

**COMPARATIVE STUDY OF SUGARCANE GROWERS USING
CONVENTIONAL IRRIGATION AND DRIP IRRIGATION
SYSTEM IN KOLHAPUR DISTRICT**

by

Miss. Jadhav Sanyogita Sanjay
(Reg. No. K-17/201)



**EXTENSION EDUCATION SECTION
RCSM COLLEGE OF AGRICULTURE
KOLHAPUR**

**MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI-413722 DIST-AHMEDNAGAR
MAHARASHTRA, INDIA**

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A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI- 413722, DIST- AHMEDNAGAR
MAHARASHTRA STATE, INDIA

In partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION



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**EXTENSION EDUCATION SECTION
RCSM COLLEGE OF AGRICULTURE
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MAHARASHTRA, INDIA**

2019

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part
there of has not been submitted
by me or other person to any
other University or Institute
for a Degree or
Diploma

Place : Kolhapur

(S. S. Jadhav)

Date : / / 2019

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CERTIFICATE

This is to certify that the thesis entitled, “**Comparative study of sugarcane growers using conventional irrigation and drip irrigation system in Kolhapur district**” submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE) in AGRICULTURAL EXTENSION**, is a record of a bonafide research work carried out by **MISS. JADHAV SANYOGITA SANJAY** under my guidance and supervision and that no part of the thesis has been submitted for any other degree or diploma

The assistance and help received during the course of this investigation and sources of literature referred to have been duly acknowledged.

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This is to certify that the thesis entitled, “**Comparative Study of Sugarcane Growers Using Conventional Irrigation and Drip Irrigation System in Kolhapur District**” submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE) in AGRICULTURAL EXTENSION**, is a record of a bonafide research work carried out by **MISS. JADHAV SANYOGITA SANJAY** under the guidance and supervision of **Dr. V. J. TARDE** (Professor of Agricultural Extension) and that no part of the thesis has been submitted for any other university for degree, diploma or publication in other form.

Place : Kolhapur.

Date : / / 2019

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Associate Dean

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(Sanyogita S. Jadhav)

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LIST OF ABBREVIATIONS

Rs.	Rupee(s)
%	Per cent
@	at the rate of
Agri.	Agriculture
Agril.	Agricultural
Cm	Centimeter
e.g.	For example
<i>et al.</i>	Et alli (and other)
etc.	Et cetra
Extn.	Extension
Fig.	Figure(s)
Govt.	Government
ha.	Hectare (S)
i.e.	Id est. (That is)
<i>J.</i>	Journal
Kg	Kilogram(s)
KVK	KrishiVigyan Kendra
No.	Number
R	Pearson correlation coefficient
<i>Res.</i>	Research
SD	Standard Deviation

ABSTRACT

COMPARATIVE STUDY OF SUGARCANE GROWERS USING CONVENTIONAL IRRIGATION AND DRIP SYSTEM IN KOLHAPUR DISTRICT

By

Miss. JADHAV SANYOGITA SANJAY

A candidate for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION**2019**

Research Guide**: Dr. V. J. Tarde****Department****: Extension Education**

The present investigation “Comparative Study of Sugarcane Growers Using Conventional Irrigation and Drip Irrigation System in Kolhapur District” was designed conducted in Hatkanangale and Karvir tahsil of Kolhapur district. Six villages from each tahsil and 10 respondents from each village were selected according to their method of irrigation. Data were collected by personally interviewing 120 sugarcane growers with the help of specially designed interview schedule. Statistical tools such as frequency, percentage, mean and standard deviation were used for grouping the data. Coefficient of correlation ‘r’ was computed to find out relationship between selected characteristics of sugarcane growers with their method of irrigation.

The findings indicated that maximum number of the respondents were educated up to college level (37.50 per cent), marginal land holding (47.50 per cent), medium annual income (92.50 per cent), medium extension contact (73.33 per cent), medium risk taking capacity (60.00 per cent), medium scientific orientation (56.67 per cent), medium innovativeness (44.70 per cent). Slightly more than one third (35.00 per cent) of the respondents had well and river as source of irrigation and nearly two third (65.00 per cent) of the respondents had medium cropping intensity (i.e. 252.13 to 284.14 per cent).

The selected characteristics of sugarcane growers viz. education, annual income, extension contact, risk taking capacity, scientific orientation, innovativeness, irrigation sources, cropping intensity, cropping pattern were positively and significantly related with drip irrigation and land holding is non-significantly related with drip irrigation.

sugarcane grower’s characteristics viz. annual income, extension contact, scientific orientation, innovativeness, irrigation sources, cropping intensity, cropping pattern were positively and significantly related with conventional irrigation while education, risk taking capacity is non-significantly related with conventional irrigation and cropping pattern is negatively and non-significantly related with conventional irrigation system.

Major constraint in adoption of conventional irrigation given by respondents was non-regularity of electricity (61.66 per cent), 48.33 per cent respondents stated high weed infestation due to conventional irrigation while 30.00 per cent of the respondents faced the problem of requirement of land levelling. Majority (85.00 per cent) of the sugarcane growers stated damage of drip irrigation set by rodents as major constraint in adoption of drip irrigation followed by breakage of laterals (78.33 per cent), high implementation cost (60.00 per cent) and 20.00 per cent of the respondents stated lengthy process of obtaining subsidy for drip irrigation, while 11.67 per cent of the respondents faced the problem of low technical knowledge

Majority (71.67 per cent) of the respondents suggested that the price should be reasonable for drip irrigation set followed by regular guidance and services should be provided by sellers/dealers/company (65.00 per cent), co-operative sugar factory should provide guidance as well as services (43.33 per cent) while, 38.33 per cent of the respondents suggested that the parts of drip irrigation set should be available at local market.

The results pertaining to comparative study of irrigation methods followed by sugarcane growers was at medium level. It calls for intensification of educational efforts and policy support to sugarcane growers regarding the use of drip irrigation by the field extension of State Agriculture Department and KVK's.

1. INTRODUCTION

As Mahatma Gandhi said “The future of India lies in its villages”. The farmer is the father of nation, who digs the wealth from soil. If he is properly trained in skills and new knowledge of scientific agriculture, he will produce more and higher wealth.

In 21st century, as people engage in perhaps one of the greatest challenges of their times to meet need of increasing agricultural production in a sustainable way, people are more actually aware than ever before that all of them are members of the vast common wealth of nature and people as continue their search for paths to human progress that meet the needs and aspirations of the present generation without compromising the ability of future generations to meet their need wise stewardship of natural resources, normal land, water and biodiversity becomes of foremost objective because agriculture is the back bone of Indian economy and largely depends upon natural resources like soil, water and vegetation.

Water is one of the most crucial and precious natural resource. Vitally important for agricultural development and our daily needs. It is indispensable resource that permeates every aspect of human society and affects every man, woman and child. Intensified agriculture and outgrowing population are depleting the already scarce resources, ‘the water’. Although water is manageable resource yet it is often used in crop production amply which initially enters the land at the head works finally becomes available for crop use in fields. The solution of water related problems is to evaluate the existing irrigation system so as to reduce the losses of this precious commodity and thereby increase its efficient use. This is challenging situation and the need of the hour is to conserve water and its efficient use. Each one of us must realize that the manner in which water is used today will determine to a large extent, its availability in the future.

Agriculture is the largest user of water, which consumes more than 80 per cent of the country’s exploitable water resources. The overall development of the agricultural sector and the intended GDP largely depends on the judicious use of the available water resources. While the irrigation projects (major and medium) have contributed to the development of water resources, the conventional method of water conveyance and irrigation, being highly inefficient, has led not only to wastage of water but also a several ecological problems like water logging, Salinization and soil degradation making productive agricultural lands unproductive. It has been recognized that use of modern irrigation methods like drip and sprinkler is the only alternative for efficient use of surface as well as groundwater resources.

Irrigation has played a divisive role in India to achieve increase agricultural production. The success of agriculture is in-extricable linked with development of irrigation since rainfall is concentrated essentially only in four months of the year and the irrigation facilities are critical to cultivate more than one crop in the year. Irrigation is potentially defined as, “The application of

water to soil for the purpose of supplying moisture essential for plant growth especially during stress periods”.

Irrigation water may be applied by surface and subsurface methods of irrigation. But the major opportunity in increasing efficiency at farm level lies in adopting drip irrigation system especially in field crops, which helps in achievement of twin objective of higher productivity and water management. The importance of using drip method of irrigation for getting good crops was a fact in early part of the twentieth century. The trend of using drip irrigation in many areas is due to short supply of water and in many countries, it is accepted as a sound agricultural practice.

Irrigation is the process of applying water to the soil, primarily to meet the needs of growing crops. Water from rivers, reservoirs, lakes or aquifers is pumped or flows by gravity through pipes, canals, ditches or even natural streams. Applying water to fields enhances the magnitude, quality and reliability of crop production. According to the Food and Agriculture Organization (FAO), United Nations, irrigation contributes to about 40 per cent of the world’s food production on 20 per cent of the world’s crop production land.

Various irrigation methods have been developed over time to meet the irrigation needs of certain crops in specific area. The three main methods of irrigation are surface, sprinkler, drip /micro. Water flows over the soil by gravity in surface irrigation. Sprinkler irrigation applies water to soil by sprinkling or spraying water droplets from fixed or moving systems. Micro-irrigation applies frequent, small applications by dripping, bubbling and spraying, and usually only wets the portion of soil surface in the field. A fourth and minor irrigation method is sub-irrigation where the water table is raised to or held near the plant root zone using ditches or subsurface drains to supply the water.

Various irrigation methods are;

- 1) Surface irrigation
 - a. Border irrigation - i. Graded border irrigation
 - ii. Level border irrigation
 - b. Check basin irrigation
 - c. Basin irrigation
 - d. Furrow irrigation – i. Straight furrow
 - ii. Contour furrow
 - iii. Corrugation
 - e. Surge irrigation
- 2) Sub-surface irrigation
- 3) Sprinkler irrigation
 - a. Nozzle line system
 - b. Perforated portable pipe system
 - c. Revolving sprinkler system

4) Drip irrigation/ Trickle irrigation/ Micro-irrigation

Much of the water scarcity in India is due to spatial variation in demand and supply of water. Irrigation is the largest water consuming sector, accounting for more than 80 per cent of the total withdrawals. Yet, irrigation so far has covered only about 40 per cent of the gross cropped area, even though India has a largest irrigated area in the world. Given the increasing scarcity and also non-agricultural water demand, demand management is receiving spatial attention. One of the demand management agriculture is micro-irrigation (MI). Unlike flood method of irrigation (FMI), micro-irrigation supplies water at the required interval and in the desired quantity at the location where water is demanded using a pipe network, emitters and nozzles. Therefore, MI in principle should result in low conveyance and distribution losses and lead to higher water use efficiency.

Among the advanced MI techniques, drip and sprinkler are gaining special attention. Drip irrigation method (DIM) and sprinkler irrigation method (SIM) have distinct characteristics in parameters such as flow rate, pressure requirement, wetted area and mobility, but they have the potential of significantly increasing water use efficiency. While DIM supplies water directly to the root zones through a network of pipes and emitters, SIM sprinkles water, similar to rainfall, into the air through nozzles which subsequently breaks into small water drops and fall on the field surface. DIM has little or no water losses through conveyance and the on-farm irrigation efficiency of a properly designed and managed drip irrigation system can be as high as 90.00 per cent, compared with 30.00 to 40.00 per cent efficiency in surface method of irrigation (Narayanmoorthy 1997). The development of DIM was very low initially, but its spread increased significantly since 1990s due to various potential schemes introduced by the Government of India and state like Maharashtra.

Agriculture plays a vital role in India's economy. 54.6% of the population is engaged in agriculture and allied activities (census 2011) and it contributes 17.4% to the country's Gross Value Added for the year 2016-17 (at current prices). Given the importance of agriculture sector, Government of India took several steps for its sustainable development. Steps have been taken to improve soil fertility on a sustainable basis through the soil health card scheme, to provide improved access to irrigation and enhanced water efficiency through Pradhan Mantri Krishi Sinchai Yojana (PMKSY), to support organic farming through Paramparagat Krishi Vikas Yojana (PKVY) and to support for creation of a unified national agriculture market to boost the income of farmers. Further, to mitigate risk in agriculture sector a new scheme "Pradhan Mantri Fasal Bima Yojana (PMFBY) has been launched for implementation from Kharif 2016.

As per the land use statistics 2014-15, total geographical area of the country is 328.7 million hectares of which reported net sown area is 140.1 million hectares and the gross cropped area is 198.4 million hectares with a cropping intensity of 142 percent. The net area

sown works out to be 43 percent of the total geographical area. The net irrigated area is 68.4 million hectare (Land use statistics at a glance 2005-06 to 2014-15).

The geographical area of Maharashtra is 32.7 million hectares. The cultivable area of Maharashtra is 17.4 million ha in 2010-11. Irrigation facilities in Maharashtra are being extended so that agriculture could be made less dependent upon rain water. Maharashtra has by far the largest number of dams in India. Despite that, the net irrigated area totals only 33,500 square kilometers or about 16 % of cultivable land (Land use statistics at a glance 2005-06 to 2014-15).

The area under drip irrigation in Kolhapur under National Mission for Micro-irrigation Programme is about 621.22 ha in year 2015-16, 1525.75 in 2016-17 and 1938.53 in 2017-18. Irrigation water is made available mainly by rivers like Panchganga, Warana, Bhogavati, Dudhganga, Hiranyakeshi, Vedganga and Krishna. Sources of irrigation in Kolhapur district are rivers, canals, tanks, open wells, bore well etc. Warana is a large canal irrigation project on the river Warana.

