8 revealed that, high percentage (40.83%) of the respondents belonged to medium level of knowledge about drought mitigation practices followed by low (30.00%) and high (29.16%) knowledge categories.

Over the years of farming farmers gain the knowledge based on their experience. Apart from over fifty per cent of the farmers were educated ,which might have prompted the respondents to acquire more knowledge and their varying degree of exposure to different mass media and interaction with extension personnel might have helped the respondents to acquire knowledge about drought mitigation practices. These results are in line with findings of Chandracharan (2005) and Naik (2009).

5.2.1 Knowledge of individual drought mitigation technologies by farmers.

The results in Table 9 depicted that more than ninety per cent of the respondents were aware of practices such as organic matter incorporation, seed treatment, mulching, live bunds, secondary tillage/ hoeing and animal husbandry. Farmers usually are familiar with these simple practices and they do not require any special skills and understanding. Added to this fact, the experience over a period of time in dealing with drought might have also added to their awareness.

On the contrary, less than fifty per cent of the respondents were aware of practices viz., contingent crop plans, conservation furrows at 15-20 cm, paired row spacing, protective irrigation and agri-pastoral systems. These are the complex practices and require additional efforts to know and understand their benefits.

5.3 Adoption of drought mitigation technologies

The data from Table 10.1 revealed that, high percentage (38.33%) of the respondents belonged to medium adoption category of drought mitigation practices. Whereas, 32.50 and 29.16 per cent of respondents belonged to high and low adoption categories, respectively.

Knowledge influences the level of action as it is pre requisite for decision making. Besides the knowledge, the resources available with the farmers also have bearing on the adoption. Each farmer tends to modify certain practices to fit into his resource level. Therefore, knowledge coupled with resource availability resulted in medium level of adoption. Percentage of respondents having medium level of

knowledge (40.83%) and medium level of adoption (38.33%) are almost corresponding each other.

Considerable percentage (29.16%) of farmers are found in low adoption category. This calls for the attention of extension machinery to educate the farmers about complex practices of drought mitigation.

5.3.1 Adoption of individual drought mitigation technologies by farmers.

The results in Table 10 revealed that, 60.83 per cent of the farmers adopted seed treatment because seed is the crucial input influencing the yield level. Farmers knowing this fact very well, certainly put sincere efforts in this regard.

Majority of the respondents adopted practices like organic matter incorporation, mulching, live bunds, farm ponds, off season tillage, secondary tillage/hoeing, animal husbandry and vermi-composting because these practices help in additional storage of moisture in the soil profile due to in situ conservation. Ground water recharge maintains soil health leading to reduction in drought risk.

It was very discouraging to observe that very less percentage of the respondents adopted conservation furrows, wider row spacing, paired row spacing, poultry and tank silt application. Practices like wider row spacing and paired row spacing were not adopted because farmers were not aware of the benefits.

5.4 Association between dependent and independent variables

5.4.1 Association between knowledge and independent variables

Age, education, farming experience, extension contact and mass media utilization were having significant association with knowledge of farmers. This implies that each of these variables has considerable influence on the knowledge of drought mitigation practices of farmers. Increase in age increases farming experience which increases the knowledge of farmers. Education is a prime factor which brings changes in behavioural complex of any individual. Extension contact and mass media utilization are greatly influenced by education of farmers.(Table.11)

5.4.2 Association between adoption and independent variables

Age, education, farming experience, extension contact, mass media utilisation and scientific orientation were having significant association with adoption at 0.05 level of probability. Acquisition of formal education helps to interpret ideas in decision making and respondents with high experience in crop cultivation show favourable attitude towards improved technologies. Extension contact provides the farmers an opportunity to expose to the improved practices and technologies. Exposure to mass media modernise farmers and makes them more familiar with drought mitigation practices. (Table.12)

5.5 ITKs practiced by farmers

Indigenous knowledge has both strengths and weaknesses. It is strong in what can be observed and weak at understanding what is not visible. Concepts such as soil fertility and nutrients are difficult to see, but with understanding can be explained in terms acceptable to the farmer (Sharland, 1997).

From Table 13, it was found that majority of the respondents (68.33%) practiced cow dung slurry for seed treatment as cow dung has insecticidal properties and increases germination rate of the seed.

With respect to tillage operations, majority of the respondents practiced zero tillage and dead furrow formation which enhances microbial growth and reduce soil and water erosion.

Less than half number of the farmers practiced broadcasting of soaked seeds. The reason as perceived by farmers was, this practice reduces dormancy and helps in germination of seeds under low soil moisture.

As high as 70.83 per cent of the farmers practiced sheep and goat penning for manuring. The sheep excreta fallen in the field was incorporated in soil which acted as a good source of nutrients.

Majority of the respondents (76.66%) grew catch crops because, a unique mixture of crop species and their genotypes are capable of confronting the menace of pest and disease.

Over seventy per cent of the farmers (74.16%) practiced burning of slashed waste after harvest. The reason behind this practice is that it improves soil fertility and destroys weed seeds.

Early morning harvest is practiced by majority (80.00%) of the farmers for harvesting to reduce grain loss. Mild weather in the morning reduces shattering of the grains.

As high as 85.83 per cent of the farmers practiced mixing of grains with fire wood ash for storage. Very less percentage of the respondents followed use of mud bins (26.66%) for storage. These practices are low cost practices, reduce the attack of rodents, pest / disease and help in better storage of the grains without damage.

