IMPACT OF INTERCROPPING ON SUGARCANE GROWERS

by

Miss. Enugula Meena
(Reg. No. 019 / 177)

A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI – 413 722, DIST. AHMEDNAGAR
MAHARASHTRA, INDIA

In partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION AND COMMUNICATION

DEPARTMENT OF AGRICULTURAL EXTENSION
AND COMMUNICATION
POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI – 413 722, DIST. - AHMEDNAGAR
MAHARASHTRA, INDIA.

2021

IMPACT OF INTERCROPPING ON SUGARCANE GROWERS

by

Miss. Enugula Meena
(Reg. No. 019 / 177)

A Thesis
submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI – 413 722, DIST. AHMEDNAGAR
MAHARASHTRA, INDIA.

In partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION AND COMMUNICATION

APPROVED BY

Dr. G. K. Sasane
(Chairman and Research Guide)

Dr. S. B. Bhange
(Committee Member)

Dr. U. S. Surve
(Committee Member)

Dr. M. R. Patil
(Committee Member)

DEPARTMENT OF AGRICULTURAL EXTENSION AND COMMUNICATION
POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI – 413 722, DIST. - AHMEDNAGAR
MAHARASHTRA, INDIA.

2021

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part

there of has not been submitted

by me or another person to any

other University or Institute

for a Degree or

Diploma

Place: MPKV, Rahuri (Enugula Meena)

Date: / /2021

Dr. G. K. Sasane
Chairman and Guide,
Department of Agril. Extension and Communication
Post Graduate Institute,
MPKV, Rahuri
Dist- Ahmednagar
Maharashtra State, India

CERTIFICATE

This is to certify that the thesis entitled, **"IMPACT OF INTERCROPPING ON SUGARCANE GROWERS"** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL EXTENSION AND COMMUNICATION,** embodies the result of a piece of bona fide research work carried out by **Miss. ENUGULA MEENA** under my guidance and supervision and 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 has been duly acknowledged.

Place: MPKV, Rahuri (**Dr**. **G. K. Sasane**)

Dated: / /2021

Dr. M. C. Ahire
Head
Department of Agril. Extension and Communication
Post Graduate Institute
Mahatma Phule Krishi Vidyapeeth
Rahuri-413722, Dist- Ahmednagar
Maharashtra, India

CERTIFICATE

This is to certify that the thesis entitled, **"IMPACT OF INTERCROPPING ON SUGARCANE GROWERS"** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirement for the award of degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL EXTENSION AND COMMUNICATION,** embodies the results of a piece of bona fide research work carried out by **Miss. ENUGULA MEENA,** under the guidance and supervision of **Dr. G. K. SASANE**, Professor of Agril. Extension and Communication, Department of Agril. Extension and Communication, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri and that no part of the thesis has been submitted for any other degree or diploma.

Place: MPKV, Rahuri **(Dr. M. C. Ahire)**

Dated: / / 2021

Dr. P. N. Rasal
Associate Dean
Post Graduate Institute
Mahatma Phule Krishi Vidyapeeth
Rahuri-413722, Dist- Ahmednagar
Maharashtra, India

CERTIFICATE

This is to certify that the thesis entitled, **"IMPACT OF INTERCROPPING ON SUGARCANE GROWERS"** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL EXTENSION AND COMMUNICATION,** embodies the results of a piece of bona fide research work carried out by **Miss. ENUGULA MEENA,** under the guidance and supervision of **Dr. G. K. SASANE**, Professor of Agril. Extension and Communication, Department of Agril. Extension and Communication, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri and that no part of the thesis has been submitted for any other degree or diploma.

Place: MPKV, Rahuri **(Dr. P. N. Rasal)**

Dated: / /2021

ACKNOWLEDGEMENTS

"Words can't give full justice
To express sense of gratitude."

At the very outset, I would like to thank Almighty God for showering his blessings upon me. He fills me with courage and confidence to fulfill the desired task. Today I stand on door of this great vision only due to my major advisor **Dr.G. K. Sasane** , Professor, Department of Agril. Extension and Communication, MPKV, Rahuri for his constructive criticism, valuable guidance, constant encouragement and everlasting inspiration during whole tenure of the investigation. It was his most co-operative and painstaking attitude, which made this thesis a reality.

The moral zeal and constant assurance at every count bestowed by the members of Advisory Committee, I would like to express my sincere thanks to Dr. S. B. Bhange, Associate Professor, Department of Agril. Extension and Communication, MPKV, Rahuri, Dr. U. S. Surve, Associate Professor, Department of Agronomy, MPKV, Rahuri and Dr. M. R. Patil, Assistant Professor, Department of Statistics, MPKV, Rahuri for their valuable, constructive criticism, timely help, suggestion and moral support during the study.

I am highly obliged to **Dr. P. G. Patil,** Honourable Vice Chancellor, MPKV, Rahuri for providing necessary facilities during the entire course of study.

I express my deepest feeling of gratitude and well devoted to **Dr. P. N. Rasal**, Dean, Faculty of Agriculture and Associate Dean, PGI, MPKV, Rahuri **Dr. S. R. Gadakh,** Director of Research and Director of Extension, MPKV, Rahuri and **Dr. M. C. Ahire**, Head, Department of Agril. Extension and Communication for providing all the necessary facilities required for completion of this study.

I am equally indebted to Dr. P, B. Kharde, Dr. S. S. Sadaphal, Dr. D. N. Pharate, Dr. A. M. Chavai, Dr. G. K. Waman, Dr. B. A. Deshmukh and other staff members of Department of Agril. Extension, MPKV, Rahuri for their suggestions and constructive encouragement during the tenure of research. I express my grateful thanks to Dr. Kishor Patil, Librarian, University Library, MPKV, Rahuri for providing necessary facilities for the research work.

I feel indebted to Shri. R.H. Rathod (Agril. Assistant), Sau. S.V. Nimse (Senior Clerk), Anil Dada and Shri. V.N. Tonde mama for their valuable help during the completion of this work.

Though inadequate I would like to express special thanks to my dear seniors Tekkem Sirisha, Sajan sir, Preethi mam, Pratap Sir, Padma Sir, Santosh Sir, Ritesh Sir, Ravi Sir, Prashant sir, Mininath sir, Gaurav sir, Ranvir sir, Shubham sir, Suraj sir, Sudhir sir, Sujit sir, Jitendra sir, Dipa Madam, Gayatri mam, Pooja Madam, Priyanka madam, Surabhi madam and my classmates Mounika and Madhugandha, Ruchika, Nikita, Varsha, Pooja, Vikas, Shivam, Vivek, Rushikesh, Sadanand, Balasaheb, Ramesh, Samadhan, Abasaheb, for helping me directly or indirectly, selfless encouragement throughout the bright and dark phase of research work.

My heart is always filled with sweet memories and amaranths love to my dear friends Rekha, Suresh, Bhargavi, Vajramma, Rakesh, Mounika, Anil, Rama Krishna, Navya, Acharitha, Bhavana, Harini for giving me encouragement affection companionship and help in all moments of life.

I express my heartiest gratitude and deep indebtedness to my parents mother Smt Neeraja and father Shri. Ramreddy and my sister Mounika Reddy, brother Vishnu Charan Reddy, who always stood like lighthouse for illumination in the pathway of every success and their sacrifice in moulding me and building up my educational career. I cannot imagine if I could do anything without them. They remain the pillars of all sources for me since beginning of my life.

I am deeply obliged to all the authors past and present whose literatures have been cited. Thanks to all those who helped me knowingly or unknowingly in this study.

Lastly, I would like to express my sincere thanks to Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar for providing me an opportunity to undertake my post graduate studies in this ***"Institute of Excellence".***

Place: MPKV, Rahuri

Date: / /2021 **(Enugula Meena)**

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS AND SYMBOLS

%	: per cent
Agril.	: Agriculture
Dr. PDKV	: Dr. Panjabrao Deshmukh Krishi Vidyapeeth
et al	: Etalia (and other)
etc.	: et cetra
Fig.	: Figure
ha.	: Hectare
i.e.	: That is
J	: Journal
MPKV	: Mahatma Phule Krishi Vidyapeeth
No.	: Number
PGI	: Post Graduate Institute
Rs.	: Rupees
Sr. No.	: Serial number
Unpub.	: Unpublished
viz.,	: Videlicet (Namely)

ABSTRACT

Impact of Intercropping on Sugarcane Growers

By

Enugula Meena

A candidate for the degree

of

Master of Science (Agriculture)

In

AGRICULTURAL EXTENSION AND COMMUNICATION

2021

Research Guide : Dr. G. K. Sasane

Department : Agricultural Extension and Communication

Sugarcane (*Saccharum officinarum L.*) is an important crop fulfilling 60 per cent of the sucrose requirement. It is considered as a cash crop and plays the main role in the rural economy of the Maharashtra. Sugarcane is very economically, socially and politically sensitive crop.

Sugarcane also supports two important rural and cottage industries *viz*., Gur (Jaggery) and khandsari industry. By- products like molasses is the main raw material for alcohol and alcohol-based industries. Sugarcane bagasse is the chief source of power in sugarcane mills. Another by-product press mud contains considerable amount of plant nutrients. It is also used in paper industries as well as fuel purpose. World population is growing exponentially and there is a need to fulfil its food requirements. An important strategy for increasing labour utilization per unit area of available land and productivity is to intensify land use. Intercropping, the agricultural practice of cultivating two or more crops in the same space at the same time, is an old and commonly used cropping practice which aims to match efficiently crop demands to the available growth resources and labour. The most common

advantage of intercropping is the production of greater yield on a given piece of land by making more efficient use of the available growth resources. Sugarcane being a long duration crop and takes about 90-120 days for canopy development, which allows for growing intercrops during the early stage. Taking advantage of this, sugarcane cultivators grow various short duration crops like pulses, vegetables, etc. as intercrops to get intermediate return since small sugarcane growers cannot wait for a long time to get financial return from sole sugarcane crop. Since sugarcane is an important commercial crop all over the world and is most suitable for intercropping, this review focuses on sugarcane based intercropping system.

In view of this, present study entitled impact of intercropping on sugarcane growers was planned and undertaken with objectives (1) To study the personal, Socio economic and psychological characteristics of respondent beneficiaries. (2) To study the impact of intercropping on sugarcane growers in terms of additional gain in yield and income. (3) To study the relationship between selected characteristics of respondent beneficiaries and the impact of intercropping. (4) To study the constraints faced by and suggestions to overcome those constrains from the respondent beneficiaries.

The study was purposefully conducted in Ahmednagar district which is under MPKV jurisdiction where the area under sugarcane is high. The Rahuri and Rahata tehsils were purposively selected from Ahmednagar district. Eight villages were selected from these two tehsils on the basis of maximum number of respondents and thus, 160 respondents out of which 80 are sole cropping farmers and 80 are sugarcane intercropping farmers were selected randomly for the present study. An interview schedule based on the objectives of the study was prepared. The collected data were statistically analyzed and presented.

From the research findings it was observed that Majority of the intercropping respondents belonged to middle age group having education up to secondary level. Majority of the respondent sugarcane-intercropping growers had possessed small size of land holding. It also revealed that a majority of the respondents were found in medium level of annual income, sources of information. Also observed that majority of the respondents had additional gain in yield and income from intercropping. Regarding the relationship between various characteristics of respondents and impact of intercropping it was observed that sources of information, economic motivation and education had positive and highly significant relationship with impact of intercropping. The other independent variables viz., land holding, area under sugarcane, annual

income had positive and significant relationship at 0.05 level of probability with impact of intercropping. There was negative and statistically no significant relationship between age of respondents, farming experience and impact of intercropping. The data indicated various constraints and suggestions of respondents like benefits of intercropping and the technology increased yield, need for pest and disease free seed, stable price for onion, establishment of cold storage facilities, training programmes on processing of onion and need for mechanization in order to escape from the drudgery.

1. INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is one of the important crops fulfilling 60 per cent of the sucrose requirement. It is considered as a cash crop and plays the main role in the rural economy of Maharashtra. Sugarcane is a very economically, socially and politically sensitive crop. World production of sugarcane is 1,324 million tons with an area of 20.42 M ha. India ranks second in both area and production next to Brazil. In Maharashtra, it is an important commercial crop occupying 0.896 M ha. of area with production of 54,046 lakh tons. Maharashtra ranks second next to Uttar Pradesh in area and productivity. Sugarcane also supports two important rural and cottage industries viz., Our (Jaggery) and khandsari industry. By-products like molasses are the main raw material for alcohol and alcohol-based industries. Sugarcane bagasse is the chief source of power in sugarcane mills. Another by-product press mud contains a considerable amount of plant nutrients. It is also used in paper industries as well as fuel purpose

Intercropping in Sugarcane

Intercropping is an age-old practice of growing two or more crops simultaneously on the same piece of land. It is a technique of crop intensification in both time and space wherein competition between crops may occur during a part or whole growth period. Sugarcane (*Saccharum officinarum* L.) crop occupies an important position in Indian agriculture and plays a pivotal role in the national economy by sustaining the second largest organized agro industry in the country next to textile. In India it is grown in 5.00 million hectares area with a production of 350.00 million tons and the average productivity is 70.00 t/ha. There is a little scope of increasing area under sugarcane due to heavy competition for food, fiber, oilseed, pulses etc. Therefore, the only alternative left is to increase the vertical production of sugarcane and sugar by finding out the efficient agronomic management practices. In recent years, several changes in the cropping system have been observed. The sole cropping has been shifted to an intercropping system which has proved to be productive, economically feasible and sustainable. As we know, Sugarcane is a long duration crop with spacing of 75 to 150 cm. It is a slow growing crop up to 80-90 days. Its efficient root system helps to tap plant nutrients and moisture from the soil deep layers allowing the intercrops to feed at the top layer of soil.

Objective of Intercropping

In Sugarcane, the wide space of inter-row 90 cm available between 2 rows of sugarcane, long duration for bud sprouting, initial slow rate of growth and its ability to compensate for any loss of tillers due to intercrop competition have helped in successful intercropping of vegetables, grain legumes, oilseeds, potato and maize, in plant crop and forage legumes in winter-initiated ratoon. The major objectives of intercropping are to produce an additional crop, to optimize the use of natural resources and to stabilize the yield of crops. In order to meet the growing demand of diverse crops

and to arrest further decline in factor productivity and to make the sugarcane production system more viable, it is necessary to enhance the productivity of the system as a whole. The companion cropping of sugarcane with high value medicinal, oilseeds and vegetable for seed purpose were found remunerative rather than growing the sole crop of sugarcane.

Sugarcane based intercropping systems, viz. sugarcane sole and sugarcane intercropped with lentil (*Lens esculentus*), rajma (*Phaseolus vulgaris L.*), Indian mustard (*Brassica campestris*), rapeseed (*Brassica* sp.) and maize (*Zea mays L.*) The intercropping with rajma had no adverse effect on the number of millable canes (117.6 thousand/ha), cane length (213 cm) and cane yield (83.4 t ha-1) compared with sole cane.

Sugarcane Intercropping with Legumes

Growing pulses with sugarcane crops not only increases the area under pulse crop but also reduces the intensity of weeds and provides midseason income to house-holds for further use of critical inputs to sugarcane along with additional employment opportunities. The reduction in cane yield was 14.0, 8.9 and 11.4 per cent with cowpea [*Vigna unguiculata (L.) Walp.*], mung bean (*Vigna radiata*) and urd bean (*Vigna mungo*) intercropping respectively. Sugarcane intercropped with Sesbania (GM) yielded similar to that of sole sugarcane. Sugarcane + cowpea gave 17.2, 15.8, 19.0 and 26.5 per cent higher mean cane equivalent yield (118.4 tons ha-1) than sole sugarcane, sugarcane + mung bean, sugarcane + urd bean and sugarcane + Sesbania intercropping respectively.

Sugarcane Intercropped with Forage

Intercropping of berseem in winter-initiated sugarcane ratoon significantly increased the number of millable canes (117.8 thousand Chogatapur et al Int. J. Pure App. Biosci. 5 (2): 319-323 (2017) ISSN: 2320 7051 Copyright © April, 2017; IJPAB 321 ha-1), cane yield (72.4 t ha-1), cane-equivalent yield (90.81 t ha-1) and commercial cane sugar (8.81 t ha-1) compared with sole cropping (7.66 t ha-1)

Sugarcane Intercropped with Vegetables

Intercropping of cereals, legumes, oilseeds, vegetables and spices in autumn sugarcane have been found to enhance natural resources use efficiency, productivity and profit margins. The intercropping of wheat, ray, methi as seed crop, sugar beet as vegetable and linseed suppressed tillering and significantly reduced the shoot production of autumn sugarcane. The vertical planted sugarcane intercropped with garlic and methi as vegetable followed by onion as vegetable produced similar cane yield and were significantly better than rest of the intercropping systems.

