ति.स्व. बाबा आणि दाजी,
यांना मनोभावे अर्पण.

भरत.

A STUDY OF TOMATO GROWERS FROM AHMEDNAGAR DISTRICT WITH PARTICULAR REFERENCE TO ADOPTION OF IMPROVED VARIETIES

By

Bharat Pandharinath Hinge

Reg. No. 94153

A Thesis Submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH,

RAHURI - 413 722 DIST.-AHMEDNAGAR

Maharashtra State (India)

In partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION

DEPARTMENT OF EXTENSION EDUCATION
POST GRADUATE INSTITUTE,
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI, DIST. AHMEDNAGAR; M. S. (INDIA)

1996

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CANDIDATE'S DECLARATION

I hereby declare that this thesis or part
thereof has not been submitted
by me or any other person to
any other University
or Institute for
a Degree or
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Dated : 30 / 12 / 1996.

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CERTIFICATE

This is to certify that the thesis entitled, "A STUDY OF TOMATO GROWERS FROM AHMEDNAGAR DISTRICT WITH PARTICULAR REFERENCE TO ADOPTION OF IMPROVED VARIETIES", submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, (Maharashtra), in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE (AGRICULTURE) in AGRICULTURAL EXTENSION, embodies the results of a piece of *bona fide* research work carried out by SHRI. B.P. HINGE, under my guidance and supervision and that no part of the thesis has been submitted for any other Degree or Diploma.

The assistance and help sought during the course of this investigations has been duly acknowledged.

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Place : MPKV, Rahuri.

Dated : 30/12/1996.

(V.M. PAWAR)

ACKNOWLEDGEMENTS

I feel extremely honoured for the opportunity bestowed upon me, to work under the guidance of Dr. B.B. Khot, Assistant Professor, Department of Extension Education, Mahatma Phule Krishi Vidyapeeth, Rahuri for his valuable inspiring guidance, constant encouragements and keen interest throughout the progress of this investigation and for his help in preparation of this thesis.

No words are descriptive enough to express my sincere sense of gratitude to Dr. K.R. Kadam, Associate Director of Communication, Dr. D.L. Sale, Professor of Agril. Economics, Dr. S.D. Warade, Senior Vegetable Breeder, Dr. B.H. Khan, Assistant Professor of Statistics, the member of my advisory committee for their valuable suggestions and kind co-operations in the conduct of this research.

I am also indebted to Dr. G.K. Sawant, Head, Department of Extension Education, Dr. S.D. Nimbalkar, Prof. P.G. Patil, Dr. R.S. Palande and staff of Department of Extension Education, M.P.K.V., Rahuri for their valuable help during the course of investigation.

I am thankful to respondent tomato growers for their willing co-operation in data collection.

My sincere thanks are also due to Dr. D.B. Yadav, Asstt.Professor of Agril. Economics and Sau and Shri S.E. Kasab for their valuable help, guidance and co-operation during my post graduate study.

My sincere thanks to Bank of Baroda, Awasari Kd. and S.G. Samant, Hon. Secretary of Shri Brihad Bharatiya Samaj, who provided the financial support during my post graduate study.

My heart is filled with sweet memories of jolley friends and colleagues. I hardly find any words to express my gratitudes to dearest friends Ashok, Malhari, Chandrashekhar, Gajanan, Atul, Balasaheb, Ranjan, Mahesh, Shatanik, Sushil, Rajesh, Sanjay, Shrikant, Sudhir, Nitin, Dinesh, Mohan, Girish, Baban, Kishor, Hanumant Bare, Vikas, Manoj, Prakash, Anil,

Acknowledgements Contd.....

Ankush, Balkrishna, Sachin and Lt. Sunil Patil, for their companionship during the study period and for their help in all moments of life.

I am also very much thankful to VERSATILE COMPUTER MEDIA, RAHURI for neat and tidy typing of this manuscript.

Indeed, the words at my command are inadequate in form as well as spirit to convey my immense indebtedness to my brother-in-law Mr. Subhash Jadhav and Mr. Suryakant Shinde, for the love, affection which was a great source of inspiration and encouragement throughout my career.

Words are not enough for expressing my heartiest gratitude to my beloved grand parents, parents (Aba and Aai), brothers Harishchandra, Arun, sisters Sau. Tai, Bai and Suwarna, vahini Sau. Sunita and my other family members and relatives for giving encouragement and affection throughout my career.

Place : MPKV, Rahuri
Dated :30/12/1996.

(Bharat P. Hinge)

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ABSTRACT

A STUDY OF TOMATO GROWERS FROM AHMEDNAGAR DISTRICT WITH PARTICULAR REFERENCE TO ADOPTION OF IMPROVED VARIETIES

By

Bharat P. Hinge
A candidate for the degree
of
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Tomato (*Lycopersicon esculentum* Mill.) is an important vegetable crop for its wide use in processing industry and its nutritional value. Thousands of farmers grow it as a commercial crop. Its production in India is fastly increasing. The total area under this crop has increased from 167 ha in 1979-81 to 308 thousand ha in 1993. The production has also increased from 1533 thousand MT in 1979-81 to 4849 thousand MT in 1993.

The present study was conducted in Sangamner tahsil of Ahmednagar district, comprising of 164 villages of which 10 villages were selected for the study. From the selected villages, 150 randomly selected tomato growers were interviewed which formed the final size of sample for the

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study. The data were collected with the help of well constructed and pretested interview schedule. The collected data were processed through primary and secondary tables and statistically analysed. The co-efficient of correlation (r) was used to find out the relationship between the selected independent and dependent variables. To explain the extent of variability caused by the set of independent variables in dependent variables, multiple regression analysis was done.

The study revealed that majority of the tomato growers were middle aged, educated between primary and secondary school level, having small size of family, belong to small farmers' category, having medium annual gross income, medium socio-economic status, medium risk orientation capacity, sixteen year experience in farming and using interpersonal and cosmopolite sources of information for tomato cultivation technology.

It was observed that the large majority of the tomato growers had medium level of knowledge about improved cultivation practices of tomato. Similarly, large majority of

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tomato growers had medium level of adoption of improved cultivation practices of tomato.

It was found that almost all the respondents used non-recommended varieties, the seeds of which were purchased from private dealers. Most of the growers were lacking in knowledge about recommended varieties and hybrids. However, most of the farmers who were cultivating hybrids of tomato expressed that the germination of these hybrids was optimum, have a good keeping quality upto eight days, give yields at expected level and fetching satisfactory market prices.

Study reveled that with the increased level of educaiton, family size, size of land holding, annual income, socio-economic status, risk orientation capacity, experience in tomato cultivation, extent of use of source of information, tomato growers' level of knowledge and adoption of improved tomato cultivation practices also increased. Variable age was found to have no relationship with knowledge and adoption of tomato growers.

The important constrainst reported by considerable number of the tomato growers with respect to cultivation and

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marketing of tomato were non-availability of F.Y.M., High cost of seed, high cost of fertilizers, high cost of insecticides and pesticides, higher charges by commission agents, cheating by middlemen and low market price as expected.

Creation of effective and efficient marketing system was one of the important suggestions made by majority of the tomato growers. Providing fertilizers and pesticides at subsidised rates, assured and reasonable selling prices of tomato and availability of timely credit were the among other suggestions.

It was observed that most of the tomato growers were self motivated to take up the cultivation of the crop followed by those who were motivated by the Village Extension Workers.

The study implies to provide technical know-how about the improved tomato cultivation technology with credit support along with training.

INTRODUCTION

1. INTRODUCTION

Scientific research in agriculture is moving fast. New practices, seeds, machinery are coming to lime light but there is laps of time and a wide gap in the research and its adoption on the farmers field. Adoption of the generated technology has always been the major aim of our development. It is beyond doubt that adoption of improved agricultural technology is the positive answer to increase the agricultural production. It is, therefore, essential for the farmers to adopt improved agricultural practices, thereby increasing the yields of various crops and thus help in improving the national economy.

It is fact that all the farmers do not adopt improved agricultural practices at the same time. Only a few farmers adopt them early, others adopt them late while still others do not adopt them at all. Even among the followers of improved practices some adopt them completely, while some adopt them only partially. Adoption of improved practices much depends upon different personal, socio-economic, communicational and psychological characteristics of the farmers.

Extension agencies are engaged in the various sectors of the community development movement in the country and are working for making the farmers to adopt recommendations of the scientists in respect of improved farming. However, adoption of these recommendations by the farmers is observed to be differential. The adopters of improved practices of tomato cultivation also do not differ much in their adoption of technology.

Vegetable cultivation is one of the major branch of horticulture. From the point of view of value of the products, it is the most important branch. In all advanced countries of the world vegetable plays an important role in human diet. It is now a well recognised fact that vegetables can go a long way to supplement the proteins carbohydrates, and mineral requirement in human nutrition in most of the developing countries. Eventhough majority of the Indian population is vegetarian paradoxically, vegetable production and consumption have not received adequate attention.