5.6 Community level drought mitigation practices in the study area.

Bunding and waste weir were the major practices taken up by the watershed department. Next important practice was forest plantation on bunds followed by horticulture plantation (Table.14).

As the research area is totally a drought prone, the major activity under land treatment would be bunding. Once the field bunds are laid, the bunds can be sown with suitable forest, horticulture and vegetable Species seeds such that, these bunds would stabilise and inturn support the vegetative cover. Bunding is one such activity which also supports generation of additional income to the beneficiary. Fodder species are grown on these bunds also.

The less fertile lands were treated with forestry and horticulture plantations. The major objective of these land treatment activities was to enhance the soil and moisture conservation and support increased availability of surface water.

Apart from these private land treatments, the emphasis was given to watershed treatments such as check dams, nala bunds and community tanks to reduce the impact of drought, which is useful for the community as a whole. The other objective set was ground water recharge (Table.14.1)

5.7 Reasons for non–adoption of drought mitigation practices

Table.15 revealed that high percentage of farmers (46.66%) expressed non-availability of seeds in time as a reason for non adoption of drought resistant varieties. All most all the farmers demand a particular variety of seed leading to non availability. Considerable per cent (35.00%) of farmers expressed lack of guidance and information support as reasons for non adoption of seed treatment and contingent crop plan because they involve scientific information about best suited seed treatment and cropping system in short period.

Thirty per cent of farmers expressed loss of cultivable land in contour bunding because most of the farmers in the study own medium and small land holding. Nearly fifty per cent of the farmers expressed mulching as time consuming operation because utility of these practices are not observable immediately. In case of live bunds, 32.00 per cent of the farmers felt maintenance problem and water logging near bunds. With respect to farm ponds farmers expressed risk of deficit rainfall as the entire study area is under rain fed farming where monsoon plays a major role.

Forty per cent of the farmers felt deep ploughing increases operational cost so farmers are reluctant to invest in such a practice. Sixty per cent of the farmers opined that wider row spacing has slower ground cover which directly reduces the soil moisture leading to low crop stand. Majority of the respondents (59.16%) expressed lack of knowledge about the benefits of paired row system because most of the farmers consider this practice is confined only to sugarcane. Lack of water storage due to temperature leads to non adoption of protective irrigation from

farm pond. Thirty five per cent of the farmers felt this problem because the entire study area is under rain fed farming and monsoon plays a major role for crop production.

High percentage of the farmers expressed maintenance problem in poultry because it requires hygienic conditions, regular feeding and health issues. Financial constraints were felt in horticulture as it involves lot of initial investment. Majority of the farmers felt labor problem in vegetable cultivation. Most of the vegetables are short durated which needs to be harvested frequently leading to high labor requirement.

Majority of the farmers expressed fragmented land holding and use of dry fodder for animals as the reasons for non adoption of agro-forestry, agri-horti system and agri-pastoral system because most of the farmers in the study belonged to small and medium land holding categories and farmers are reluctant in investing for green fodder production, for live stock rather, they use crop residue as a fodder.

Majority of the farmers felt tank silt application as labor intensive. Non availability of the labors was a severe problem as the young generation gets engaged in non agricultural operations.

6. SUMMARY AND CONCLUSIONS

There is ample scientific evidence to suggest that productivity of drought prone areas can be enhanced significantly on a sustainable basis, provided the two basic natural resources, soil and rainwater, are managed in a judicious manner. Over the last several decades, researchers have concentrated on methods of increasing crop production under dryland conditions in order to mitigate drought effects at farm level. Simple easily implementable practices were developed for increasing the yields even in dry years over farmers' practices. To meet the weather aberrations, conservation of natural resources, alternate land use systems and diversification of agriculture forms important components. Above all, drought planning must be viewed as a dynamic process requiring continued attention. Keeping this in the view, the present investigation was designed to understand drought mitigation practices followed by the farmers with the following specific objectives

1. To assess knowledge and adoption of recommended drought mitigating technologies.

2. To document the ITKs of drought mitigation.

3. To enlist the community approaches of drought mitigation.

4. To elicit reasons for non-adoption of recommended drought mitigating technologies.

The study was an "ex-post facto" research carried out in Gadag district of Karnataka during the year 2014-15. Gadag district was purposively selected for the study, as it is "drought prone district". Twelve villages from four taluks were selected. From each village, ten farmers were selected randomly. Thus, a total of 120 farmers constituted sample for the study. The data was collected by using structured interview schedule developed for the study. The collected data was analysed by using frequency, percentage, mean, standard deviation and chi-square test.

Major findings:

1. Higher percentage of the respondents (42.50%) belonged to middle age, followed by young age and old age categories. Higher proportion of the respondents (25.00%) studied up to high school level and 19.16 per cent of the respondents were graduates.

2. Thirty per cent of the farmers belonged to medium land holding category and 45.00 per cent of the farmers had medium farming experience. High majority of the respondents possessed cows (87.50%) followed by bullocks (75.00%) and buffaloes (62.50%) and 36.66 per cent of the respondents belonged to medium farm implements possession category.

3. Nearly forty per cent of the farmers (36.66%) had medium extension contact. Majority of the respondents (89.16%) followed cotton-chilli-onion cropping system and 39.16 per cent of farmers had medium level of risk taking ability.