Maharashtra ranks second in sugarcane production, but it boasts of the highest yield in the country 80 tons per hectare. In 2016-17, the total sugarcane area was reported at 45.22 lakh hectares in Maharashtra, as per the report total cultivated area of sugarcane was 9.28 lakh hectares upto July 06, area increased by 45.02 % against previous season.(Sugarcane in India: State wise area, production and productivity)

Total area under sugarcane cultivation in Kolhapur in year 2014-15 is about 145236 hectares, in year 2015-16 is about 132661 hectares, in 2016-17 about 143905 hectares and in 2017-18 it is about 149280 hectares

Importance of the Study

Availability of water for agriculture is sufficient in Kolhapur district. Sugarcane and paddy are major crops under cultivation in Kolhapur district which requires more water for their growth and production. Most of the farmers use traditional methods of irrigation for sugarcane. Farmers are aware about disadvantages of traditional methods and benefits of drip irrigation. The Government also provides subsidy for implementation of drip irrigation set, still today farmers adopted drip irrigation system not upto the mark. With this background present study was conducted with following objectives.

Objectives of Study

1. To study the personal and socio-economic characteristics of sugarcane growers.
2. Comparative analysis of conventional and drip irrigation system followed by sugarcane growers.
3. To study the relationship between selected independent variables and comparative study of drip and conventional irrigation system adopted by sugarcane growers.
4. To obtain the constraints in adoption of conventional and drip irrigation system by sugarcane growers

Scope of the Study

There has been concern in recent years regarding the efficient utilization of irrigation resources. With increasing population and economic growth, water demand is likely to pick up consideration in the future. The agricultural consumption in total demand, resulting in relatively reduced availability for domestic and industrial uses. This should pose a large challenge for Maharashtra's water sector planning, considering the growing urbanization and industrialization trends of the state.

Limitation of the Study

The present study, being part of the master's programme, has the normal limitations of time, funds and lack of other facilities normally faced by single student researcher. The limitations lead to the purposive selection of only one district as the locale of the study. Generalizations made based on the findings of the study may not be directly applicable too the rare as and need to be substantiated with other, similar studies since, the study has adopted the ex-post facto design and the memory bias on the part of the respondents cannot be ruled out.

2. REVIEW OF LITERATURE

Research is continuous process. It is to be always based on previous findings. Review of literature is essential be for enveaden after actual start of research. It helps the researcher to get acquainted with the subject matter specialist and get insight into their search problem. Though the process of review, the researcher become aware about various concepts, their definitions and procedures adopted for their quantification. It provides guidelines at every stage in the process of research. Efforts have been made to review the result of various past research studies and literature having direct or indirect relation with the present study.

Considering the objectives the review of literature of present investigation has been presented under following sections

1. Personal and socio-economic characteristics of sugarcane growers.
2. Comparative analysis of conventional and drip irrigation system followed by sugarcane growers.
3. Relationship between selected independent variables and comparative study of drip and conventional irrigation system adopted by sugarcane growers.
4. Constraints in adoption of conventional and drip irrigation system by sugarcane growers.

2.1 Independent Variables

The review of past studies pertaining to the selected variables has been presented below.

2.1.1 Education

Ahire et al. (1999) observed that the majority (58.30 per cent) of the drip irrigation system users were highly educated.

Patil (2002) observed that considerable number of drip adopters (42.22 per cent) received primary education followed by secondary 30.00 per cent, higher 11.11 per cent and college education 7.77 per cent.

Sonwalkar (2002) shown that majority of respondents (41.60 per cent) were educated up to secondary school level whereas 26.6 per cent respondents had educated up to high school and remaining 22.60 per cent of respondents were educated up to college level and 6.60 per cent respondents had received primary education and only 2.60 per cent respondents were illiterate.

Chavan et al. (2003) observed that large majority (84.00 per cent) of drip owners received secondary education.

Thamban et al. (2004) reported that notable number of farmers (41.67 per cent) were educated up to pre degree level by 31.67 per cent high school and rest of them educated up to degree 23. 33 per cent, primary school 21.67 per cent and post graduate 1.67 per cent.

Bannapure (2007) indicates that less than half of the drip adopter (45.45 per cent) had higher secondary education followed by one fourth (24.55 per cent) and 18.18 percent having

secondary education and graduation respectively and very negligible per cent of drip adopters were illiterate.

Prasad (2008) found that majority of drip adopters (63.73 per cent) belonged to high school followed by 17.50 per cent and 13.33 percent college and middle level education respectively and primary level 3.33 per cent and can read and write only 2.50 per cent.

Dharam N. J. (2012) observed that majority of drip users had moderate to higher education.

2.1.2 Land holding

Chavan et al. (2003) observed that more than two third of drip adopters (68.00 per cent) possessed medium size of land holding.

Nagade et al. (2003) revealed that majority of drip owners (55.10 per cent) had small size of land holding.

Bannapure (2007) revealed that near about two third of respondents (64.55 per cent) has medium size of land holding followed by 26.36 per cent respondents having small size of land holding.

Patil (2007) in comparative study of users and non users of drip irrigation system by grapes grower indicated that a large portion of the respondents had medium size area under drip of grape orchard.

Prasad (2008) revealed that considerable number of drip adopters (44.16 per cent) belonged to medium size of land holding followed by 40.00 per cent and 15.84 per cent respondents belonged to low and high size of land holding respectively.

Kiranyami (2013) reported that more than half (56.67 per cent) of the chilli farmers were semi-medium farmers followed by medium farmers (23.33 per cent) and small farmers (20.00 per cent)

2.1.3 Annual Income

Ahire et al. (1999) observed that nearly two third of respondents (65.00 per cent) had high level of income.

Katkar (2000) revealed that 61.00 per cent of the respondents had medium level of annual income followed by low 23.00 per cent and high 16.00 per cent of annual income.

Patil (2002) observed that drip adopters (38.88 per cent) were in medium income group followed by high 28.88 per cent and low 24.44 per cent annual income group.

Patel (2003) observed that most of the drip owners (60.00 per cent) had annual income up to Rs. 50000/-

Bannapure (2007) indicated that two third of respondents (67.57 per cent) had medium level of annual income followed by considerable proportion of drip adopters i.e. 19.09 per cent and 13.64 per cent had low and high level of annual income.

Sonwalker (2007) observed that majority of the respondents (84.20 per cent) were having medium income level, whereas 9.20 per cent of them were from comparatively low income group having income of below Rs. 45000/- per annum and only 6.60 per cent of the respondents were from high income groups.

Kadam (2008) observed that highest percentage of respondents (79.34 per cent) were in medium income group while 14.00 per cent and 66.00 per cent respondents were in high and low income group respectively.

Sasane *et al.* (2010) indicated that more than two fifths (41.66 per cent) of the respondents had obtained annual income less than Rs. 50000/-

Barbade (2014) observed that more than two-fifth (43.33 per cent) of drip owners had 50.00 per cent of area under drip irrigation system followed by 33.33, 13.34 and 10.00 per cent of them having 25.00, 75.00 and cent per cent area under drip irrigation system respectively.

2.1.4 Extension Contacts

Kale (2000) indicated that nearly two third of drip adopters (64.00 per cent) had used medium number of sources followed by 15.00 and 21.00 per cent had used low and high sources of information respectively.

Chavan (2005) found that about 69.34 per cent of respondents had used medium sources of information channels of communication while 17.33 and 13.33 of them had used low and high sources of information respectively. He observed that 62.00 per cent of respondents were found from the group of medium level.

Kumar *et al.*(2012) revealed that majority of paddy growers belonged to medium (63.12 per cent) extension contact category followed by high (24.38 per cent) and low (12.50 per cent) extension contact.

Mandlik (2012) observed that 10.18 per cent of respondents had low level of extension contacts. Whereas 75.00 per cent of the respondents had medium level of extension contact followed by 14.16 per cent of respondents having high level of extension contacts.

Thorat (2013) noticed that majority (59.00 per cent) of the respondents had medium extension contact, 22.00 per cent having high extension contact while 19.00 per cent having low extension contact.

2.1.5 Risk Taking Capacity

Katkar (2000) concluded that nearly two third (65.00 per cent) of drip adopters belonged to medium risk oriented group followed by low orientation 17.00 per cent and high risk orientation 18 per cent.

Khot (2003) observed that majority (53.00 per cent) of the respondents had medium level of risk orientation about drip irrigation.

Patel (2003) found that majority (59.00 per cent) of the drip adopters had medium level of drip adoption.

Bannapure (2007) noticed that majority (69.10 per cent) of the respondents belonged to medium risk orientation category followed by 20.00 per cent and 10.90 per cent were belonged to low and high risk orientation category.

Palanisamy (2011) revealed that 45.00 per cent of Irrigated Agriculture Modernization And Water Bodies Restoration And Management Project in Pudukkottai District of Tamil Nadu (TN-IAMWARM) project beneficiaries had high level of risk orientation, while 42.00 per cent of the beneficiaries had medium level of risk orientation and rest 13.00 per cent of the beneficiaries had low level of the risk orientation.

Hanjabam (2014) reported that about 62.67 per cent of the precision farmers were highly risk oriented and 38.33 per cent were in medium level of risk orientation.

2.1.6 Scientific Orientation

Kale (2000) concluded that slightly more than three fifth (63.00 per cent) of drip adopters had medium level of scientific orientation, followed by 22 per cent of drip adopters had low level of scientific orientation and rest 15.00 per cent had high level of scientific orientation.

Jeevan kumar (2013) indicated that majority (68.33 per cent) students had medium scientific orientation followed by 16.67 per cent with low scientific orientation and 15.00 per cent with high scientific orientation.

Kiranmayi (2013) revealed that a little more than half of the chilli farmers had medium (53.33 per cent) scientific orientation, followed by those with low 26.67 per cent and high 20.00 per cent scientific orientation.

Rathod *et al.* (2013) revealed that nearly half (40.00 per cent) of the soybean growers had high scientific orientation followed by those having medium 36.00 per cent and low 24.00 per cent scientific orientation.

G. Sravani Sandhya (2014) revealed that 47.50 per cent of sugarcane cultivating respondents had medium scientific orientation followed by those with high 28.33 per cent and low 24.17 per cent level of scientific orientation.

2.1.7 Innovativeness

Raghupati (1994) reported that 42.50 per cent of command area farmers were in the medium score range (10-15) and high (15-20) score range whereas 15.00 per cent were in low score range (5-10) of innovative proneness.

Shashidhara (2003) in his study of socio-economic profile of drip irrigation farmers in Shimoga and Davangere district of Karnataka found that, majority of farmers belonged to medium innovativeness category 47.50 per cent followed by low 31.66 per cent and high

innovative proneness category 20.83 per cent .

Rathode (2005) in his study of knowledge and adoption pattern of improved sugarcane practices in Bidar district noted that the respondents were distributed at 33.33, 52.50 and 14.16 per cent for low medium and high innovative proneness category respectively.

Supriya B. B. (2013) reported that 42.50 percent of farmers come under the category of medium innovativeness, whereas 33.33 per cent and 24.17 per cent of farmers had low and high innovativeness, respectively.

2.1.8 Irrigation Sources

Gupta (2001) seminar on drought and water resources, IWRS Nagpur and showed that participatory irrigation management increases with increase in awareness about the people.

Bhatnagar (2004) observed that the groundwater is an important source of irrigation all over the country. It is considered a reliable source of irrigation (barring the uncertainties in availability if electricity) when compared with canal irrigation.

Rathod (2005) observed that the majority of respondents (77.50 per cent) irrigated the field from open wells, followed by open wells and bore wells 20.00 per cent, open well and nala 02.50 per cent.

Naik (2006) reported that the problem of agriculture in Maharashtra that the proportion of gross irrigated area to gross cropped area was only 16.40 per cent as against 38.20 per cent at national level.

Sasane et al. (2010) found that majority (71.67 per cent) of the respondents had well as a source of irrigation followed by river 24.17 per cent.

2.1.9 Cropping Intensity

Balasubramani et al. (2004) revealed that majority of the respondents (86.67 per cent) practiced a single season of cropping pattern, while 13.33 per cent of the respondents practiced more than one season cropping pattern.

Sengar *et al.*(2008) reported that 90.00 per cent of respondents had cropping intensity 100 per cent followed by 4.50 per cent of the respondents had cropping intensity in between 100.1- 150.00 per cent , 4.00 per had cropping intensity in between 150.1- 200.00 per cent and 1.50 per cent respondents had cropping intensity above 200 per cent.

Ghintala (2013) observed that 70.83 per cent farmers had medium level of cropping intensity followed by 17.50 per cent and 11.67 per cent of farmers had high and low level of cropping intensity respectively.

2.1.10 Cropping Pattern

Pallavi (2003) indicated that a majority (82.35 per cent) of respondents were growing paddy, followed by groundnut 76.47 per cent, gram 44.70 per cent, jowar 40 per cent and wheat 39.41 per cent.

Balasubramani et al. (2004) revealed that majority of the respondents (86.67 per cent) practiced a single season of cropping pattern, while 13.33 per cent of the respondents practiced more than one season cropping pattern.

Ramesh P. et al. (2005) reported that half (51.00 per cent) of the respondents comes under low category of cropping pattern, whereas only 12.00 per cent belong to higher category, while 37.00 per cent respondents obtained medium category of cropping pattern this might be due to non availability of irrigation.

2.2 Dependent Variable

2.2.1 Comparative study of conventional and drip irrigation system

Singh and Singh (1978) compared drip irrigation with conventional irrigation for vegetable crops in hot arid climate and found that drip irrigation increased yield of long gourd by 45.00 to 47.00 per cent and round gourd 21.00 to 38.00 per cent as compared to sprinkler and furrow irrigation methods and found that water use efficiency with drip is almost double as that furrow irrigated crops.

Somasundaram *et al.*(1995) reported that yield of okra increased upto 167 per cent in case of drip irrigation as compared to the yield in the plot irrigated through conventional irrigation method of irrigation.