Requirement of vegetables per man per day is 300gm. Average Indian consumption is only about 10% of the total food taken. To increase the consumption of vegetables in India, production of vegetables should be increased. An individual needs about 1.1 million calories every year. This quantity

can be supplied by cereals produced from 0.45 ha. of land. However, if vegetables are grown in the same area they would supply four times more calories. On an average we consume 375 gm of cereals and only 30 gm of vegetables as against 328 gm of vegetables and 362 gm of fruits in advanced countries. The daily minimum requirement of vegetables according to dieticians is, 300 gm per head i.e. about 30% of daily requirement of the total food of an adult. But this requirement is more in case of vegetarian diet (Bose et al., 1986). It has been, therefore, recognised that there is an eminent need for further increase in food production especially protective food such as fruits and vegetables. Vegetable crops are more economic than food grains due to their higher production per unit area in less time. It provides a good source of income to farmers.

The production of vegetables has increased considerably during the recent years because of introduction of modern inputs and development of new production technique. Vegetables are rich source of protective elements, carbohydrates, fats, proteins, vitamins and mineral elements. Among the various commercial vegetables grown in India, tomato is one of the most popular vegetable and tops the list of canned vegetables.

Tomato (*Lycopersicon esculentum* mill.) a solanaceous fruit vegetable has prime position among vegetable crops and its cultivation is done all most all the year round. It is popular vegetable crop of Maharashtra due to its versality in fresh and processed form. Tomatoes, which are grown both in home gardens and commercially, are a good source of vitamins 'A' and 'C'and mineral elements. The origin of tomato crop has been designated as the 'Andears' region of South America. The first record of tomato was made in Italy in 1554, where it was known as "Pomidaro' the golden apple. From Europe, it was introduced in India in the 17th century. Tomato gained a rapid popularity after 1820 and was used as one of the useful articles of diet in many sections in 1835 Today,tomato out ranks all other vegetables, except potato in popularity and in value. However, it ranks first as a processing vegetable.

1.1 Information about tomato cultivation

1.1.1 Area and production

Tomato (*Lycopersicon esculentum* mill) is the native of South America but the cultivation of this crop has now been extended to Africa, China, Italy, Turkey and Egypt which are having highest area and production of tomato crop. The area and production of the tomato crop in the world in last decade is as shown below :

Table 1. Area and production of tomato in world

Year	Area (000 ha)	Per cent (increase or decrease)	Production (000 MT)	Per cent (Increase or decrease)
1979-81	2453	-	53787	-
1991	2800	+ 14.47	75246	+ 39.00
1992	2776	- 1.13	72362	- 3.83
1993	2723	- 1.90	70623	- 2.40

(Source: FAO Quarterly Bulletin of Statistic, 1994, Page 129).

The area and production of the tomato crop in the world has increased in 1991 but afterwards exhibited the decreasing trend.

Table 2. Area and production of tomato in India

Year	Area (000 ha)	Per cent (increase or decrease)	Production (000 MT)	Per cent (Increase or decrease)
1979-81	167	-	1533	-
1991	289	+ 73.05	4244	+ 176.84
1992	300	+ 3.80	4500	+ 6.00
1993	308	+ 2.66	4849	+ 7.75

(Source: FAO Quarterly Bulletin of Statistic, 1994, Page 129).

In India the total area under this crop has increased from 167 thousand ha in 1979-81 to 308 thousand ha in 1993. The production has also increased from 1533 thousand MT in 1979-81 to 4849 thousand MT in 1993. The average yield of tomato in India is 15.71 t/ha.

Table 3. Statewise area and production of tomato in India

	States	Area (ha)	Production (MT)
1.	Bihar	54400	761600
2.	Orrisa	43500	475000
3.	Andra Pradesh	40300	403010
4.	Karanataka	32361	624548
5.	Madhya Pradesh	22323	334845
6.	Maharashtra	22125	553125
7.	West Bengal	18000	450000
8.	Tamilnadu	17380	444928
9.	Assam	12350	242547
10.	Rajasthan	10867	40020
11.	Gujrath	6000	90000
12.	Uttar Pradesh (Hills)	5580	37640
	Uttar Pradesh (Plain)	4915	30423
13.	Haryana	4820	93925
14.	Punjab	4700	110717
15.	Delhi	4200	85683
16.	Himachal Pradesh	2366	53578
17.	Sikkim	575	2779
18.	Kerala	470	3290
19.	Manipur	390	3120
20.	Meghalaya	389	2412
21.	Others	642	6378
	Total	308653	4849568

(Source : DATABASE, National Horticulture Board, Ministry of Agriculturte, Govt. of India, 1992-93).

The major tomato growing states in India are Bihar, Orrisa, Andra Pradesh, Karnataka and Madhya Pradesh having more area and production than that of Maharashtra (Table 3).

In Maharashtra tomato is grown on an area of 22,125 hectares with the production of 5,53,125 metric tonnes with an average yield of 25 t/ha (1992-93). Two Third of this area is

concentrated in Nasik, Ahmednagar, Sangli and Pune districts. Due to urbanization and increase in the population, the demand for tomato has been dramatically increased in the recent years. It is, therefore, necessary to increase the productivity of this crop to meet the ever increasing dietic demand of the country.

1.2 Importance of tomato

Tomato is one of the most popular vegetables used in diet in fresh and processed form. It is cooked as a vegetable alone when it is ripe, it is consumed a fresh or is made into salad, soup, sauce, ketchup and many other products. Commercial manufactures of tomato products rank first among all processed vegetables. Tomato juice on account of its distinctive flavour and high vitamin `C' content, has become very popular. Canned ketchup, sauce are widely used in restaurants. Tomato soup is also very popular. It has a very high nutritive value and so it is some times called as "Poor man's orange". Tomato also possesses valuable medicinal properties as an excellent blood purifier. Green tomatoes are also used for pickles. Tomato is being used by the agro-industries to produce processed products like ketchups, sauces which are having export market.

Summarising the advantages of tomato, it may be stated that it supplies better food and higher income. It promotes the development of natural resource, yields higher returns from lands, enhances the land value, creates better purchasing power among people and consequently adds to the general property of the nation.

1.3 Statement of the problem

All the farmers do not adopt the recommended practices at the same time and at the same rate. The research problem, therefore, addressed to the following research questions :

- Do the farmers possess sufficient knowledge about recommended technologies of tomato crop production and to what extent?
- Why some farmers adopt improved crop production technologies quickly while other do not? what are the reasons for non adoption?
- Why some farmers adopt the non-recommended hybrid varieties of tomato and not the recommended improved varieties?
- Do the farmers know recommended varieties?
- What are the reasons for non adoption of recommended varieties?

Socio-economic and other behavioural aspects of farmers might be influencing the adoption of crop production technologies. These might be certain kind of relationship between these aspects and adoption of tomato cultivation

practices. Farmers might be facing certain constraints particularly securing of input, marketing of tomato and non availability of plant protection measures. The study will focus towards these aspects also. With this back ground, the present study entitled "A study of tomato growers from Ahmednagar district with particular reference to adoption of improved varieties" was planned and carried out with the following specific objectives :

1.4 Specific objectives of the study

i) To study the personal and socio-economic back-ground of tomato growers.

ii) To study the level of knowledge and adoption of improved practices of tomato cultivation by tomato growers.

iii) To know the adoption of different varieties of tomatoes by the farmers.

iv) To understand the constraints encountered by tomato growers in securing improved varieties, cultivation and marketing of tomato.

v) To find out the relationship between selected characteristics of the tomato growers and their knowledge and adoption of improved package of practices of tomato.

1.5 Hypotheses of the study

i) There is a relationship between socio-economic characteristics of tomato growers and their knowledge and adoption of cultivation practices of tomato crop.

ii) The farmers cultivating tomato face the constraints in production and marketing of tomato produce.

iii) Tomato growers cultivate the non-recommended varieties and hybrids.

1.6 Importance and scope of the study

It has been observed that researchers in social sciences particularly in extension education have completed their research studies mostly in the areas of pomology and floriculture. Scanty efforts of studies in the areas of olericulture have been made. On this background, the present study is an addition to the studies in the area of olericulture.

The research was focused on the experiences of farmers growing tomato. In addition to this efforts were made to know the farmers' knowledge and level of adoption of recommended practices of tomato and the problems in adopting such practices. Besides, State Agricultural Universities (SAUs). Private firms are producing number of hybrid varieties every year and selling the seeds to the farmers. Adoption of improved and recommended varieties of tomato by the farmers is one of the important consideration in its production and the same has been dealt in the present study. It is expected that the study will provide a feed back to the

vegetable breeders working in SAUs in particular and plant breeding scientists in general. The finding of this study will also help to extention workers and others associated with tomato production in performing their functions more effectively.

1.7 Limitations of the study

As the present study is confined to only 150 tomato growing farmers selected from ten villages from Sangamner block of Ahmednagar district of Maharashtra State, its findings would have limited use. The findings of the study might be applicable to the localities having ecological and social environment as that of 'Sangamner' block.

Similar studies, therefore, at different locations with larger sample size need to be under- taken for arriving at gerneral conclusions regarding the knowledge and adoption of tomato cultivation practices. In short, the present investigation has been of exploratory nature and needs to be replicated for wider applicability and generalization of findings.