4. Higher proportion of the farmers (38.33%) had medium level of scientific orientation and 36.66 per cent of the farmers had medium mass media utilization. Majority of the respondents (68.33%) were of the opinion that intensity of drought was very mild in previous year.

5. Nearly forty per cent of the farmers belonged to medium level of knowledge about drought mitigation practices.

6. Regarding pre-sowing arrangements, cent percent of the farmers were aware about organic matter incorporation and seed treatment (96.66%).

7. With respect to land grading and conservation of natural resources, majority of the farmers were aware of live bunds (97.50%) followed by mulching (96.66%).

8. Very high majority of the farmers (93.33%) were aware of secondary tillage/hoeing (93.33%) followed by off season tillage (88.33%) in case of tillage operations and planting geometry.

9. Regarding diversification of agriculture, cent per cent of the farmers were aware of animal husbandry followed by vermi-compost (78.33%).

10. Majority of the farmers (87.50%) were aware of green leaf manuring.

11. High percentage (38.33%) of the respondents belonged to medium adoption category of drought mitigation practices.

12. Majority (85.00%) of the farmers adopted organic matter incorporation. Less per cent of the farmers (21.66) adopted contingent crop plans.

13. Majority of the farmers (73.33%) adopted live bunds. Only 9.16 per cent of the farmers adopted conservation furrows at 15-20cm.

14. More than sixty per cent of the farmers adopted secondary tillage/ hoeing and off season tillage in case of tillage operations and planting geometry.

15. High percentage (76.66%) of the farmers adopted animal husbandry and only 6.66 per cent of the respondents adopted poultry with regard to diversification of agriculture.

16. Less than thirty five per cent of the respondents adopted agro forestry, agri-horti systems and agri-pastoral systems in case of alternate land use systems.

17. Nearly fifty per cent of the farmers adopted green leaf manuring and only 15.00 per cent of the respondents adopted tank silt application.

18. Age, education, farming experience, extension contact, mass media utilisation were having significant association with knowledge of drought mitigation practices.

19. Age, education, farming experience, extension contact, mass media utilisation and scientific orientation were having significant association with adoption of drought mitigation practices by farmers.

20. With respect to ITKs, majority of the respondents (85.83%) practiced mixing of grains with neem seeds/leaves for storing and eighty per cent of the farmers practiced early morning harvest to reduce the grain loss.

21. Bunding and waste weir were the major practices taken up by the watershed department at community level for drought mitigation.

22. Majority of the farmers expressed labour problems (63.33%), lack of knowledge (59.16%), time consuming operation (55.00%) and fragmented land holdings (60.00%) as the major reasons for non-adoption of drought mitigation practices.

IMPLICATIONS OF THE STUDY

The current study brought out certain important findings which have got direct bearing on those involved in technology transfer and policy making. They are detailed below.

1. Majority of the respondents belonged to medium level of knowledge regarding drought mitigating practices. This indicates a vast scope for the line departments to intervene and improve the knowledge level of farmers about improved and low cost drought mitigating practices.

2. Conservation furrows (9.16%), paired row spacing (13.33%), wider row spacing (15.00%), poultry (6.66%), contingent crop plans (21.66%) and alternate land use systems were the practices adopted by less number of respondents. However, these are the practices which are crucial for soil/ water conservation and sustainable yield levels. These are crucial interventions to enhance their adoption by establishing model demonstration units by line departments to convince and build confidence of farmers.

3. The identified indigenous technologies viz., puffed rice application and sowing the seeds embedded in cow dung implied that farmers are active experimenters. These are the issues for scientific validation and further research.

4. Majority of the farmers expressed obstruction for cultural operations and loss of cultivable area as constraints for non adoption of drought mitigation practices. This calls for the attention of extension agency to change the mindset and educate the farmers about long range benefits of soil and water conservation structures.

Suggestions for future research

1. There is need to validate the indigenous technical know hows identified to mitigate the drought and popularise among farmers.

REFERENCES

Aher, S. B and Pawar, J. R., 2013, Socio-economic and environmental impact of participatory watershed management programme: A case study of sundarwadi watershed in Maharashtra. *J. Chem. Bio. Phy. Sci. Sec. D.*, 3(1): 637-645.

Anastasi, A., 1961, *Psychological testing*, Macmillian Company, New York. p.428-436.

Anonymous, 1992, Ministry of Rural Development, Government of India vide circular No. 280-12/16/19 RD-III (Vol. 2).

Anonymous, 2011, Drought preparedness and mitigation. *Policy Paper 50*, National Academy of Agricultural Sciences, New Delhi. p 4-5.

Anonymous, 2014, *Annu. Rep.* Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

Bagadi, G. L., Samra, J. S. and Kumar, V., 2001, People's participation in soil and water conservation programme in sardar sarvour project catchment. *Indian J. Soil Conser.,* 30(2): 179-180.

Benal, D., Patel, M. M., Jain, M. P. and Singh, V. B., 2010, Adoption of dryland technology. *Indian. J. Dryland Agric . Res. Dev.*, 25(1): 1-3.

Bhagwat, M. R. and Gohad, V. V., 2003, Adoption of dryland cotton cultivation technology by the farmers. *Maharashtra J. Ext. Edu.,* 22(2): 108-110.