Suryawanshi (1995) revealed that the yield of okra irrigated through drip and surface method of irrigation were 177.24 and 152.61 q/ha respectively, with a net increase of 16.00 per cent in case of drip irrigation method. The amount of water applied during the crop period through drip and surface methods was 32.44 and 53.68 mm respectively, with a net water saving of 40 per cent in case of drip irrigation method.

Narayanmoorthy (1997) studied the economic viability of drip irrigation. The results shows that drip method of irrigation not only contributes to water conservation and additional irrigation benefits but also reduces cultivation cost and increases crop productivity as compares to conventional irrigation methods. The economic vaibility of drip system holds good even for farmer with just one hectare land.

Narayanmoorthy (2003) studied on water crisis by drip method of irrigation; a study of two water intensive crops. The study shows that water saving due to drip method of irrigation over the method of conventional irrigation is about 47 per cent in sugarcane and 29 per cent of banana. Water require to produce one quintal of sugarcane under drip method of irrigation is only about 1.33 horse power (HP) hours against requirement of 3.17 HP hours under flood

method of irrigation. The same trend is observed in banana crop as well. The private benefit cost ratio estimated using discounted cash flow technique clearly indicates that the drip investment is economically viable and environmentally viable even without subsidy.

Gowtham and Manjula (2016) revealed that the average yield of sugarcane among drip adopters was high i.e. 53.60 t/acre compared to nonadopters of drip irrigation i.e. 44.80 t/acre by the difference of 8.80

2.2.2 Relationship between Selected Independent and Dependent Variable

2.3.1 Education and conventional and drip irrigation system

Katkar (2000) revealed that there was positive and significant correlation between educational level of drip adopters and their knowledge level

Khot *et al.* (2003) revealed the relationship between of respondents with the knowledge level of drip irrigation was found positive and significant

Bannapure (2007) observed that there was positive and significant relationship between knowledge level and educational level of drip adopters.

2.3.2 Land holding and conventional and drip irrigation system

Patel (2003) reported that there was relationship between size of land holding of farmers showed positive and significant correlation with their knowledge of drip irrigation system.

Barse *et al.* (2010) observed that land holding had showed negative and non-significant relationship with adoption of drip irrigation system.

Kumar and Jitrawal (2012) reported that land holding was found positively and significantly associated with extent of adoption of drip irrigation by farmers.

Gauttam *et al.* (2014) observed that land holding had negative but significant association with extent of adoption of drip irrigation technology.

2.3.3 Annual income and conventional and drip irrigation system

Nagare (1987) observed that the annual income of farmers had no significant relationship with knowledge level of drip irrigation system.

Chowdhary (2003) revealed that annual income of the farmer had positive significant relationship with attitude of respondents towards drip irrigation

Khot *et al.* (2003) observed that there were positive and significant correlation between annual income and knowledge level of farmers.

2.3.4 Extension contact and conventional and drip irrigation system

Aundhkar *et al.* (2013) found that extension contact had positive and significant relationship with adoption of drip irrigation technology.

Doley (2015) observed that extension contact of the farmer had positive significant relationship with the extent of water management technologies.

2.3.5 Risk taking capacity and conventional and drip irrigation system

Bahire (2011) found that there was positive and significant correlation between risk orientation and knowledge level of drip adopters.

Aundhkar *et al.* (2013) found that risk preference showed positive and significant relationship with adoption of drip irrigation technology.

Gauttam *et al.* (2014) observed that risk taking capacity had positive and significant association with adoption of drip irrigation technology.

2.3.6 Scientific orientation and conventional and drip irrigation system

Katkar and Ahire (2006) reported that scientific orientation was positively and significantly related to adoption of drip irrigation.

Patel *et al.* (2016) observed that level of attitude of respondents towards drip irrigation system was positively and significantly associated with scientific orientation.

2.3.7 Innovativeness and conventional and drip irrigation system

Aundhkar *et al.* (2013) found that innovativeness showed positive and significant relationship with adoption of drip irrigation technology.

Kher and Hayal (1998) found that there was significant relationship between innovative proneness and adoption level of sugarcane growers.

2.3.8 Irrigation sources and conventional and drip irrigation system

Aundhkar *et al.* (2013) found that irrigation sources showed positive and significant relationship with adoption of drip irrigation technology.

2.3.9 Cropping Intensity and conventional and drip irrigation system

Gauttam *et al.* (2014) observed that cropping intensity had positive and significant association with adoption of drip irrigation technology.

Patel *et al.* (2016) reported that cropping intensity is positively and significantly associated with adoption of drip irrigation technology by the farmers.

2.3.10 Cropping Pattern and conventional and drip irrigation system

Doddamani *et al.* (2011) reported that cropping pattern was found to be non-significantly associated with knowledge of land reclamation practices of saline and water logged soils.

Aundhkar *et al.* (2013) found that cropping pattern showed positive and significant relationship with adoption of drip irrigation technology.

Khare *et al.* (2013) reported that cropping pattern was non-significantly related with adoption of improved gram cultivation practices.

2.4 Constraints Faced by Farmers in adoption of Drip irrigation system

Ingale and Sagane (1992) reported that the important technical constraints as experience by most of the drip adopters were clogging of drippers and micro tubes 78.98 per cent, inferior quality of spare parts 56.63 per cent and in adequacy of perfect information about drip irrigation system.

Puranik et al. (1992) revealed that drip irrigation was very costly as responded by 60.00 per cent of drip adopters. A large majority of farmers 94.00 per cent also said that drip irrigation sets required frequently cleaning mains, sub-mains, laterals, drippers.

Kale (2000) reported that major constraint faced by drip adopter were clogging of emitters, breaking of laterals, lack of instruments and high initial cost of drip set.

Patil A. A. (2007) reported that main constraint faced by drip adopters were clogging of emitters 82.50 per cent, breaking of laterals 61.25 per cent, and the problem of availability of instruments 56.25 per cent.

Dharam N. J. (2012) reported that economics constraints are the major constraint faced by the farmer. High initial cost, problem in preparation of loan proposal, high cost of spare parts are also reported.

Kakade V. S. (2012) observed that large proportion of marginal, small, medium farmers using drip irrigation system for banana had constraints of lack of technical knowledge and clogging of emitters. Another constraint faced by them was breakage of laterals.

Bhuriya *et al.* (2016) observed that major constraint faced by farmers were hard management practices in drip irrigation system by 97.50 per cent respondents followed by lack of credit facility for drip irrigation system by 93.33 per cent respondents and risk in adoption of drip irrigation system by 91.66 per cent respondents.

Verma and Sharma (2017) reported the major constraint faced by farmers were clogging of drippers by suspended materials perceived by 88.46 per cent farmers, insufficient supply of electricity for irrigation by 81.00 per cent farmers, initial installation cost is high perceived by 96.50 per cent farmers, inadequate awareness about advantages of drip irrigation was perceived by 81.62 per cent farmers and unsuitable for area where water is highly saline perceived by 68.80 per cent farmers in the adoption of drip irrigation system.

2.5 Suggestions by Respondents to Overcome Constraints about adoption of drip irrigation system

Deshmukh *et al.* (1997) reported that 69.57% drip adopters stressed the point of subsidy, 61.96% of them demanded frequent guidance and supervision from company agent. Whereas 55% insisted upon informing the farmers regarding varying rates and quality of drip sets.

Kale (2000) reported that major suggestions made by the farmers were timely availability

of loans, regular guidance and effective service by for maintainance from dealers, reduction in cost of drip set, availability of spare parts at reasonable price and provide training to farmers to improve skills to use the system effectively.

Dharam N. J. (2012) suggested that farmers insisted economic suggestions regarding initial investment of drip irrigations. Another economic suggestion insisted by farmer was to overcome difficulty in preparation of loan proposals. Users of drip irrigation system for sugarcane had mainly suggested that dealer should provide technical knowledge regarding drip irrigation system and to find solution on clogging of emitters.

Kakade V. S. (2012) reported that major suggestions by banana growers are reduction in initial cost and cost of spare parts by government. Dealers should provide technical knowledge regarding advanced irrigation system and its maintenance.

3. METHODOLOGY

This chapter describes the method and procedure used for carrying out present study. Every possible effort was made to adopt appropriate method and procedures in order to research reliable, unbiased and practical conclusions. It contains the tools and techniques employed for data collection. The sampling procedure adopted as well as the devices used for analysis of data are also explained. This chapter also incorporates the procedure for measurement of independent variable under study.

The methodology adopted described in this chapter is as given below.

3.1 Locale of research study

3.2 Research design

3.3 Sampling plan

3.4 Selection and measurement of the variables

3.5 Prepare in farm schedule

3.6 Pre-testing of interview schedule

3.7 Collection of data

3.8 Complication of data

3.9 Categorization of variables and their empirical measures

3.10 Analysis of data

3.11 Statistical technique used for analysis of data

3.1 Locale of research study

The study was conducted in Kolhapur district of Maharashtra state.

3.1.1 Geographical location

The Kolhapur district situated in the extreme southern part of Maharashtra state. It lies between 15⁰43' north to 17⁰17' north latitude and 73⁰40' east longitude. It is surrounded by Sangali district to the north, Belgaum district of Karnataka state to the east and south, Ratnagiri and Sindhudurga district to the west. The Kolhapur district comprises 7685 sq.km area and administratively divided into 12 tahsils.

The National Highway Pune-Benglore (NH-48) passes through Kolhapur. Kolhapur is situated on the banks of the river Panchganga. The holy place Goddess Mahalakshmi Temple in Kolhapur headquarter and Jyotiba Temple 20 km away from Kolhapur city.

3.1.2 Area and Population

The total geographical area of the district is 776261.00 ha. With a population of 3,876,001. The Male number is 1,980,658 & Female 1,895,343 constituting a male / female ratio of 1000:957. The Urban population is 12,30,009. The scheduled Cast (SC) population is 5,04,461 constituting a 13.01 % of the total population whereas Scheduled Tribes (ST) population is 30,206 constituting a 0.77 % of the total population. The Literacy percentage of the District is 72.91. The population Density is 504/Sq.km. (Data is as per 2011 Census).

Total area of selected Hatkanagale and Karvir tahsils are 612 sq.km and 664 sq.km respectively. Hatkanagale and Karvir tahsils comprises 63 villages and 130 villages respectively. According to population census of 2011, the population of Hatkanangale tahsil is 8,07,751 and Karvir is 10,37,718.

3.1.3 Land Utilization Pattern

A) Land utilization pattern of Kolhapur district is given below

Sr. No.	Particulars	Area ('00'ha)
1	Total geographical area	7763
2	Area under forest	1401
3	Barren / uncultivable land	590
4	Non- agricultural land	300
5	Cultivated wasteland	460
6	Permanent pasture and other grazing land	414
7	Land under trees, crops	72
8	Current fallow	130
9	Other fallow	200
10	Net area sown	4590
11	Area sown more than once	278.8
12	Total cropped area	4870

Source: Socio-economic review & district statistical abstract of Kolhapur District (2016- 2017).

B) Land utilization pattern of selected tahsils is given below.

Sr. No.	Classification	Hatkanangale	Karvir
1	Geographical area	60973	67113
2	Area under forest	1433	804
3	Land put to non-agricultural use	5906	15707
4	Non-agricultural land	5108	8070
5	Barren / uncultivated land	798	7636
6	Gross cultivated area	65446	52762
7	Net sown area	58032	49399
8	Area sown more than Once	7441	3363
9	Total cultivable land	59050	50920

Source: Socio-economic review and district statistical abstract of Kolhapur District (2016-2017)

3.1.4 Soil

The soils of Kolhapur district can be divided into three major geographical regions. The Western region comprises of hilly region with red soils covering the areas of Shahuwadi, Radhanagari, Gaganbawda, Bhudargad, Ajar and Chandgad tahsils. The middle region is the area of fertile soils comprising Karveer and Kagal and the eastern region is made up of medium soil comprising Hatkanangale, Shiral, and Panhala tahsils. The area along rivers Bhogawati, Kumbhi, Kasari, Panchaganga, Hiranyakeshi and Vedganga are fertile with alluvial soils.

3.1.5 Rivers

Rivers are one of the important source of irrigation in Kolhapur district. The major rivers in Kolhapur district are Krishna, Warana, Panchganga, Dudhganga, Vedganga, Hiranyakeshi, and Ghatprabha. A river Tilari is flowing at South-West end of the district.

3.1.6 Climate

Kolhapur's climate is a blend of coastal and inland climate of Maharashtra. The temperature has a relatively narrow range between 10⁰ C to 35⁰ C. Summer in Kolhapur is comparatively cooler, but much more humid, compared to neighboring inland cities. Maximum temperature is rarely exceed 38 C and typically range between 33 to 35⁰ C. Low during this season is around 24⁰ C to 26⁰ C. The city receives abundant rainfall from June to September due to its proximity to the Western Ghats. Humidity is low in this season making weather much more pleasant. Average rainfall of the district is 1035.

3.1.7 Cropping Pattern

The detail cropping pattern of Kolhapur district is given below

Sr. No.	Crop	Area(ha)
A	<u>Cereals</u>	
1	Paddy	109453
2	Finger milete	22343
3	Kharif Sorghum	4998
4	Maize	8019
5	Other cereals	25
	Total Cereals	181431
B	<u>Pulses</u>	
1	Tur	2756
2	Green Gram	1672
3	Black gram	1917
4	Other pulses	817
	Total Pulses	15976
C	<u>Oilseeds</u>	
1	Groundnut	49344
2	Sesamum	44742
3	Soybean	44742
4	Other oilseeds	382
	Total Oilseeds	95209
D	<u>Cash Crops</u>	
1	Sugarcane	143905

Source: Socio-economic review and district statistical abstract of Kolhapur District (2016-2017)

A) Crop wise area of selected tahsils is given below

Sr. No.	Name of Crop	Hatkanangale (ha.)	Karvir (ha.)
A	<u>Cereals</u>		
1	Paddy	921	10526
2	Jowar	5242	650
3	Sorghum	937	2220
4	Maize	1700	629
5	Nachani	0	707
B	<u>Pulses</u>		
1	Gram	95	773
2	Tur	95	240
C	<u>Oilseeds</u>		
1	Groundnut	7647	4845
2	Sunflower	0	80
3	Soybean	12336	4700
D	<u>Cash Crop</u>		
1	Sugarcane	21181	22418

Source: Socio-economic review and district statistical abstract of Kolhapur District (2016-2017)

3.1.8 Area Under Irrigation of the Selected Research Site

Irrigation statistics of the selected research site is given below.