Sugarcane Intercropped with Other Crops

Sugarcane + maize gave the highest mean cane-equivalent yield (200.6 tons ha-1) being 52.5, 45.4, 55.7, 50.0 and 48.6 per cent higher than sole sugarcane and its intercropping with lentil, mustard, rajma and rapeseed, respectively. However, all the intercrops except maize, reduced cane yield

attributed to decline in the number of millable canes. Mean reduction in cane yield was 8.7 per cent with lentil, 14.8 per cent with mustard, 13.3 per cent with rajma and 8.7 per cent with rapeseed

Profit from Maize Intercropping with Sugarcane

Sugarcane intercropped with maize gave a highest net return of Rs 124,874 ha-1 followed by sugarcane alone (Rs 71,145) as against Rs 62,104; 65,067; 67,138 and 69,040 with intercropping of mustard, rajma, rapeseed and lentil respectively. Sugarcane + cowpea also gave the highest net return of Rs 57,772 compared to Rs 41,449 with urd bean and Rs 48,330 with sole sugarcane.

Profit from Onion Intercropping with Sugarcane

Among all intercrops, onions appeared to be easy to manage and get results. Thus, the inclusion of short-duration intercrops like onion, potato, and methi in autumn-planted sugarcane may improve the socio-economic status of small and marginal cane growers by generating mid-season income.

Scope and Importance of Study

Scope for Intercropping in Sugarcane

Great potential exists in India for increasing crop production and productivity through wider use of multiple cropping in cereals, millets, oilseeds, legumes and fibre crops. In long duration crops like sugarcane, intercropping holds much promise. Due to slow establishment of sugarcane during the first 90-120 days, the greatest scope for complementary effect lies in the addition of annual intercrops to the temporal system to improve resource use efficiency in the early crop growth period.

The findings of the study would be helpful to understand adoption level of sugarcane-intercropping growers with regards to various aspects like yield and income for both sole cropping and also with intercrop. The study will also provide information regarding the best suitable intercropping in sugarcane.

Purpose of Study

Taking intercrop is beneficial to the farmers but only few farmers are taking intercropping in sugarcane.so the main purpose of my study is to find out the impact of intercropping in terms of yield and income on sugarcane growers besides sole sugarcane cropping. It was, therefore, thought necessary to assess the impact of intercropping on the sugarcane growers.

Objectives

1. To study the personal, socio-economic and psychological characteristics of sugarcane growers
2. To study the impact of intercropping on sugarcane growers.
3. To find the relationship between the personal, socio-economic and psychological characteristics and their impact.
4. To study the constraints faced by sugarcane growers in following intercropping patterns and suggestions to overcome them.

Hypothesis

The following hypotheses were developed for testing empirically on the basis of past research and objectives of the present study.

1. The personal, socio-economic and psychological characteristics of the respondents are in

2.Taking intercrop may have made a positive impact on the farmers.

Limitations of Study

The study suffers from the following limitations: -

1. As the data collection of this study was confined to the intercropping in sugarcane in the operational area, the generalizations of the findings will be limited to this area only.

2. The findings of this study are based on the ability of the respondents to recall and on the verbal opinion expressed by them. Hence, the objectivity of this study would be limited to their ability to recall and also their honesty in furnishing the required information.

Layout of Thesis

The thesis contains five chapters. The first chapter is introduction. It deals with the purpose of the study of specific objectives as well as importance and limitations of the study. The second chapter Review of Literature gives a brief account of relevant work done in the past on the topic of present investigation. Chapter third deals with the Methodology followed in the study. The fourth chapter deals with the presentation of Results and Discussion. The last chapter constitutes Summary, Conclusions and Implications of the study. The literature cited in the body of presentation has been given under the head Literature Cited. The interview schedule and other material are appended at the end.

2. REVIEW OF LITERATURE

This chapter deals with the comprehensive review of literature, which is directly or indirectly relevant to the objectives of the study. Comprehensive review of literature is an essential part of any scientific investigation. Its main functions are to determine the previous work done, assist in delineation of problem areas which provide basis of theoretical framework, provide an insight into methods and procedure to be used and operational definitions of major concepts to help in interpretation of findings. Considering the objectives, the review of literature of present investigation has been presented under the following sections.

2.1 To study the personal, socio-economic and psychological characteristics of sugarcane growers

2.2 To study the impact of intercropping on sugarcane growers

2.3 To find the relationship between the personal, socio-economic and psychological characteristics and their impact.

2.4 To study the constraints faced by sugarcane growers in following intercropping and suggestions to overcome them**.**

A) Independent Variables

2.1. Personal, Socio-Economic and Psychological Characteristics of Sugarcane Growers

2.1.1 Age

Solanki *et al* (2004) observed that 56.44 per cent of the sugarcane growers were above 45 years age groups followed by 30.69 per cent of growers between 31 to 45 years age group.

Thorat *et al* (2004) observed that 39.44 per cent of the sugarcane growers were of middle age group followed by 32.22 per cent were of old age group and 28.34 per cent were of young age group.

Mate (2006) observed that 41.50 per cent of the potato growing respondents were in the middle age group (i.e 36 to 50 years) and 35.50 per cent of them were from the young age group of 51 and above years.

Sasane *et al.* (2008) observed that the sugarcane growers belonged to the old age group of above 56 years (41.67 %).

2.1.2 Education

Gurav (2000) revealed that most sugarcane growers had acquired secondary (41.77 %) and higher secondary (27.45 %) level of education, 14.72 per cent had the education of college level, whereas, very few (6.86 %) were illiterate.

Thorat *et al* (2004) observed that 36.67 per cent of sugarcane growers were having secondary school education followed by higher secondary education (22.22 %).

Solanki *et al* (2004) reported that about 48.00 per cent of the sugarcane growers had secondary education (8th to 12th standard) followed by 24.75 per cent had primary education.

Mate (2006) revealed that more than 93.00 per cent of the potato respondents were educated. Out of that 55.00 per cent had received secondary or college education. Only 6.50 per cent of them did not receive any formal education.

Shanthy *et al*. (2012) found that the majority (63.33 %) of sugarcane growers were having a secondary level of education, while only 10 per cent of them had college level of education.

2.1.3 Annual Income

Shaikh *et al*. (2004) observed that about 63.00 per cent of the sugarcane growers had annual income less than Rs.1,00,000 followed by 29.00 per cent had annual income between Rs. 1,00,000 to Rs. 2,00,000.

Mande and Thombre (2009) found that 26.39 per cent sugarcane growers had annual income of Rs.1 lakh. However, 31.94 per cent respondents had annual income between Rs.1 lakh to Rs 1.5 lakh and 41.67 per cent had more than Rs.1.5 lakh annual income.

Khandave and Suryawanshi (2015) observed that, majority (76.00 %) of the farmers beneficiaries had medium annual income i.e. Rs. 200001 to 900000, followed by 24.00 per cent of the farmers beneficiaries had high annual income i.e. above Rs. 900000.

Bhabhor (2015) found that slightly less than two-fifths (39.17 %) of soybean growers had obtained secondary and higher secondary education, followed by primary level of education (28.33 %) and illiterate (15.00 %). While, 13.33 per cent of the respondents had college level and above level of education and only 04.17 per cent of them can read and write.

Venkatachalam *et al*. (2016) revealed that 46.00 per cent of the respondents had annual income of Rs. 10,001 to Rs. 25,000 followed by 40.00 per cent of the respondent's income between Rs.25,001 to Rs. 4,00,000, 08.00 per cent growers had income below Rs. 1,00,000 and only 06.00 per cent respondents were annual income of above Rs. 400000.

Jatapara (2014) reported that about 43.33 per cent of the gram growers had found in low level of (up to Rs. 50,000) annual income followed by 35.84 and 20.83 per cent medium and high annual income, respectively.

2.1.4 Size of Land Holding

Gurav (2000) observed that nearly half of the respondents (48.03 %) had medium size of land holding, whereas, 29.43 per cent and 22.54 per cent respondents had large and small size farms, respectively.

Shaikh *et al*. (2004) found that the majority (56.45 %) of the respondents were having medium land holding of 2.01 to 5.00 ha followed by small farmers (25.81 %).

Solanki *et al*. (2004) reported that the majority (62.37 %) sugarcane growers had land holding up to 1 ha. followed by 26.74 per cent of growers had land holding of 1 to 2 ha.

Thorat *et al*. (2004) observed that the majority of sugarcane growers (86.11 %) had a large size of land holding followed by medium land holding (10.00 %). Mande and Thombre (2009) observed that the majority of the respondents had medium land holding.

Rathod *et al*. (2013) observed that, half (50 %) respondents were having large land holding while 30.00 per cent were having small land holding and remaining 20.00 per cent were having medium land holding.

Bhabhor (2015) estimated that more than two-fifths of the soybean growers (45.00 %) had a small size of land holding, followed by 35.84 per cent had marginal size of land holding and 13.33 per cent had medium size of land holding. While only 05.83 per cent belonged to the large size of land holding.

Patil (2015) reported that 32.99 per cent of the soybean growers were possessed semi medium size of land holding, followed by 29.86 per cent small size of land holding, 18.75 per cent of marginal size of land holding, 17.36 per cent of medium size land holding and 01.04 per cent of the respondents were large size of land holding.

Deshmukh (2016) elucidated that, nearly half of the respondents (49.00%) from watershed villages were having semi medium size of land holding i.e., 2.1 to 4 ha., followed by 30.00 per cent of them had small size of land holding i.e., 1.1 to 2 ha. Whereas 12.00 per cent and 08.00 per cent of them were having medium i.e., 4.1 to 10 ha. and marginal size of land holding i.e., up to 1 ha. respectively and only few (1.00 %) of them were belongs to big size of land holding i.e., more than 10.1 ha.

Siraj (2016) revealed that majority of the respondents (80.00 %) possessed smaller land holdings, 20.00 per cent of the soybean growers belonged to below 5 ha of land.

2.1.5 Sources of Information

Sonawane *et al.* (2001) in her study entitled, Utilization of communication sources by the farmers for seeking farm information concluded that a large majority (96.87 %) of the respondents gained information from Agriculture Assistant (25.78 %), Circle Agriculture Officer (21.87 %) and Agriculture Officer (21.09 %).

Thorat *et al.* (2004) observed that 68.89 per cent of farmers always obtained information from friends and relatives followed by Agricultural Assistants (43.89 %) and university scientists (38.89 %).

Sasane *et al.* (2008) observed that the majority (63.33 %) of sugarcane growers were always obtaining information through Agricultural Assistants.

Tijare (2018) reported that 66.00 per cent of the respondents were utilized medium level of information sources, followed by 22.00 per cent were used low and only 12.00 per cent of them were used high source of information.

Borase (2015) affirmed that 60.84 per cent of the respondents were from medium (23 to 28) source of information.

2.1.6 Area under Sugarcane

Shaikh *et al.* (2004) observed that (62.91 %) of the respondents had area under sugarcane upto 1.00 ha, while, 27.42 per cent of them had area under sugarcane of 1.01 to 2.00 ha. and 8.87 per cent of them had area between 2.01 to 5.00 ha.

Gaikwad (2013) observed that more than half (51.66 %) of the respondents had an area between 1.01 to 2.00 ha. under sugarcane followed by 29.15 per cent of them had area upto.00

Dhodia *et al.* (2014) found that the majority (69.00 %) of respondents were having medium economic motivation, followed by 20.00 per cent of the respondents had low level economic motivation and 11.00 per cent with high level of economic motivation.

Shete (2014) revealed that most (75.83 %) of the respondents had a medium level of economic motivation. Whereas 14.16 per cent of the respondents had low level economic motivation and 10.00 per cent with high level of economic motivation.

Thorat (2014) noticed that the majority (66.67 %) of respondents were having medium economic motivation, followed by 23.33 per cent and 10.00 per cent high and low economic motivation, respectively.

2.1.8 Cropping Pattern

Chavan (2009) noted that 58.00 per cent soybean respondents had medium adoption level about contingency cropping pattern.

Jadhav (2015) reported that 58.33 per cent of the soybean respondents were fair cropping pattern and 29.17 per cent of the soybean respondents had poor cropping pattern, while 12.50 per cent of soybean respondents had best cropping pattern.

Mergewar (2017) revealed that 79.17 per cent of the soybean respondents possessed fair cropping pattern, whereas 10.83 per cent were good and 10.00 per cent of them were poor cropping pattern.

Vipinkumar (2017) revealed that cropping pattern and cropping combination were mostly controlled by topography, soil and irrigation facilities. The spatial variations of cropping pattern recognized in the basin area were highly useful not only for watershed development planning but also for the economic development of the respondents lives in basin area.

2.1.9 Experience in Farming

Kadam (2016) reported that 60.00 per cent of the respondents were 11 to 20 years of farming experience, followed by 27.00 per cent were up to 10 years farming experience and 13.00 per cent of the respondents were above 20 years farming experience.

Chengappa (2017) concluded that 67.50 per cent of the soybean growers had medium farming experience, followed by 16.07 per cent high and 15.83 per cent possessed low farming experience.

Sapate (2018) studied that 62.50 per cent of the soybean growers were medium farming experience (8 to 14 years), followed by high i.e., more than 15 years and low (<7 years) farming experience.

2.1.10 Economic Motivation

Jatapara (2014) stated that 52.50 per cent gram respondents had medium economic motivation, followed by 22.50 per cent low, 16.67 per cent high, 05.83 per cent very low and 02.50 per cent of gram respondents were belonged to very high level of economic motivation.

Darandle (2010) reported that 60.00 per cent tribal maize growers were medium level of economic motivation, followed by 24.16 per cent maize growers were high and 15.84 per cent of tribal maize growers were low level of economic motivation.

Parikh (2013) affirmed that 60.00 per cent of the soybean respondents possessed medium economic motivation followed by 21.67 per cent and 18.33 per cent soybean respondents had low level and high level of economic motivation, respectively.

2.2 Impact of Intercropping on Sugarcane Growers

Kumbhare and Khonde (2009) reported that half (50.00%) of the respondents had medium level of impact, followed by equal per centage (25.00%) of the respondents had high and low impact.

Jatav *et at.* (2010) observed that, more than half 55.55 per cent of the respondents possessed medium level of impact, while about one fourth 25.55 per cent of the respondents possessed high and remaining 18.88 per cent of the respondents possessed low level of impact.

Mankar *et al.* (2013) observed that, NEM had created a moderate impact on 68.33 per cent of beneficiaries, followed by high impact on 15.00 per cent of beneficiaries and 16.67 per cent of beneficiaries had low impact on NHM.

Bhandari (2014) noticed that 69.16 per cent beneficiaries of MGNREGA had a medium level of overall impact followed by (16.67%) low and (14.67 %) high level of overall impact of MGNREGA on the beneficiaries of MGNREGA.

Mankar *et al.* (2014) observed that, near about 70.00 per cent of the respondents had a low level of overall impact of soybean technology, followed by 30.00 per cent of them had medium and none of the respondents from high level of overall impact of soybean technology.

Ahire and Kapse (2015) revealed that 45.00 per cent of respondents had high overall impact whereas a similar per centage of respondents had medium overall impact and 10.00 per cent of respondents had low overall impact.

2.3 The Relationship between the Personal, Socio-economic and Psychological Characteristics and their Impact.

Patel *et al.* (2012) found that the age of tribal farmers had negative but significant correlation with their socio-techno-economic change.

Kale (2012) observed that there was a highly positive significant relationship between age of respondents and impact of SGSY on socio- economic condition of beneficiaries.

Sirohiya *et al.* (2012) observed that, there was a non-significant relationship between age of respondent's trainees and impact in terms of adoption.

Soni *et al.* (2012) observed that, there was a non-significant relationship between age of trained farmers and impact of training programme in terms of adoption of organic farming practices.

Bansode *et al.* (2013) observed that, there was not show any relation of age with impact of SHG on socio-economic development of their members.

Patel (2011) found that the education level of peasants had a positive and significant relationship with their level of socio-techno-economic change.

Bansode *et al.* (2013) observed that, there was not any relation of education with impact of SHG on socio-economic development of their members.

Kumawat and Bhati (2013) observed that, there was a positive and significant relationship between education of respondents and impact in terms of knowledge.

Parate (2013) observed that, there was a non-significant relationship between education of beneficiary farmers and overall impact of farm ponds on agricultural development of beneficiary farmers.

Ingole (2014) observed that, there was a non-significant relationship between education of beneficiaries and overall impact of farm ponds on beneficiaries.

Chavhan (2019) found that there was non-significant relationship between respondents and overall impact of mobile based agro advisory services.

Soni (2005) revealed that annual income of the knishi go vidhya faun magazine subscriber and non-subscriber farmers had positive and significant relationship with their techno-economic change.

Patel (2007) found that the size of land holding of peasants had positive and significant correlation with their level of socio-techno-economic change.

Soni (2005) observed that land holding of the Krishi-Go-Vidhya Farm Magazine subscriber farmers had established linear correlation with their techno-economic change.

Matwa *et al.* (2013) found that maize growers had positively and significantly correlated with their socio-techno-economic change.

Bhandari (2014) observed that, there was a significant relationship between land holding of beneficiaries of MGNREGA and socio-economic impact of MGNREGA.

Ingole (2014) observed that, there was a non-significant relationship between land holding of beneficiaries and overall impact of farm ponds on beneficiaries.

Meenakshi (2014) observed that, there was a negative significant relationship between age of land holding and socio-economic impact of labour migration on the families.

Rathod and Pawar (2014) observed that, there was a positive and highly significant relationship between land holding and socio-economic status of the respondents.

Chaudhari *et al.* (2015) observed that, there was non-significant relationship between land holding of respondents and impact in terms of knowledge regarding improved agricultural technology of wheat crop.