Bheemappa, A., 2001, Comparative analysis of knowledge and technological gap in adoption of paddy and cotton cultivation practices between migrant and nonmigrant farmers of TBP command area in Karnataka. *Ph. D. Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Chandracharan, V., 2005, Profile of Sujala watershed project beneficiary farmers in Dharwad district of Karnataka state. *M. Sc. (Agri) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Chandrashekhar, S. K., 2007, Analysis of onion production and marketing behavior of the farmers in Gadag district of Karnataka state. *M. Sc. (Agri) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Chandaragi, D.M. ,1996, Study on leadership styles of extension workers. *Ph.D. Thesis*, Univ. Agric. Sci., Dharwad (India).

Chetan, M. G., 2011, A study on knowledge and adoption of cardamom cultivation practices by the farmers of Chikmagalur district. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Chetrry, G. N. and Belbahri, L., 2009, Indigenous pest and disease management practices in traditional farming systems in north east India. *J. Plant Breed. Crop Sci.* 1(3): 28-38.

Dange, M. T., 2012, Mechanization needs of sugarcane growers in Belgaum district. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci. Dharwad, Karnataka (India).

Datta, K. K. and Dayal, B., 2000, Irrigation with poor quality water : An empirical study of input use, economic loss and cropping strategies. *Indian J. Agric. Econ.,* 55(1): 28-37.

Desai, B. R., Waman, G. K. and Girnse, K. A., 2000, Adoption of recommended technology for rainfed cotton NHH- 44. *Maharashtra J. Ext. Edu.,* 19: 165-169.

Devappa, V. M., Khageshan, P., Mise, S. R and Dwarakish, G. S., 2009, Meteorological drought events –A case study of Gulbarga district in Karnataka. *International J. Earth Sci. Eng.,* 2(2): 165-172.

Dolli, S. S., Biradar, B. and Karki, M., 2013, Community ownership building through participation and contribution in natural resource management. Paper presented In: *International Conference on Extension Educational Strategies for Sustainable Agricultural Development.* UAS, Bangalore, December 5-8. pp. 60

Eshwarappa, G. and Doddamani, A., 2013, Impact of irrigation tanks rehabilitation on livelihood of farmers in southern Karnataka. Paper presented In: *International Conference on Extension Educational Strategies for Sustainable Agricultural Development.* UAS, Bangalore, December 5-8, p.45.

Gamannavar, S. B., 2011, Impact of sujala watershed development programme in Dharwad district of Karnataka. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Gamannavar, S. B. and Halakatti, S. V., 2013, Benefits and constraints of sujala watershed development programme in Dharwad. Paper presented In: *International Conference on Extension Educational Strategies for Sustainable Agricultural Development.* UAS, Bangalore, December 5-8. pp. 57.

Ghosh, S., Kumar, A., Nanda, P and Chandra, D., 2007, Institutional arrangements and linkage mechanism for water management in Orissa's agriculture. *Indian Res J. Ext. Edu.*, 9(2): 28-34.

Gore, P. G., Thakur, P and Hatwar, H. R., 2010, Mapping of drought areas over India, *National Climate Centre*, Indian Meteorological Department, Pune. p.5.

Gour, A. K., 2002, Factors influencing adoption of some improved animal husbandry practices of dairying in Anand and Vadodara districts of Gujarat State. *Ph. D. Thesis*, Univ. Agric. Sci., S. K. Nagar, Gujarat (India).

Govindagowda, V., Lakshminarayana, M. T. and Chandrashekhar, S. V., 2000, Knowledge of farmers on dryland farming practices in groundnut cultivation. *J. Ext. Edu.,* 11(1): 2651-2655.

Huded, S., 2013, Perceived attributes of IPM technologies as perceived by Bt cotton growers. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Hulagur, B. F., 2006, Watershed development–NABARD initiatives. *Technical digest.,* 6: 1-4.

Ito Kasumi, Takeya Hiroyuki and Ourayumi, 2001, NGO involvement in bilateral aid project for community forestry in Nepal. *Indian J. Agric*., 8: 7-20.

Jagadale, U. D., Shinde, S. B. and Kolgane, B. T., 2013, Knowledge and adoption of dryland technology for rabi jowar. Paper presented In: *International Conference on Extension Educational Strategies for Sustainable Agricultural Development.* UAS, Bangalore, December 5-8, pp. 35.

Jamadar, R., 2012, Farmers awareness of climate change and their adaptations. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Jirli, B. and Kumari, N., 2005, Documentation and validation of convectional seed storage methods: A key for managing rural resources. Paper presented In: *National Seminar on Appropriate Extension Strategies for Management of Rural Resources.* UAS, Dharwad. December 18-20. pp.166.

Kadam, J. R., Patil, V. G. and Hardikar, D. P., 2001, Knowledge and adoption of soil and water conservation practices in watershed development project. *Maharashtra J. Ext. Edu.,* 20 : 138-140.

Kalaskar, A. P., Raut, U. S., Chole, R. R. and Kapse, P. S., 2007, Knowledge and adoption of indigenous technologies about agriculture and allied fields by tribal farmers, Paper presented In: *National Seminar on Appropriate Extension Strategies for Management of Rural Resources.* UAS, Dharwad. December 18-20. pp.152.