1.8 Layout of dissertation

The dissertation comprises five chapters. The first chapter "Introduction" deals with the relevant information about the tomato crop, statement of the problem,

specific objectives, hypotheses formulated as well as scope and limitations of the study. The second chapter "Review of literature" gives brief account of relevant research work done in the past on the topic of the present investigation. Chapter third deals with "Methodology" followed in the study. The fourth chapter deals with "Presentation of findings and discussion". The last chapter constitutes the "Summary, conclusions and implications" of the study. The references, schedules and other such material are appended at the end.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

A comprehensive review of literature is an essential part of any scientific investigation. It is always helpful to investigator as a guideline for his approach. Review of literature is useful to compare the findings of study with the studies undertaken by previous research workers.

In view of above an attempt has been made to review the published literature from scientific journals, reports surveys,committee and books relating directly as well as indirectly to the problem under investigation. From the review of literature made so far, it is noticed that the scanty efforts of social studies were observed to be in the areas of olericulture particularly about tomato crop. As such an attempt was made to review the past studies which were directly as well as indirectly related to the present study. Efforts were made to review the studies about the olericulture and horticultural crops as nearest to tomato. In view of the objectives of the study and variables selected the review was made. Theoretical orientation about important concepts is included in the study which are in the form of constructs. The research studies reviewed were grouped under sub-heads and are presented in the following sequence.

2.1 Knowledge and its relationship with selected variables

2.1.1 Knowledge : Concept and meaning :

The awareness, knowledge may be defined as the change in person's cognitive learning behaviour resulting from a specific learning experience.

English and English (1958) defined knowledge as a body of understood information possessed by an individual or by a culture. They further explained that knowledge is that part of person's information which is in accordance with established fact.

Bloom *et al.* (1969) stated that knowledge involves the recall of specific facts and isolable bits of information about the message.

An attempt was made to review past researches related to knowledge aspect of tomato growers. The studies related to knowledge of improved farm technologies in relation to the characteristics of adopters were reviewed.

2.1.2 Age and knowledge

Pachori and Tripathi (1983) observed that there was significant association between age and knowledge of the farmers regarding agricultural technology.

Nimje *et al.* (1991) found that age did not show any association with the knowledge about ber cultivation.

Gaikwad (1992) found that age of flower growers was found to have no relationship with knowledge about production and management practices of flower cultivation.

Waman (1993) observed that age of onion growers was found to have non-significant relationship with their knowledge about improved cultivation, storage and marketing practices of onion growers.

Thus majority of the studies indicated that there was non-significant association between age and knowledge level of the farmers.

2.1.3 Education and knowledge

Singh and Shankariah (1967) reported that education of farmers was positively associated with knowledge of improved practices of vegetable cultivation.

Nimje *et al.* (1991) observed that education of farmers did not show any association with knowledge about ber cultivation practices.

Gaikwad (1992) found positive and highly significant relationship between education of farmers and their level of knowledge about flower cultivation.

Kunjir (1993) observed that there was significant association between education and knowledge of fig growers.

Pandya and Vekaria (1994) reported significant association between education of banana growers and their level of knowledge about banana production.

Most of the above studies indicated that the education of the farmers was positively associated with their knowledge of improved farm practices.

2.1.4 Size of family and knowledge

Mundhwa and Patel (1987) inferred that there was no relationship between the respondent's level of knowledge of improved practices of rainfed wheat cultivation and their size of family.

Nimje *et al.* (1990) found that total number of family members has highly significant relationship with the level of knowledge about dryland technology of cotton crop.

Deshmukh (1991) observed that family size has negative but non-significant relationship with knowledge level of kisan nursery growers.

Waman (1993) found that there was a non-significant relationship between the farm size and knowledge level of onion growers.

The above studies indicated that the size of family had no influence over knowledge level of farmers about recommended practices.

2.1.5 Size of land holding and knowledge

Nimje *et al.* (1991) found that there was significant association between size of land holding and knowledge about ber cultivation.

Hiremath (1993) observed that farmers with larger size of holding had higher level of knowledge about horticultural development programme.

Kunjir (1993) found that there was significant association between area under fig crop and knowledge level regarding improved fig crop cultivation practices.

Pandya and Vekaria (1994) found that there was significant association between land holding and their level of knowledge of banana growers.

Most of the above studies indicated that the size of land holding of the farmers was positively associated with the knowledge.

2.1.6 Annual gross income and knowledge

Singh and Shankariah (1967) found that annual gross income of the farmers was positively associated with the knowledge of improved practices of vegetable cultivation

Mehta *et al.* (1989) reported that there was significant association between annual income and farmers knowledge level about rice and mango cultivation practices.

Nimje *et al.* (1990) observed that there was highly significant association between annual income and cotton growing farmers' knowledge level.

Badiger *et al.* (1991) found that there was no significant relationship between annual income and knowledge level of farm women about forestry.

Waman (1993) reported the significant relationship between annual income and knowledge level of onion growers.

From the above studies it can be inferred that the annual gross income is significantly associated with the knowledge of farmers.

2.1.7 Socio-economic status and knowledge

Sharma and Sharma (1988) indicated that socio-economic status of the wheat growers was significantly land positively correlated with their knowledge about wheat production technology.

Deshmukh (1991) found that there was non-significant relationship between socio-economic status of nursery growers and their level of knowledge.

Gaikwad (1992) found that socio-economic status of flower growers exhibited positive and highly significant relationship with their knowledge level of about flower production.

Hiremath (1993) found the significant association between socio-economic status of the farmers and their level of knowledge about horticultural development programme.

Patil (1995) observed that there was significant association between socio-economic status of farmers and their knowledge level about improved practices of banana cultivation.

Majority of the studies indicated that the socio-economic status of the farmers was positively associated with knowledge of improved farm practices.

2.1.8 Risk orientation and knowledge

Sinha *et al.* (1988) reported that risk preference was found to have significant association with knowledge.

Rao and Rao (1993) found that risk orientation failed to have any influence on acquisition of knowlege.

Pandya and Vekaria (1994) found that there was significant association between risk preference and their level of knowledge of banana growers.

Patil (1995) reported that there was significant association between risk orientation of banana growers and their level of knowledge about banana production.

Studies so far reviewed above showed that risk orientation behaviour of cultivators is positively influencing their knowledge level about farming practices.

2.1.9 Sources of information and knowledge

Jain and Verma (1987) reported that information source utilisation was found to be positively and significantly related with knowledge level of farmers.

Waghmare *et al.* (1988) observed that increase in different sources of informations increased the knowledge level of farmers.

Thakur *et al.* (1991) reported that source of information of mango growers about horticultural development programme were radio, extension workers and television. It was concluded that radio, television and extension personnel were the important source of information of mango growers for increasing their knowledge level.

Waman (1993) observed the significant relationship between the use of information sources and knowledge level of onion growers. Above studies indicated that the sources of information was positively associated with knowledge.

2.2 Adoption and its relationship with selected variables

2.2.1 Adoption : concept and its meaning

Adoption, as viewed by the rural sociologists, is not a snap decision but a process. Important nature of adoption process is that it occurs in different stages.

Rogers and Shoemaker (1971) formulated four stages in their conceptualization of adoption process. These were knowledge, persuation, decision and confirmation.

Rochin (1980) noticed that the adoption of new technology was a very uneven process, varying geographically from farmer to farmer, region to region and country to country as well as among various crop to crop systems.

Rogers (1983) expressed that the adoption process is the mental process through which an individual passes from first hearing about an innovation to the final adoption. He has given the five stages in his recent concept of innovation decision process which includes knowledge, persuation, decision, implementation and confirmation.

2.2.2 Age and adoption

Sheshaghar (1981) stated that the adoption behaviour of the chilli cultivators was not significantly associated with age.

Waman (1993) reported that the relationship between the age of onion growers and the level of adoption of improved cultivation, storage and marketing practices was non-significant.

Javale and Nachane (1994) found that the age of the respondent was significantly but negatively correlated with the adoption of recommended practices of mango and citrus.

Bhujbal (1995) concluded that there was statistically non-significant association between age and adoption level of fig growers.

Kharat (1996) found that there was significant association between level of adoption and age of the pomegranate cultivators.

Few studies reviewed above indicated the varying nature of relationship between the age of the farmers and their extent of adoption of improved farm practices.

2.2.3 Education and adoption

Siddalingappa (1978) concluded that education had shown statistically significant association with adoption behaviour of potato growers.

Nalawade (1989) observed that higher the educational level, more was the adoption of improved practices of potato cultivation by the potato growers.

Waman (1993) reported that the education and level of adoption of onion growers was significant.

Pandya and Vekaria (1994) found that there was significant association between education and adoption of improved banana technology.

Kharat (1995) observed that education had significant association with adoption of pomegranate technology.

Above studies indicated that the education of the farmers was positively associated with adoption of improved farm technology.

2.1.4 Experience and adoption

Karale (1985) reported that as the length of occupational experience increased the adoption level of improved groundnut technology was also increased.

Takate (1987) observed that farming experience was found to be significantly associated with the level of adoption of the respondents.

Nalwade (1989) found non-significant association between experience in farming and adoption of improved practices of potato cultivation.

Lianbika and Nikhade (1993) reported that the farming experience of pineapple growers was significantly associated with their adoption of recommended practices of pineapple technology.

Kharat (1996) observed that there was non-significant relationship between farming experience of pomegranate cultivators and adoption level of farmers.

Above studies indicated that the experience in farming in a particular crop may not have necessarily a positive influence over adoption of improved package of practices.