2.4 Constraints Faced by Sugarcane Growers in Following Intercropping Pattern

Thorat *et al*. (2004) observed that high cost of micro-nutrients (66.67 %), lack of knowledge (50.00 %) and non-availability of different micro-nutrients (33.33 %) were the major constraints reported by the respondents regarding its use to the Sugarcane crop.

Shaikh *et al.* (2004) showed that a large majority of the Sugarcane growing farmers faced problems like non-availability of predators (82.26 %), no use of Sugarcane as a fodder (77.42 %), insecticides are costly (73.39 %), interculturing is difficult in old crop (64.52 %) and no technical knowledge about spraying of insecticides (62.90 %).

Solanki *et al*. (2004) found that majority (84.16 %) of the Sugarcane growers faced problem of irregular supply of electricity followed by high cost of inputs (64.3 %).

Mande and Thombre (2009) observed the problems like irregular supply of electricity (77.32 %), low prices offered by sugar factories and harvesting schedule not followed properly by sugar factories in adoption of Sugarcane cultivation practices (62.77 %).

Rasool *et al.* (2011) conducted a study on prospect of intercropping rabi crops in autumn planted sugarcane and indicated that sugarcane planted alone produced highest cane yield of 130.5 t ha- 1, while sugarcane intercropped with wheat produced lowest cane yield of 105.5 t ha-1. The yields of wheat, lentil and gram were 1.18, 0.57 and 0.43 t/ha, respectively. However, it was observed that intercropping of wheat, lentil and gram with sugarcane decreased cane yield by 19.2, 18.6 and 14.3%, respectively. The maximum economic return of r 156641 ha-1 was noticed when sugarcane was planted without intercropping, whereas, intercropping of sugarcane with wheat resulted in minimum

return of 138889 ha-1. Findings of the study revealed that autumn planting of sugarcane without any intercropping is more profitable than intercropping with cereal and leguminous crops.

Kumar *et al.* (2011) studied the production potentials of winter vegetables as intercrop in autumn planted sugarcane and indicated that intercropping of onion with autumn planting sugarcane is economically viable and feasible option to replace the existing cropping system without left sugarcane which is highly suitable cash crop in agro-marketing condition of western Uttar Pradesh and crop-animal husbandry based farming system which is predominant and success farming system considered by majority of the farmers.

Rehman *et al.* (2014) conducted a study on intercropping in sugarcane received much attention and need to properly manage for getting higher net return from same unit area. It is becoming popular among farming community due to resourcefully utilization of land. Intercropping has the potential to inspire the farmers to get maximum economic return per acre per annum. For intercropping, wheat, gram, soybean, and potato were used as an intercrop in September-sown sugarcane. intercrops gave higher land equivalent ratio and net return over sole sugarcane planted while sole sugarcane gave maximum benefit cost ratio compared with other intercrops.

In short, most of the previous studies revealed that sugarcane growers were not fully aware about the intercropping method of sugarcane cultivation. Socio-economic as well as geographical factors was major barriers in adoption of intercropping method for sugarcane cultivation. The constraints in adoption of intercropping method depend on geographical situation and socio-economic status of the farmers in respective area. Therefore, there is a need to test the above factors or constraints in the study area in adoption of intercropping method of sugarcane cultivation. To sum up all the reviews, it is revealed that the use levels of resources, cost incurred and profits obtained, resource use productivities and its efficiencies etc. varied with locality and method of sugarcane cultivation. Therefore, in the present study efforts are made to test these facts in sugarcane v/s sugarcane + intercropping system.

2.5 Suggestions to Overcome the Constraints

Shete (2006) found that majority (86.15 per cent) of the tomato growers suggested that bio pesticides, pheromone traps and light trap should be available in low prices at local places, 76.15 per cent of the respondents suggested that plant protection equipments should be made available in time and reasonable rate, 60.00 per cent of the respondents suggested that disease and pest forecasting from State Department of Agriculture and Agril. University, 31.31 per cent of the respondents suggested that the literature about IPM should be made available in local language.

Sasane *et al.* (2008) observed the suggestions of Sugarcane growing farmers regarding reasonable cost of electricity (78.60 %), cent per cent subsidy for drip irrigation (57.81 %) and technical knowledge about drip irrigation system (55.00 %).

Gurav *et al.* (2015) observed that majority (25.55 %) of the sugarcane growers suggested that CoM-0265 should be harvested along with other varieties, rates of the chemical fertilizers should be lowered (22.22 %), sugar factories should harvest crop within time (18.88 per cent), Information regarding sugarcane INM should be provided timely (16.66 %) and Bio-fertilizers should be made easily available and in time (10.00 %).

3. METHODOLOGY

For scientific study of any research problem, the researcher has to adopt appropriate materials, methods and procedures in order to arrive at useful conclusions. Keeping this view in mind, this chapter deals with where and how research work was carried out, construction of the interview schedule, methods used for the selection of the respondents, means adopted for the quantification of qualitative data and preparation of primary and secondary tables. The details of the procedure used in this study are given here as under.

3.1 Locale of study

3.2 Sampling procedure

3.3 Measurement of variables

3.4 Devices and methods used for data collection

3.5 Statistical tools used for analysis of data

3.6 Operational definitions and terms used

3.1 Locale of the Study

The present study was conducted in Rahuri and Rahata tahsils of Ahmednagar district of Maharashtra state. This district was purposely selected since the area under sugarcane is high which is under MPKV jurisdiction.

3.1.1 Geographical Background

Ahmednagar district lies between 19004’58.96” North latitude and 74045’09.54” East longitude and Altitude 715.3 m MSL. Beed district is on the East, Thane and Pune districts to the West, Osmanabad district to the South-East, Solapur district to South and Nashik and Aurangabad to the North side of Ahmednagar district.

3.1.2 Area

Ahmednagar district has a geographical area of 1703 sq.km. comprising of 14 tahsils. The geographical area of Rahuri tahsil is 1,035.11 $km^2$and Rahata tahasil is 759.19 km^2.

3.1.3 Population

As per 2011 census the total population of Ahmednagar district was 40.87 lakh. Out of this 21.06 lakh is male and 19.81 lakh is female population. The total population of Rahuri tahsil is 2.94 lakh, out of this 1.52 lakh male and 1.42 lakh is female, while, the total population of Rahata tahsil is 2.88 lakh, out of this 1.48 lakh male and 1.39 lakh is female. The sex ratio is 956 females out of 1000 male in Ahmednagar district and 955 females out of 1000 male in Rahuri and 952 females out of 1000

male in Rahata tahsils, respectively. Literacy percentage of Ahmednagar district is 75.82 per cent. The male literacy is 86.90 per cent, while female literacy is 64.10 per cent.

3.1.4 Topography and Soils

3.1.4.1 Soils

The soils of Rahuri and Rahata tahsils are commonly grouped as light to medium black. In very few places black soils are observed. Medium fertile soils are suitable for both kharif and rabi season crops.

3.1.5 Climate

The climate of this tahsil is generally dry and hot.

3.1.5.1 Temperature

The temperature of this tahsil varies from 9^0C (during Dec.) to 41^0C (during April and May).

3.1.5.2 Rainfall

Annual average rainfall of Ahmednagar district is 566 mm and that of Rahuri tahsil is 455 mm. and Rahata tahasil is 490 mm.

3.1.6. Land Utilization Pattern

Table 1. Land utilization pattern of Ahmednagar district, Rahuri and Rahata tahsils

Sr.No.	Land use category	Ahmednagar (Lack ha.)	Rahuri (Lack ha.)	Rahata (Lack ha.)
1.	Total geographical area	17.02	1.35	0.759
2.	Area under forest	1.63	0.15	0.10
3	Barren and uncultivated land	1.31	0.13	0.07
4	Land put on non-agriculture use	1.3	0.08	0.04
5	Cultivable waste	1.9	0.198	0.144
6	Permanent pasture and grazing land	17	NA	NA
7	Current fallow	0.89	0.37	0.25
8	Other fallow	0.93	0.64	0.50
9	Net sown area	10.79	0.33	0.22
10	Area sown more than once	3.63	0.74	0.52
11	Gross cropped area	NA	0.20	0.07
12	Gross cultivable area	11.46	1.34	0.74

3.1.7 Cropping Pattern

The major crops of Rahuri and Rahata tahsils are sugarcane, maize, wheat, jowar, cotton, soybean, wheat, red gram, bajra, onion and pomegranate, grape, guava. In kharif season major crops grown are sugarcane, cotton, maize, soybean, red gram and bajra, while, in rabi season, wheat, jowar (rabi) are grown. Sugarcane is the major cash crop cultivated on maximum cultivable land in the tahsils annually.

3.1.8. Sources of Irrigation

Well is the major source of irrigation in Rahuri and Rahata tahsils which covers a large area of these two tahsils. However, canal irrigation is available with limited area.

3.1.9. Livestock

According to the 2002-03 census, the total number of livestock in Rahuri tahsil was 4,61,659 which includes cattle and bullock 1,14,233, buffaloes 10,009, sheep 60,115 and the total size of poultry was 1,15,834. The livestock population in Rahata tahsil was 2, 31,546 which includes cattle and bullock 85,215, buffaloes 75,165, sheep 70,165 and total size of poultry 80,830.

3.1.10. Other Facilities

The educational facilities are available through primary, secondary schools, technical and non-technical colleges throughout the district. Medical facilities are also available through primary health centers and private practitioners. The credit facilities are available through district co-operative bank, land development bank and State Bank of India. Ahmednagar district is well known for co-operative sector especially cooperative sugar factories.

3.2 Sampling Procedure

3.2.1 Selection of Tahsils

The Rahuri and Rahata tahsils of Ahmednagar district were purposely selected for the study since under MPKV jurisdiction the area under sugarcane is high.

3.2.2 Selection of Villages

Rahuri(tahsil)	Rahata(tahsil)
4 villages from each tahsil	4 villages from each tahsil
20 farmers from each village	20 farmers from each village
10 sole sugarcane cropping farmer	10 sole sugarcane cropping farmer
10 intercropping farmer	10 intercropping farmer

In Ahmednagar district, the study will be conducted in rahuri and rahata tahsils, from each tahsil information was collected from 4 villages and from each village information was taken from

20 farmers. Among 20 farmers, 10 are sole cropping farmer and 10 are intercropping farmer.Thus from 4 villages information was collected from 80 farmers growing sole sugarcane crop and 80 farmers having intercrop were selected for this study.Thus a total 160 respondents and samples were selected for study.

3.2.3 Selection of Respondents

The farmers who are taking sole sugarcane cropping and those who are taking intercrop in sugarcane were randomly selected for the study. Hence, from all 8 villages, 160 respondents were selected for the present study. The details of selected villages and number of respondents from each village are shown as under.

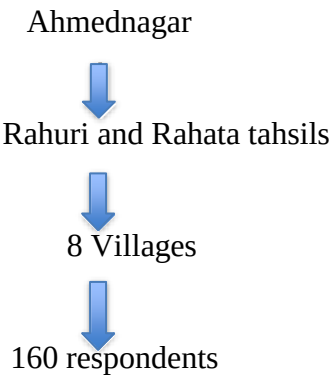


Table 2. Selected Villages and Number of Respondents

Name of tahsil	Selected villages	No of respondents	Distribution of respondents
Rahata	Rajuri	20	10-Sole cropping 10-Intercropping
Rahata	Bableshwar	20	10-Sole sugarcane cropping 10-Intercropping
Rahata	Nandur	20	10-Sole sugarcane cropping 10-Intercropping
Rahata	Nirmal	20	10-Sole sugarcane cropping 10-Intercropping
Rahuri	Digras	20	10-Sole sugarcane cropping 10-Intercropping
Rahuri	Rahuri	20	10-Sole sugarcane cropping 10-Intercropping
Rahuri	Baragaon nandur	20	10-Sole sugarcane cropping 10-Intercropping
Rahuri	Khadambe	20	10-Sole sugarcane cropping 10-Intercropping

3.3 Measurement of Variables

The methods and techniques used for measuring the independent and dependent variables are explained as under,

Table 3. Measurement of variables

Variables	Measurement
A. Independent Variables	
Age	Chronological age of respondents
Education	Formal education of the respondent Beneficiaries
Size of land holding	Total land possessed by respondent Farmer
Annual income	Total annual income of the respondents through all sources during a year
Source of Information	Schedule was developed
Area under sugarcane	Actual area under sugarcane cultivation
Farming experience	Number of years a farmer actually engaged in farming
Economic motivation	Scale developed by Supe (2007) will be use with ue modification
Cropping pattern	Schedule will be developed
B. Dependent Variable	
Impact of intercropping	Schedule will be developed

Scoring Techniques and Categorization of the Variables

3.3.1 Independent Variables

3.3.1.1. Age

The age has been operationalized as the chronological age of the respondents in completed years at the time of interview. The respondents were categorized in the following categories.

Sr. No.	Age group	Category
1.	Up to 35 years	Young
2.	36-55 years	Middle
3.	56 & above	Old

3.3.1.2. Education

Education was operationalized as formal schooling 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 formed by classifying the respondents on the basis of their education.

Sr. No	Level of Education	Category
1.	No education	Illiterate
2.	1^{st} to 4^{th} standard	Primary education
3.	5^{th} to 10^{th} standard	Secondary education
4.	11^{th} to 12^{th} standard	Higher secondary education
5.	Above 12^{th} standard	Degree and post-graduation

3.3.1.3. Annual Income

For the purpose of this study, the annual gross income of the respondent family from all the sources was considered. This included agricultural income and the income from other subsidiary occupations such as dairy, poultry, goat/sheep keeping, business and service. On the basis of the total income, the respondents were classified into following categories.

Sr. No	Annual Income (Rs.)	Category
1.	Up to 70,000	Low
2.	70,000 to 2,73,000	Low-Medium
3.	Rs. 2,73,000 to 8,44,000	High-Medium
4.	Above 8,44,000	High

3.3.1.4. Size of Land Holding

Land holding is one of the factors that influence the use of improved technologies. Persons operating large farms are likely to put in more efforts to use new technology for improving their condition. A small land holding does not encourage farmers to go for adoption of improved agricultural techniques which they consider as a risk. In the present study the respondents were grouped into four categories based on the existing norms of land holding in Maharashtra state.

Sr. No	Size of Land Holding (ha.)	Category
1.	Up to 1.00 ha.	Marginal
2.	1.01 to 2.00 ha.	Small
3.	2.01 to 4.00 ha.	Medium
4.	4.01 to and above	Large

3.3.1.5. Sources of Information

It refers to various information sources and communication channels used by the respondents for getting information regarding sugarcane intercropping technology. The respondents were asked to record the consulting pattern used by them at three levels i.e. always, sometimes or never respond. The numerical score of 2, 1 and 0, respectively was assigned. Thus, the total score was worked out. The respondents were classified into following categories:

Sr. No.	Sources of Information(score)	Category
1.	Up to 22	Low
2.	23 to 27 score	Medium
3.	28 and above score	High

3.3.1.6. Area Under Sugarcane

It was the actual area under sugarcane possessed by the respondents. On the basis of actual area possessed by sugarcane growers they were categorized as follows.

Sr. No.	Area Under Sugarcane	Category
1.	Up to 1.00 ha.	Small
2.	1.01 to 2.00 ha.	Medium
3.	2.01 ha and above	Large

3.3.1.7. Farming Experience

Farming experience means number of years under taking the farming as occupation, respondents were categorized as follows.

Sr. No.	Category	Farming Experience
1.	Low	Up to 14
2.	Medium	15-27
3.	High	28 and above

3.3.1.8. Economic Motivation

Economic motivation refers to the occupational success in items of profit maximization and the relative value an individual place on economic ends. It was measured with the help of economic motivation scale developed by Supe (2007). This scale consists of six statements and the responses of the farmers were obtained on the five-point continuum, i.e, strongly agree, Agree, Undecided, disagree and strongly disagree with the score 5, 4, 3, 2, 1. This scoring system was reversed during negative statements.

Sr. No.	Category	Score
1.	Low	24-26
2.	Medium	26-28
3.	High	28-30

3.3.1.9 Cropping Pattern

The area under various crops at a particular time in a unit of area is referred to as the cropping pattern. On their field, the Sugarcane growers used a different cropping pattern. On their farm, they cultivated crops in the kharif, rabi, summer, as well as the annual and perennial seasons. They cultivated turmeric, soybean, maize, and wheat in the kharif season, and chickpea in the rabi season. The maximum area was found in the yearly sugarcane crop. As a result, sugarcane growers used a new cropping scheme. For the purpose of measuring the cropping pattern, a schedule was prepared. One score was given for crops grown in each of the three seasons, four score for annual crops, and five scores for perennial crops cultivated by sugarcane farmers. The sum of scores of all the categories of crops cultivated by beneficiary farmer formed the score of total cropping pattern. The maximum score obtained for cropping pattern was 17 and the lowest possible score was 8.

Sr. No.	Category	Score Range
1.	Poor	Up to 11
2.	Fair	12 to 14
3.	Good	15& above

3.3.1.10. Impact Measured in Terms of Additional Gain in Yield.

Impact was measured by comparing per hectare yield from both the respondents i.e; sole as well as intercropping.

According to the additional gain in yield from intercropping, respondents were categorised into three groups.

Sr. No.	Category	Average gain in yield(tons)
1.	Low	Less than 100
2.	Medium	100-150
3.	High	More than 150

3.3.1.11. Impact of Intercropping in Terms of Additional gain in Income

Impact was also measured in terms of per hectare additional income earned by farmer from intercropping.