Sr. No.	Particulars	Hatkanangale (ha.)	Karvir (ha.)
1	Net area under irrigation	26559	29653
2	Total area under irrigation	28238	26980
3	Total area under cultivation	55786	51148
4	Percent area under irrigation to area under cultivation	50.6	52.7

Source: Socio-economic review and district statistical abstract of Kolhapur District (2016-2017)

3.1.9 Irrigation Facility

According to the Socio-economic survey of Kolhapur District of 2011, Kolhapur district has 135151 hectares area under irrigation. Out of total , 128584 hectars net area was under irrigation, which was 95 percent out of total irrigation area. Out of net irrigation area, 38 per cent area irrigated by surface drip irrigation and remaining 62 per cent area irrigated by tube wells. At the same time, out of total irrigated area, 8 per cent area was under food grains and 72.00 per cent area under Sugarcane. The population of irrigated area with total cultivated area was 23 per cent in the district. About 37 per cent of the total irrigated area was in the talukas of Hatkanangale and

Karveer, next importance is the tahsils of Shirol, Radhanagari, Kagal, Panhala and Shahuwadi.

3.1.10 Transport and Communication Facilities

In Kolhapur district buses and railway are the significant means of transportation. The state transport buses, corporation buses, trucks, tempos, private jeeps, autos are the major means of transportation.

Total road length 9299 kms. and railway track length of 35.7 kms. National Highway No. 48 (Pune- Bengaluru) passes through the Kolhapur district. Total Post offices (560) and landline telephone facilities (150269) are available in almost all the villages. The radio and television means of communication are also spreading in the district.

3.1.11 Other Facilities

Education facilities are available through primary, secondary schools, technical and non technical colleges throughout the district. Agriculture college situated in Kolhapur district which provide education, research and provide knowledge to farmers about recommended practices for agriculture and dairy. The Shivaji Vidyapeeth and Mouni Vidyapeeth is one of the institute which runs many educational programmes like Diploma in Engineering, Science, Commerce, Arts graduate level programmes, Ded, Bed courses. Medical facilities are also available through primary health center and private practitioners. Credit facilities are available through branches of Kolhapur district central cooperative Bank Ltd, Nationalized banks and other commercial banks. Transport and communication facilities are quite adequate. Most of villages in all selected tahsils are connected by good roads. Regulated markets are available in both tahsils.

3.2 Research Design

The present investigation was conducted to ascertain the use of sugarcane harvester by the farmers of Kolhapur district. Therefore, a descriptive and diagnostic design of social research was used for the present investigation.

3.3 Sampling plan

Sampling plan adopted for this research study is as under.

3.3.1 Locale of the Study: Kolhapur district

3.3.2 Selection of tahsils

There are twelve tahsils in Kolhapur district. Shahuwadi, Panhala, Hatkanangale, Shirol, Radhanagari, Kagal, Karveer, Bhudargad, Chandgad, Ajara, Gadhinglaj and Gaganbawda. Out of which Hatkanangale and Karvir tahsils were purposively selected on the basis of maximum area under Sugarcane cultivation.

3.3.3 Selection of villages

Six villages from each tahsils were selected on the basis of maximum area under sugarcane cultivation.

3.3.4 Selection of Respondents

With the help of extension personnel working at village level the list of both types of sugarcane growers having at least 0.40 ha area under drip irrigation and traditional method of irrigation prepared. From each list 10 farmers were selected randomly. Thus total 120 respondents were selected from 12 villages constituted the sample of study. Village wise selected farmers list along with their mobile number are given in Appendix- I.

3.4 Selection and measurement of the Variables

Variables included in the study were selected on the basis of an extensive review of literature, discussion of the experts and preliminary study conducted in the area of the investigations. Only those variables which were considered to having some relevance with the comparative study of conventional irrigation and drip irrigation system selected for the study

3.5 Preparation of Interview Schedule

Interview schedule consisting of relevant questions related with the objectives of the study was prepared. Necessary care was taken to keep the language simple so as to get desired responses from the respondents. The interview schedule was developed in English language and then translated into Marathi for local use. The interview schedule contained questions related to personal, psychological and socio-economical characteristics of the sugarcane growers in the first part, the questions related to comparative study of sugarcane growers using drip and conventional irrigation systems were asked in the second part and constraints faced by sugarcane growers in adoption of drip irrigation and suggestion made to overcome the constraints were asked in third part of the schedule.

3.6 Pre-testing of Interview Schedule

The pre-testing of interview schedule is necessary on the part of researcher. It identifies mistakes, ambiguities and shortfalls. It also helps in achieving clarity, reliability and validity of the interview schedule. The pre-testing of interview schedule was done on 10 farmers of non sampled area. The data collected from these farmer were thoroughly studied to detect unfamiliar words, vagueness and complexity of questions included in the schedule. Considering the experiences of pre testing, language of few questions was appropriately modified to increase clarity of questions included in the interview schedule. The interview Schedule was then finalized and required number of copies were prepared for data collection. The final interview schedule is given in Appendix-II.

3.7 Collection of Data

Personal interview techniques was used for collection of data. Majority of the selected respondents were contacted at their home and at their leisure time. In some cases they were contacted at their farms also. In the first instance researcher introduced himself for introduced by Agricultural Assistant or friends. After the introduction, purpose of visit, object and importance

of the study and the significance of the co-operation of the respondents in the investigation were explained to respondents to establish proper rapport. Thereafter, the interview was conducted and responses were marked in the schedule. Every possible case was taken to maintain congenial atmosphere free from discomfort and outside influence to get the unbiased opinions of the responder. Some of the respondents were visited more than once to collect the data as per their convenience. The Interview schedule thus filled was checked before closer of interview for its completion in all respects. The final interview schedule is given in Appendix-II.

3.8 Compilation of Data

The information collected through interview was transferred from the interview schedule to the primary table (master table) and then to the secondary tables. Wherever necessary the information in qualitative form and computation of score was done. The data was analyzed through statistical tools.

3.9 Categorization of variables and their empirical Measures

Categorization of variables and their empirical measures was made as under

Variables selected for the study with their empirical measurements

Sr. No	Independent variables	Empirical measurements
1.	Education	The extent of formal education standard completed by the respondent at the time of interview.
2.	Land holding	The total land possessed by respondent in million ha.
3.	Annual income	Gross income in rupees derived from all sources in one year.
4.	Extension contact	Contacts of respondents with extension agencies for getting information about drip irrigation.
5.	Risk taking capacity	Degree of uncertainty that respondents are able to handle
6.	Scientific orientation	It was measured with the help of scale developed by Supe (1969) and modified by Nagraj (2002).
7.	Innovativeness	Time taken by the respondents for adoption of drip irrigation
8.	Irrigation sources	Various water sources used by respondents for irrigating agricultural crops.
9.	Cropping Intensity	It is the area arrived at by deducting the gross irrigated area from the gross sown area.
10.	Cropping Pattern	Cultivation of different crops by the respondents in different seasons
	DEPENDENT VARIABLE	
1.	Comparative study of drip and conventional irrigation	Schedule was developed for the comparative study of sugarcane growers using conventional and drip irrigation system.

3.9.1 Independent variables

3.9.1.1 Education

Education was operationalized as formal schooling standard completed by an individual respondent. It was measured in terms of standard in formal school passed by the respondent and considered the score as such. Following categories are made and accordingly the respondents were classified on the basis of their education.

Sr. No.	Education	Standard passed
1.	Illiterate	No formal education.
2.	Primary education	(I st to IV th standard)
3.	Secondary education	(V th to X th standard)
4.	Higher secondary education	(XI th to XII th standard)
5.	College	Graduation and above

3.9.1.2 Land Holding

Land holding was defined as the number of hectares of land possessed by the farmers. The farmers were grouped into five categories according to the standard category made by Government of Maharashtra as below.

Sr. No.	Category	Land (ha)
1.	Marginal	Up to 1.00
2.	Small	1.01 to 2.00
3.	Semi-medium	2.01 to 4.00
4.	Medium	4.01 to 10.00
5	Large	10.01 and above

3.9.1.3 Annual Income

Annual income of sugarcane growers was determined by considering the total income earned from all the sources in one year and expressed in terms of rupees. The categories were made on the basis of using mean \pm S.D. as given below.

Sr. No.	Category	Annual income (Rs.)
1.	Low	Up to Rs.48106
2.	Medium	Rs.48107 to Rs.10,26534
3.	High	Rs.10,26,535 and above
Mean=537321		S.D. = 489215

3.9.1.4 Extension Contact

Operationally extension contact of respondents refers to the various extension contact made by individual respondents for seeking information about drip irrigation. Extension contact was measured on three point continuum namely regular, occasionally and never by assigning score 2, 1 and 0 respectively. The raw score of extension contact was work out. The categorization of respondent was made with the help of mean and standard deviation.

Sr. No.	Category	Score
1.	Low	Up to 7
2.	Medium	8 to 12
3.	High	13 and above
Mean = 9.55		S.D. = 2.26

3.9.1.5 Risk Taking Capacity

Operationally risk taking capacity refers to the degree of uncertainty that respondents are able to handle in adoption of drip irrigation system. The scale developed by Supe (1969) was used with suitable modifications. Risk taking capacity was measured on three point continuum agree, undecided and disagree by assigning score 3, 2, 1 for positive statements and 1, 2, 3 for negative statement respectively.

Particulars	Responses Score		
	Agree	Undecided	Disagree
positive statements	3	2	1
negative statements	1	2	3

The raw score of risk taking capacity was work out. The categorization of respondents was made with the help of mean \pm standard deviation.

Sr. No.	Category	Risk Taking Capacity
1.	Low	Up to 11
2.	Medium	12 to 15
3.	High	16 and above
Mean = 13.82		S.D. = 2.55

3.9.1.6 Scientific Orientation

It is operationally defined as the degree to which respondents are oriented to use of scientific methods in relation to adoption of drip irrigation. Supe (1969) defined scientific orientation as the degree to which farmer was oriented towards the use of scientific methods in farming. The scale of Supe (1969) was used for measuring scientific orientation with slight modifications of Nagraj (2002) The scale consisted of six statements out of that one statement is negative the responses for each statement measured on three point continuum ranging from agree, undecided and disagree and

score assigned 3, 2, 1 and reverse for negative statement. The respondents were classified according to their level of scientific orientation towards drip irrigation system into three categories on the basis of mean \pm S.D. as given below.

Sr. No.	Category	Scientific Orientation
1.	Low	Up to 12
2.	Medium	13 to 15
3.	High	16 and above
Mean = 13.88		S.D. = 1.99

3.9.1.7 Innovativeness

It is a time taken by respondents for adoption of drip irrigation system. The respondents were classified according to level of their innovativeness. The scale developed by Singh (1972) was used to measure innovativeness. In the scale consisted of six statements and the responses was calculated on three point continuum namely agree, somewhat agree and disagree assigning score 3, 2 and 1. The raw score of innovativeness was work out. The categorization of respondents was made with the help of mean \pm standard deviation.

Sr. No.	Category	Innovativeness
1.	Low	Up to 11
2.	Medium	12 to 13
3.	High	14 and above
Mean = 12.44		S.D. = 1.55

3.9.1.8 Irrigation Sources

Irrigation sources involve various sources of water for irrigation like river, canal or farm ponds, tube-wells and open wells. The categorization of respondents was made on the basis of probability of availability of respective irrigation sources on the basis of frequency and percentage distribution.

Sr. No.	Irrigation sources	No. of Respondents	Percentage
1.	River		
2.	Canal/Farm pond		
3.	Tube-well		
4.	Well		
5.	River and canal/farm pond		
6.	River and tube-well		
7.	River and well		
8.	Canal/farm pond and tube-well		
9.	Canal/farm pond and river		
10.	Tube-well and well		

11. River, canal/farm pond, tube-well
12. River, tube-well and well
13. River, canal/farm pond and well
14. Canal/farm pond, tube-well, well

3.9.1.9 Cropping Intensity

Cropping intensity is nothing but the no of crops cultivated in a year by the respondents. Cropping intensity refers to raising of number of crops from the same field during one agricultural year. Cropping intensity was calculated by a formula,

$$\text{Cropping Intensity} = \frac{\text{Gross cropped area}}{\text{Net sown area}} \times 100$$

Cropping intensity was calculated with the help of above formula. Mean and standard deviation was calculated and categorization of respondents was made as below

Sr. No.	Category	Cropping Intensity
1.	Low	Up to 252
2.	Medium	253 to 284
3.	High	285 and above
Mean = 268.18		S.D. = 15.97

3.9.1.10 Cropping Pattern

Cropping pattern means the area under various crops at a point of time in a unit area. The respondents follow different cropping pattern on their field. They grow crops like paddy, soybean, groundnut and finger millet in *kharif* season, wheat, sorghum and gram mostly in *rabi* season and maize in summer season and sugarcane as a main crop which is annual in habitat. Such a different kind of cropping pattern is measured by frequency distribution method.