2.2.5 Size of family and adoption

Jagtap (1984) noticed that there was no correlation between size of the family of the potato growers and adoption of improved potato cultivation practices.

Nalwade (1989) reported that size of family had statistically non significant association with adoption of improved technology of potato cultivation.

Kadam and Jagtap(1991) reported that size of family was not significantly associated with adoption of potato cultivation.

Waman (1993) concluded that size of family and adoption level of onion practices was found to be highly significant.

Kharat (1996)) concluded that size of family and adoption level of pomegranate cultivators was found to be non significant.

Findings of the above studies indicated the mix picture of relationship between the size of family and adoption of farm practices. Family size may influence the adoption behaviour both way.

2.2.6 Size of land holding and adoption

Jagtap (1984) found that size of land holding was significantly correlated with adoption of improved practices of potato cultivation.

Nalwade (1989) observed that potato growers having larger size of land holding adopted more number of improved farm practices.

Hanichal (1991) found that land holding status was found to have significant association with the adoption level of potato cultivation practices.

Pandya and Vekaria (1994) found that there was significant association between size of land holding and adoption of improved banana technology.

Bhujbal (1995) concluded that the size of land holding of the fig growers was significantly associated with their level of adoption.

Thus, majority of the studies indicated that there was positive association between the size of land holding and adoption of improved farm technology.

2.2.7 Annual gross income and adoption

Siddalingappa (1978) reported that adoption of improved practices of potato cultivation was significantly associated with annual income of the farmers.

Chiprikar (1988) revealed that annual income of grape growers had significant and positive relationship with adoption of grape production technology.

Kadam and Jagtap (1991) revealed that there was significant association between annual income and adoption level of potato growers. With increase in annual income, adoption level also increased.

Waman (1993) observed that the annual gross income was significantly associated with adoption level of onion growers.

Javale and Nachane (1994) revealed that there was significant association between annual gross income and adoption level of mango and citrus growers

It can be inferred from the above studies that the annual gross income has a positive association with the adoption level of farmers.

2.2.8 Socio-economic status and adoption

Chiprikar (1988) found that socio-economic status of grape growers had significant and positive correlation with adoption of grape production technology.

Kadam and Jagtap (1991) observed a significant correlation between adoption of improved practices of potato cultivation and socio-economic status of potato growers.

Kote (1992) and Kharat (1996) in their studies on pomegranate production technology observed the positive and significant relationship between adopters' socio-economic status and their adoption level.

Bhujbal (1995) concluded that there was a statistically significant association between the socio-economic status of the fig growers and their level of adoption.

Thus, most of the studies indicated that socio-economic status of the farmers was positively correlated with adoption of improved farm technology.

2.2.9 Risk orientation and adoption

Jagtap (1984) and Kadam and Jagtap (1991) in their studies on potato technology observed the positive and significant relationship between adopters risk orientation and their adoption level.

Patil and Waghdhare (1989) found that risk orientation was significantly associated with adoption of banana cultivation practices.

Supe *et al.* (1990) reported that risk orientation was significantly associated with adoption of high yielding varieties of improved jowar.

Pandya and Vekaria (1994) found that there was significant association between risk preference and adoption of improved practices of banana.

Thus, most of studies indicated that risk orientation was positively correlated with adoption of improved farm technology.

2.1.10 Sources of information and adoption

Waghmare *et al.* (1988) found that there was statistically significant association between sources of information and adoption of horticultural practices of fruit and vegetable growers.

Javale and Nachane (1994) found that there was significant correlation between sources of information used by the mango growers and citrus growers and their level of adoption.

Kharat (1996) found that there was significant association between sources of information and adoption of pomegranate cultivation practices.

The above studies indicated that there was positive association between sources of information and farm technology adoption by farmers.

2.3 Constraints

2.3.1 Constraints : concept and meaning

One of the important specific objectives of the study was to analyse the constraints and problem faced by the tomato growers in cultivation and marketing.

Constraint is a reason, cause or circumstances which compels the respondent in non-adoption or partial adoption of advocated technology which ultimately results in poor yield.

The oxford English Dictionary (1961) defined the constraints as a confusement, bound or fettered condition resriction of liberty or the free action.

According to the American Heritage Dictionary (1969) constraint is the stage,quality or sense of being restricted to a given course of action or in action. Some of the related studies reported by different researches are given as under.

2.3.2 Constraints in adoption of technology

Bhopale and Agarwal (1987) reported biological and situational constraints in adoption of recommended chilli cultivation, practices by chilli growers which included non-availability of improved seed in time and non-availability of labour at the time of transplanting and harvesting. The

technical constraints faced by the chilli growers were lack of scientific knowledge about raising of seedlings,lack of knowledge about the control measures of insect pest and diseases of chilli.

Kothikhane *et al.* (1987) observed that unsuitability and use of improved farm implements, high cost of inputs like fertilizers, pesticides, non-availability of inputs at proper time and inadequate quantities, low price of farm produce, non-availability of resources at farmers level, lack of proper irrigation schedule, conflicting attitude among farmers regarding irrigation, apathetic attitude of departmental personnel, problems of development of salinity due to prolonged use of irrigation, etc. were the prominent constraints reported by the farmers confined to the area which hinder in adoption of agricultural technology appropriately under irrigated farming system on their farms.

Pandey (1990) reported that the major constraints in development of horticulture was lack of data base for identifying the priorities and gap in perspective planning, inadequate availability of appropriate genotype and quality of planting material,weak post harvest management infrastructure, long gestation period and heavy initial investment coupled with inadequate finance and high rate of interest were the major constraints of horticultural crop production.

Chander *et al.* (1990) concluded that high cost of inputs and their non-availability at proper time, risk damage to the crop, non-availability of cold storage in rural areas to enable the farmers to market their produce at remunerative price and non-availability of funds with the farmers to meet high cost of cultivation were the constraints in adoption of potato technology.

Negi (1990) studied the constraints regarding exporting cutflowers from India at production, transport and marketing stages. He found poor production in terms of quality, lack of planting material of export varieties, high air freight charges, lack of incentives and financial assistance for export and absence of an organized marketing monitoring system as the constraints to exporting cutflowers from India.

Singh (1991) reported that inadequate organizational set up, unreliable data on area, production and productivity, inadequate irrigation facilities, high cost and low use of feritilizers, no linkage with the other rural development programmes, inadequate extenion service, lack of organised marketing and transport, inadequate quality seed, lack of presevation, post harvest losses, lack of suitable varieties for processing and export, lack of cargo storage and

cargo-space for export, inadequate budget allocation were the major constraints in vegetable production in India.

2.3.3 Constraints in marketing

Sayane (1984) in his study reported that the middle- man performed certain dissemble functions of marketing of agricultural produce. In his study, he further stated that the aim should not be undermining or reducing the services rendered by the independent intermediaries but be a effectively taking over these functions by well organized integrated wholeselling and retailing by the farmers and consumers themselves largely through co-operative means.

Subbanarasaih (1987) stated that the problems observed in marketing of citrus in Andhra Pradesh were lack of storage and warehousing, transportation and high fluctuation in the prices.

Vighenshwara (1988) studied the problems in marketing of banana in India based on secondary data. He examined the method of sale, transportation and market structure in banana marketing and suggested some measures to improve banana marketing. Transportation was the major problem since this service had significant relationship with the margin of profit of cultivators. He further noted that the banana marketing suffered due to the absence of

RESEARCH METHODOLOGY

3. METHODOLOGY

This chapter describes in detail the general information about the research site, selection of respondents, designing of interview schedule, procedure and techniques followed in and interpretation of data and measurement of concepts used in the study. The methodology followed has been explained under the following sub-headings.

3.1 Research site

The present study was conducted in Sangamner tahsil of Ahmednagar district of Maharashtra State. The Sangamner tahsil of Ahmednagar district was purposively selected for the study because there was large hactarage under the tomato in the district as evidenced through the statistics for the year 1993-94. Sangamner is surrounded by Akole tahsil from West, Shrirampur, Rahuri, Parner and Kopergaon tahsils from East, Nasik district from North and pune district from South side. The National highway namely Nasik-Pune passes through this tahsil. The nearest railway station at Belapur which is situated 47 km from tahsil head quarter.