According to the additional gain in income from intercropping, respondents were categorized as below

Sr. No.	Category	Average gain in Income(tons)
1.	Low	Less than 3,00,000
2.	Medium	3,00,000-5,00,000
3.	High	More than 5,00,000

3.4 Devices and Methods Used for Data Collection

3.4.1 Designing of Interview Schedule

On the basis of objectives of the study and the variables, the interview schedule was developed for the collection of the data. The interview was done in mother tongue i.e; in Marathi for the convenience of the respondents and to get accurate response from them for collection of data. The schedule was prepared in such a manner that the dual meaning questions and contradictory statements were avoided. The language of questions was simple and easy for the respondents to understand. Questions related to economic aspects of respondents having possible correlation with the impact of intercropping were designed. Open end questions were designed leading to obtaining their feedback about the intercropping.

3.4.2 Pretesting of Interview Schedule

Pretesting of the interview schedule was carried out to test its accuracy and suitability. It is also important to find out whether the schedule designed for data collection gave required information for the study. The farmers who were used as respondents for a pretest of an interview schedule were different from those of the respondents under study. However, the socioeconomic and situational factors of these farmers were similar to the selected farmers who were respondents of the study. After pretesting of the schedule, necessary improvements were made in the draft schedule and then sufficient numbers of copies were prepared.

3.4.3 Collection of Data

The data were collected through face-to-face contact method by contacting the selected farmers at their houses or their farms as per their convenience. Before actual seeking of information, farmers were introduced with the objectives of the present study. The pre-tested interview schedule was used for data collection. They were assured that the information furnished by them would be kept confidential and would be used only for research study.

3.4.4 Processing of Data

The information collected from farmers through a personal interview schedule was processed through primary and secondary tables. The data of qualitative nature was converted into quantitative form and computation of score was done for each dependent and independent variable. Statistical methods such as per centage, mean, range, standard deviation and a coefficient of correlation was used.

3.4.5 Compilation of Data

The collected information was compiled according to the objectives, nature, concepts and variables of the study. The information so collected through interviews was transferred from the schedule to the primary tables and then to the secondary tables. Whenever necessary by using the appropriate scoring methods, the collected qualitative data were converted into quantitative forms. Quantified form of data was used to find out the nature of relationship between independent and dependent variables. The statistical methods and tools were used for classification and tabulation of data for grouping or categorizing process and measures of central tendency. The relevant relationship was obtained by feeding the data to the computer which facilitated accurate and easy analysis. The process helped to establish the significance of the results and to correlate the selected independent and dependent variables.

3.5 Statistical Tools Used for Analysis of Data

In the present study the following statistical methods were used for analysis of data and interpretation of the results.

a. Mean

Mean was calculated by using the formula.

$$\bar{X} = \frac{\Sigma Xi}{N}$$

Where,

X - Mean

N - Number of respondents

Xi - Value of observation

b. Frequency and per centage

c. Range

d. Standard deviation

e. Coefficient of correlation

3.5.2 Frequency Distribution and Percentage

Frequencies and per centage were used to know the distribution pattern of respondents according to variables. Per centage was used for standardization of size by calculating the number of individuals that would be in a given category if the total number of cases were 100.

3.5.3 Standard Deviation

Standard deviation was calculated by using formula

Where,

$$S.D = \sqrt{1/n \ [\Sigma X^2 - (\Sigma X)^2] \ /_n}$$

ΣX2 - Sum of square of X series

(ΣX)2 - Square of summation of X series

n - Number of respondents

3.5.4 Coefficient of Correlation

For computing relationship between the selected independent and dependent variables, the Karl Pearson's coefficient was used.

The coefficient of correlation formula as given below was used.

$$r = \frac{\sum xy - \sum x \sum y/n}{\sqrt{[\sum x^2 - (\sum x)^2/n][\sum y^2 - (\sum x)^2/n]}}$$

Where,

r - Coefficient of correlation between X and Y

Σx - Sum of the score of variable X

Σy - Sum of the score of variable Y

Σxy - Sum of the product of X and Y

ΣX2 - Sum of the square of variable X

Σy2 - Sum of the square of variable Y

n - Size of sample

3.6 Operational Definitions and Terms Used

1. **Age:** Age refers to the chronological age as such in completed years.
2. **Education**: Education is a standard of formal schooling possessed by the respondents.
3. **Land Holding**: It refers to the number of hectares of land owned and operated by the respondent.
4. **Annual Income**: It refers to income in rupees in a year of the respondents' family derived from all sources.
5. **Sources of Information**: The sources of information refer to the use of different sources of information, communication channels used by the respondents to know more about intercropping.
6. **Farming Experience**: In this study, it referred as the total number of years of experience in cultivating farm.
8. **Impact**: This refers to overall changes or profound effect on the lives of farmers in terms of changes occurred in their economic status, working and living conditions due to the intercropping.
9. **Feedback of Respondents**: Feedback is the response of the respondents towards the performance of intercropping in sugarcane. The objective of the present investigation was to determine feedback of respondents. The feedback was worked out by using frequency and per centage.

4. RESULTS AND DISCUSSION

This chapter deals with the presentation of analysis and interpretation of data with the view to draw meaningful conclusions by use of the 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 following sections.

4.1 Personal, socio-economic and psychological characteristics of respondent beneficiaries.

4.2 Impact of intercropping in terms of additional gain in yield and income.

4.3 Relationship between the selected characteristics of respondent beneficiaries and its impact.

4.4 Constraints and Feedback of the respondents.

4.1 Personal, Socio-Economic and Psychological Characteristics of the Respondents

4.1.1 Age

Chronologically age denotes completed years by the respondents. Age influences the behavior of an individual by exposing him/her to varied situations a number of times. The distribution of the respondents according to their age is presented as below in Table 1 and table 2.

Table 2. Distribution of Sole & Sugarcane Intercropping Farmers according to their Age

Sr. No	Age	Sole cropping		Intercropping	
		Frequency	**Percentage**	**Frequency**	**Percentage**
1.	Young (up to 35)	17	21.25	44	55.00
2.	Middle (36-55)	28	35.00	23	28.70
3.	Old (56 and above)	35	43.75	13	16.30
	Total	**80**	**100.00**	**80**	**100.00**

The data in the above table 1 revealed that most (43.75%) of sole sugarcane cropping farmers were from the old age group, while 35.00 per cent of respondents belongs to middle age group. Only 21.25 per cent belongs to young age group. While the data on intercropping revealed that more than half (55.00%) of the respondents were from the young age group, while 28.70 per cent of the respondents belonged to the middle age group. Only 16.30 per cent belonged to the old age group.

According to the above findings it can be concluded that the respondents who belongs to young and middle age are ready to take new technologies and also takes risk compared to old age groups in order to get more yield and income.

Hence it can be concluded that the highest per centage of the intercropping farmers belonged to young and middle age group category.

"These findings are similar with those of Thorat et al. (2004) and Sasane *et al.* (2008)"

4.1.2 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 improving the skill of an individual in problem solving. The information regarding education of the respondents is presented in Table 2

Table 2. Distribution of the Sole and Intercropping Farmers According to their Education

Sr.No.	Education	Sole cropping		Intercropping	
		Frequency	**Per centage**	**Frequency**	**Per centage**
1.	Illiterate	28	35.00	9	11.25
2.	Primary education	25	31.25	10	12.50
3.	Secondary education	11	13.75	12	15.00
4.	Higher education	10	12.50	22	27.50
5.	Graduation and above	06	7.50	27	33.75
	Total	**80**	**100.00**	**80**	**100.00**

It was observed from the Table 2 that most (35.00 %) of the sole sugarcane growers were belongs to illiterate category and 31.25 per cent had primary education and 13.75 per cent respondents had completed secondary education. Further, it was found that 12.50 per cent had higher secondary education, only 7.50 per cent were educated up to graduation and above. From the Table it was observed that majority (33.75 %) of the sugarcane intercropping farmers were educated up to graduation and above and 12.50 per cent respondents had completed primary education. Further, it was found that 11.25 per cent of the respondents were illiterate, while, 15 per cent had higher secondary education, 27.50 per cent were having higher education.

From the above findings it was concluded that sugarcane intercropping farmers are having higher education and are ready to take new technologies. As we know that an educated individual is more prone to analyze the cause-and-effect relationship of different phenomena.

"These findings are in line with those of Gurav (2000) and Solanki *et al*. (2004)".

4.1.3 Annual Income

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 distribution of the respondents according to their annual income is presented in Table 3

Table 3. Distribution of the Sole Sugarcane Cropping Farmers According to their Annual Income.

Sr.No.	Category	Sole cropping		Intercropping	
		Frequency	**Per centage**	**Frequency**	**Per centage**
1.	Low	39	48.75	14	17.50
2.	Low medium	22	27.50	35	43.75
3.	High medium	14	17.50	26	32.50
4.	High	5	6.25	05	6.25
	Total	**80**	**100.00**	**80**	**100**

The observations from Table 3 revealed that more than three fourth (75.00 %) of the sugarcane-intercropping farmers were found in the low medium and high medium level of annual income category. About 17.50 per cent respondents were found in the low annual income category. Only 6.25 per cent of respondents were found in the high annual income category.

The above data from table 3 revealed that maximum sugarcane-intercropping respondents had enough income from this cash crop to try the new production technology compared to sole sugarcane cropping farmers.

"This finding is in line with Aitwade (2012)."

4.1.4 Size of Land Holding

Size of land holding largely determines both economic and social status of the respondents and adoption of improved farm technologies. The information regarding size of land holding of the respondents is presented in Table below.

Table 4. Distribution of the Sole & Intercropping Farmers According to their Size of Land Holding

Sr.No.	Size of land holding	Sole cropping		Intercropping	
		Frequency	**Percentage**	**Frequency**	**Percentage**
1.	Marginal (up to 1.00 ha)	36	45.00	21	26.25
2.	Small (1.01 to 2.00 ha	24	30.00	34	42.50
3.	Medium (2.01 to 4.00 ha)	16	20.00	16	20.00
4.	Large (more than 4.01 ha)	04	5.00	9	11.25
	Total	**80**	**100.00**	**80**	**100.00**

The analysis presented in Table 4 revealed that 45.00 per cent sole sugarcane farmers possessed marginal size of land holding, while, 30 per cent, 20 per cent, and 5 per cent of respondents possessed small, medium and large size of land holdings, respectively.

It was also observed that revealed that 42.00 per cent respondents possessed small size of land holding, while, 26.25 per cent, 20.00 per cent, and 11.25 per cent of respondents possessed marginal, medium and large size of land holdings, respectively.

From the above findings it can be concluded that the small size of the land holding is not too large to manage or too small to afford the family needs. Medium size of land holding is manageable and the respondents can adopt new technologies or improved practices/recommendations for increasing the level of productivity.

"These findings are in line with Nale (1993) and Jaybhay (1995)."

4.1.5 Sources of Information

An attempt was made to know about the sources for receiving information about the technology. If respondents have more sources of information, he can have easy access to the technology. The data are presented in Table 5:-

Table 5. Distribution of Respondents according to their Level of Sources of Information

Sr.No.	Source of information	Sole cropping		Intercropping	
		Frequency	**Percentage**	**Frequency**	**Percentage**
1.	Low	40	50.00	15	18.75
2.	Medium	23	28.70	23	28.75
3.	High	17	21.30	42	52.50
	Total	**80**	**100.00**	**80**	**100.00**

From Table 5 it was revealed that, 50.00 per cent of sole sugarcane respondents used low level of source of information, 28.70 per cent, 21.30 per cent using medium level and high-level source of

information. Whereas in case of intercropping respondents 52.50 per cent of the respondents were using high level of sources of information, whereas 18.75 per cent and 28.75 per cent had used high- and low-level sources of information, respectively. It may be due to the present era of electronic media and mass media.

"This finding is in consistent with the observations made by Hadole *et al.* (2005)."

4.1.6. Area Under Sugarcane

The area under sugarcane largely determines both economic and social status of the respondents and adoption of improved farm technologies. The information regarding the area under sugarcane of the respondents is presented in. Table 6

Table 6. Distribution of sole and intercropping farmers according to their area under sugarcane

Sr.No.	Area under sugarcane	Sole cropping		Intercropping	
		Frequency	Per centage	Frequency	Per centage
1	Small	47	58.75	20	25.00
2	Medium	22	27.50	46	57.50
3	Large	11	13.75	14	17.50
	Total	**80**	**100.00**	**80**	**100.00**

The analysis presented in table 6 revealed that, more than three fifth (58.75 %) of sole sugarcane farmers possessed a small area under sugarcane up to 1.00 ha. While, 27.50 per cent of them had an area of 1.01 to 2.00 ha. Under sugarcane and 13.75 per cent of them had a large area of 2.01 ha. and above.

The analysis in case of intercropping farmers revealed that, major (57.50 %) of sugarcane intercropping farmers possessed medium area of 1.01 to 2.00 ha under sugarcane. while, 25.00 per cent of them had less than 1.00 ha. under sugarcane and 17.50 per cent of them had a large area of 2.01 and above.

From the above findings we can conclude that, the small size of the area under sugarcane is not too large to manage or too small to afford to the family needs. Medium size of area under sugarcane is manageable and the respondents can adopt new technologies or improved practices/recommendations for increasing the level of productivity.

"These findings are in line with that of Shaikh *et al*. (2004)."

4.1.7. Farming experience

Farming experience largely determines the extent to which respondents are ready to adopt new farming technologies. The distribution of respondents based on the farming experience was recorded in the table as below'

Table 7. Distribution of sole sugarcane cropping farmers according to their experience on farming.

Sr.No.	Farming experience	Sole cropping		Intercropping	
		Frequency	**Percentage**	**Frequency**	**Percentage**
1.	Low	19	23.75	44	55.00
2.	Medium	25	31.25	19	23.75
3.	High	36	45.00	17	21.25
	Total	**80**	**100.00**	**80**	**100.00**

The analysis in the table 7 revealed that, 45.00 per cent of of farmers having high farming experience. while, 31.25 per cent farmers having medium and 23.75 per cent farmers having low farming experience.

the analysis in the table 7 also revealed that, 55.00 per cent of sugarcane intercropping farmers having low farming experience. while, 23.80 per cent and 21.30 per cent farmers having medium and high farming experience.

From the above table 7 it can be stated that even though the old aged farmers having high experience in farming only young farmers are ready to adopt new techonologies, because they are ready to take risk in order to get more yield and income.

4.1.8. Economic Motivation

Economic motivation largely determines both social and economic status of respondents. the distribution of respondents was recorded in the table as below.

Table 8. Distribution of Sole & Intercropping Sugarcane Respondents Based on their Economic Motivation.

Sr.No.	Economic motivation	Sole cropping		Intercropping	
		Frequency	**Percentage**	**Frequency**	**Percentage**
1.	Low	40	50.00	14	17.50
2.	Medium	23	28.30	47	58.75
3.	High	17	21.70	19	23.75
	Total	**80**	**100.00**	**80**	**100.00**

Analysis in the table 8 revealed that, 50.00 per cent of sole sugarcane farmers are having low economic motivation. while, 28.30 per cent and 21.70 per cent farmers having medium level and high level of economic motivation. The analysis in the table 8 also revealed that, 58.75 per cent of sugarcane intercropping farmers had medium economic motivation. while, 23.75 per cent and 17.50 per cent farmers had high and low level of economic motivation.

From the above findings it can be concluded that the respondents having medium and high economic motivation are ready to take new farming technologies in order to get more income.

Table 4.1.9. Distribution of the Sugarcane Growers According to their Cropping Pattern

Sr. No.	Category	Respondents (n=160)	
		Frequency	**Percentage**
1	Poor (Up to 11)	25	15.62
2	Fair (12 to 14)	40	25.00
3	Good (15 & above)	95	59.38
	Total	**160**	**100.00**

It was concluded from the Table 4.1.9 that, 59.38 per cent of the sugarcane growers was possessed the good cropping pattern, while 25.00 per cent of the sugarcane growers had fair cropping pattern followed by 15.62 per cent of the sugarcane growers possessed poor cropping pattern. This cropping pattern showed the economic conditions of the sugarcane growers as they have taken different crops in a year as per availability of input. The study area belonged to good irrigation facilities therefore the respondents possessed good cropping pattern.

The major crops of Rahuri and Rahata tahsils are sugarcane, maize, wheat, jowar, cotton, soybean, wheat, red gram, bajra, onion and pomegranate, grape, guava. In kharif season major crops grown are sugarcane, cotton, maize, soybean, red gram and bajra, while, in rabi season wheat, jowar (rabi) are grown. Sugarcane is the major cash crop cultivated on maximum cultivable land in the tahsils annually. Agriculture sector is directly depended on the environmental factors and variations in climate that have direct effects on the production and yield of crops. So, there is a need to adopt diversified cropping pattern to sustained in the changed environment.

4.2 Impact of Intercropping on Sugarcane Growers.

In the present study the impact of intercropping on sugarcane growers was measured in terms of:

1. Additional gain in yield
2. Additional gain in income

4.2.1 Impact of Intercropping on Sugarcane Growers in terms of Additional Yield.

The assessment of the impact of intercropping on the respondents was made by comparing per ha. yield of sugarcane-intercropping with the per ha. Yield obtained from sole sugarcane cropping. The data is presented in Table 10.