Kharamtol, S. N., 2006, Impact of trainings conducted on vermicompost by Krishi Vigyan Kendra, Bijapur. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Khatik, G. L., 1993, Adoption of soil and water conservation technologies. *Indian J. Ext. Edu.,* 42(3): 47-48.

Khin Mar Oo, 2005, Knowledge and adoption of improved dairy management practices by women dairy farmers in Dharwad district. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Kikon, W., 2010, Adoption gap in groundnut production in northern transition zone of Karnataka. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Kulshresta, A. and Kushwaha, T., 2010, Adoption of watershed technologies by the farmers in Morena district of Madya Pradesh. *Indian Res. J. Ext. Edu.,* 10(2): 58-60.

Kulshrestha, A., Sen, S. and Singh, Y. K., 2014, Study of technological knowledge level about watershed practices in Morena District of Madhya Pradesh. *Indian Res. J. Ext. Edu.,* 15 (1): 89-93.

Kumar, N and Singh, R. P., 1995, Fertiliser use in dryland: An in-depth study of farmers knowledge. *Maharashtra J. Ext. Edu.,* 14(1): 167-170.

Lakshminarayana, M. T., Bhaskar, V. and Sarlakumari., 2005, People's participation in the conservation and development of forests. Paper presented In: *National Seminar on Appropriate Extension Strategies for Management of Rural Resources.* UAS, Dharwad. December 18-20. pp.178.

Lal, C. and Verma L. R., 2006, Indigenous technological knowledge on soil and water management in Himachal. *Indian J. Trad. Know.*, 7(3): 485-493.

Lingappa, S. and Itnal, C.J., 2003, Drought proofing and contingent crop planning in northern Karnataka. Tech. Bull. No.24: Univ. Agric. Sci., Dharwad, Karnataka (India).

Madhu, B. M., 2010, Technological gap in turmeric production practices in Belgaum district. *M. Sc.(Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Manjunatha, B. N., Lakshminarayana, M. T. and Vaster, C. S., 2002, Adoption pattern of sustainable water management practices by sugarcane farmers. *J. Agric. Sci.,* 14(4): 1115- 1117. Z

Maraddi, G. N., Meti, S. K. and Tulasiram, J., 2014, Extent of adoption of improved technologies by groundnut farmers and constraints analysis, *Karnataka J. Agric. Sci.,* 27(2*):* 177-180.

Mavinakatti, J., 2013, Knowledge and opinion of farmers regarding Bhoochetana programme. *M.Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Modi, D. R., 2010, Knowledge and adoption of post-harvest management practices among the mango growers of Northern Karnataka. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Mohapotra, S., Dash, S. R and Sahoo, B. K., 2007, Storage of cowpea and hill arhar through indigenous technical knowledge in Kandhamal district of Orissa. Paper presented In: *National seminar on Appropriate Extension Strategies for Management of Rural Resources.* UAS, Dharwad. December 18-20. pp. 162.

More, M. R., Jadhav, S. N. and Penke, M. S., 2000, Impact of training of KVK on knowledge and adoption of cotton cultivation practices. *Maharashtra J. Ext. Edu.,*19: 200.

Moulasab, Sankal, Mallanagoda and Patil, D. H., 2007, Established ITKs practices for weather forecast and seed germination. Paper presented In: *National Seminar on Appropriate Extension Strategies for Management of Rural Resources.* UAS, Dharwad. December 18-20. p. 158.

Moyo, B., Dube, S. and Moyo, P., 2013, Rangeland management and drought coping strategies for livestock farmers in the semi-arid Savanna communal areas of Zimbabwe*. J. Hum Ecol.,* 44(1): 9-21.

Muthuraman, P. and Meera, S. N., 2011, Indigenous technical knowledge in rice cultivation, Directorate of Rice Research (ICAR) Hyderabad.

Nagabhushanam, K and Nanjaiyan, K., 2001, Knowledge of eco- friendly practices among watershed farmers. *Karnataka J. Agric. Sci.,* 14(4): 977-980.

Nagadev, B. and Venkataramaih, P., 2007, Characteristics of integrated pest management (IPM) trained dry paddy farmers. *Andhra Agric. J.,* 54(3&4): 240-242.

Nagaraj, K. H., 1996, Knowledge and adoption pattern of improved cultivation practices of groundnut among farmers of Pavagada taluk in Tumkur district. *M. Sc. (Agri) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Nagaraja, B. C., Somashekar R. K. and Kavitha. A., 2004, Impact of drought on agriculture: challenges facing poor farmers of Karnataka, south India. *Dept. of Environmental Sciences.,* Bangalore.

Naik, S. B., 2009, A study on knowledge and adoption of *Bacillus thuringiensis* (Bt) cotton practices followed by farmers in Haveri district. Karnataka, *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Naik, G. R. and Jayaramaiah, K. M., 1997, Adoption of watershed management practices and productivity levels attained by farmers in Mittemari watershed. *Indian. J. Ext. Edu.,* 33(1&2): 53-57.

Naik, Y. K. G. L., Jahagirdar, K. A., Natikar, K. V. and Hawaldar, Y. N., 2010, A study on knowledge and adoption level of integrated crop management practices by the participants of farmers field school on maize. *Karnataka J. Agric. Sci.*, 23(2): 386-389.