3.1.1 Area and population

The Sangamner tahsil has an area of 1.68 lakh hectares comprising 164 villages and one city. According to

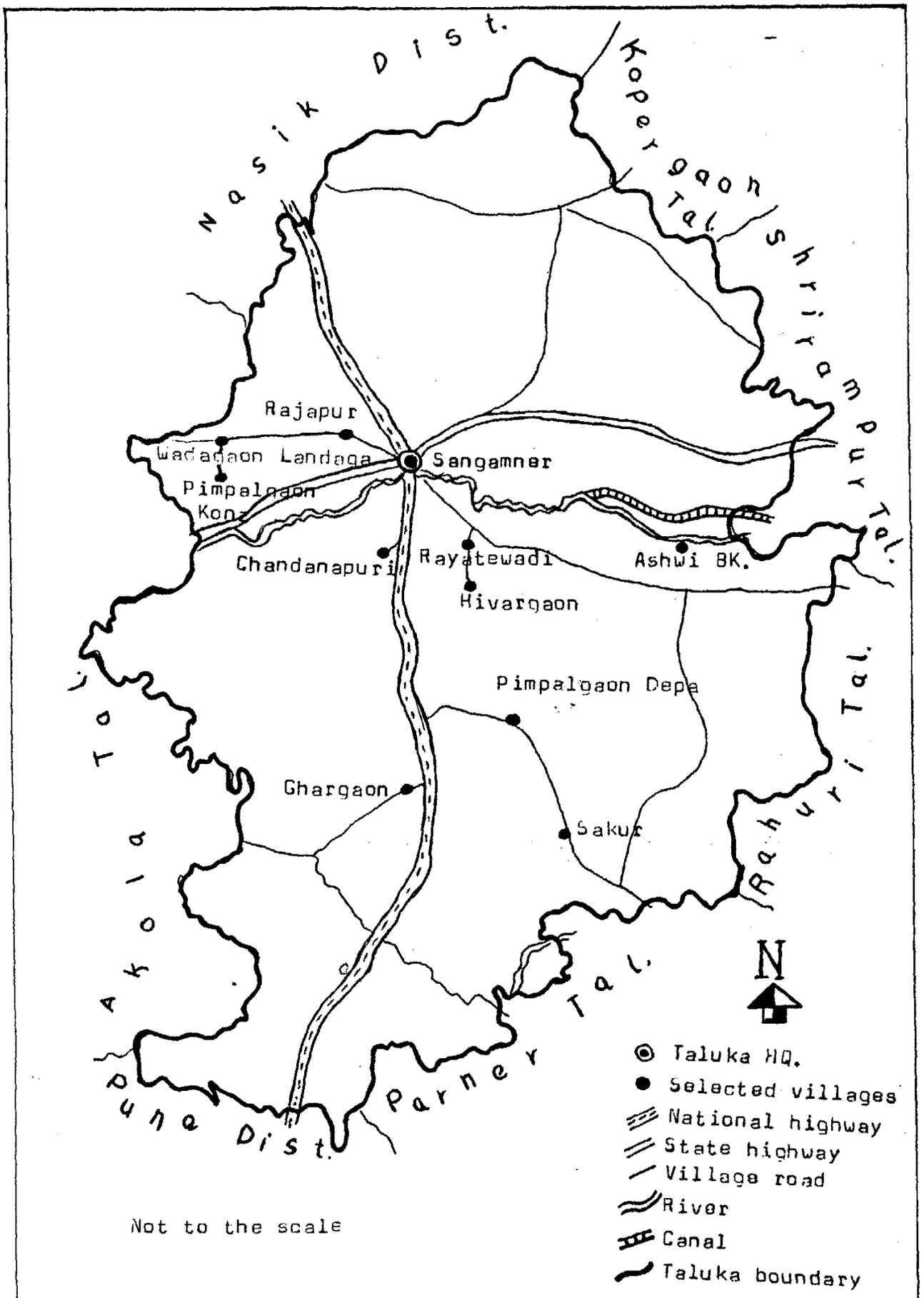

Fig.1 MAP OF SANGAMNER TAHSIL, DIST. AHMEDNAGAR.

1991 Census, the total population of the tahsil was 3.55 lakh. The literacy percentage for rural male and female is 49.74 and 21.87, while in urban, male and female it is 53.27 and 34.63 respectively. The growth rate of population is 24.15 during last decade.

3.1.2 Soils

The soils of this tahsil are derived from the deccan trap of volcanic origin. These vary from medium Black to Light soils.

3.1.3 Rainfall

This tahsil mainly receives its precipitation from the south-west monsoon but the distribution of precipitation is uneven. The average annual rainfall is 486.00 mm. There is relatively more precipitation in the western part, medium precipitation in the central part and very poor precipitation in the eastern part.

3.1.4 Temperature

The temperature variations recorded in the study area was 19°C (minimum) and 42°C (maximum) during the year.

3.1.5 Irrigation

The total gross area under irrigation is 32890 hectares comprising of 30463 hectares to net area irrigated. The surface irrigation sources irrigated 441 ha. of land

while well irrigation is for 30022 hectares. In other words the maximum area is irrigated through the irrigation sources of wells.

3.1.6 Industrial development

Sangamner tahsil of Ahmednagar district is recognised by its agro-industrial development. One co-operative sugar factory, one paper industry and two oil mills are established in this tahsil.

3.1.7 Transport facilities

The road communication facilities prevailing in Sangamner tahsil comprise of Nasik-Pune National Highway. Besides, the villages are well connected to Sangamner with the help of pucca roads. Transport facilities by rails are not available to the farmers in tahsil.

3.1.8 Land utilization pattern

The land utilization pattern of this tahsil which was available for the year 1993-94 is given in Table 4.

Table 4 indicates that out of total geographical area 61.14 per cent is net sown, 13.24 per cent is under forest and 1.72 per cent is permanent fallow. Area not available for cultivation is 11.28 per cent while area sown more than once is 4.93 per cent. Gross cropped area is 64.38 per cent.

Table 4. Land utilization pattern of Sangamner tahsil

	Particulars	Area (ha)	Percentage
1.	Total geographical area	1683	100.00
2.	Area under forest	307	18.24
3.	Area not available for cultivation (Barren land)	190	11.28
4.	Other uncultivated land including fallow land		
	i) Culturable waste	64	3.30
	ii) Permanent pastures	29	1.72
5.	Fallow Land		
	a) Current fallow	12	0.71
	b) Net fallow	72	4.27
6.	Net sown area	1029	61.14
7.	Area sown more than once	83	4.93
8.	Gross cropped area	1092	64.88

[Source : Socio-Ecomomic Review and District Statistical Abstract, 1993-94].

3.1.9 Cropping pattern

The information relating to area under various crops grown in tahsil is presented in Table 5.

Information in Table 5 indicates that rabi Jowar shared the highest proportion of area (17.53%) and it was followed by Bajra (16.44%), Sugarcane (15.19%), Wheat (14.37%), Pulses (8.95%), Green gram (6.15%) and Vegetables (4.45%).

Table 5. Cropping pattern of Sangamner tahsil

	Crops	Area (ha)	Percentage
1.	Kharif crops		
	i) Paddy	250	0.52
	ii) Jowar	49	0.10
	iii) Bajra	7838	16.44
	iv) Other cereals	41	0.08
	v) Red gram (Tur)	58	0.12
	vi) Green gram (mung)	2847	6.15
	vii) Other pulses	4232	8.95
2.	Rabi		
	i) Wheat	6787	14.37
	ii) Jowar	8306	17.53
	iii) Gram	1299	2.74
	iv) Horse gram	1729	3.64
3.	Oilseeds		
	i) Groundnut	2013	4.24
	ii) Other oilseeds	430	0.90
4.	Other Crops		
	i) Fruits	1268	2.60
	ii) Vegetables	2089	4.45
	iii) Sugarcane	7200	15.19
	iv) Fiber crops	941	1.98
	Gross cropped area	47377	100.00

[Source : Socio-Economic Review and District Statistical Abstract, 1993-94].

The total area under tomato in this tahsil is 839 ha as shown in Table 6 which is the maximum as compared to the other tahsils in Ahmednagar districts.

Table 6 shows the major tomato growing tashils which are Sangamner, Akole, Parner, Nagar, Pathardi, Kopergaon and Shrirampur. Sangamner having maximum acerage under tomato crop in area.

Table 6. Tahsilwise area under tomato crop in Ahmednagar district

	Tahasil	Area (ha)	Percentage
1.	Nagar	109	5.27
2.	Parner	110	5.32
3.	Shrigonda	38	1.83
4.	Karjat	53	2.56
5.	Jamkhed	43	2.08
6.	Shevgaon	16	0.77
7.	Pathardi	103	4.98
8.	Newasa	47	2.27
9.	Rahuri	60	2.90
10.	Sangamner	839	40.66
11.	Akole	480	23.23
12.	Kopergaon	93	4.50
13.	Shrirampur	75	3.63
	Total	2066	100.00

[Source : Commisionarate of Agriculture, Statistical Department, Pune, 1993-94].

3.2 Sampling

3.2.1 Selection of tahsil

Sangamner tahsil of the Ahmednagar District was selected for the study on the criterion of having the highest area under tomato in this tahsil as evidenced through the data presented in Table 6. Area under tomato cultivation in the sample tahsil was 839 ha in preceeding year of the study. Another reason attributed to the selection of Sangamner tahsil was the financial and time restrictions with the student

researcher. The research site was convenient to the researcher from both these points of view.

3.2.2 Selection of respondents

Two stage ranodom sampling technique was used for selecting the respondents of the study. In the first stage the villages were selected and in the second stage respondents for the study were finalized. The list of villages in which tomato crop was grown in Sangamner block was obtained from the Agricultural Officer of Sangamner Panchayat Samiti. There were 29 villages where tomato was extensively grown. From these villages, ten villages were randomly selected by using two digit random table.

A list of tomato growers from the selected villages was prepared with the help of village level functionaries viz., Talathi and Gramsevak. There were 520 tomato growing farmers in the selected villages. From the selected villages proportionate size of sample was drawn by using the Lottery method in order to make the total size of sample of 150 tomato growing farmers.

The information about the selected villages and number of farmers selected is presented in Table 7. The selected villages are shown in map (Fig. 1).