Sr. No.	Crop	No. of respondents	Percentage	Total area under crop (ha.)	Total yield (qtls.)	Average production (qt/ha.)
A	Kharif					
1.	Paddy					
2.	Groundnut					
3.	Soybean					
B.	Rabi					
1.	Wheat					
2.	Gram					

3.	Sorghum					
C.	Summer					
1.	Maize					
D	Annual					
1.	Sugarcane					

3.9.2 Dependent Variable

3.9.2.1 Comparative study of Drip and Conventional irrigation system

Comparative study of drip and conventional irrigation system is used by sugarcane growers was the dependent variable for the study. The responses were obtained from drip adopters and from those who adopts conventional system for irrigation to sugarcane on following aspects namely,

1. Awareness about drip irrigation
2. Guidance about drip irrigation
3. Motivation about drip irrigation
4. Fertigation
5. Subsidy for installment of drip irrigation set
6. Cleaning of filter and laterals of drip
7. Changes in properties of soil due to adoption of drip
8. Reasons for adoption of conventional irrigation system
9. Reasons for non adoption of advanced irrigation method

The categorization of respondents is made on the basis of frequency and percentage according to the responses on above aspects.

1. Awareness about drip irrigation

There are different sources of awareness about drip irrigation among the farmers like by progressive farmers, relatives, neighborhood farmers, friends, agricultural exhibitions, shetkari melawas, Kruihi Seva Kendra etc. The information pertaining to the awareness of respondents about drip irrigation was collected, tabulated and analyzed.

Sr. No.	Source	Respondents	
		Number	Percentage
1	Progressive Farmers		
2	Agriculture Exhibition		
3	Shetkari Melawa		
4	Relatives		
5	Neighborhood Farmers		
6	Krishi Seva Kendra		

2. Guidance for drip irrigation

Guidance for drip irrigation was obtained to the respondents from various companies and other successful farmers. Information pertaining to guidance for drip irrigation to respondents was collected, tabulated, analyzed.

Sr. No.	Source	Respondents	
		Number	Percentage

3. Motivation for Drip irrigation

Motivation for drip irrigation was obtained to the respondents by friends, relatives, various companies and other successful farmers. Information pertaining to motivation for drip irrigation to respondents was collected, tabulated, analyzed.

Sr. No.	Source	Respondents	
		Number	Percentage

4. Numbers of years of adoption of drip irrigation

Categorization of sugarcane growers according to their numbers of years of adoption is made as follows,

Sr. No.	Category(Years)	No. of respondents	Percentage
1	1 – 5		
2	6 – 10		
3	11 – 15		
4	16 – 20		
5	21 – 25		
6	26 – 30		
7	31-35		

5. Fertigation

Fertigation is the process in which fertilizer is dissolved, diluted and distributed along with water in drip or sprinkler irrigation system. Firstly the respondents were divided into two categories, one who were using fertigation and another who were not using fertigation. Again they were categoried according the use of fertilizer through fertigation.

Fertigation	Yes	No

If yes,

Sr. No.	Fertilizer	Respondents	
		Number	Percentage

6. Change in fertilizer dose after adoption of Drip irrigation

Categorization of respondents was made in two categories one who changed fertilizer dose and another who was not changed fertilizer dose after adoption of drip irrigation.

Sr. No.	Category	Respondents	
		Number	Percentage

7. Changes in properties of soil

Information pertaining to the changes in properties of soil observed by respondents was collected, tabulated and analyzed.

Sr. No.	Changes	Respondents	
		Number	Percentage

8. Cleaning of Filter and Laterals of Drip

Information pertaining to the cleaning of filter and laterals of drip irrigation set by use of water or any other chemical was collected, tabulated and analyzed.

Sr. No.	Part	Chemical	Respondents	
			Number	Percentage
A	Filter	Water		
		Acid		
		Other		
B	Lateral	Water		
		Acid		
		Other		

9. Reasons for adoption of conventional irrigation system

Information pertaining to the reasons for adoption of conventional irrigation system by respondents was collected, tabulated and analyzed.

Sr. No.	Particulars	Respondents	
		Number	Percentage

10. Reasons for non adoption of advanced irrigation systems

Reasons for non adoption of advanced irrigation systems by respondents were collected, tabulated, analyzed.

Sr. No.	Particulars	Respondents	
		Number	Percentage

11. Comparison of Conventional and Drip irrigation system

Advantages and disadvantages of drip and conventional irrigation systems were considered for comparative analysis of respective irrigation systems. Comparison of conventional and drip irrigation was made by collecting responses from sugarcane growers regarding different parameters like maximum water requirement, irrigation provided according to the need of crop, implementation cost, labour requirement, electricity requirement, requirement of land leveling, possibility of crop production in saline soil, minimum loss of chemical fertilizers, depth of soil weed infestation, saving of water repair and maintenance cost, soil erosion, increase in production etc.

Sr. No.	Particulars	No. of Respondents (N=120)	
		Conventional Irrigation	Drip irrigation
1	Maximum water requirement		
2	Water provided according need of crop		
3	High implementation cost		
4	Labour requirement		
5	Electricity requirement		
6	Requirement of land leveling		
7	Possibility of crop production in saline soil		
8	Minimum loss of chemical fertilizers		
9	Low depth of soil		
10	High weed infestation		
11	Saving of water		
12	Repair and maintenance cost		

13	Soil erosion		
14	High production		
15	Increase in production (%)		

3.9.3 Constraints for Adoption of Conventional Irrigation and Drip Irrigation System

For the present study constraint refers to the problem and difficulties faced by the farmer in actual adoption of drip irrigation system. Efforts were made to identify the constraints faced by farmers. They were asked to indicate the difficulties they have aspects connected with the drip irrigation. The difficulties reported by the farmers were listed out and frequency and percentage to each were worked out and the rank was given to each constraint based on the frequencies.

3.9.4 Suggestions given by sugarcane growers to overcome the constraints in adoption of drip irrigation.

The suggestion given by the farmers were listed out and frequency and percentage to each were worked out and the rank was given to each suggestions based on the frequencies.

3.10 Analysis of Data

The information collected through the interviews was transferred from the interview schedules to primary tables and then secondary tables. Wherever necessary the information of qualitative nature was converted into quantitative form.

3.11 Statistical Techniques used for Data Analysis

The statistical testes used in the present study for analysis of data, are given below.

3.11.1 Frequency and percentage

Frequency and percentage were used for making simple comparisons. The frequency of the particular category was multiplied by hundred and divided by total number of respondents to get percentage.

3.11.2 Arithmetic Mean

Mean of sample was calculated by summing all the individuals score and dividing it by number of cases. the formula is

$$\bar{X} = \frac{\sum Xi}{n}$$

Where,

X = Arithmetic mean

Xi = Value of the ith respondent

n = Number of cases

3.11.3 Standard Deviation

Standard deviation is a measure of variability calculated around mean. It was denoted by Greek letter Σ (sigma) and calculated with the following formula.

$$S.D = \sqrt{\frac{\Sigma(X_i - \bar{X})^2}{n-1}}$$

Where, S.D = Standard deviation,

\bar{X} = Mean of sample

X_i = Individual score of i^{th} respondent,

n = Total number of respondents.

3.11.4 Karl Pearson's Coefficient of Correlation Analysis

To find out the relationship between the selected dependent and independent variables.

Karl Pearson's Coefficient of Correlation 'r' by following formula

$$r = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{n}}{\sqrt{\left[\frac{\Sigma X^2 - (\Sigma X)^2}{n}\right] \times \left[\frac{\Sigma Y^2 - (\Sigma Y)^2}{n}\right]}}$$

Where, r = Correlation coefficient

X = Independent variables

Y = Dependent Variables

n = No. of respondents

4.RESULTS AND DISCUSSION

This chapter deals with the presentation of analysis and interpretation of data with view to draw meaningful conclusions by the use of appropriate statistical tests. The results of the various aspects under study are discussed considering the findings of the past studies and rationales are provided wherever needed. In general, this chapter presents the findings of the study under the followings section.

1. Personal and socio-economic characteristics of sugarcane growers.
2. Comparative analysis of conventional and drip irrigation system followed by sugarcane growers.
3. Relationship between selected independent variables and comparative study of conventional and drip irrigation system adopted by sugarcane growers.
4. Constraints in adoption of conventional and drip irrigation system by sugarcane growers.

4.1 Personal and Socio-Economic Characteristics of Sugarcane Growers.

4.1.1 Education

The information pertaining to the education of the sugarcane growers was collected, tabulated, analyzed and categorized in five categories according to the standard category made on the basis of prevailing norms and shown in Table 4.1

Table 4.1 Classification of the respondents according to their education

Sr. No.	Category	Respondent (N = 120)	
		Number	Percentage
1	Illiterate	2	01.67
2	Primary education (I st to VII th standard)	16	13.33
3	Secondary education (VIII th to X th standard)	32	26.67
4	Higher Secondary education (XI th to XII th standard)	25	20.83
5	College level (Graduation and above)	45	37.50

It was observed from Table 4.1 and fig. 4.1 that, considerable (37.50 per cent) of sugarcane growers had college level education followed by secondary education (26.67 per cent), Higher secondary education (20.83 per cent), primary education (13.33 per cent), and only 1.67 per cent respondents were found illiterate. The average education of the sugarcane growers is 11th standard.

The result shows that the sugarcane cultivation was preferred mostly by graduated people, secondary and higher secondary educated people. The majority of the respondents were well educated that they are enough aware and had knowledge about the various sugarcane cultivation practices. They manage all types of farm operations. From the above observation it has clearly seen that majority of the respondents were educated up to college level education.

Formal education enhances comprehensibility and skill of an individual. An educated individual is more prone to analyze the cause and effect relationship of different phenomena. This also leads to improve skill of an individual in problem solving.

The finding are in line with Ahire *et al.* (1999)

4.1.2 Land holding

The information pertaining to the land holding of the sugarcane growers was collected, tabulated, analyzed and categorized in five categories according to the standard category made by Government of Maharashtra and depicted in table 4.2.

Table 4.2 Classification of the respondents according to their land holding

Sr. No.	Category	Respondents (N = 120)	
		Number	Percentage
1	Marginal (Up to 1.00 ha.)	57	47.50
2	Small (1.01-2.00 ha.)	47	39.17
3	Semi-medium (2.01-4.00 ha.)	12	10.00
4	Medium (4.01-10.00 ha.)	04	03.33
5	Large (Above 10.00)	00	0.00
	Total	120	100.00

It is evident from Table 4.2 and fig. 4.2 that nearly half (47.50 per cent) of the respondents had 'Marginal' size of land holding, while, 39.17 per cent of the sugarcane growers had 'Small' size of land holding followed by 'Semi-medium' (10.00 per cent) and 'Medium' (3.33 per cent). The average land holding of the sugarcane growers is 1.55 ha.

Land holding is assumed as an important variable that influences perception behavior of the respondents. Due to the more population the piece of land was bifurcated or distributed into the next generation so 47.50 per cent respondents had marginal land holding.

The findings are in line with Nagade *et al.* (2003).

4.1.3 Annual Income

The information pertaining to the annual income of the sugarcane growers was collected, tabulated, analyzed and categorized in three categories on the basis of mean \pm S.D and depicted in Table 4.3.

Table 4.3 Classification of the respondents according to their annual income

Sr. No.	Category	Respondents (N = 120)	
		Number	Percentage
1	Low Up to Rs. 48,106/-	00	0.00
2	Medium Rs. 48,107 –Rs. 10,26,534/-	111	92.50
3	High Rs. 10,26,535/- and above	9	07.50
	Total	120	100.00

It is noticed from Table 4.3 and fig. 4.3 that majority 92.50 per cent of the sugarcane growers had medium annual income i.e. between Rs.48,107 - Rs.10,26,534/- whereas, 7.50 per cent respondents had high annual income . The average income of the sugarcane grower is Rs 5,37,321/-

The data revealed that maximum sugarcane growers had medium level of income. This is because of majority of the sugarcane had marginal size of land holding. The respondents with higher income are ready to invest large amount on inputs and ready to adopt various types of new technologies as compared to low income group of sugarcane growers

Annual income is a major determinant of the economic status of an individual. Better financial position of an individual provides him a chance to take risks in trying out improved crop production technology. He can also afford to spend more on items required in connection with the new farming techniques. Thus, annual income motivates and influences farmers to adopt more new agricultural techniques.

The findings are in line with Kadam (2008).

4.1.4 Extension Contact

The information pertaining to the extension contact of the sugarcane growers was collected, tabulated, analyzed and categorized in three category on the basis of mean \pm S.D and presented in Table 4.4

Table 4.4 Classification of the respondents according to their extension contact

Sr. No.	Category	Respondents (N = 120)	
		Number	Percentage
1	Low (Upto 7)	19	15.83
2	Medium (8 to 12)	88	73.33
3	High (13 and above)	13	10.84
	Total	120	100.00

It is observed from the Table 4.4 and fig. 4.4 that nearly three fourth (73.33 per cent) of the respondents had medium extension contact followed by 15.83 per cent and 10.84 per cent of the respondents had low and high extension contacts respectively. The average extension contact score is 9.5.

Thus it is concluded that majority of the respondent had medium level of contact with extension agencies for seeking the information about agriculture including recommended cultivation practices of sugarcane crop.

Extension contact is an important indicator for adoption of Sugarcane cultivation practices. It is presumed that the farmers have more contacts with extension worker and other agencies may derive more benefits from development agencies.

Similar finding were reported by Kale (2008), Mandlik (2012) and Thorat (2013).

4.1.5 Risk Taking Capacity

The information pertaining to the risk taking capacity of respondents was collected, tabulated and analysed and depicted in following Table 4.5

Table 4.5: Classification of respondents according to their risk taking capacity

Sr. No.	Category	Respondents (N = 120)	
		Number	Percentage
1	Low (Upto 11)	28	23.33
2	Medium (12 to 16)	72	60.00
3	High (17 and above)	20	16.67
	Total	120	100.00

Data depicted in Table 4.5 and Fig. 4.5 revealed that three fifth (60.00 per cent) of the respondents have medium risk taking capacity followed by 23.33 per cent of the sugarcane growers have low risk taking capacity and 16.67 per cent of sugarcane growers have high risk taking capacity.