Naik , Y. K. G. L., 2008, A study on knowledge and adoption level of integrated crop management practices by the participants of farmers field school on maize. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Nayak, B. R., 2007, A study on management practices of pineapple growers in Karnataka. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Nirban, A. A., 2006, A study on indigenous technical knowledge about rice cultivation and bovine health management practices in Konkan region of Maharashtra. *Ph.D. Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Nirmala, B., 2003, Impact of watershed development programme on socio-economic status of chilli growers in Guntur district of Andhra Pradesh. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Nithyashree, D. A and Angadi, J. G., 2001, A study on knowledge and adoption of IPM practices among cotton growers of Raichur district. *Karnataka J. Agric. Sci.,* 14(4): 992-993.

Patil, N., 2005, A study on knowledge, extent of participation and benefits derived by participant farmers of the watershed development programme in Raichur district of Karnataka state, *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Patil , R., Bhairappanavar, S. T., Madhu Prasad, M. L . and Moulasab., 2007, Documentation of ITKs and their use pattern in plantation crops in Davanagere district. Paper presented In: *National Seminar on Appropriate Extension Strategies for Management of Rural Resources.* UAS, Dharwad. December 18-20. pp.150.

Patil, V. G. and Mahadik, R. P., 2007, Established indigenous knowledge in forestry crops, Paper presented In: *National Seminar on Appropriate Extension Strategies for Management of Rural Resources.* UAS, Dharwad. December 18-20. p. 162.

Pawar, S., 2014, Technological gap in pepper cultivation in Uttara Kannada district. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Prabhakar, S. V. and Shaw, R., 2007, Climate change adaptation implications for drought risk mitigation: A perspective for India*. J. Climatic change.,* 10(1)*:* 1-18

Prasad, M. S., 1995, Adoption of dry land agricultural technologies by farmers of Rangareddy district of Andhra Pradesh. *Ph. D. Thesis*, Univ. Agric. Sci. Dharwad, Karnataka (India).

Prasad, M. S and Mahipal., 1995, Technological gap and constraints in adoption of sorghum cultivation in dryland agriculture. *Maharashtra J. Ext. Edu.,* 10(1): 31-40.

Prasad, M. S., Sundarswamy, B. and Anasari, M. R., 2000, Adoption pattern of dryland agricultural technologies by farmers of Andhra Pradesh. *Karnataka J. Agric. Sci.,* 13(3): 665-669.

Pushpendra, S. R and Ajay Kumar., 2013, Assessment of meteorological drought in Satna district. Madhya Pradesh. *Uni. J. Env. Res. Tech.,* 3(5): 538-543.

Pushpendra, S. R and Ajay Kumar., 2014, Assessment of environmental stress as meteorological drought due to rainfall variability in Jaipur, Rajasthan. *Int. J. Sci. Res. Know.,* 2(11): 509-516.

Raghavendra, K. M., 2010, An impact study on farmer's knowledge and adoption level of sunflower frontline demonstrations in Bijapur district of Karnataka state. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad (India).

Raghavendra, R., 2005, Knowledge and adoption of recommended cultivation practices of cauliflower growers in Belgaum district of Karnataka. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Rao, R. C. A., Reddy, Y. V. R., Sastry and Ramakrishana, Y. S., 2004, A comparative analysis of performance of watershed development programmes in India. *Indian J. Agric. Econ.*, 59(3): 369.

Ranganath, A. D., 2002, Identification of Indigenous farm practices followed by Soliga tribals. *M. Sc.(Agri.) Thesis*, Univ. Agri. Sci., Banglore, Karnataka (India).

Rathore, M. S., 2004, State level analysis of drought policies and impacts in Rajasthan. India, *International Water Management Institute.* Colombo, Sri Lanka*:* 40. (Working paper 93: Drought Series Paper No. 6).

Rockstrom, J., Nuhu, H., Theib, Y. and Oweisand, W., 2007, Managing water in rain-fed agriculture. *International Water Management Institute.* Colombo, Srilanka: 315-348.

Sabi, S., 2012, Knowledge and technological gap in wheat production. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Santosh., 2013, Study on perception of national horticulture mission and its impact on crop diversification among the beneficiaries in Dharwad district. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Satish., 2010, Farmers perceptions, preferences and utilization of sri and traditional paddy straw for livestock. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Satyanarayana, P. N., 2002, An evaluation study of watershed programme in Tumkur district. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Saxena, K. K. and Singh. R. L., 2000, Adoption of organic farming practices by farmers of Malwa region. *Maharashtra. J. Ext. Edu*., 19:53-58.

Sengupta, T., 1967, A study on adoption scale for selection of farmers for high yielding varieties programme on rice*. Indian. J. Ext. Edu.,* 3(3): 107-115.

Shashidhara, K. K., 2003, A study on socio-economic profile of drip irrigation farmers on Shimoga and Davengere district of Karnataka. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Shashidhara, K. K., 2012, Adoption of eco-friendly technologies by cotton growers. *Indian Res. J. Ext. Edu.,* Special Issue 2(1): 217-221.

Sharland, R. W., 1997, Understanding traditional perception of wood ash: A means of communicating soil fertility. *ILEIA Newsletter.* 13(3): 28-29.

Sharma, S., 2003, Rethinking watershed development in India: Strategy for the twenty-first century. Paper presented In: *Asian Regional Workshop on Watershed Management*. Nepal . September 11-13. p-1-7.