Table 7. Villagewise number of farmers selected

Name of village selected	Number of tomato growing farmers	Number of farmers studied
1. Ghargaon	62	18
2. Chandanapuri	63	18
3. Sakur	48	14
4. Rayatewadi	49	14
5. Hivargaon	48	14
6. Pimpalgaon Depa	55	16
7. Ashwi Bk.	49	14
8. Wadgaon Landga	48	14
9. Pimpalgaon Konzira	49	14
10. Rajapur	49	14
Total	520	150

3.2.3 Designing of interview schedule

An interview schedule based on the objectives of the study was prepared for data collection. The schedule was prepared in Marathi (local language) in order to get accurate responses from the participants, while preparing the schedule, due care was taken to avoid questions having dual meaning and contradictory statements. The language of questions was kept simple for easy understanding by the respondents. Questions on various socio-economic and psychological aspects of tomato growers having possible correlation with the knowledge and adoption of the recommended tomato cultivation practices and the constraints faced by them in adoption were included in the schedule.

3.2.4 Pretesting of schedule

The interview schedule was pre-tested prior to its finalization. For this purpose ten tomato growers who were not included in this study were selected and interviewed. This pre-testing of interview schedule helped the researcher to make the modifications and alternations, in order to get spontaneous responses from the respondents. Based on the pre-testing the schedule was finalized by modifying and adding some of questions or statements. After making required changes the interview schedule was finalized.

3.2.5 Procedure for collecting data

The researcher personally interviewed all tomato growers selected for the study. An attempt was made to interview the tomato growers preferably at the site of field. This helped to record the responses more spontaneously and easily. Qestions were asked informally during the discussions. The interview schedule was a guideline for collecting data. Whenever required supplementary questions were put to elicit data. For example while getting information regarding knowledge about a recommended tomato cultivation practices, their responses were verified by putting additional questions, so as to understand actually what they know. Thus, as far a possible efforts were made to get reliable data. Replies of

the respondents were recorded while the interview was in progress. Some of the points, comments and observations were also noted related to the olericulture development in the study area.

The total period required for data collection was about one and half month i.e. from mid February to end of March 1996. Minimum of three and maximum of five interviews could be completed in a day. The student researcher was staying at friends house for some days and at relatives in the remaining days. The mode of transport for the study was mostly private vehicles like jeeps though sometimes it was buses of State Transport.

3.2.6 Compilation of data

The information collected through interviews was transferred from the interview schedule to the primary tables (master tables) and then to the secondary tables. Wherever necessary the information of qualitative form was converted into quantitative form and computation of score was done. The quantified data were used to findout the nature of relationship between independent and dependent variables. The data have been analysed in the Department of Statistics, Mahatma Phule Krishi Vidyapeeth, Rahuri.

3.3 Measurement of variables

3.3.1 Independent variables

In the present study following personal, socio-economic, psychological and communicational characteritics of the respondents were studied.

a) Personal Characteristics
   i. Age
   ii (a) Education
   ii (b) Family educational status
   iii. Experience of tomato cultivation

b) Socio-economic characteristics
   i. Size of family
   ii. Size of land holding
   iii. Annual gross income
   iv. Socio-economic status

c) Psychological characteristics
   i. Risk orientation

d) Communication characteristics
   i. Sources of information

a) Personal characteristics :

i) Age : Chronological age of the respondent at the time of interview was taken into consideration. All the respondents were classified into three age groups viz.,

i. Upto 35 years	:	Younger
ii. between 36 to 50 years	:	Middle
iii. Above 50 years	:	Olders

ii.a) Education : It is the level of formal education attained by the farmers. Accordingly they were classified into following five categories viz.,

i. Illiterate - Having no formal education
ii. Primary education - Education upto 7th Standard
iii. Secondary education - Between 8th to 10th Standard
iv. Higher secondary education - 11th and 12th Standard
v. College education - Above 12th Standard

ii.b) Family education status : Member of the family besides the head of the family also contribute in family welfare decisions and activities. Education of other family members, therefore, is also important consideration in behavioural studies of the rural families. With this view the family educational status was also studied.

Family education status is the level of the formal education attained by the family members of the farmers.

For measuring the family education status the educational achievements of every member of the family was noted and scored as suggested by Pareek and Trivedi (1964) in the item education of socio-economic status scale for rural area. An education standard was considered for giving score. A score one was assigned for first standard, two for second standard and so on. For example, the member educated upto fifth standard was given five score and eleven standard educated was assigned eleven score and so on. The total score of a family on education was then divided by the efficient family size to get the educational status of the family. The

effective family size was obtained by substracting the number of members upto four years of age from the total number of members of family. Based on the total score, they were grouped by using the statistics mean ± SD.

i. Low family education status : Score upto 3
ii. Medium family education status : Score 4 to 10
iii. High family education status : Above 10

iii) Experience of tomato cultivation : It refers to the number of years tomato growing farmers was engaged in the farm enterprises. On the basis of number of years in tomato farming, the tomato growers were grouped into three categories based on mean ± SD.

i. Upto 9 years
ii. 10 to 23 years
iii. Above 23 years

b) Socio-economic characteristics :

i) Size of family : It was operationalised as the total number of members living together in a family under a common roof having blood relations and sharing common food. Adopted members residing permanently with family were also included. According to size of family the respondents were grouped into two groups viz.,

i. Small family : Upto 5 members
ii. Big family : 6 and above

ii) **Size of land holding** : It refers to the total land holding possessed by the tomato growers. In the present investigation the size of land holding was measured in terms of hectares of land possessed by the respondent. As per the size of land holding of the respondents they were grouped into three categories based on the definitions given in Land Reform Acts, 1972 formulated by the Government of Maharashtra. These groups are viz.,

i.	Small holding	: Below 2 ha
ii.	Medium holding	: 2 to 4 ha
iii.	Large holding	: 4 ha and above

iii) **Annual gross income** : Annual gross income of respondents from the main and secondary occupations during preceeding year. The minimum annual gross income of tomato growers was Rs. 25,000 and maximum was 1,20,000. On the basis of annual income the respondents were grouped into three categories by using the statistics mean $\pm$ SD.

i.	Low income group	: Upto Rs. 40000
ii.	Medium income group	: Rs.41000 to 89000
iii.	High income group	: Above Rs. 89000

iv) **Socio-economic status** : It refers to the social and economic position of farmers under study. Socio-economic status scale developed by Chorge (1985) was used. Chorge's scale covers all the social, economical, educational and sanitary aspects of family. It also includes physical and

mechanical assets possessed by the family. The scale found to be fitted with the rural setting of the study area and hence it was used. Respondents were grouped into following categories by using mean ± SD as suggested in the scale.

i. Low socio-economic status : Score up to 61
ii. Medium socio-economic status : 62 to 89
iii. High socio-economic status : Above 89

c) Psychological characteristics :

i) Risk orientation : For studying risk orientation six statements regarding tomato cultivation were incorporated in the schedule five point continuum was used.

To measure risk orientation for positive statement responses, strongly agree, agree, neutral, disagree and strongly disagree were assigned scores 5, 4, 3, 2 and 1, respectively. While for negative statements opposite scoring was given. Thus total scores of the each tomato growing farmer were calculated and they were then classified into three categories viz.,

i. Low risk orientation : Score upto 13
ii. Medium risk orientation : Score 14 to 20
iii. High risk orientation : Above 20

d) Communication characteristics :

i) Sources of information : The term source of information was referred to the various information sources and channels used by the farmers for getting the information

about cultivation practices of tomato. It was ascertained by asking open end questions to the respondents to know the channels and source through which they received the information about cultivation practices of tomato. Responses about this aspect were recorded and respective percentages were worked out in order to draw conclusions.

3.2.3 Dependent variables

Dependent variables are those which vary with the independent variables. For the present study following were the dependent variables.

I) **Knowledge** : It is the body of information possessed by a farmer in respect of improved cultivation of tomato.

For measuring knowledge level of respondents about cultivation practices of tomato 12 recommended practices were used, which were published by the Mahatma Phule Krishi Vidyapeeth, Rahuri for the use of farmers (Technical Publication No.180, 1996).

Score two was assigned for knowing the practice perfectly, one score was assigned for knowing the practice partially and score zero was assigned for total lack of knowledge about the practice. Maximum total possible score was 60 and minimum was zero. Accordingly total score of every

respondent was grouped by using formula mean ± SD into three groups viz.,

i. Low level of knowlege : Score upto 45
ii. Medium level of knowledge : Score 46 to 57
iii. High level of knowledge : Above 57

II) Adoption : It was operationalised as the continued use of recommended practices of tomato cultivation by the respondents for at least two years.

For measuring the level of adoption of cultivation practices of tomato by the participant farmers list of recommended practices regarding tomato cultivation was selected.

Score two was assigned for each of the practices if it was fully adopted. If it was partially adopted score one was given and zero score was assigned if it was not adopted. The maximum total possible score was 60 and minimum was zero. Total score of every respondent was worked out and they were grouped by using formula mean ± SD into three categories viz.,

i. Low level of adoption : Score upto 36
ii. Medium level of adoption : Score 37 to 52
iii. High level of adoption : Above 52

3.4 Other related aspects studied

3.4.1 Additional supporting information

Additional and supporting to the study information about aspects such as i) irrigation source ii) extent of

irrigation facility available iii) area under toamto iv) frequency of toamto growing and v) use of tomato in diet and knowledge about its bi-product, was also collected and analysed for presentation and discussion.