Table 10. Impact of Intercropping on Sugarcane Growers in terms of Additional Yield

Sr. No.	Category	Sole cropping		Intercropping	
		Frequency	percentage	Frequency	Percentage
1.	Low yield	22	27.50	15	18.75
2.	Medium yield	41	51.20	46	57.50
3.	High yield	17	21.30	19	23.75
	Total	**80**	**100**	**80**	**100**

Sr. No.	Average gain in yield from sole sugarcane cropping(tons)	Average gain in yield from sugarcane-intercropping
1.	**100**	**100(t)+40(q)**

The data from table 10 revealed that, there is an average yield of 100 tons/ha. from sole sugarcane cropping whereas 100 tons/ha from sugarcane and additional 40 quintals/ ha. of yield from the subsidiary crop. Hence it can be concluded that there is an additional gain in yield from sugarcane intercropping compared to the sugarcane sole cropping.

Table 11. Impact of Intercropping on Respondents in terms of Additional Income.

Sr. No	Category	Average income from sole sugarcane cropping		Average income from sugarcane intercropping	
		Frequency	Percentage	Frequency	Percentage
1	Low (<3,00,000)	24	30.00	12	15.00
2	Medium (3,00,000-5,00,000)	41	51.25	46	57.50
3	High (>5,00,000)	15	18.75	22	27.50
	Total	80	100.00	80	100.00

The data from Table 11 revealed that the majority of respondents have average gain in income from sole sugarcane is 3,00,000. Similarly, the average gain in income from sugarcane intercropping is 3,60,000. That means there is an additional gain in income from intercropping besides sole sugarcane cropping. Thus, it can be concluded that there was considerable impact of intercropping in terms of additional income on beneficiary farmers.

This finding is similar to finding of Dound (2014).

4.3. Relationship between the Personal, Socio-Economic and Psychological Characteristics of Respondents with Impact of Intercropping.

The study pertaining to relationship between the personal, socio-economic and psychological characteristics of the respondents and impact of intercropping was undertaken.

This study was undertaken to know whether the selected characteristics of the respondents have any relationship with the increased yields of sugarcane-intercropping. The results are presented in Table 12.

Table 12. Relationship of Selected Characteristics of Sole Sugarcane Farmers & Intercropping farmers with the Impact of Intercropping

Sr. No.	Independent variable	Karl Pearson correlation co-coefficient for sole sugarcane farmers	Karl Pearson correlation co-coefficient for sugarcane Intercropping farmers
1.	Age	0.268*	-0.165^{NS}
2.	Education	0.140^{NS}	0.404**
3.	Annual income	0.037^{NS}	0.166*
4.	Size of land holding	0.035^{NS}	0.273*
5.	Source of information	0.053^{NS}	0.530**
6.	Area under sugarcane	0.164^{NS}	0.223*
7.	Farming experience	0.272*	-0.106^{NS}
8.	Economic motivation	0.142^{NS}	0.410*
9.	Cropping pattern	0.201	0.1724*

* = Significant at 0.05 per cent level

** = Significant at 0.01 per cent level

NS = Nonsignificant.

4.3.1 Age

The correlation coefficient ($r = -0.165^{NS}$) from Table 12 stated that the relationship between the age of the respondents and impact of intercropping was negative and nonsignificant.

It is, therefore, concluded that as the age of the respondents increased, there was a decrease in the production level and income. That means young and middle-aged respondents achieved greater production and income compared to the older ones. This might be due to fact that young people are enthusiastic, creative and progressive in nature and they are ready to take new production technologies.

“These findings are in similar with those of Nale (1993) and Dhere (2009).”

4.3.2 Education

The level of formal education of respondents showed a statistically significant correlation (r = 0.404**) with impact of intercropping. most of the sole sugarcane farmers having less or no education compared to the sugarcane intercropping farmers, who have higher secondary education. It is, therefore, concluded that higher the education, more was the impact in terms of productivity level and income. The respondent's education brings about changes in their knowledge, attitude and skills.

"These findings are in line with those of Gurav (2000) and Shanty *et al.* (2012)".

4.3.3 Annual Income

The relationship between the annual income and impact of intercropping on the respondents was positive and statistically significant (r = 0.166*). Annual income helps to determine the economic condition of farmers. They could afford to spend money on purchase of inputs.

"This finding is in line with those of Sawant and Dalvi (1989)".

4.3.4 Size of Land Holding

The correlation coefficient (r =0.273*) showed that the relationship between the size of land holding and impact if intercropping was positive and statistically significant. It means that the impact in terms of productivity level and income of respondents increased with increase in the size of land holding. Farmers with large size of land holding have higher socio-economic status and have higher social participation. Because of larger size land holding and sound economic position, they are likely to take higher risks, accept new ideas earlier and adopt modern technology on their farm.

Thus, it is concluded from Table 12 that yield and income of respondents was influenced by the size of land holding.

"This finding is in line with that of Deshmukh (2002)".

4.3.5 Sources of Information

There was positive (r =0.530**) and statistically highly significant correlation between the sources of information used by the respondents and impact of intercropping.

This means that the respondents having more source of information helped them to get more knowledge and more knowledge leads to higher adoption of sugarcane-potato intercropping technology and ultimately increased yield and income of respondents.

"Similar finding was reported by Aski (1989)".

4.3.6 Area under Sugarcane

The correlation coefficient (r =0.223*) showed that the relationship between the area under sugarcane and impact of intercropping was positive and statistically significant. It means that the impact in terms of productivity level and income of respondents increased with increase in the area under sugarcane. Farmers with large area under sugarcane have higher socio-economic status and

social participation. Because of larger area under sugarcane and sound economic position, they are likely to take higher risks, accept new ideas earlier and adopt modern technology on their farm.

4.3.7 Farming Experience

The correlation coefficient ($r=-0.106^{NS}$) showed that the relationship between the farming experience and impact of intercropping was negative and nonsignificant.it means that even though the farming experience is more, the impact of intercropping on the sugarcane farmers was nonsignificant. Farmers who are taking sole sugarcane are having more experience but impact of intercropping is very less on them.

4.3.8 Economic Motivation

The correlation coefficient (r=410*) showed that the relationship between the economic motivation and impact of intercropping was positively and significantly co-related.

4.3.9 Cropping Pattern

The correlation coefficient (r=0.172*) showed that there is a positive and significant correlation between the cropping pattern and impact of intercropping

4.4 Constraints Faced and Suggestion Given by Respondents in Following Sugarcane-Intercropping.

Efforts were made to get the feedback of the respondents about the use of sugarcane-intercropping. The data is presented in Table 13.

Table 13. Distribution of Respondents based on their Constraints Faced and Suggestions to Overcome those Constraints by Respondents.

Sr. No.	Constraints faced and Suggestions given to overcome those constraints	No. of Respondents (N=80)	Per cent
1.	Taking sugarcane-Onion intercropping is beneficial for farmers	80	100.00
2.	The yield of onion is a bonus for the farmers which helps in reducing the cost of cultivation of sugarcane.	74	92.50
3.	Pests and disease-free quality onion seed is vital for increasing the yield. Proper arrangements should be made to procure the seed for the farmers.	72	90.00
4.	Market rates of onion are very fluctuating. Hence, a minimum support price mechanism is needed to support the farmers.	70	87.50
5.	Cold storage facilities need to be established by the government for storing of onion especially after harvest to avoid glut in the market and to increase its shelf life. The prominent onion growing areas may be demarcated for this facility.	70	87.50

6.	Processing of onion can give an additional income for the farmers. Hence training programmes need to be organized on this line.	63	78.75

The data presented in Table 13 indicated that cent per cent of the respondents (100.00 %) expressed that most of the farmers are taking onion as intercrop because of easy in handling and giving good returns. Hence sugarcane-onion intercropping technology is beneficial for the farmers. Majority of the respondents gave the feedback that the yield of intercrop is a bonus income for the farmers which helps in reducing the cost of cultivation of sugarcane (92.50 %). Pest and disease-free quality seed are vital for increasing the yield, hence proper arrangements should be made to procure quality seed for the farmers. They also suggested that market rates of onion are very fluctuating, hence, a minimum support price mechanism is needed to support the farmers (87.50 %), cold storage facilities need to be established by the Government for storing onion especially after harvest to avoid glut in market and to increase its shelf life. The prominent onion growing areas may be demarked for this facility (87.5 %), processing of onion can give an additional income for the farmers, hence, training programmes need to be organized on this line (78.75 %).

"These findings are in line with those of Thorat *et al.* (2004)."

5. SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Sugarcane (*Saccharum officinarum L.*) is one of the important crops fulfilling 60 per cent of the sucrose requirement. It is considered as a cash crop and plays the main role in the rural economy of the Maharashtra.

Taking intercropping in sugarcane is very much beneficial to the farmers as it gives mid-season income to the sugarcane farmers which will be helpful for the famers to spend that on further operations required for sugarcane.

5.1 Summary

The findings of the study are summarized as below.

5.1.1 Socio-Economic Profile of the Respondents

1. The majority (43.75 %) of sole sugarcane cropping farmers were from the old age group, while 35.00 per cent of respondents belongs to middle age group. Only 21.25 per cent belongs to young age group. but in case of sugarcane intercropping, more than half (55%) of the respondents were from the young age group, while 28.70 per cent of the respondents belonged to the middle age group. Only 16.30 per cent belonged to the old age group.
2. The majority (35.00 %) of the sole sugarcane growers were belongs to illiterate category and 31.25 per cent had primary education and 13.75 per cent respondents had completed secondary education. Further, it was found that 12.50 per cent had higher secondary education, only 7.50 per cent were educated up to graduation and above.

But in case of sugarcane intercropping farmers majority (33.75 %) of the them were having higher graduation and above and 27.50 per cent were educated upto graduation and above. while, 12.50 per cent respondents had completed primary education. Further, it was found that 11.25 per cent of the respondents were illiterate, while 15.00 per cent had secondary education.

3. It was observed that more than three fourth (75.00 %) of the sole sugarcane farmers were found in the low and low medium annual income category. About 17.50 per cent respondents were found in the high medium annual income category. Only 6.30 per cent of respondents were found in the high annual income category.

In case of sugarcane intercropping, it was observed that more than three fourth (75.00 %) of the sugarcane-intercropping farmers were found in the low medium and high medium level of annual income category. About 17.50 per cent respondents were found in the low annual income category. Only 6.25 per cent of respondents were found in the high annual income category.

4. About 45.00 per cent sole sugarcane farmers possessed marginal size of land holding, while, 30.00 per cent, 20.00 per cent, and 5.00 per cent of respondents possessed small, medium and large size of land holdings, respectively.

In case of sugarcane intercropping farmers, it was observed that 42.50 per cent respondents possessed small size of land holding, while, 26.25 per cent, 20.00 per cent, and 11.25 per cent of respondents possessed medium, marginal and large size of land holdings, respectively.

5. It was found that 50.00 per cent of the respondents were using low level of sources of information, whereas 21.30 per cent and 28.70 per cent had used medium and low level of sources of information in case of sole sugarcane farmers whereas 52.50 per cent,28.75 per cent, 18.75 per cent intercropping respondents had high, medium, low source of information respectively it may be due to the present era of electronic media.

6. About 58.75 per cent of sole sugarcane farmers possessed a small area under sugarcane upto 1.00 ha. While 27.50 per cent of them had an area of 1.01 to 2.00 ha. Under sugarcane and 13.75 per cent of them had a large area of 2.01 ha. and above.

In case of intercropping farmers majority (57.50 %) of respondents possessed medium area of 1.01 to 2.00 ha under sugarcane. while 25.00 per cent of them had less than 1.00 ha. under sugarcane and 17.50 per cent of them had a large area of 2.01 and above.

7. It was observed that 45.00 per cent of farmers having high farming experience, while 31.25 per cent farmers having medium and 23.75 per cent farmers having low farming experience.

In case of sugarcane intercropping farmers nearly 55.00 per cent of intercropping farmers having low farming experience, while 23.75 per cent and 21.25 per cent farmers having medium and high farming experience. Even though the old farmers having more experience in farming mostly young farmers are ready to take intercropping. It may be due to the reason that young farmers are energetic and enthusiastic, ready to take risk for getting high returns

8. About 50.00 per cent of sole sugarcane farmers are having low economic motivation, while 28.30 per cent and 21.70 per cent farmers having medium level and high level of economic motivation. The analysis in the table 8 revealed that, 58.75 per cent of sugarcane intercropping farmers had medium economic motivation. while 23.75 per cent and 17.50 per cent farmers had high and low level of economic motivation.

9. The study revealed that the sugarcane intercropping farmers accrued the benefits from intercropping

5.1.2 Impact of Intercropping on the Respondents

It was observed that there is an average yield of 100 tons/ha. from sole sugarcane cropping whereas 100 tons/ha from sugarcane and additional 40 quintals/ ha. of yield from the subsidiary crop.

hence it can be concluded that there is an additional gain in yeild from sugarcane intercropping compared to the sugarcane sole cropping.

It was also observed that the respondents have average gain in income from sole sugarcane is 3,00,000. similarly, the average gain in income from sugarcane intercropping is 3,60,000. That means there is an additional gain in income from intercropping besides sole sugarcane cropping. Thus, it can be concluded that there was considerable impact of intercropping in terms of additional income on beneficiary farmers.

5.1.3 Relationship between Various Characteristics of the Respondents with their Impact

It was revealed from study regarding the relationship between the various characteristics of respondents and impact of intercropping that source of information, economic motivation and education had positive and highly significant relationship at 0.01 level of probability with impact of intercropping. The other independent variables viz., annual income, land holding, area under sugarcane had positive and significant relationship at 0.05 level of probability with impact of intercropping. There was negative and statistically no significant relationship between age of respondents, farming experience and impact of intercropping

5.1.4 Constrains Faced and Suggestions Given by Respondents

The feedback obtained from the respondents on the demonstrations revealed that majority of them expressed the benefits of intercropping, yield of intercrop(onion) helped in reducing cost of sugarcane cultivation, requirement of pest and disease free quality onion seed, remunerative price for intercrop(onion), establishment of cold storage facilities for onion, organization of training programmes on processing of onion, need for mechanization and demonstrations coupled with training programmes for achieving sustainable yield.

5.2 Conclusions

Most of the intercropping respondents majorly belonged to middle age group having education upto secondary level. Majority of the respondent sugarcane-intercropping growers had possessed small size of land holding. It also revealed that a majority of the respondents were found in medium level of annual income, sources of information. Majority of the respondents had additional gain in yield and income. Regarding the relationship between various characteristics of respondents and impact of intercropping, it was observed that sources of information, economic motivation and education had positive and highly significant relationship with impact of intercropping. The other independent variables viz., land holding, area under sugarcane, annual income had positive and significant relationship at 0.05 level of probability with impact of intercropping. There was negative and statistically no significant relationship between age of respondents, farming experience and impact of intercropping. The data indicated various feedback of respondents like benefits of intercropping and the technology increased yield, need for pest, disease free seed, stable price for

onion, establishment of cold storage facilities, training programmes on processing of onion and need for mechanization.

5.3 Implications

Based on the findings and observations of this study following implications are drawn.

5.3.1 Action Implications

1. The results of the present study revealed that there was a considerable impact of intercropping on beneficiary farmers. The farmers who have taken intercropping had an additional gain in their yield as well as their income. Thus, the study implies that there is a need to develop awareness to the farmers on benefits of taking intercropping.

2. Education, Sugarcane intercropping cultivation knowledge, Source of information had positive and significant relationship with their adoption of intercropping in sugarcane. Therefore, it is recommended that arrangements should be made by the sugarcane factories and agricultural departments of state agricultural universities for increasing the education, sugarcane intercropping cultivation, providing source of information by proper training and motivational programmes. Education may be increased by establishing night schools for adult farmers.

5.3.2 Research Implications

1. Various facts of profile of participants have been changed due to impact of intercropping. However, the profile other than those studied in present work need to be studied.

2. The personal, psychological, socio-economic factors which contribute towards high and low agricultural productivity may be studied to a greater depth.

3. This study would also be helpful as a benchmark for further probe into the studies of same type. The study alike to the present one needs to be replicated in other parts of the state.

4. In order to cover wide range of factors related to behavior of farmers in transfer of technology further inter disciplinary research is necessary.

6. LITERATURE CITED

Ahire, R. D. and Kapse P. S. (2015). Socio-Economic Impact of Commodity Interest Group among Pomegranate Growers. AGRESCO Report of Social Sciences Sub-committee, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. pp: 9-21.

Aitwade, N.M. (2012). Constraints faced in utilization of improved farm implements by sugarcane growers, M.Sc. (Agri.) Thesis, Unpublished, MPKV, Rahuri.

Aski, S.K. (1989). A comparative study on knowledge level and adoption behaviour of trained and untrained farmers at FTC, Arabhavi. M.Sc. (Agri.) Thesis, Unpublished, Univ. Agric. Sci., Dharwad.

Bansode, S. M., Ankush G. S, Mande J.S., and Suradkar, D. D. (2013). Impact of SHG on socio-economic Development of Their members. *Journal o*f *Community Mobilization on Sustainable Development* 8 (11), pp :(117-120).

Barbade, D.S. (2014). Impact of drip irrigation on socio-economic development of the farmers. M.Sc. (Agri.) Thesis, Unpublished, MPKV, Rahuri.