Shinde, P. S ., Vaidya, V. R. and Sapute, S. K., 2000, Identification and adoption of indigenous agricultural practices by dryland farmers. *Maharashtra J. Ext. Edu* ., 19: 259-263.

Sidram, 2008, Analysis of organic farming practices in pigeon pea in Gulbarga district of Karnataka. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Sowjanya, N., 2014, Management efficiency of dairy farm women. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Sowmya, N., 2014, Analysis of change in cropping system in northern transitional zone of Dharwad district. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Sridhara, K., 2002, An evaluative study of watershed programme in Pavagad taluk of Tumkur district in Karnataka. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

Sriram, N. and Palaniswamy, A., 1999, Farmers extent of adoption of eco-friendly agricultural practices in cotton cultivation. *J. Ext. Edu.,* 10(1): 2318-2323.

Sudhakar, B. and Kanagasabapathi. K., 2002, Awareness and adoption of integrated pest management practices in cotton cultivation. *J. Ext. Edu.* 13(3): 3364-3367.

Sumitra, A., 1991, Economics of agroforestry: Two case studies. *Agroforestry System,* 5(1): 8- 11.

Sunil Kumar, G. M., 2004, A study on farmers knowledge and adoption of production and post-harvest technology in tomato crop of Belgaum district in Karnataka. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Suresh Kumar, 2009, Technological gap in adoption of improved cultivation practices by soybean growers. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Supe, S. V., 1969, Factors related to different degrees of rationality in decision making among farmers in Buldana district. *Ph.D. Thesis*, Indian Agricultural Research Institute, New Delhi.

Swami, S., 2006, A study on technological gap and constraints of bidi tobacco cultivation in Belgaum District, Karnataka state*. M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Temkar, G. K., 2000, A study on extent of knowledge and attitude towards artificial insemination in the milch animals of the dairy farmers of Anand district. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., S. K. Nagar, Gujarat (India).

Tripathi, K. P. and Sharda, V. N., 2014, Mitigation of impact of climate change through watershed management. *J. Agril. Ext.,*48 (1): 24-32.

Vekaria, R. S., Pandya, R. D. and Thumar, D. N., 2000, Knowledge and adoption behavior of rain fed groundnut growers. *Indian J. Ext. Edu.,* 33(1&2): 10-13.

Verma, A. R., Rajut, A. M. and Srivastava, 2004, Economic evaluation of national Watershed development programme for rainfed agriculture in Indore district of Madhya Pradesh. *Indian J. Agric. Econ.*, 59(3): 368-369.

Wadear, P. R., Kiresur, V. R. and Gaddi, G. M., 2003, Human labour absorption in dairy farming in Karnataka – An economic analysis. *Rural India.,* 66(12) : 243-247.

Waghmore , R. S. and Ingle, P. O., 2001, Awareness and adoption of soil and water conservation practices by the farmers of saline tract of purna valley. *Maharashtra J. Ext. Edu.*, 20: 88-91.

APPENDIX
INTERVIEW SCHEDULE

TITLE : Knowledge and adoption of drought mitigating technologies followed by farmers of Gadag district

Respondent no:

PART-1

A. GENERAL INFORMATION:

Name of the farmer:

Village:

Taluk:

District:

Mobile number:

B .PERSONAL AND SOCIO-ECONOMIC CHARACTERISTICS:

1.Age:_____ in completed years

2.Education level: _____

3.Size of the land holding (acres):

- Irrigated:_____
- Dry land:_____
- horticulture land:_____
- Leased in:_____
- Leased out:_____
- Total:_____

4.Farming experience:_____years

5.Cropping system:

Season	Crops	Area under the crop. In acres
Kharif		
Rabi		
summer		

6. INTENSITY OF DROUGHT: $\frac{\text{Total number of drought months in year}}{12} \times 100$

7. LIVESTOCK POSSESSION: Please give the details of livestock possessed.

Livestock	Breed name	Number
Bullock		
Cow		
Buffalo		
Goat		
Sheep		
Poultry		

8. FARM IMPLEMENTS: Please give the details of implements possessed.

MATERIALS	NUMBER
Wooden plough	
Iron plough	
Harrow	
Sparyer	
Bullock cart	
Tractor	
Pumpset	
Seed cum fertiliser drill	
Any other	

9. EXTENSION CONTACT: How often do you contact the following extension workers

Sl. no	Extension workers	Frequency of contact				
		Once in week	Once in fortnight	Once in month	When problem arises	Never
1	AAO					
2	AO					
3	Scientists of KVK					
4	Agril. Field officers of bank					
5.	Relevant extension personnel					
6	Others(specify) a. b.					

10. MASS MEDIA UTILISATION: please indicate how often you use mass media.

Sl.no	Mass media sources	Subscriber/possessed	programmes	Frequency of use		
				Regular	Occasionally	Never
1	Radio		General			
			Agricultural			
2	Television		General			
			Agricultural			
3	News paper		General			
			Agricultural			
4	Farm magazine		General			
			Agricultural			
5.	ICT tools.(specify)		General			
			Agricultural			

11. RISK ORIENTATION: Please indicate whether you agree or disagree with the following statements.

Sl. no	Statement	Agree	Undecided	Disagree
1	A farmer should grow large number of crops to avoid greater risks involved in growing one or more crops.			
2	A farmer should rather take more of a chance in making a big profit rather than to be content with smaller but less risky profits.			
3	A farmer who is willing to take greater risks than the average farmer usually have better financial condition.			
4	It's good for a farmer to take risks when he knows his chance of success is high.			
5	It is better for a farmer not to try new drought mitigation practices unless most other farmers have used them.			
6	Trying an entirely new method in drought mitigation by farmer involves risk, but it's worth.			