3.4.2 Constraints

Constraints are the circumstances or causes which prohibit farmer to adopt improved farm technology. It was ascertained by asking open end questions to the respondents as which factors were responsible for non-adoption of recommended tomato cultivation practices. Responses about this aspect were recorded. Respective percentages were worked out in order to draw conclusions.

3.4.3 Suggestions

Suggestions were secured from the tomato growers to overcome the problems faced by them in production, management and marketing of tomato. The suggestions were grouped and the frequencies and percentages of suggestions were worked out.

3.4.4 Motivation

It is the process of initiating a conscious and purposeful action. It was ascertained by asking open end questions to the respondents as to who initiated them as well as what factors motivated them to go for tomato production. Responses were recorded and then frequencies were worked out.

3.5 Statistical methods used

3.5.1 Co-efficient of correlation

To find out the relationship between the selected independent and dependent variables "Karl Pearsons co-efficient of correlation" "r" was worked out by using the following formula.

$$r_{xy} = \frac{\sum xi\ yi}{\sqrt{(xi)^2\ (yi)^2}}$$

Where, $xi = xi - X \quad i = 1 \ldots\ldots\ldots n$

$yi = yi - Y \quad i = 1 \ldots\ldots\ldots n$

3.5.2 Multiple regression analysis

To explain the extent of variability caused by the set of independent variables in dependent variables multiple regression analysis was done.

$$Y = a + b_1 x_1 + b_2 x_2 + \ldots\ldots b_n x_n + u$$

Where,

- Y = Dependent variable knowledge and adoption
- $x_1 - x_n$ = Independent variables
- a = Intercept
- $b_1 - b_n$ = Regression co-efficient
- x_1 = Age
- x_2 = Education
- x_3 = Experience
- x_4 = Size of family
- x_5 = Size of land holding
- x_6 = Annual gross income
- x_7 = Socio-economic status
- x_8 = Risk orientation
- x_9 = Source of information
- u = Error term

3.6 Operational definitions of important terms used

1) **Tomato grower** : A farmer who has cultivated a tomato crop at least for two years.

2) **Knowledge** : The term knowledge refers to the extent of information known to the farmers about the improved tomato cultivation practices.

3) **Adoption** : The term adoption refers to the continuous use of improved tomato cultivation practices by the respondent under the study. For the present investigation, it was operationalised as a continuous use of that practice for two years preceeding the time of investigation.

4) **Constraint** : A constraint is a reason, cause or circumstance which compels a farmer to non-adoption or partial adoption of advocated technology for tomato which ultimately results in poor yield.

5) **Age** : The term age refers to the chronological age of the respondent at the time of interview.

6) **Education** : It is the level of formal education attained by the farmer.

7) **Size of family** : It is the number of persons living with the farmers under study.

8) **Size of land holding** : It refers to the number of hectares of land owned and operated by the respondent.

9) Sources of information : It refers to the various information sources and channels used by the tomato grower for getting information of improved practices of tomato.

10) Annual gress income : It refers to the total gross income of farmers from all sources during preceeding year of the study.

11) Socio-economic status : The term "Socio-economic status" refers to the social and economic position of the farmers under study.

12) Risk orientation : The term "Risk orientation" refers to his willingness to take risk in adopting new technology or undertake change in traditional practices through following the newly introduced innovations.

13) Experience : It refers to the number of years tomato growing farmer was engaged in the farm enterprise.

PRESENTATION OF FINDINGS AND DISCUSSION

4. PRESENTATION OF FINDINGS AND DISCUSSION

The data are presented in three parts. In the first part the auxillary and supporting information to the study about tomato growers and motivational factors responsible for tomato adoption are presented. In the second part data pertaining to the independent and dependent variables are presented and in the third part the data regarding the other related aspects studied about tomato growers are given.

4.1 General information about tomato growers

Information on certain aspects related to tomato cultivation was obtained from the growers. The same is presented in following paras.

4.1.1. Distribution of tomato growers according to the irrigation source and irrigation availability

For crop production assured source of irrigation with the farmer is very much essential. The information regarding source of irrigation and irrigation availability for tomato production was obtained. It is analysed and presented in Table 8.

It is indicated from Table 8 that majority of tomato growers (82.67 per cent) had irrigation source of well whereas only 17.33 per cent of them were having irrigation source of canal.

Table 8. Distribution of tomato growers according to the irrigation source and extent irrigation facility available

Particulars	Frequency	Per cent
A) Sources of irrigation :		
1. Wells	124	82.67
2. Canal	26	17.33
B) Irrigation availability :		
1. Round the year	90	60.00
2. Seasonal	60	40.00

It is also seen that large majority of tomato growers (60.00 per cent) were having round the year irrigation availability while 40.00 per cent having seasonal availability. It is because of that some area of taluka having only river water source and other people in the remaining area depend on well irrigation. Availability of assured irrigation water facilitates the farmers for crop planning according to their choice.

4.1.2. Distribution of tomato growers according to their area under tomato

Based on the area under tomato crop, the tomato growers were classified as shown in Table 9.

Data in Table 9 revealed that three fourth of the tomato growers (70.67 per cent) had grown tomato on the area

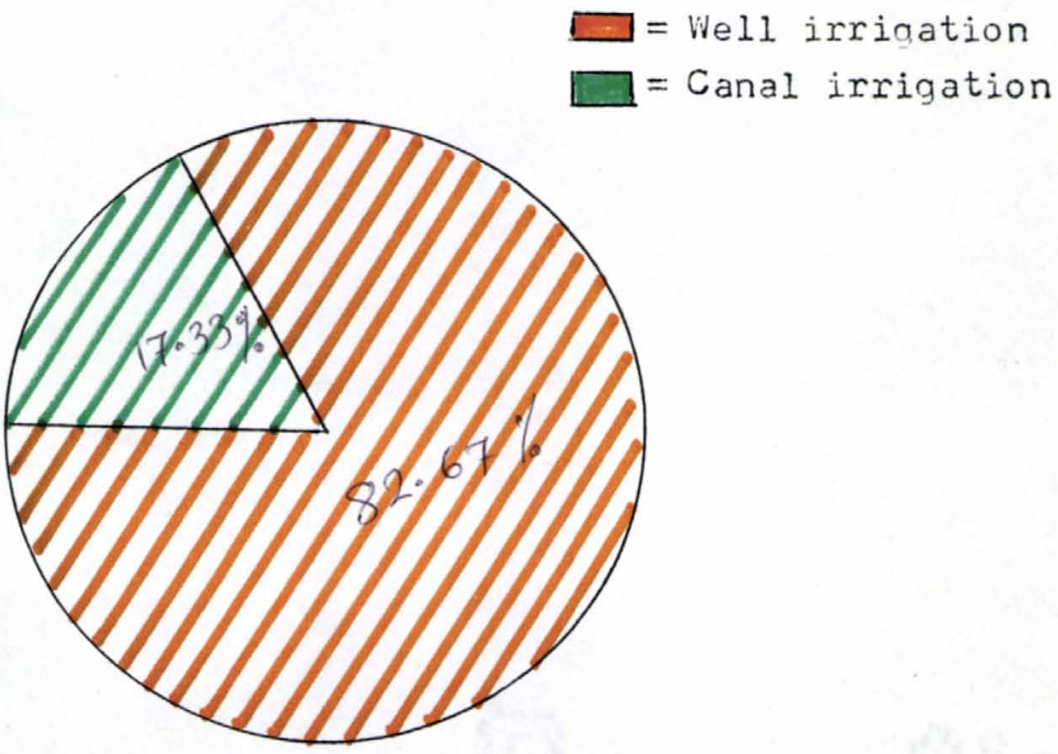

Fig. 2 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO IRRIGATION SOURCE.

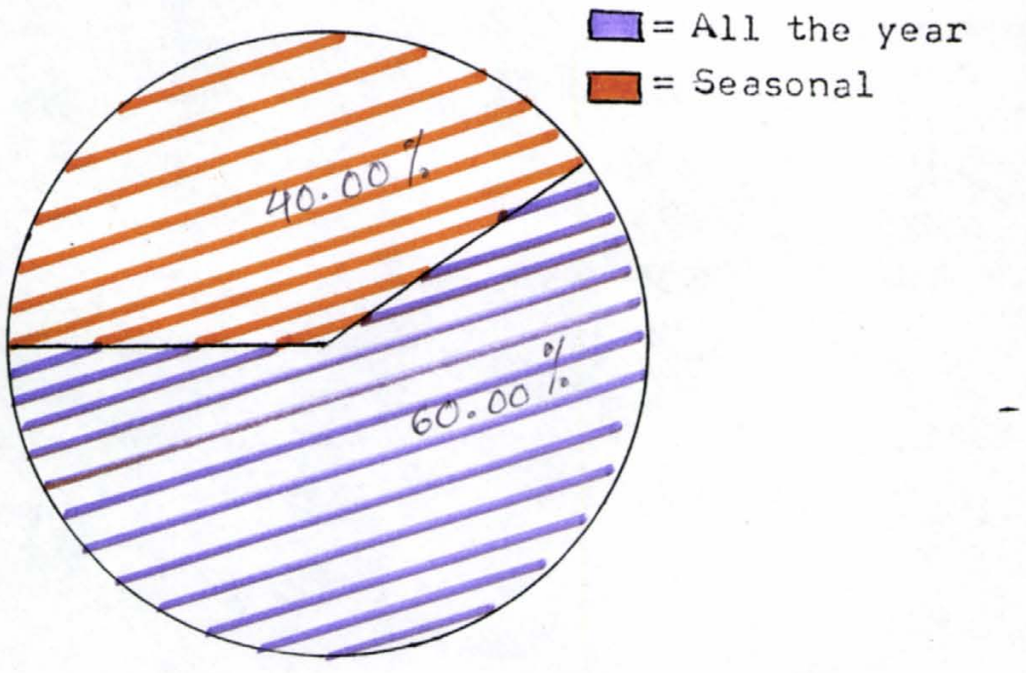

Fig. 3 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THE IRRIGATION AVAILABILITY.

upto 0.5 ha, while 26.00, 1.33 and 2.00 per cent of them had grown tomato on 0.5 to 1.00 ha, 1.00 to 1.5 ha and above 1.5 ha area respectively.