This is concluded that majority of the sugarcane growers have medium risk taking capacity to improve farming practices. Majority of sugarcane growers are highly educated, so they are aware about new technologies and its benefits so they come forward for adoption of new technologies.

Similar finds are reported by Katkar (2000), Patel (2003) and Bannapure (2007)

4.1.6 Scientific Orientation

The information pertaining to the scientific orientation of respondents was collected, tabulated and analysed and depicted in following Table 4.6

Table 4.6: Classification of respondents according to their extent of scientific orientation

Sr. No.	Category	Respondents (N = 120)	
		Number	Percentage
1	Low (Upto 12)	32	26.67
2	Medium (13 to 16)	68	56.67
3	High (17 and above)	20	16.66
	Total	120	100.00

It is observed from Table 4.6 and Fig. 4.6 that majority (56.67 per cent) of sugarcane growers shows medium scientific orientation followed by 26.67 per cent shows low scientific orientation and 16.66 per cent shows high scientific orientation.

Majority of sugarcane growers are having education from medium to high, so they know the technologies which are beneficial in future. That's why, majority of respondents shows medium level of scientific orientation which influences them to adopt improved cropping practices.

Similar finding was reported by Kale (2000) and Kiranmayi (2013).

4.1.7 Innovativeness

Innovativeness is one of the important factor which influences the adoption behavior of respondents. The result is given in Table 4.7

Table 4.7: Classification of respondents according to their innovativeness

Sr. No.	Category	Respondent (N=120)	
		Number	Percentage
1	Low (Up to 11)	38	31.67
2	Medium (12 to 14)	53	44.17
3	High (15 and above)	29	24.16
	Total	120	100.00

It is observed from Table 4.7 and Fig. 4.7 that majority (44.17 per cent) of the sugarcane growers belonged to medium innovativeness category followed by 31.67 per cent belonged to low innovativeness category and 24.16 per cent respondents belonged to high innovativeness category.

It is revealed from above table that majority of the respondents comes under medium innovativeness category which influences them to adopt new cropping practices. This might be

farmers come forward for adoption of new technology. Their knowledge and experiences motivate them for innovativeness.

The findings are in line with Rathod (2005) and Supriya B. B. (2013).

4.1.8 Irrigation Sources

River, canal/farm pond, tube-well and well are sources of irrigation of the farmers. Categorization is made on the basis of number of irrigation sources available to the farmers is made and depicted in following Table 4.8

Table 4.8: Classification of respondents according to their irrigation sources

Sr. No.	Category	Respondent (N=120)	
		Number	Percentage
1	River	31	25.83
2	Canal/Farm pond	3	02.50
3	Well	18	15.00
4	River and tube-well	7	05.83
5	River and well	42	35.00
6	Canal/farm pond and tube-well	1	0.83
7	Canal/farm pond and well	2	01.67
8	Tube-well and well	14	11.67
9	River, canal/farm pond ,well	2	01.67
	Total	120	100.00

It is observed from Table 4.8 and Fig 4.8 that considerable number (35.00 per cent) of sugarcane growers had river and well as irrigation sources followed by 25.83 per cent had river, 15.00 per cent had well, 11.67 per cent had tube-well and well, 5.83 per cent had river and tube-well and 2.50 per cent had canal or Farm pond, 1.67 per cent had Canal/farm pond and 1.67 per cent had river, canal/farm pond and well as irrigation sources. Only 0.83 per cent of sugarcane growers had canal/farm pond and tube-well as irrigation source.

Panchganga river is a big source of water in Kolhapur district. Most of the selected villages are located on banks of river Panchganga so that majority of the sugarcane growers had river as a irrigation source.

Findings are not in line with Sasane *et al.* (2010).

4.1.9 Cropping Intensity

The information pertaining to the cropping intensity of respondents was collected, tabulated and analysed and depicted in following Table 4.9

Table 4.9: Classification of respondents according to their cropping intensity

Sr. No.	Category	Respondent (N=120)	
		Number	Percentage
1	Low (Up to 252.12)	26	21.67
2	Medium (252.13 to 284.14)	78	65.00
3	High (284.15 and above)	16	13.33
	Total	120	100.00

It is observed from Table 4.9 and Fig 4.9 that two third (65.00 per cent) of sugarcane growers had medium cropping intensity followed by 21.67 per cent had low cropping intensity and 13.33 per cent of sugarcane growers had high cropping intensity.

It is concluded from above table that majority of sugarcane growers had medium cropping intensity. There is adequate water available in selected area so, farmers cultivate various crops in three seasons. Therefore the cropping intensity is more than 200.00 per cent. Also the land holding of farmers is marginal so, for the income they cultivate more crops to fulfil their needs.

The findings are in line with Ghintala (2013) .

4.1.10 Cropping Pattern

On the basis of yearly sequence and special arrangement of crops the farmers were categorised and the results obtained are depicted in Table 4.10.

Table 4.10: Classification of respondents according to their cropping pattern

Sr. No.	Crop	No. of respondents	Percentage	Total area under crop (ha.)	Total yield (qtls.)	Average productivity (qt/ha.)
A	Kharif					
1.	Paddy	43	35.83	14.2	497	35.00
2.	Groundnut	33	27.50	13	234	18.00
3.	Soybean	41	34.17	14.5	362.5	25.00
B.	Rabi					

1.	Wheat	28	23.33	12.6	567	45.00
2.	Gram	20	16.67	4.8	144	30.00
3.	Sorghum	32	26.67	9.7	242.5	25.00
C.	Summer					
1.	Maize	24	20.00	3.5	105	30.00
D	Annual					
1.	Sugarcane	120	100.00	141.7	15020.2	106.00

The analysis presented in Table 4.10 and Fig. 4.10 revealed that, in *Kharif* season the respondents mostly grown paddy, groundnut, soybean crops. 35.83 per cent respondents cultivate paddy crop in *Kharif* season followed by 34.17 per cent and 27.50 per cent respondents cultivate soybean and groundnut respectively. In *rabi* season majority 26.67 per cent respondents cultivate sorghum followed by 23.33 per cent and 16.67 per cent respondents cultivate wheat and gram. In summer season, maize crop was cultivated by respondents. Maize was cultivated by 20 per cent respondents. All 120 (100.00 per cent) respondents cultivate sugarcane as a main crop on their field.

Cropping pattern is the area under various crops at a point of time in a unit area. The respondents follow different cropping pattern on their field. They cultivate different kind of crops on their field in a whole year. They sow cereals, pulses, oilseed crops and cash crops etc. on their farm but percentage of these crops are very less.

4.2 Dependent Variables

4.2.1 Comparative study of conventional and drip irrigation system followed by sugarcane growers

Comparative study of drip and conventional irrigation system is used by sugarcane growers was the dependent variable for the study. The responses were obtained from drip adopters and from those who adopts conventional system for irrigation to sugarcane on following aspects namely,

1. Awareness about drip irrigation
2. Guidance about drip irrigation
3. Motivation about drip irrigation
4. Fertigation
5. Subsidy for installment of drip irrigation set
6. Cleaning of filter and laterals of drip
7. Changes in properties of soil due to adoption of drip

8. Reasons for adoption of conventional irrigation system
9. Reasons for non adoption of advanced irrigation method

4.2.1.1 Awareness about drip irrigation

The information pertaining to the awareness of respondents about drip irrigation was collected, tabulated and analysed and depicted in Table 4.11

Table 4.11: Classification of respondents according to their source of awareness about drip irrigation

Sr. No.	Source	Respondents (N=60)	
		Number	Percentage
1	Progressive Farmers	21	35.00
2	Agriculture Exhibition	14	23.33
3	Shetkari Melawa	5	08.33
4	Relatives	10	16.67
5	Neighbourhood Farmers	7	11.67
6	Krishi Seva Kendra	3	05.00
	Total	60	100.00

It is observed from above table that more than one third (35.00 per cent) respondents made aware about drip irrigation from progressive farmers followed by 23.33 per cent by agricultural exhibition, 16.67 per cent by relatives, 11.67 per cent by neighbourhood farmers, 8.33 per cent from shetkari melawa and 5.00 per cent respondents made aware from Krishi Seva Kendra.

4.2.1.2 Guidance for drip irrigation

Information pertaining to guidance for drip irrigation to respondents was collected, tabulated, analysed and depicted in Table 4.12

Table 4.12: Classification of respondents according to their source of guidance for drip irrigation

Sr. No.	Source	Respondents	
		Number	Percentage
1	Progressive Farmers	16	26.67
2	Jain Irrigation Company	29	48.33

3	Netafim Irrigation Company	15	25.00
	Total	60	100.00

It is revealed from Table 4.12 that nearly half of the drip adopters 48.33 per cent was obtaining guidance from Jain irrigation company followed by 26.67 per cent was taking from progressive farmers and 25.00 per cent from Netafim irrigation company.

4.2.1.3 Motivation for drip irrigation

Information pertaining to the source of motivation for adoption of drip irrigation to respondents was collected, tabulated, analysed and depicted in Table 4.13

Table 4.13: Classification of respondents according to their source of motivation for drip irrigation

Sr. No.	Source	Respondents	
		Number	Percentage
1	Progressive Farmers	21	35.00
2	Jain Irrigation Company	16	26.67
3	Netafim Irrigation Company	9	15.00
4	Relatives	14	23.33
	Total	60	100.00

It is observed from above Table 4.13 that majority (35.00 per cent) of the respondents was motivated for adoption of drip irrigation by progressive farmers followed by 26.67 per cent was motivated by Jain irrigation company, 23.33 per cent was motivated by relatives and 15.00 per cent respondents was motivated by Netafim irrigation company.

4.2.1.4 Number of years of adoption of drip irrigation

Information pertaining to the number of years of adoption of drip irrigation was collected, tabulated and analysed and depicted in Table 4.14

Table 4.14: Classification of respondents according to their experience of drip irrigation

Sr. No.	Category (Years)	Respondents	
		Number	Percentage
1	1 – 5	39	65.00
2	6 – 10	15	25.00

3	11 – 15	2	03.33
4	16 – 20	2	03.33
5	21 – 25	1	01.67
6	26 – 30	0	0.00
7	31- 35	1	01.67
	Total	60	100.00

It is observed from above Table 4.14 that two third (65.00) per cent of the respondents comes under the category of 1 to 5 years followed by 25.00 per cent of the respondents comes under the category of 6 to 10 years, 3.33 per cent respondents comes under 11 to 15 years, another 3.33 per cent respondents comes under category of 16 to 20, 1.67 per cent of the respondents comes under category of 21 to 25 years and another 1.67 per cent respondents comes under the category of 31 to 35 years.

It is concluded from above Table 4.14 that in last decade adoption of drip irrigation is more i. e. about 90.00 per cent more as farmers know the value of water and requirement of water for specific crop.

4.2.1.5 Fertigation

Information pertaining to the fertigation through drip irrigation was collected, tabulated and analysed and depicted in Table 4.15 and Table 4.16

Table 4.15: Classification of respondents according to fertigation

Sr. No.	Fertigation	Respondents	
		Number	Percentage
1	Yes	57	95.00
2	No	3	05.00
	Total	60	100.00

If yes,

Table 4.16: Classification of respondents according to use of fertilizer for fertigation

Sr. No.	Fertilizer	Respondents	
		Number	Percentage
1	Urea	55	30.56

2	SSP (Single SuperPhosphate)	45	25.00
3	10:26:26	24	13.33
4	19:19	18	10.00
5	13:0:45	8	04.44
6	Neem Cake	30	16.67
	Total	180	100.00

It is observed from above Table 4.15 and 4.16 that majority 95.00 per cent of the respondents were using fertigation and only 5.00 per cent of respondents were not using fertigation. From the 95.00 per cent respondents, who were using fertigation majority 30.56 per cent respondents were applying urea, 25.00 per cent respondents were applying SSP (Single Super Phosphate), 16.67 per cent respondents were applying neem cake, 13.33 per cent were using 10:26:26, 10.00 per cent were using 19:19 and 4.44 per cent respondents were using 13:0:45 fertilizer for application.

4.2.1.6 Changes in fertilizer dose after adoption of drip irrigation

Information pertaining to the changes in fertilizer dose after adoption of drip irrigation was collected, tabulated and analysed and depicted in Table 4.17

Table 4.17: Classification of respondents according to changes in fertilizer dose after adoption of drip irrigation

Sr. No.	Category	Respondents	
		Number	Percentage
1	Yes	43	71.67
2	No	17	28.33
	Total	60	100.00

It is observed from Table 4.17 that (71.67 per cent) of the respondents were changed fertilizer dose after adoption of drip irrigation whereas, 28.33 per cent of the respondents didn't changed fertilizer dose after adoption of drip irrigation.

4.2.1.7 Changes in properties of soil

Information pertaining to the changes in properties of soil observed by respondents was collected, tabulated, analysed and depicted in Table 4.12

Table 4.18: Classification of respondents according to changes in properties of soil

Sr. No.	Changes	Respondents	
		Number	Percentage
A	Changes occurred in soil properties		
1	Increase in water holding capacity of soil	10	16.67
2	Increase in soil fertility	15	25.00
3	Maintainace in soil porosity	6	10.00
4	Increase in soil productivity	16	26.66
5	Decrease in soil stickiness	5	08.33
	Total	52	86.66
B	No change in soil properties	8	13.34
	Total	60	100.00

It is observed from Table 4.18 that majority (86.66 per cent) respondents observed changes in properties of soil after adoption of drip irrigation and 13.34 per cent of the respondents observed no change in soil properties after adoption of drip irrigation.

It is oserved that 26.66 per cent found increase in soil productivity and 25.00 per cent respondents found increase in soil fertility followed by 16.67 per cent respondents found increase in water holding capacity of soil, 10 per cent respondents found maintainance in soil porosity and 8.33 per cent of respondents found decrease in soil stickiness.