Bhabhor, G. K. (2015) information needs of soybean growers. Thesis submitted to Anand Agricultural University.

Bhandari, S. D. (2014). Impact of Mahatma Gandhi National Rural Employment Guarantee Act on the Beneficiaries. M.Sc. (Agri.) Thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

Borase, J. M. (2015). Varietal Preferences of Groundnut Growers in Kolhapur District. M.Sc. (Agri.) Thesis, (Un pub.) Mahatma Phule Krishi Vidyapeeth, Rahuri, (M.S.)

Chaudhari, J. K., B. S. Patel and Parikh, A. H. (2015). Impact of Krishi Vigyan Kendra on knowledge

Chavan, C. A. (2014). Technological gap in adoption of recommended cultivation practices of Mango growers. M. Sc. (Agri.) Thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.)

Chavan, G. O. (2009). Adoption of contingency cropping pattern by Western Vidarbha farmers, *M.Sc Thesis* (Un pub.) Dr. PDKV, Akola.

Chavhan, P. N. (2019). Impact of mobile based Agro-advisory services by state department of agriculture in Marathwada region. Ph. D. (Agri.) Thesis, Vasantrao Naik Marathwada

Chengappa, K. K. (2017). Marketing behaviour of coffee growers in kodgagu district of Karnataka state. (Unpub.) M.Sc. (Agri.) Thesis, MPKV, Rahuri.

Darandle, A. D. (2010). Attitude of tribal farmer towards organic farming practices in maize crop. (M.Sc.) Un pub. AAU, Anand.

Deshmukh, K. U. (2016). Impact of national watershed development programme on its beneficiaries in Marathwada region. Ph. D. (Agri.) Thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

Dhere, T.B. (2009). A study on the impact of seed village programme on the productivity level of chickpea participant farmers. M.Sc. (Agri.) Thesis, Unpublished, MPKV, Rahuri.

Gaikwad, A.S. (2013). White grub management practices adopted by sugarcane growers M.Sc. (Agri.) Thesis, Unpublished, MPKV, Rahuri. of Extn Edu. 18:98 -101.

Gurav, B.S. (2000). Study of maintenance, knowledge and experiences of sugarcane growers about the drip irrigation system for sugarcane crop in Rahuri tahsil of Ahmednagar district, M.Sc.(Agri). Thesis (Unpublished), MPKV, Rahuri.

Hadole, S.M.; Dakhore, K.M.; Basunathe, V.K.; Dalvi, S.T. and Bhutkar,T.B. 2005. Adoption of sugarcane production technology by sugarcane growers of Latur district. *Asian J. of Extn. Edu.* Vol XXIV: 84-88.

Ingole, S. A. (2014). Impact of farm ponds in saline tract of western Vidarbha. M.Sc. (Agri.) Thesis Dr. Panjab Rao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra).

Jadhav, B. (2015). Technological gap in adoption of recommended practices of mango cultivation. Agriculture Update **6**(2):38-41.

Jatav, H, Patel M. M., Kumar K. S., and Saxena, A (2010). Impact of front-line Demonstration on Scientific temperament of wheat growers. Raj. *J. Ext. Education* (17), pp:14-16.

Jaybhay, C.D. 1995. A study on impact on Operational Research Project on the productivity of the farmers from village Kolhewadi. M.Sc. (Agri.) Thesis, Unpublished, MPKV.

Kale, M. G. (2012). Impact of Swarnjayanti Gram Swarojgar Yojana on socio-economic condition of beneficiaries. M. Sc. (Agri) Thesis, Marathwada Krishi Vidyapeeth, Parbhani(Maharashtra)

Kapoor, N. (2011). Role of mass media in promotion of environmental awareness along with skill development among the rural people of Shringverpur, Allahabad district, India, Paper presented in International Conference on Chemical, Biological and Envinmental Sci. (ACCESS 2011) held at Bangkok in Dec. 2011.

Khandave, S. R. and Suryawanshi P. S. (2015). Impact of National Horticulture Mission on beneficiaries. *Journal of Agriculture Research Technology* 40 (2), pp: 348-350.8. Khandave, S. R. and Suryawanshi P. S. (2015). Impact of National Horticulture Mission on beneficiaries. Journal of Agriculture Research Technology 40 (2), pp: 348-350.

Kumar S. Singh S. S. and Singh, (2011). Production potential of winter vegetables as intercrops in autumn planted sugarcane under valley conditions of Uttarakhand. Progressive horticulture, 43(1):153-154.

Kumawat, S. R. and Bhati, D. S. (2013). Impact of farmers friends (Krishak Mitras) training on different aspects of agriculture. *Indian Journal of Extension Education and Rural Development.* (21), pp: 79-83.

Kumbhare, N. V. and Khonde, S. R. (2009). Impact of KVK training on farmers adoption behavior and knowledge gain. *Indian Journal of Extension Education.* (45), No. 3 and 4, pp: 60-62.

M.Sc. (Agri.) Thesis, Unpublished, MPKV, Rahuri.

Mande, J.V. and Thombre, B.M. (2009). Adoption of cultivation practices by sugarcane growers. Agril. Sci. Digest. Vol XXIX (3): 35-38.

Manikdurge, B.A. (2014). Training needs of sugarcane growers in low productivity area.M.Sc. (Agri.) Thesis, Unpublished, MPKV, Rahuri.

Mate, P.S. 2006. A study of knowledge and adoption recommended potato cultivation practices by the farmers in Pune district. M.Sc. (Agri. Thesis. Unpublished, MPKV, Rahuri).

Meenakshi, K. (2014). Socio-economic impact of labour migration on the families left behind in Golaghat district of Assam. M. Sc. (Agri.) Thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra).

Mergewar, A. R. (2017). Cropping pattern followed by awardee Farmers in Marathwada region. M.Sc. (Aggri.) Thesis, VNMKV. Parbhani.

Nale, A.K. (1993). A study of the impact of sugarcane pilot project on the productivity level of the participant farmers. M.Sc. (Agri.) Thesis, Unpublished, MPKV, Rahuri.

Pandhare, S.P., Khonde, S.R. and Narkar, G.S. (2003). Adoption of improved cultivation practices by sugarcane growers. *Mah.J. of Extn Edu*. Vol. XXII (1): 91-93.

Parate, M. B. (2013). Impact of farm ponds on its beneficiaries in Yavatmal district. M.Sc. (Agri.) Thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra).

Parikh, A. H. (2013). Technological gap in adoption of improved cultivation practices by soybean growers. M.Sc. (Agri.). Thesis (Un pub.), AAU, Anand.

Patel, J. B. (2007). Impact of Integrated Pest Management Technology on cotton growers in Vadodara district of Gujarat State. Ph.d. (Agri.) Thesis (unpublished) C.C.S. University, Meerut.

Patel, M. R., Patel U. A. and Patel P.P., (2012). To Study the level of overall Modernization in Agriculture under Integrated Tribal Development Project. *Gujarat Journal of Extension Education,* 23:180-183.

Patil S. D., Shide S. B. and Kharde P. B. (2015). Utilization of mass media by the farmers for seeking the information on farm mechanization. Journal of Communication Studies. 33(3): 40-44.

Rathod, M. K., Tidke G. R., and Mandave, R. P. (2013). Impact of front-line demonstration on adoption of seed treatment in soybean. Indian Res. Journal of Extension Education. 13(2): 72-77.

Sapate, A. U. (2018). Marketing Behaviour of Pomegranate Growers. M.Sc. (Agri.) Thesis (Unpub.), MPKV, Rahuri. pp. 94.

Sasane, G. K., Jagdale, U. D., Khule, R. P., and Patil, R. G., (2008). Study of knowledge and adoption of Sugarcane water management practices recommended by MPKV, Rahuri. Research Review Committee Report, MPKV, Rahuri: 22-49.

Sawant, A.G. and Dalvi, V.B. (1989). Knowledge status and training needs of farm women, Mah. J. Extn. Edu. 11: 85.

Shaikh, A.M., Tarde, V.J., Dalve, A.D., Vedpathak, A.P., Ingawale, S.M. and Jedhe, T.B. 2004. study of knowledge and adoption level of wooly aphid control measures by sugarcane growers from Pune district.Research Review Committee Report, MPKV, Rahuri :30-35.

Shanty Rajula T., Thiyajarajan R. and Mukunthan N. (2012). Farmers perception about white wooly aphid in sugarcane and its management practices. *Ind. Res. J. Extn*. Edn. 12 (1).

Shete, D. S. (2014). Knowledge and Adoption of Drip irrigation for Sugarcane crop. M. Sc. (Agri) Thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

Siraj, M. (2016). A model for ICT based services for agriculture extension in Pakistan available at http://r4d.dfid.gov.uk/PDF/Outputs/Misc_Infocomm/60818extensionmodel Pakistan.pdf

Sirohiya, L., Singh D. K., and Agrawal, S. K. (2012). Impact of trainings on adoption of chickpea (*Cicer arientinum L.*) production technology. *Indian Journal of Extension Education* (48), No. 3 & 4 pp:(87-89)

Solanki, G.K., Phalke, D.H., Pawar, S.M. and Bhoi, P.G. (2004).Extent of adoption of improved sugarcane technology by the sugarcane growers in Satara district. Research Review Committee Report, MPKV, Rahuri:55-60.

Sonawane, S. N, Kharde P. B. and Gaikwad J.H. (2004). Reactions of beneficiary farmers towards the Mobile Crop Dispensary of ATIC, MPKV, Rahuri from Nasik District. Research Review Committee Meeting Report, MPKV, Rahuri,

Sonawane, S.B. Chikhlikar, P.J. and Nirban A.J. (2001). Utilization of communication sources by the farmers for seeking farm information. Mah.J. Extn.Edu.20:61-63.

Soni, R. L., Kothari G. L., and Singh, R. (2012). Impact of training programme on adoption of organic farming practices. *Raj. J. Ext. Education* (20), pp: 148-151.

Thorat, D.R. and Bhoite, H.S. (1992). The socio-economic constraints in the use of drip irrigation. *Mah.J. of Extn. Edu*. Vol. XI: 324-326.

Thorat, D.R., Shirke, V.S., Bodhale, D.A., Jagdale, U.D. and Patil, P.R. (2004). A study on technology of sugarcane cultivation generated by university considering attributes of the innovations as perceived by thefarmers. Research Review Committee Report, MPKV, Rahuri: 50-60.

Tijare, D. R. (2018). Entrepreneurial Behaviour of Nursery Owners. M.Sc. (Agri.) Thesis. (Un pub) MPKV, Rahuri.

Venkatachalam, C. D. and Sengottian, M. (2016). Study on Roasted Date Seed Non-Caffeinated Coffee Powder as a Promising Alternative, *Asian Journal of Research in Social Sciences and Humanities.*, 6(6): 1387-1394.

7. APPENDIX

DEPARTMENT OF EXTENSION EDUCATION
POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH, RAHURI -413722

Interview Schedule

Impact of intercropping on sugarcane growers

Name of the student: Miss Enugula Meena
Research Guide: Dr. G. K. Sasane
Professor, department of
Agril.Extension and communication
Post Graduate Institute, MPKV, Rahuri

Part – I

Name of the farmer: -……
Village: -……. Tahsil:……District:……..
1. Age……years. Ph.No./Mobile No:……
2.Education: .....std.
3. Annual Income/ha (in rupees)

(A) From agriculture and allied occupations		
Sr.No	Source of income	Annual Income (Rs.)
1.	Agriculture	
2.	Dairy farming	
3.	Goat and Sheep rearing	
4.	Poultry	
5.	Business	
6.	Service	
7.	Others	
	Total annual income in Rs.	

4.Size of Land Holding

Sr.	**Land holding (Area)**	**Score**
1.	Marginal (up to 1.00 ha)	
2.	Small (1.01- 2.00 ha)	
3.	Medium (2.01-4.00 ha)	
4.	Large holding (Above 4.00 ha)	

5.Sources of information

From which sources do you get information about intercropping in Sugar cane?

Sr. No	**Sources of information**	**Frequency**		
A)	**Individual contact Method**	**Always**	**Sometimes**	**Never**
1.	Agril.Assistant			
2.	Agril.Extension Officer (Panchayat samiti)			
3.	Taluka Agriculture Officer			
4.	Cane development officer			
4.	Agril. University Scientist			
5.	Krishi Vigyan Kendra SMS			
6.	Progressive Farmer			
7.	Others			
(B)	**Group contact method**			
1.	Demonstrations (Method, Result, Minikit trials)			
2.	Group discussion			
3.	Campaign			
4.	Agricultutal tours			
5.	Farmer's fair /Farmers rally			
6.	Other			
C)	**Mass contact method**			
A.	**Print media**			
1.	News paper			
2.	Magazine			
3.	Agril.Literature/bulletin			
4.	Other			
B.	**Electronic media**			
1.	Radio			
2.	T. V			
3.	Internet			
4.	Mobile sms			
5.	CD/DVD			
6.	Other			

6.Area under Sugarcane Cultivation

Sr. No	**Planting season**	**Area(ha.)**	**Variety**
1.	Adsali (July-Aug)		
2.	Pre-seasonal (Oct-Nov)		
3.	Suru (Jan-Feb)		
	Total		

A. Total area under cultivation

Type of Land	Rainfed	Irrigated
Owned		
Leased		
Total		

7.Farming Experience:..... Years

8. Economic motivation (Supe, 1969)

Sr. No	**Economic motivation**	**SA**	**A**	**UD**	**DA**	**SD**
1)	A farmer should work towards larger yields and economic profits					
2)	The most successful farmer is one who makes more profits					
3)	A farmer should try any new farming idea which may earn him more money					
4)	A farmer should grow cash crops like sugarcane to increase monetary profits in comparison to growing of food crops for home consumption					
5)	It is difficult for the farmer's children to make good start unless provides them with economic assistance					
6)	A farmer must earn his living but the most important thing in life cannot be defined in economic terms					

SA- Strongly Agree A- Agree UD- Undecided

D- Disagree SDA-Strongly Disagree

9. Cropping pattern:

Sr.	Season	Crop	Variety
1.	Kharif	1.	
		2.	
2.	Rabi	1.	
		2.	
3.	Summer	1.	
		2.	
4.	Annual	1.	
		2.	
5.	Perennial	1.	
		2.	

Part II

10.impact of intercropping on socio-economic characteristics of Sugarcane growers

1. Sugarcane: -Seasonal/Pre-seasonal/Adsali----------
2. Month in which planted.....
3. Name of intercrop taken in sugarcane----------

(wheat/Gram/Onion/Vegetables/Any other)

4. Month in which intercrop is sown----------

5.Total cost of sugarcane planting----------Rs.
6.Total cost of intercrop planting----------Rs.
7.Fertiliser application to sugarcane ---------- Rs.
8.Fertiliser application to intercrop----------Rs.
9.Number of irrigations given to sugarcane crop----------
10.Number of irrigations given to intercrop----------
11.Any additional irrigation required----------
12. Method of irrigation (Drip/Sprinkler/Raingun/Flood) ----------
13. Spraying of pesticides to sugarcane crop ---------- Rs.
14. Spraying of pesticides to intercrop ---------- Rs.
15. Total man days required for sugarcane----------
16. Total man days required for intercrop----------
17. Total yield of sugarcane ton
18.Total yield of intercrop----------quintals
19.Income from sugarcane Rs.
20.Income from intercrop Rs.

11. Constraints faced by the sugarcane growers in following intercropping in sugarcane

1. ----------
2. -
3. -
4.
5.
6.

12. Suggestions made by the sugarcane growers in following intercropping.

1. -
2. -
3. -
4. -
5. -
6.

8. VITAE

Miss. Enugula Meena

MASTER OF SCIENCE (AGRICULTURE)

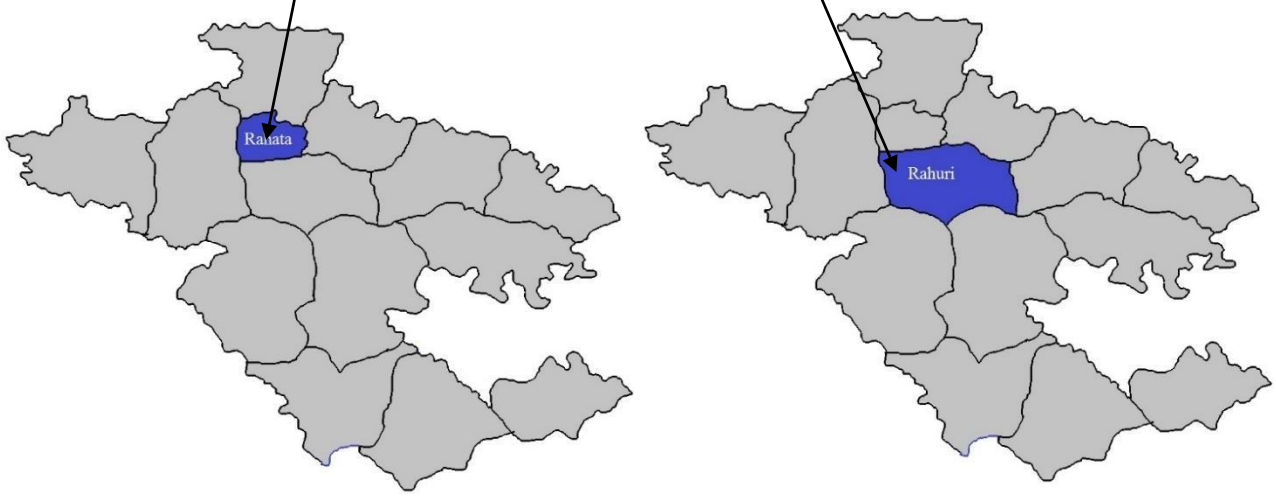
in

AGRICULTURAL EXTENSION AND COMMUNICATION

2021

Title of Thesis		:	"Impact of Intercropping on Sugarcane Growers."
Major field		:	Agricultural Extension and Communication.
Personal	**Date of Birth**	:	14 /02 /1996
	Place of Birth	:	Thorrur(v), Palakurthy(m), Jangaon(d), Telangana
	Father's Name	:	Enugula Ramreddy
	Mother's Name	:	Enugula Neeraja
Educational	**Bachelor Degree Obtained**	:	Received B.Sc. (Agriculture) degree from Professor Jayashankar Telangana State Agricultural University, Aswaraopet, Khammam.
	Class	:	First Class
	Name of University	:	Professor Jayashankar Telangana State Agricultural University, Rajendranagar.
Address		:	H.No: 2-9/1, Thorrur, Palakurthy, Jangaon, pin: 506302,Telangana, India.
	Email-id	:	meenareddy976@gmail.com
	Contact Number	:	9640628752.