12. SCIENTIFIC ORIENTATION: Please indicate do you agree or disagree with the following statements.

Sl. no	Statements	Agree	Undecided	Disagree
1	New methods of drought mitigation give better results to a farmer than the old methods.			
2	The way our forefathers practised drought mitigation practices are still the best way even today.			
3	Even farmer with lot of experience should use new methods of drought mitigation.			
4	Though it takes time for a farmer to learn new methods of drought mitigation it is worth of efforts.			
5	A good farmer experiments with new methods in drought mitigation.			
6	Traditional methods of drought mitigation have to be changed in order to raise levels of livings of farmers.			

PART-2

KNOWLEDGE AND ADOPTION : Please provide the details on the following aspects of drought mitigation practices.

Sl. no	Practices	Awareness Knowledge		Adoption		Reasons for non-adoption
		Yes	No	Adoption	Non adoption	
1.	PRE –SOWING ARRANGEMENTS					
a)	Organic matter incorporation					
b)	Use of drought resistant varieties					
c)	Seed treatment					
d)	Contigent crop plans					
2.	LAND GRADING AND CONSERVATION OF NATURAL RESOURCES					
a)	Contour bunding					
b)	Conservation furrows at 15-20cm					
d)	Compartment bunding					
e)	Mulching					
f)	Live bunds					
i)	Farm pond					
3.	TILLAGE OPERATIONS AND PLANTING GEOMETRY					
a)	Off- season tillage					
b)	Secondary tillage/hoeing					
c)	Deep ploughing					
d)	Wider row spacing					
e)	Paired row spacing					
f)	Protective irrigation from farm pond					
4.	DIVERSIFICATION OF AGRICULTURE					
a)	Animal husbandry					
b)	Horticulture					
c)	Poultry					
d)	Vegetables cultivation					
e)	Vermi-compost					
5.	ALTERNATE LAND USE SYSTEMS					
a)	Agroforestry					
b)	Agri-horti system					
c)	Agri-pastoral system					
6.	NUTRIENT MANAGEMENT					
a)	Green leaf manuring					
b)	Tank silt application					

PART-3

Please provide information regarding ITKs used in following aspects.

Sl. no	Farm activities	ITKs used by farmers
1	Local varieties/HYVs/Hybrids if any	
2	Seed treatment	
3	Tillage operations	
4	Sowing	
5	Manuring	
6	Pest and disease control	
7	Weed control	
8	Harvesting	
9	Storage	

PART-4

Community based drought mitigating technologies:

(The following information will be collected from government institutes such as watershed department or agriculture office).

Watershed: Treatment details.

Activity	Year	Area covered in ha	No. Of beneficiaries
Bunding			
Waste weir			
Entire horticulture plantation			
Forestry plantation on bunds			
Grass plantation			
Drought proof models Simarouba + jatropha)			

Activity	Year	Time span	Area covered in (ha)	Farmers participated
Check dam				
Nala bunds				
Community tanks				
Others				

KNOWLEDGE AND ADOPTION OF DROUGHT MITIGATING TECHNOLOGIES FOLLOWED BY FARMERS OF GADAG DISTRICT

VIJAYLAXMI B. SOMANATTI 2015 Dr. J. G. ANGADI
MAJOR ADVISOR

ABSTRACT

The present study was conducted in Gadag district of Karnataka state during 2014-15 to assess the knowledge and adoption of drought mitigation technologies. The sample for the study consisted of 120 farmers. Ex-post facto research design was used for the study. The data was collected by personal interview method.

High percentage (40.83%) of the farmers belonged to medium level of knowledge about drought mitigation practices. Cent per cent of the farmers were aware about organic matter incorporation. More than ninety per cent of the farmers were aware of seed treatment (96.66%), live bunds (97.50%), mulching (96.66%) and secondary tillage/hoeing (93.33%).

Nearly forty per cent (38.33%) of the farmers belonged to medium adoption category of drought mitigation practices. High majority (85.00%) of the farmers adopted organic matter incorporation, live bunds (73.33%) and animal husbandry (76.66%). More than sixty per cent of the farmers adopted secondary tillage/ hoeing and off season tillage in case of tillage operations and planting geometry. Less than thirty five per cent of the farmers adopted agro forestry, agri-horti systems and agri-pastoral systems in case of alternate land use systems.

Majority of the farmers (68.33%) practiced cow dung slurry treatment for seed treatment followed by cow urine treatment (31.66%) as the important ITKs. Early morning harvest was practiced by 80.00 per cent of the farmers for harvesting. Bunding and waste weir were the major practices taken up by the watershed department covering over 12,483 ha and 11,012 ha of area, respectively as the community level approaches of drought mitigation.

Majority of the farmers expressed labour problems (63.33%), lack of knowledge (59.16%), time consuming operation (55.00%) and fragmented land holdings (60.00%) as the major reasons for non-adoption of drought mitigation practices.