4.2.1.8 Cleaning of filter and laterals of drip irrigation

Information pertaining to the cleaning of filter and laterals of drip irrigation set by use of water or any other chemical by respondents was collected, tabulated, analysed and depicted in Table 4.19

Table 4.19: Classification of respondents according to the cleaning of filter and laterals of Drip

Sr. No.	Part	Chemical	Respondents	
			Number	Percentage
A	Filter	Water	60	100.00
B	Lateral	Water	27	45.00
		Hydrochloric acid (HCl)	31	28.18
		Sulphuric acid (H ₂ SO ₄)	24	51.67
		Phosphoric acid (H ₂ PO ₄)	15	40.00
		Nitric Acid (HNO ₃)	9	25.00
		Copper Sulphate (CuSO ₄)	4	06.67

It is observed from table 4.19 that all (100.00 per cent) respondents were using water for cleaning of filter of drip irrigation set.

Slightly more than half (51.67 per cent) number of respondents were using Sulphuric acid (H₂SO₄) for cleaning of laterals followed by 45.00 per cent respondents were using water for cleaning of laterals, 40.00 per cent respondents were using Phosphoric acid (H₂PO₄), 28.18 per cent respondents using Hydrochloric acid (HCl), 25.00 per cent were using Nitric acid (HNO₃) and 6.67 per respondents were using copper sulphate (CuSO₄) for cleaning of laterals.

4.2.1.9 Reasons for adoption of conventional irrigation systems

Reasons for adoption of conventional irrigation by respondents was collected, tabulated, analysed and depicted in Table 4.20

Table 4.20: Classification of respondents according to their reasons for adoption of conventional irrigation systems

Sr. No.	Particulars	Respondents	
		Number	Percentage
1	Availability of more water	28	46.67
2	Small area of cultivation	10	16.66
3	Affordable method and low cost	7	11.67
4	Simple and easy method	7	11.67

5	Lack of knowledge of advanced methods	8	13.33
	Total	60	100.00

It is observed from Table 4.20 that majority (46.67 per cent) respondents were adopted conventional irrigation method due to availability of more water followed by 16.66 per cent respondents were adopted due to small area of cultivation , 11.67 per cent respondents were adopted due to low cost and they perceived it was a affordable method of irrigation. Another 11.67 per cent respondents adopted conventional method as they was perceived is as a simple and easy method of irrigation and 13.33 per cent respondents adopted conventional irrigation method due to they had low knowledge about advanced irrigation methods.

4.2.1.10 Reasons for non adoption of advanced irrigation systems

Reasons for non adoption of advanced irrigation systems by respondents were collected, tabulated, analysed and depicted in Table 4.21

Table 4.21: Classification of respondents according to the reasons for non adoption of advanced irrigation systems

Sr. No.	Particulars	Respondents	
		Number	Percentage
1	Lack of knowledge of advanced methods	11	18.33
2	High cost	36	60.00
3	Traditional farming is better	5	08.34
4	Risk of damage due to flood	8	13.33
	Total	60	100.00

It is observed from Table 4.21 that three fifth of the respondents (60.00 per cent) had not adopted advanced irrigation systems because of high cost of advanced irrigation methods, 18.33 per cent of respondents had not adopted due to lack of knowledge of advanced irrigation methods, 13.33 per cent respondents not adopted advanced irrigation methods because of to risk of damage due to flood and 8.34 per cent respondents said that traditional method of farming is better.

4.2.1.11 Comparison of Conventional and Drip Irrigation System

Advantages and dis-advantages of drip and conventional irrigation systems was considered for comparative analysis of respective irrigation systems. Comparison of conventional and drip irrigation was made by collecting responses from sugarcane growers

Table 4.22 : Classification of respondents according to the comparison of conventional and drip irrigation system

Sr. No.	Particulars	No. of Respondents (N=120)	
		Conventional Irrigation	Drip irrigation
1	Maximum water requirement	120 (100.00)	0 (0.00)
2	Water provided according need of crop	9 (7.50)	111 (92.50)
3	High implementation cost	0 (0.00)	120 (100.00)
4	Labour requirement	116 (96.67)	4 (3.33)
5	Electricity requirement	81 (72.50)	39 (32.50)
6	Requirement of land levelling	120 (100.00)	0 (0.00)
7	Possibility of crop production in saline soil	0 (0.00)	120 (100.00)
8	Minimum loss of chemical fertilizers	0 (0.00)	120 (100.00)
9	Low depth of soil	120 (100.00)	0 (0.00)
10	High weed infestation	120 (100.00)	0 (0.00)
11	Saving of water	0 (0.00)	120 (100.00)
12	Repair and maintenance cost	0 (0.00)	120 (100.00)
13	Soil erosion	120 (100.00)	0 (0.00)
14	High production	19 (15.83)	101 (84.17)
15	Increase in production (%)	16 (13.33)	104 (86.67)

It is observed from Table 4.22 that for the parameter of maximum water requirement all respondents (100.00 per cent) belongs to conventional irrigation, for the category of water provided according to need of crop large majority (92.50 per cent) respondents belonged to drip irrigation and only about 7.50 per cent respondents belonged to conventional irrigation. According to the high implementation cost all (100.00) per cent respondents belonged to drip irrigation. According to the labour requirement majority (96.67 per cent) respondents belonged to conventional irrigation and only little (3.33 per cent) under drip irrigation. For the parameter of

requirement of electricity majority (72.50 per cent) of the respondents belonged to conventional irrigation and 32.50 per cent respondents belonged to drip irrigation. While to the requirement of land levelling all 120 (100.00 per cent) respondents belonged to conventional irrigation. According to the possibility of crop production in saline soil all 120 (100.00 per cent) respondents belonged to drip irrigation method. Regarding minimum loss of chemical fertilizer all 120 (100.00 per cent) respondents belonged to drip irrigation method. According to the low depth of soil all 120 (100.00 per cent) respondents belonged to conventional irrigation. While to the high weed infestation all 120 (100.00 per cent) respondents belonged to conventional irrigation. According to saving of water all 120 (100.00 per cent) respondents belonged to drip irrigation method. For the parameter of repair and maintainance cost 120 (100.00 per cent) respondents belonged to drip irrigation method. About soil erosion all 120 (100.00 per cent) respondents belonged to conventional irrigation. According to the high production majority (84.17 per cent) respondents belonged to drip irrigation and only about 15.83 per cent belonged to conventional irrigation. For the percent increase in production majority (86.67 per cent) respondents belonged to drip irrigation and only about 13.33 per cent belonged to conventional irrigation.

4.3 Relationship Between Personal and Socio-Economic Characteristics of the Sugarcane Growers with Conventional and Drip irrigation system

In the present study an attempt was made to find out the nature of relationship between the selected characteristics of the sugarcane growers with their level of knowledge. To ascertain the relationship, coefficient of correlation (r) was worked out. The data in this respect is present in Table 4.23

Table 4.23 Relationship between personal and socio-economic characteristics of the sugarcane growers with conventional and drip irrigation system

Sr. No.	Independent Variables	Correlation Coefficient	
		Drip Irrigation	Conventional Irrigation
1	Education	0.2885*	0.200NS
2	Land Holding	0.133NS	0.334***
3	Annual Income	0.234*	0.218*
4	Extension Contact	0.268**	0.229*
5	Risk Taking Capacity	0.216*	0.173NS
6	Scientific Orientation	0.281**	0.224*
7	Innovativeness	0.262**	0.233*

8	Irrigation Sources	0.252*	0.231*
9	Cropping Intensity	0.221*	0.323**
10	Cropping Pattern	0.319**	-0.143NS

* = 10 per cent level of significance

** = 5 per cent level of significance

*** = 1 per cent level of significance

NS= Non significant

4.3.1 Education with Conventional Irrigation and Drip Irrigation system

Relation between education of the sugarcane growers is positively significant with drip irrigation ($r = 0.288$) and non significant with conventional irrigation ($r = 0.200$).

The probable reason might be that more the education more is the knowledge of sugarcane growers about the improved sugarcane production technology.

4.3.2 Land holding Conventional Irrigation and Drip Irrigation system

Land holding of sugarcane growers was found to be non-significant with drip irrigation ($r = 0.1328$) and highly significant with conventional irrigation method ($r = 0.3341$).

This indicates that drip irrigation system is not influenced by land holding of farmer but land holding influences conventional irrigation methods as peoples were using conventional irrigation methods since long days but drip irrigation is a comparatively new method and requires more cost than conventional irrigation methods.

4.3.3 Annual Income with Conventional Irrigation and Drip Irrigation system

Annual Income of sugarcane growers was observed significant and positively related with drip irrigation ($r = 0.234$) as well as conventional irrigation system ($r = 0.218$).

This indicates that both the methods of irrigation, drip and conventional was influenced by annual income of the sugarcane growers. Annual income of an individual is an indicator of his economic status. An individual with higher economic status has better access to different sources of information. He has good relations with the officials and non-officials in different organizations. This ultimately widens his vision and horizons of knowledge. Resultantly, he can take rational decisions on the issues concerning him and his profession.

4.3.4 Extension Contact with Conventional Irrigation and Drip Irrigation system

Extension contact of respondents was highly significant and positively related with drip irrigation ($r = 0.268$) and conventional irrigation method ($r = 0.229$).

Individual having more contact with extension agencies might be more prone to get information about advanced irrigation methods and recommended cultivation practices of sugarcane.

4.3.5 Risk taking Capacity with Conventional Irrigation and Drip Irrigation system

Risk taking capacity of sugarcane growers is significant and positively related with drip irrigation ($r = 0.216$) and non-significantly related with conventional irrigation method ($r = 0.173$).

This indicates that drip irrigation method of the sugarcane growers was influenced by risk taking capacity and conventional irrigation method was not influenced by risk taking capacity. As risk taking capacity is more, a farmer can conduct the trials of different recommended cultivation practices of sugarcane through which he gets more income.

4.3.6 Scientific Orientation with Conventional Irrigation and Drip Irrigation system

Scientific orientation and drip irrigation were positive and significant with each other ($r = 0.281$) and scientific orientation and conventional irrigation are also significantly related with each other ($r = 0.224$).

The finding shows that as the area under sugarcane increased, the knowledge of the sugarcane growers also improved remarkably. More area under cultivation might have helped the sugarcane growers to go for commercial cultivation.

4.3.7 Innovativeness with Conventional Irrigation and Drip Irrigation system

Innovativeness of sugarcane growers is significant and positively related with drip irrigation ($r = 0.265$) and also with conventional irrigation ($r = 0.233$).

The findings lead to conclude that innovativeness was a crucial factor influencing the drip and conventional irrigation method adopted by sugarcane growers.

4.3.8 Irrigation sources with Conventional Irrigation and Drip Irrigation system

Irrigation sources of sugarcane growers is significant and positively related with drip irrigation ($r = 0.252$) as well as conventional irrigation method ($r = 0.231$).

Availability of irrigation source mainly influences the adoption of irrigation method by the farmers. Farmers adopt conventional method of irrigation when the water is available in large quantity but when there is scarcity of water and irrigation sources are not near, they prefer drip irrigation method.

4.3.9 Cropping Intensity with Conventional Irrigation and Drip Irrigation system

Cropping intensity of sugarcane growers was significant and positively related with drip irrigation method ($r = 0.221$) and cropping intensity of sugarcane growers was highly significant and positively related with conventional irrigation ($r = 0.323$).

It is indicated that cropping intensity influences both the methods of irrigation, drip as well as conventional irrigation. Farmers adopt conventional irrigation systems where water is available in large quantity and farmers can cultivate large number of crops in a year due availability of more water. In the areas of water scarcity it is also possible to cultivate number of crops in a year by adopting drip irrigation system.

4.3.10 Cropping Pattern with Conventional Irrigation and Drip Irrigation system

Cropping pattern of sugarcane growers was significant and positively related with drip

irrigation method ($r = 0.319$) and cropping pattern of sugarcane growers was negatively and non-significantly related with conventional irrigation ($r = - 0.143$).

4.4 Constraints Faced by the Sugarcane Growers in Adoption of Conventional and Drip Irrigation System

4.4.1 Constraints Faced by the Sugarcane Growers in Adoption of Conventional Irrigation System

Constraints refer to the difficulties or causes which prohibit farmers to adopt recommended cultivation practices of sugarcane.

Table 4.24 Constraints in adoption of conventional irrigation system

Sr. No.	Constraints	Respondent (N = 60)		Rank
		Frequency	Percentage	
1	Non-regularity of electricity	37	61.66	I
2	High weed infestation	29	48.33	II
3	Requirement of land levelling	18	30.00	III

It was observed from table 4.24 that, slightly more than three fifth 61.66 per cent of the sugarcane growers were stated non-regularity of electricity major constraint in adoption of conventional irrigation followed by 48.33 per cent respondents stated high weed infestation due to conventional irrigation while 30.00 per cent of the respondents faced the problem of requirement of land levelling.

4.4.2 Constraints Faced by the Sugarcane Growers in Adoption of Drip Irrigation System

Constraints refer to the difficulties or causes which prohibit farmers to adopt recommended cultivation practices of sugarcane.

Table 4.25 Constraints in adoption of drip irrigation system

Sr. No.	Constraints	Respondent (N = 60)		Rank
		Frequency	Percentage	
1	Damage of drip irrigation set by rodents	51	85.00	I
2	Breakage of laterals	47	78.33	II
3	Clogging in laterals	36	60.00	III
4	High installation cost	32	53.33	IV
5	Lengthy process for obtaining subsidy for drip irrigation	12	20.00	V

6	Less technical knowledge	7	11.67	VI
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It was observed from table 4.25 that, majority 85.00 per cent of the sugarcane growers were stated damage of drip irrigation set by rodents as major constraint in adoption of drip irrigation followed by breakage of laterals 78.33 per cent, clogging of laterals 60.00 per cent, high installation cost 53.33 per cent and 20.00 per cent of the respondents stated lengthy process of obtaining subsidy for drip irrigation, while 11.67 per cent of the respondents faced the problem of less technical knowledge.