Map of Ahmednagar district



Selected tahsils

Fig. 3.1: Locale of the study

Data Collection by Personal Interview method in Rahata Tahsil

Data Collection by Personal Interview Method in Rahuri Tahsil.

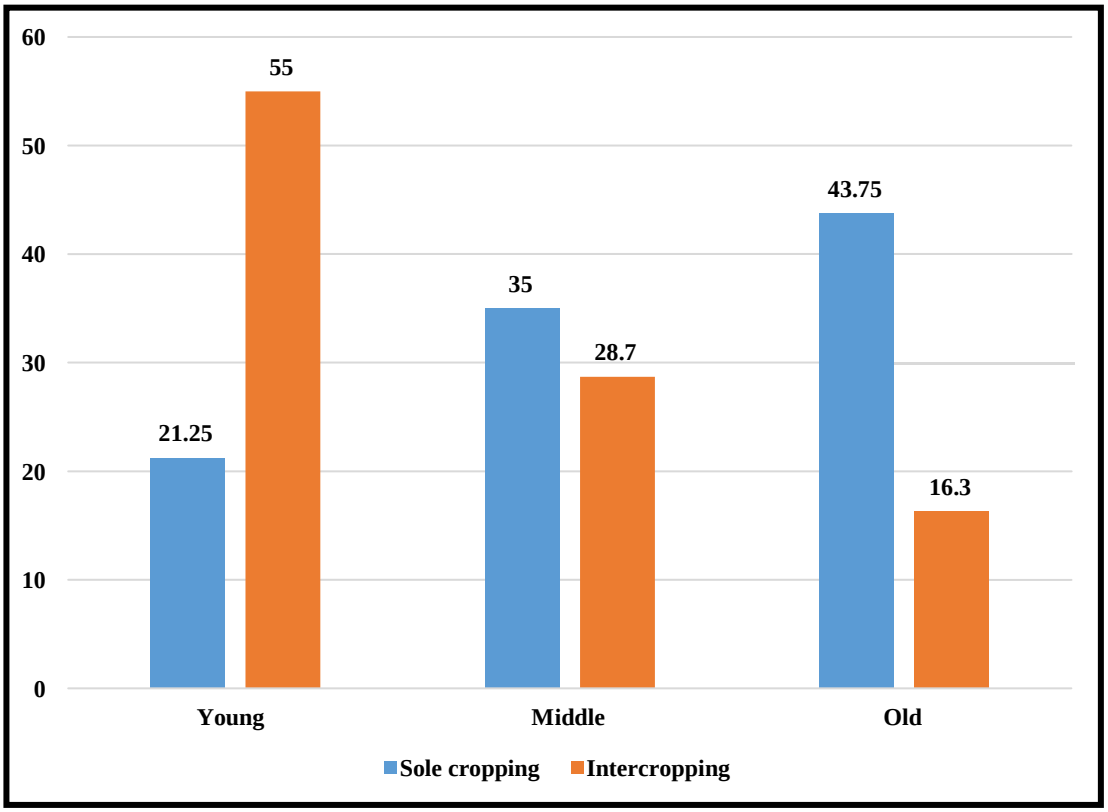


Fig. 4.1:- Distribution of respondents according to their age

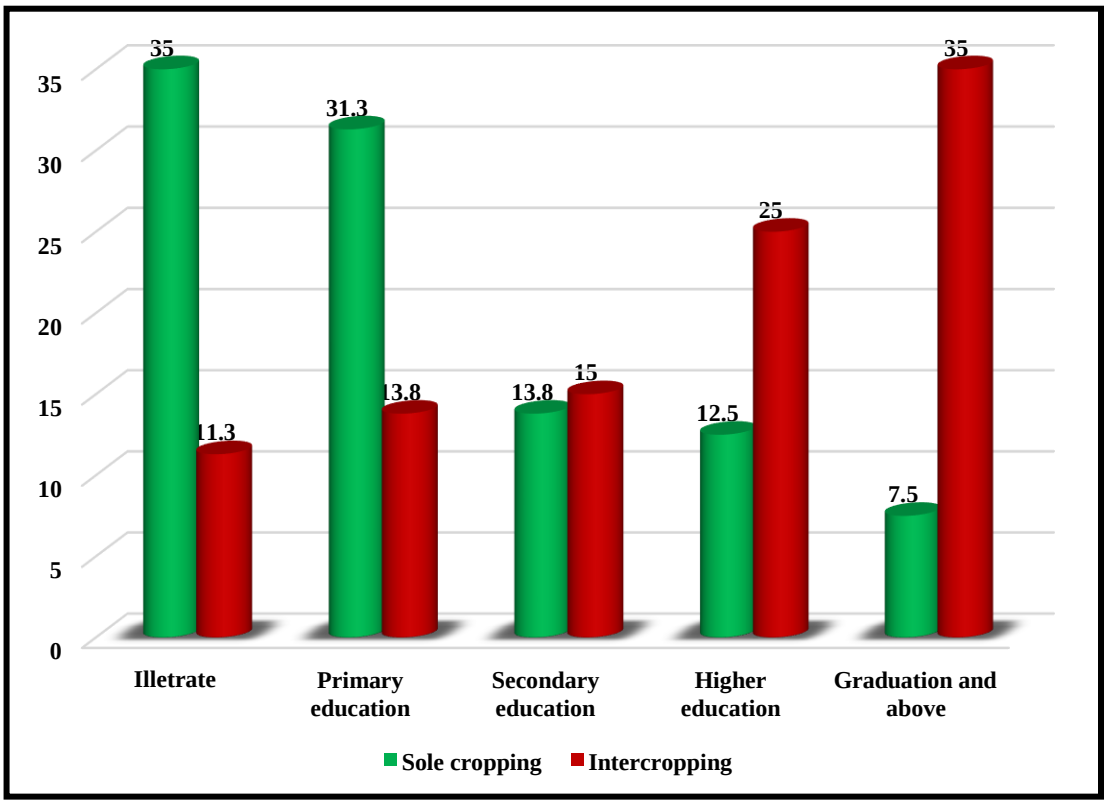


Fig. 4.2:- Distribution of respondents according to level of education

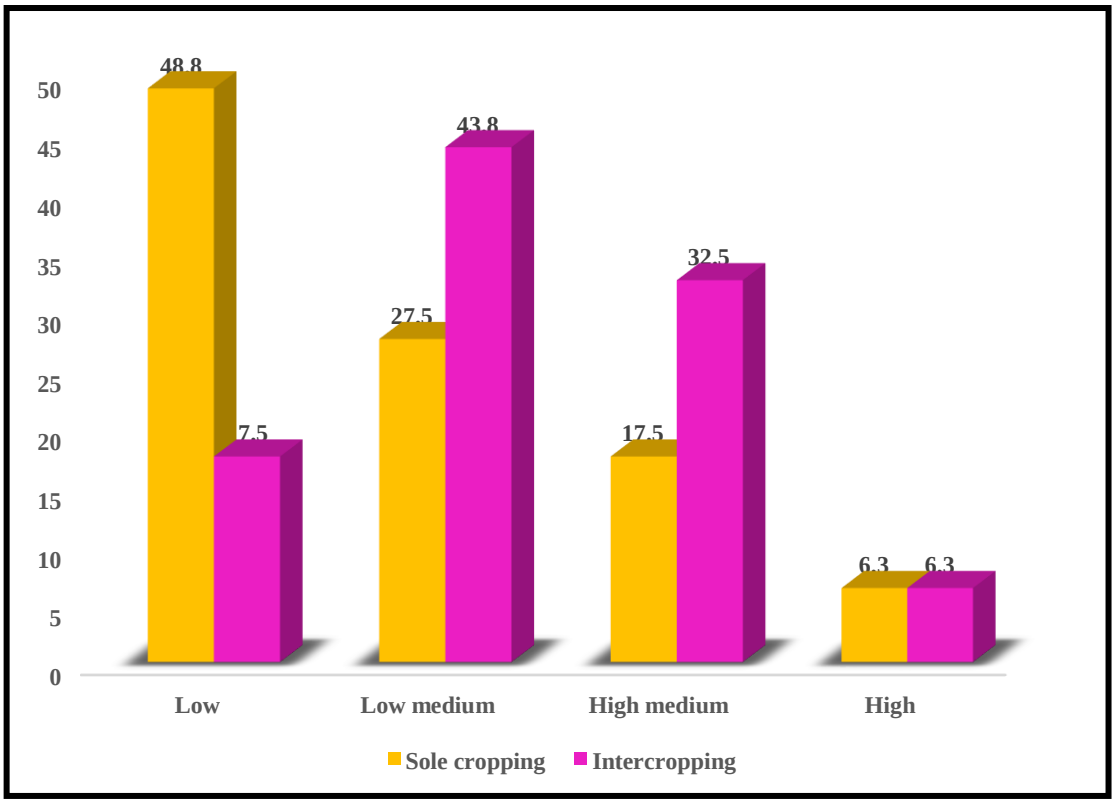


Fig. 4.3:- Distribution of respondents according to their annual income

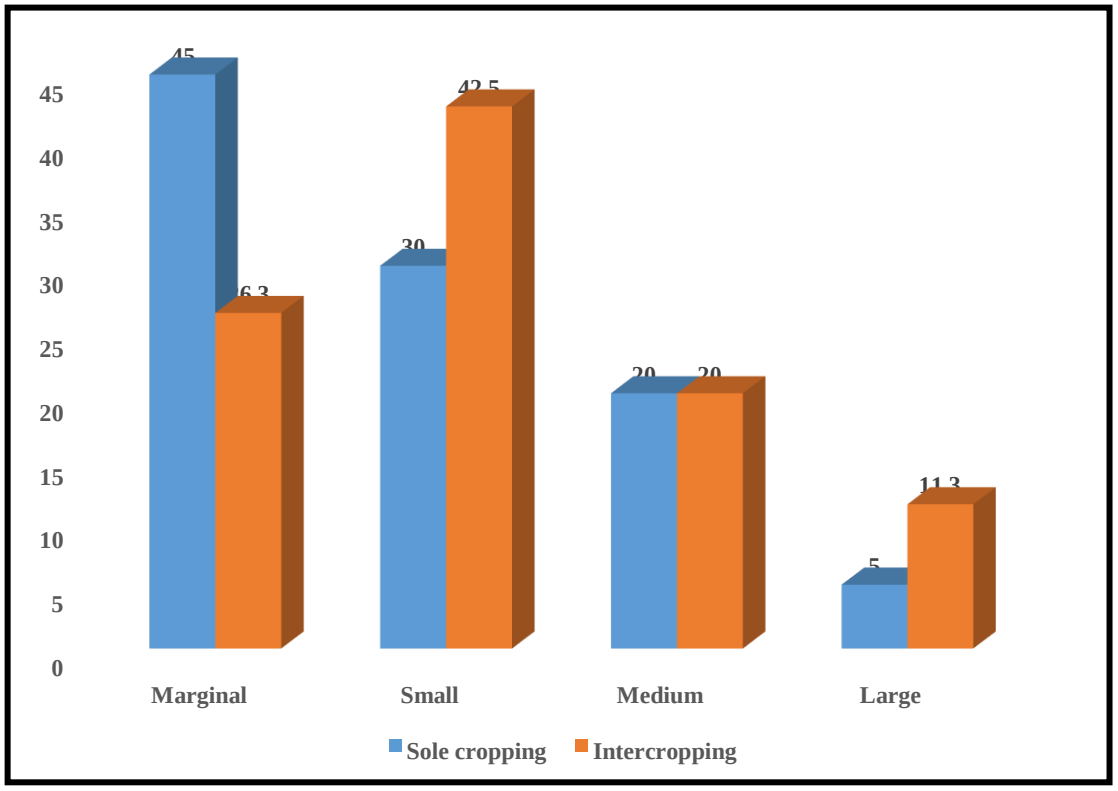


Fig. 4.4:- Distribution of respondents according to land holding

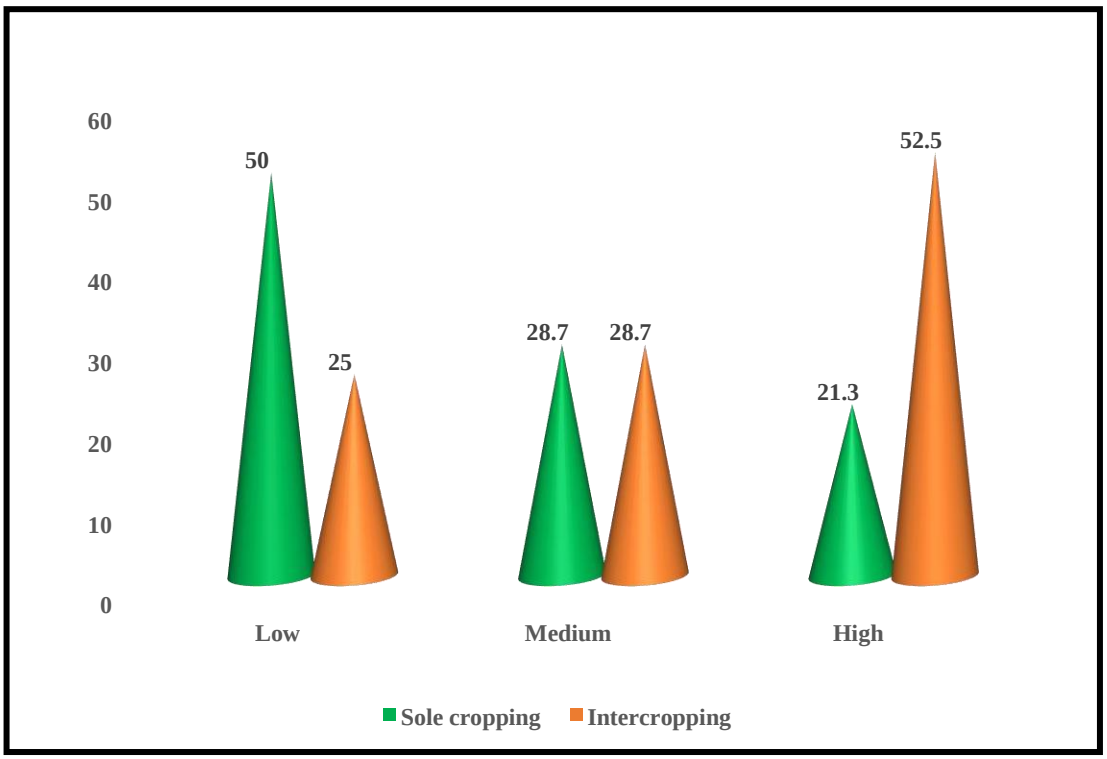


Fig. 4.5:- Distribution of respondents according to source of information

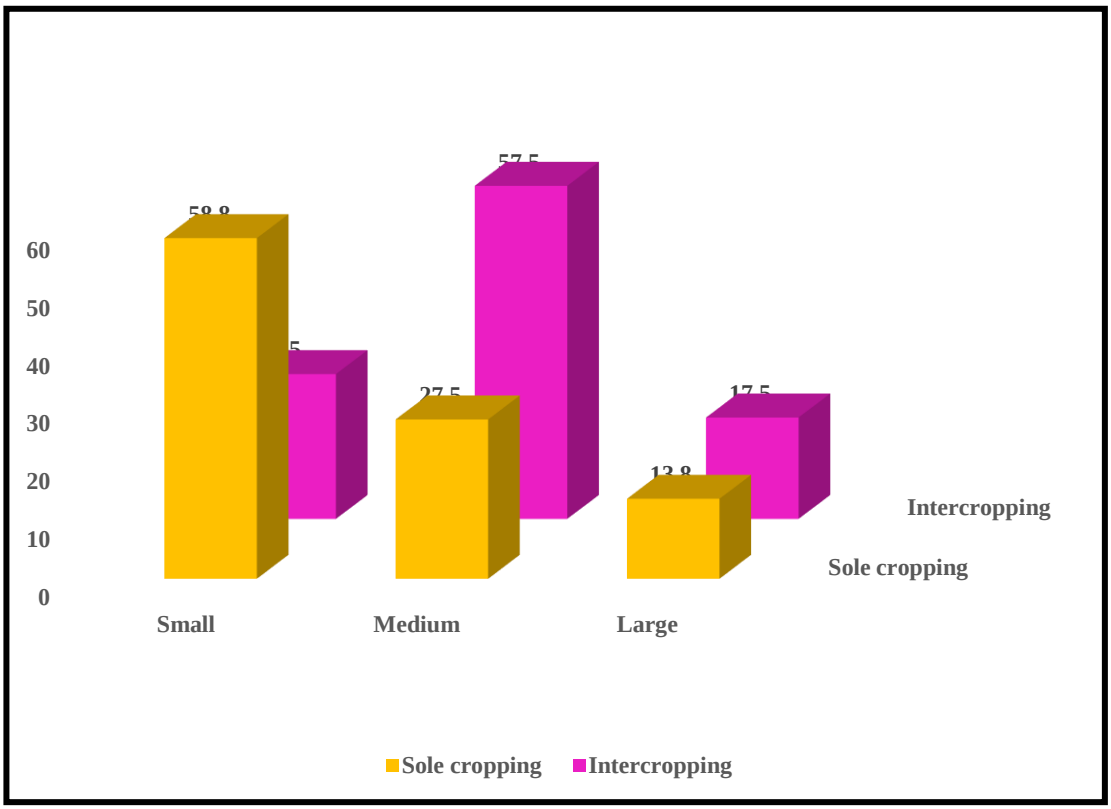


Fig. 4.6:- Distribution of respondents according to area under sugarcane

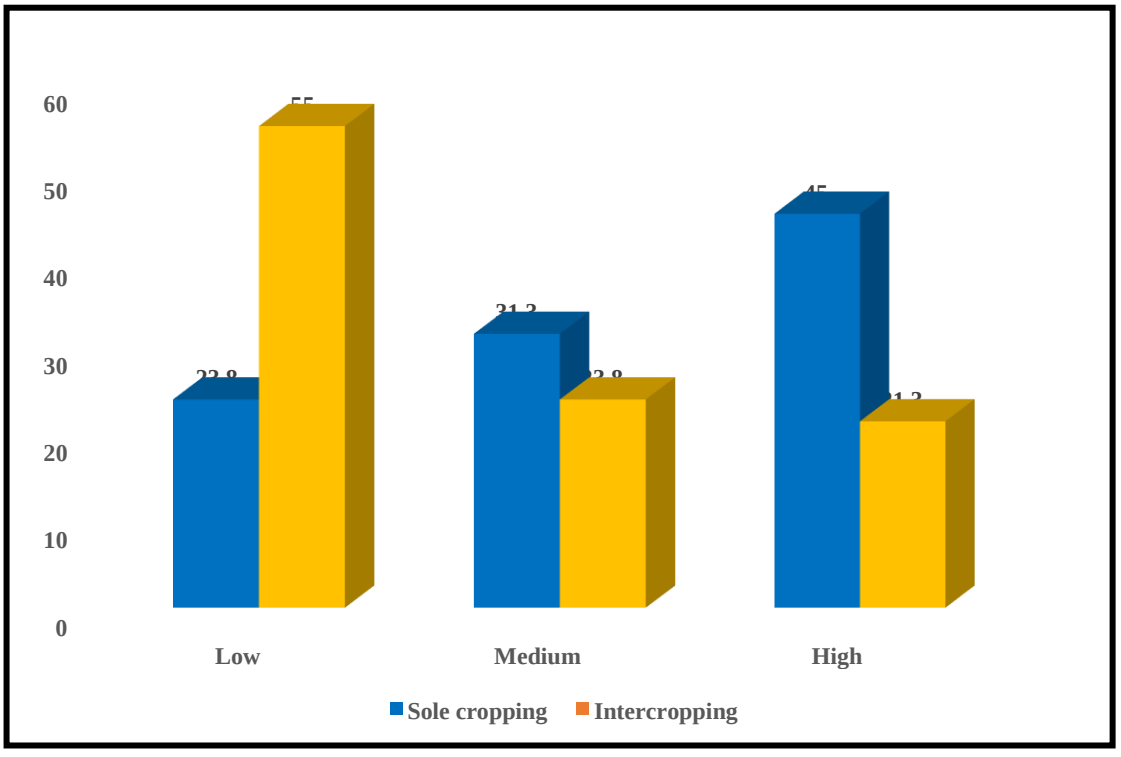


Fig. 4.7:- Distribution of respondents according to farming experience

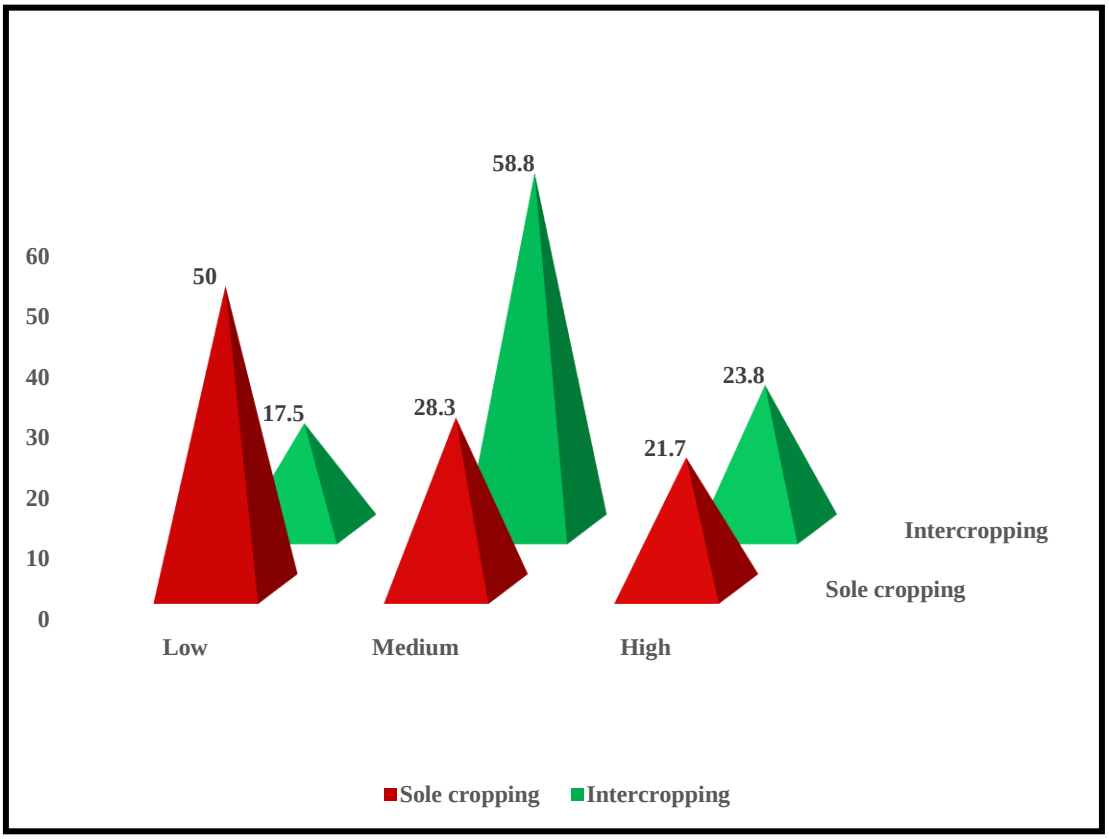


Fig. 4.8:- Distribution of respondents according to economic motivation

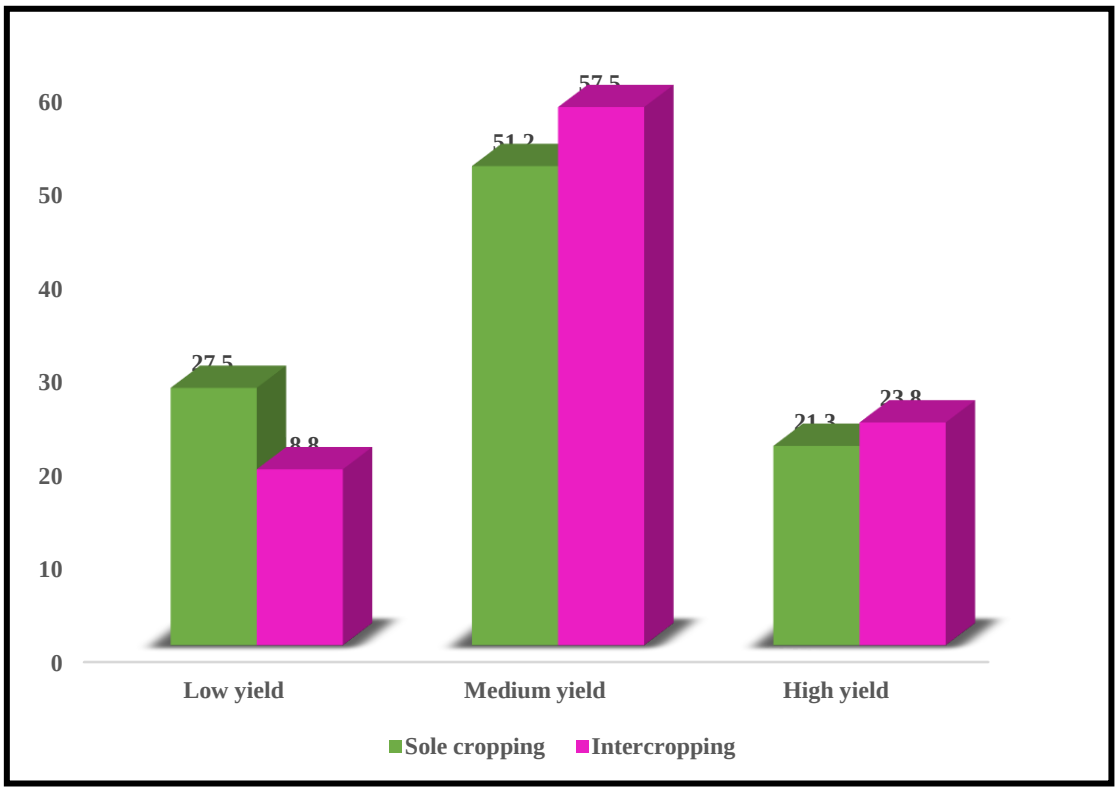


Fig. 4.9:- Impact of intercropping on sugarcane growers in terms of additional yield

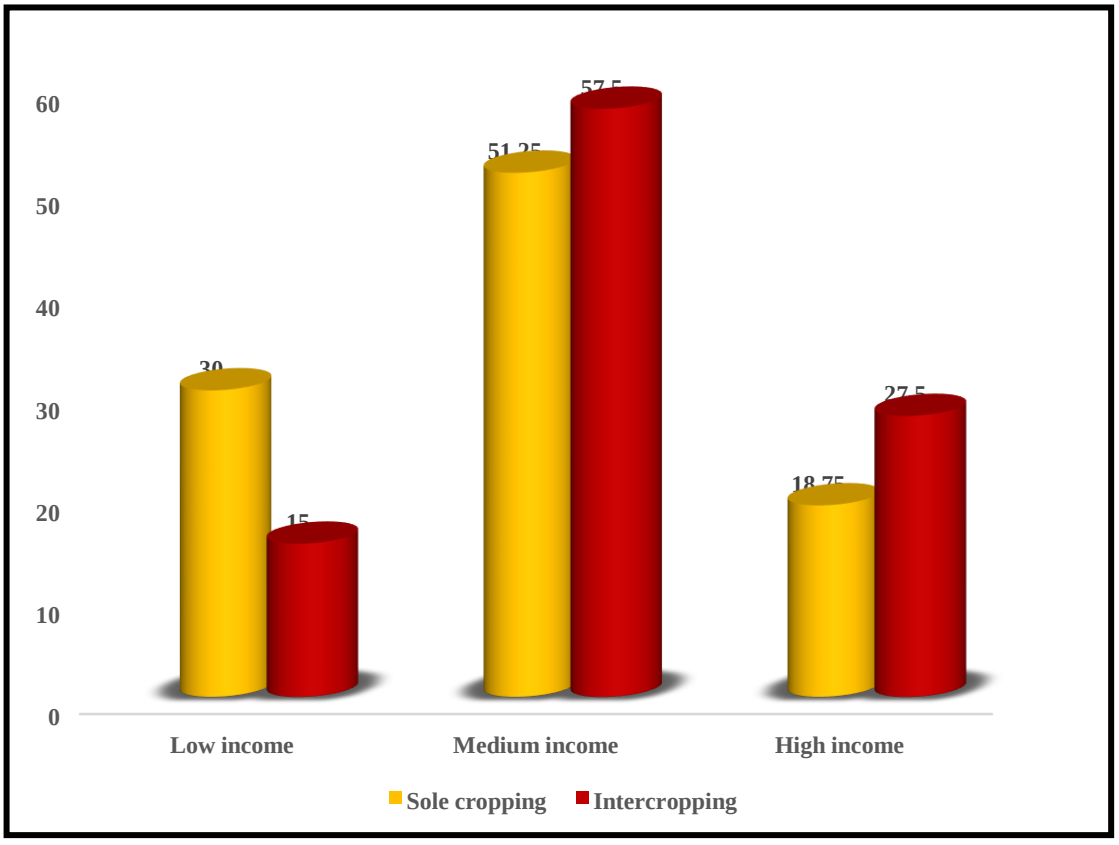


Fig. 4.10:- Impact of intercropping on respondents in terms of additional income

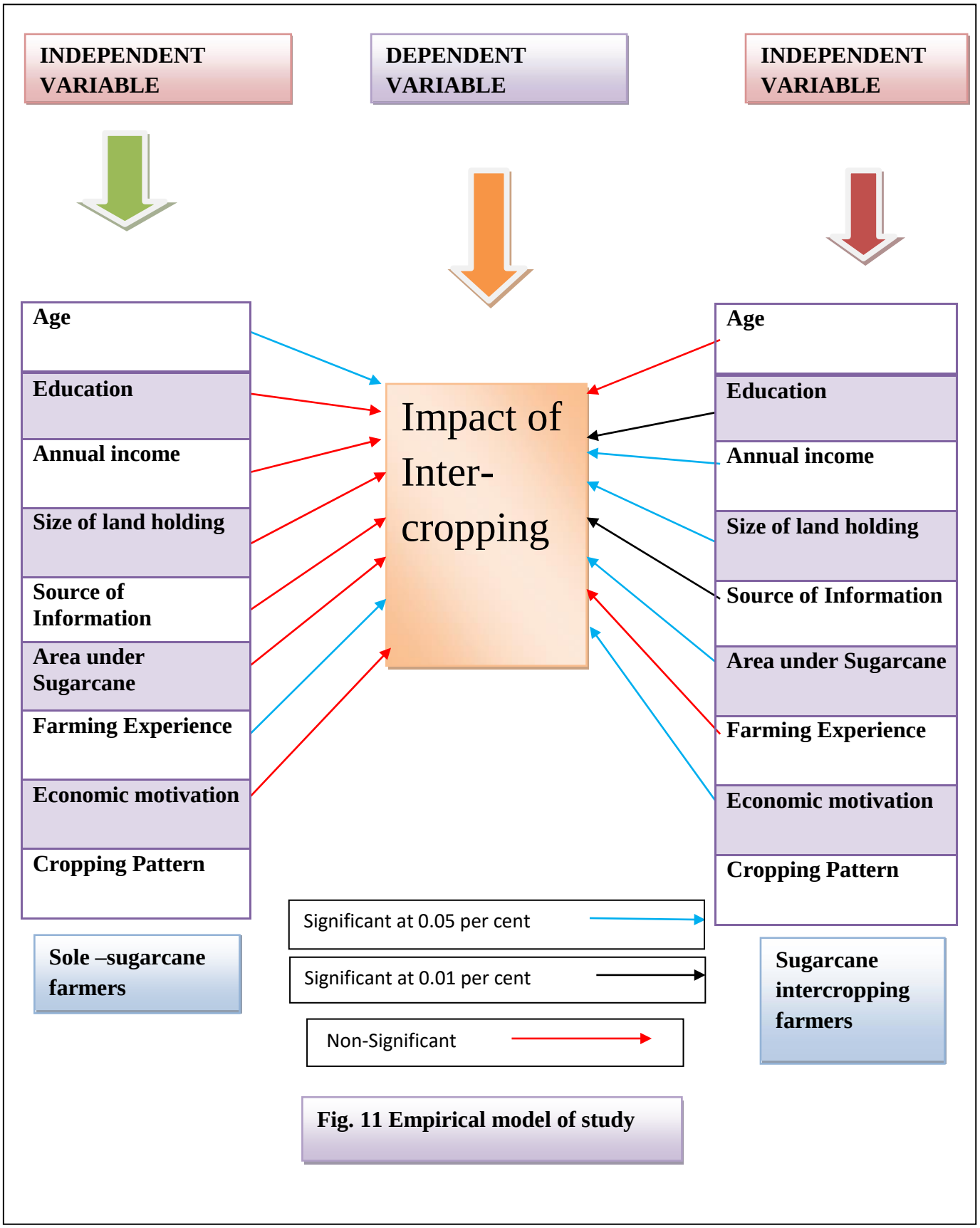


Fig. 11 Empirical model of study