4.5 Suggestions to overcome the Constraints in Adoption of Drip Irrigation System by Sugarcane Growers.

The suggestions given by the farmers to overcome constraints and adoption of cultivation practices of sugarcane recommendations were collected and depicted in table 4.18

Table 4.26 Suggestions of the sugarcane growers for adoption of recommended cultivation practices

Sr. No.	Suggestion	Respondents (N=60)		Rank
		Frequency	Percentage	
1	Price should be reasonable for drip irrigation set.	43	71.67	I
2	Regular guidance and services should be provided by sellers.	39	65.00	II
3	Co-operative sugar factory should provide guidance as well as services.	26	43.33	III
4	Availability of parts of drip irrigation set at local market	23	38.33	IV

It is concluded from Table 4.18 that Majority 71.67 per cent of the respondents suggested that the price should be reasonable for drip irrigation set followed by regular guidance and services should be provided by sellers 65.00 per cent, co-operative sugar factory should provide guidance as well as services 43.33 per cent while, 38.33 per cent of the respondents suggested that the parts of drip irrigation set should be available at local market.

5. SUMMARY, CONCLUSION AND IMPLICATIONS

This chapter deals with summary of the findings of the study and implications for the future line of action and research.

The present investigation entitled Comparative study of sugarcane growers using conventional irrigation and drip irrigation system in Kolhapur district was designed and conducted in Karvir and Hatkanangale of Kolhapur district following were objectives of the study.

1. To study the personal and socio-economic characteristics of the sugarcane growers.
2. Comparative analysis of conventional and drip irrigation system adopted by sugarcane growers.
3. To study the relationship between selected independent variable and comparative study of conventional and drip irrigation system adopted by sugarcane growers.
4. To obtain the constraints in adoption of conventional and drip irrigation systems by sugarcane growers .

5.1 Summary

5.1.1 Personal and Socio-Economic Characteristics of the Sugarcane Growers.

5.1.1.1 Education

Considerable 37.50% of sugarcane growers had college level education followed by secondary education 26.67%, Higher secondary education 20.83%, primary education 13.33%, and only 1.67% respondents were found illiterate.

5.1.1.2 Land Holding

Nearly half 47.50% of the respondents had 'Marginal' size of land holding, while, 39.17% of the sugarcane growers had 'Small' size of land holding followed by 'Semi-medium' 10.00% and 'Large' 3.33%.

5.1.1.3 Annual Income

Large majority 92.50% of the sugarcane growers had medium annual income between Rs.48,107 - Rs.10,26,534/- whereas, 7.50% respondents had high annual income i.e. Rs.10,26,535.

5.1.1.4 Extension Contact

Nerally three fourth 73.33% of the respondents had medium extension contact followed by 15.83% and 10.84% of the respondents had low and high extension contacts respectively.

5.1.1.5 Risk Taking Capacity

Three fifth 60.00% of the respondents have medium risk taking capacity followed by 23.33% of the sugarcane growers have low risk taking capacity and 16.67% of sugarcane growers have high risk taking capacity.

5.1.1.6 Scientific Orientation

Majority 56.67% of sugarcane growers shows medium scientific orientation followed by 26.67% shows low scientific orientation and 16.66% shows high scientific orientation.

5.1.1.7 Innovativeness

Majority 44.70% of the sugarcane growers belonged to medium innovativeness category followed by 31.67% belonged to low innovativeness category and 24.16% respondents belonged to high innovativeness category.

5.1.1.8 Irrigation Sources

Slightly more than one third number 35.00% of sugarcane growers are had river and well as sources of irrigation followed by 25.83% are had river, 15.00% had well, 11.67% had tube-well and well, 5.83% had river and tube-well and 2.50% had canal or Farm pond, 1.67% had Canal/farm pond and 1.67% had river, canal/farm pond and well as irrigation sources. Only 0.83% of sugarcane growers had canal/farm pond and tube-well as irrigation source.

5.1.1.9 Cropping Intensity

Two third 65.00% of sugarcane growers had medium cropping intensity followed by 21.67% had low cropping intensity and 13.33% of sugarcane growers had high cropping intensity.

5.1.1.10 Cropping Pattern

The study revealed that slightly more than one third 35.83% respondents cultivate paddy crop in *Khariif* season followed by 26.67% respondents cultivate sorghum in *rabi* season and maize was cultivated by 20% respondents in summer season. All 120, 100.00% respondents cultivate sugarcane as a main crop on their field.

5.1.2 Comparative study of Conventional and Drip Irrigation system followed by sugarcane growers

5.1.2.1 Awareness about drip irrigation

Slightly more than one third 35.00% respondents made aware about drip irrigation from progressive farmers followed by 23.33% by agricultural exhibition, 16.67% by relatives, 11.67% by neighbourhood farmers, 8.33% from shetkari melawa and 5.00% respondents made aware from Krishi Seva Kendra.

5.1.2.2 Guidance for drip irrigation

Nearly half of the drip adopters 48.33% was taking guidance from Jain irrigation company followed by 26.67% was taking from progressive farmers and 25.00% from Netafim irrigation company.

5.1.2.3 Motivation for drip irrigation

Slightly more than one third 35.00% of the respondents was motivated for adoption of drip irrigation from progressive farmers followed by 26.67% was motivated from Jain irrigation

company, 23.33% was motivated from relatives and 15.00% respondents was motivated from Netafim irrigation company.

5.1.2.4 Number of years of adoption of drip irrigation

Two third 65.00% of the respondents comes under the category of 1 to 5 years followed by 25.00% of the respondents comes under the category of 6 to 10 years, 3.33% respondents comes under 11 to 15 years, another 3.33% respondents comes under category of 16 to 20, 1.67% of the respondents comes under category of 21 to 25 years and another 1.67% respondents comes under the category of 31 to 35 years.

5.1.2.5 Fertigation

Large majority 95.00% of the respondents were using fertigation and only 5.00% of respondents were not using fertigation. From the 95.00% respondents, who were using fertigation majority 30.56% respondents were applying urea, 25.00% respondents were applying SSP (Single Super Phosphate), 16.67% respondents were applying neem cake, 13.33% were using 10:26:26, 10.00 per were using 19:19 and 4.44% respondents were using 13:0:45 fertilizer for application.

5.2.1.6 Changes in fertilizer dose after adoption of drip irrigation

Majority 71.67% were changed fertilizer dose after adoption of drip irrigation where, 28.33% of the respondents didn't changed fertilizer dose after adoption of drip irrigation.

5.2.1.7 Changes in properties of soil

Majority 86.66% respondents observed changes in properties of soil after adoption of drip irrigation and 13.34% of the respondents observed no change in soil properties after adoption of drip irrigation

5.2.1.8 Cleaning of filter and laterals of drip

All 100.00% respondents were using water for cleaning of filter of drip irrigation set. Slightly more than half 51.67% number of respondents were using Sulphuric acid (H_2SO_4) for cleaning of laterals followed by 45.00% respondents were using water for cleaning of laterals, 40.00% respondents were using Phosphoric acid (H_2PO_4), 28.18% respondents using Hydrochloric acid (HCl), 25.00% were using Nitric acid (HNO_3) and 6.67% respondents were using copper sulphate ($CuSO_4$) for cleaning of laterals.

5.2.1.9 Reasons for adoption of conventional irrigation systems

Majority 46.67% respondents were adopted conventional irrigation method due to availability of more water followed by 16.66% respondents were adopted due to small area of cultivation, 11.67% respondents were adopted due to low cost and they perceived it was a affordable method of irrigation. Another 11.67% respondents adopted conventional method as they was perceived is as a simple and easy method of irrigation and 13.33% respondents adopted conventional irrigation method due to they had low knowledge about advanced irrigation

methods.

5.2.1.10 Reasons for non adoption of advanced irrigation systems

Three fifth of the respondents 60.00% had not adopted advanced irrigation systems because of high cost of advanced irrigation methods, 18.33% of respondents had not adopted due to lack of knowledge of advanced irrigation methods, 13.33% respondents not adopted advanced irrigation methods because of to risk of damage due to flood and 8.34% respondents found traditional way of farming is better.

5.2.1.11 Comparison of Conventional and Drip Irrigation System

It is revealed that for the parameters of maximum water requirement, requirement of land leveling, low depth of soil, high weed infestation, soil erosion all respondents 100.00% belongs to conventional irrigation, for the category of water provided according to need of crop large majority 92.50% respondents belonged to drip irrigation and only about 7.50% respondents belonged to conventional irrigation. For the parameters of high implementation cost, possibility of crop production in saline soil, minimum loss of chemical fertilizer, repair and maintainance cost, saving of water, all 100.00% respondents belonged to drip irrigation. According to the labour requirement majority 96.67% respondents belonged to conventional irrigation and only little 3.33% under drip irrigation. For the parameter of requirement of electricity nerly about three fourth 72.50% of the respondents belonged to conventional irrigation and 32.50% respondents belonged to drip irrigation. Regarding high production majority 84.17% respondents belonged to drip irrigation and only about 15.83% belonged to conventional irrigation. While to the percent increase in production majority 86.67% respondents belonged to drip irrigation and only about 13.33% belonged to conventional irrigation.

5.3 Relationship Between Personal and Socio-Economic Characteristics of the Sugarcane Growers with Comparative study of Conventional and Drip irrigation system

It is concluded that sugarcane grower's characteristics viz. education, annual income, extension contact, risk taking capacity, scientific orientation, innovativeness, irrigation sources, cropping intensity, cropping pattern were positively and significantly related with drip irrigation and land holding is non-significantly related with drip irrigation.

sugarcane grower's characteristics viz. annual income, extension contact, scientific orientation, innovativeness, irrigation sources, cropping intensity, cropping pattern were positively and significantly related with conventional irrigation while education, risk taking capacity is non-significantly related with conventional irrigation and cropping pattern is negatively and non-significantly related with conventional irrigation system.

5.4 Constraints Faced by the Sugarcane Growers in Adoption of Conventional and Drip Irrigation System

5.4.1 Constraints Faced by the Sugarcane Growers in Adoption of Conventional Irrigation

System

Major constraint in adoption of conventional irrigation given by respondents was non-regularity of electricity 61.66% , 48.33% respondents stated high weed infestation due to conventional irrigation while 30.00% of the respondents faced the problem of requirement of land levelling.

5.4.2 Constraints Faced by the Sugarcane Growers in Adoption of Drip Irrigation System

Majority 85.00% of the sugarcane growers were stated damage of drip irrigation set by rodents as major constraint in adoption of drip irrigation followed by breakage of laterals 78.33%, high implementation cost 60.00% and 20.00% of the respondents stated lengthy process of obtaining subsidy for drip irrigation, while 11.67% of the respondents faced the problem of low technical knowledge

5.4 Suggestions Given by Sugarcane Growers for Adoption of Drip Irrigation System

Majority 71.67% of the respondents suggested that co-operative sugar factory should provide the drip irrigation set and payment form assurity followed by 65.00% respondents suggested that regular guidance and services should be provided by sellers/dealers/company followed by 43.33% respondents suggested that co-operative sugar factory sould provide guidance as well as services and 38.33% respondents suggested that availability of parts of drip irrigation at local market

5.5 Conclusion.

5.5.1 Personal and Socio-Economic Characteristics of the Respondents.

Majority of the sugarcane growers had received college level education, having marginal size of land holding, having medium annual income, having medium extension contacts, having medium risk taking capacity, having medium scientific orientation, medium innovativeness, river as a irrigation source and medium cropping intensity.

5.5.2 Comparative study of Conventional and Drip Irrigation system followed by sugarcane growers

It was observed that majority of the sugarcane growers were made aware about drip irrigation from progressive farmers, got guidance for drip irrigation from Jain irrigation company, got motivated from profressive farmers, adopted drip irrigation from 1 to 5 years, using fertigation through drip irrigation, applying urea through fertigation, changed their fertilizer dose after adoption of drip irrigation, observed changes in soil properties mostly increase in soil fertility, cleaning filter by using water and laterals by using hydrochloric acid (HCl), adopted conventional irrigation method due to availability of more water, not adopted advanced irrigation systems because of high cost of advanced irrigation methods.

5.6 Implications

The implications based on the findings of the present study, following suggestions in the form of implication are offered. The implications are presented into two parts viz., implication for action and implications for future research. Implications with regards to research are based on experiences during the course of investigation and will be useful for guidelines and suggestions for further research on same topic. Action implications may also be useful for extension personnel, development departments, policy makers, NGO's personnel and other related personnel, engaged in agricultural development.

Implication for Action

Even though the people have aware about advantages of drip irrigation, adoption is not up to the mark. So the Department of Agricultural, Maharashtra state should conduct the awareness programmes, result demonstrations which convince the people about how drip irrigation is profitable and better over other conventional irrigation methods.

Training programmes should have to be organised by agricultural department to the farmers aware about advanced irrigation methods and to overcome the constraints in adoption of drip irrigation.

The present study was confined to limited area and sample. So, the conclusion will be applicable to area of the study only. For generalizing the conclusions, it is necessary to conduct similar studies in other districts of the regions by drawing larger sample.

Research Implications

1. In the present study the research made an effort on comparative study of sugarcane growers using conventional and drip irrigation system. Though, the study was limited to only two tahsils of Kolhapur district of Maharashtra. Therefore, it is suggested that the study may be conducted in other district of Maharashtra as well as other state of country. This will help to make valid and wider generalization regarding comparative study of drip and conventional irrigation system
2. The studies regarding the characteristics of farmers in relation to their knowledge of irrigation water management practices of selective nature are suggested.
3. Majaority of sugarcane growers in Kolhapur district are having medium annual income, it means there is good scope to promote advanced irrigation methods in study area.
4. This study would also be useful as a benchmark for further probe into the studies of similar type.
5. To cover wide range of factors of human behaviour of the farmers in transfer of technology further interdisciplinary research is necessary.

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8.VITAE

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IN
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2019

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