Table 9. Distribution of tomato growers according to their area under tomato

	Area in hectare	Frequency	Per cent
1.	Upto 0.5 ha	106	70.67
2.	0.5 to 1.00 ha	39	26.00
3.	1.00 to 1.5 ha	2	1.33
4.	Above 1.5 ha	3	2.00
	Total	150	100

Thus, it can be stated that majority of the tomato growers had taken tomato on relatively small size of land i.e. upto 0.5 ha. This may be because of small holding of the farmers. This observation is in agreement with those of Kote (1992) regarding pomegranate cultivation.

4.1.3. Distribution of tomato growers according to the frequency of tomato growing

It was also tried to know whether the farmers have continued the adoption of tomato. For this purpose frequency of taking up of the crop during number of seasons was noted. Data in this respect are presented in Table 10.

It is seen from Table 10 that more than half of the tomato growers (57.34 per cent) had cultivated tomato for 6 to

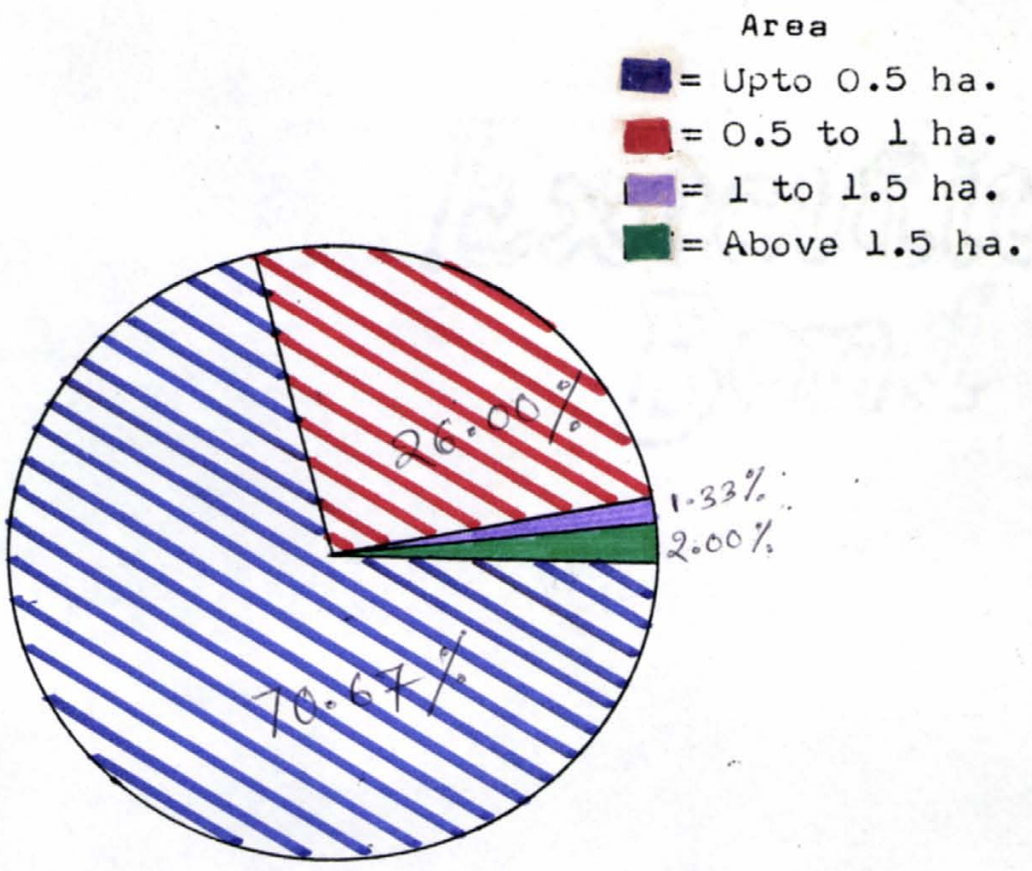

Fig.4 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THE AREA UNDER TOMATO.

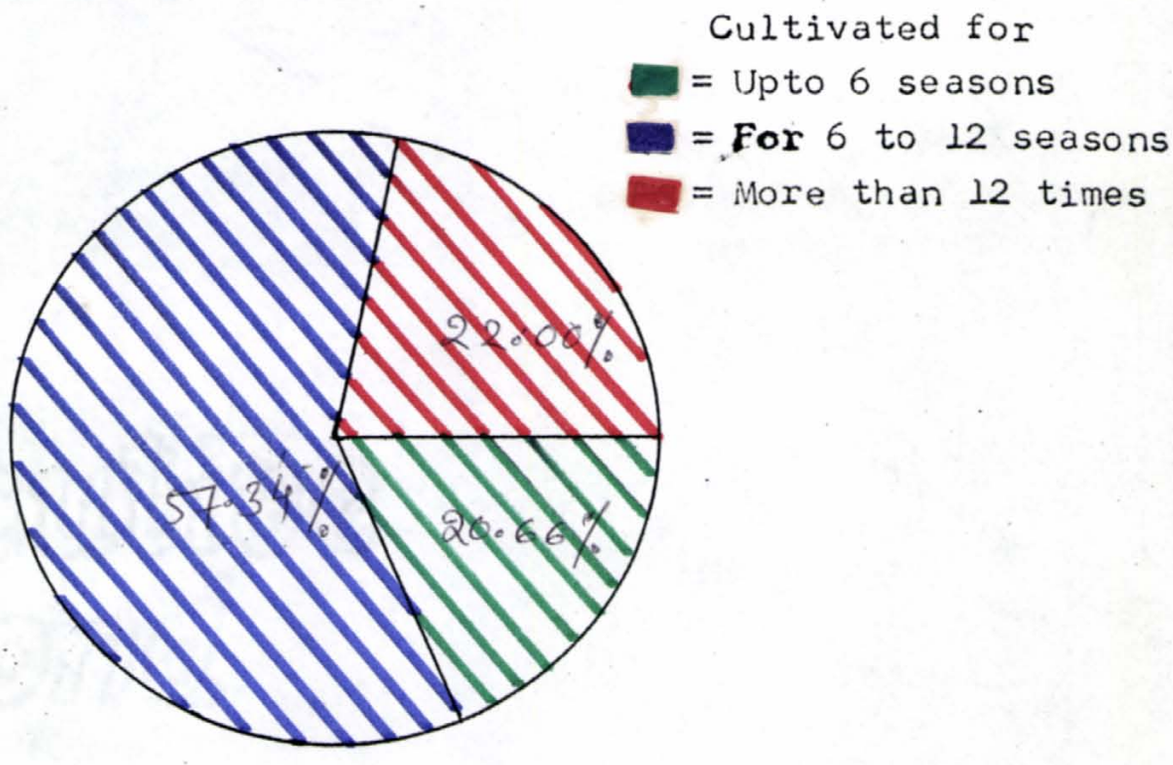

Fig.5 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THE FREQUENCY OF TOMATO GROWING.

12 seasons, followed by 22.00 per cent and 20.66 per cent cultivated the crop for more than 12 times and upto 6 seasons. From this it can be inferred that farmers have shown positive response in continuing its adoption.

Table 10. Distribution of tomato growers according to the frequency of tomato growing

	Cultivated for	Frequency	Per cent
1.	Upto 6 seasons	31	20.66
2.	For 6 to 12 seasons	86	57.34
3.	More than 12 times/continuous	33	22.00
	Total	150	100.00

4.1.4. Use of tomato in diet

It was thought worthwhile to know the farmers use of tomato in their diet and what type of food products they prepare from it. The data, therefore, on this aspect were analysed and presented in Table 11.

Table 11. Distribution of tomato growers according to use of tomato in diet

	Particulars	Frequency	Per cent
A)	**Use**		
	1. Do not use in diet	08	5.34
	2. Use in diet	142	93.33
B)	**Types of recipe**		
	1. Table purpose	27	19.00
	2. Bhaji	90	63.38
	3. Chatani	15	10.58
	4. Koshimbir	10	7.04

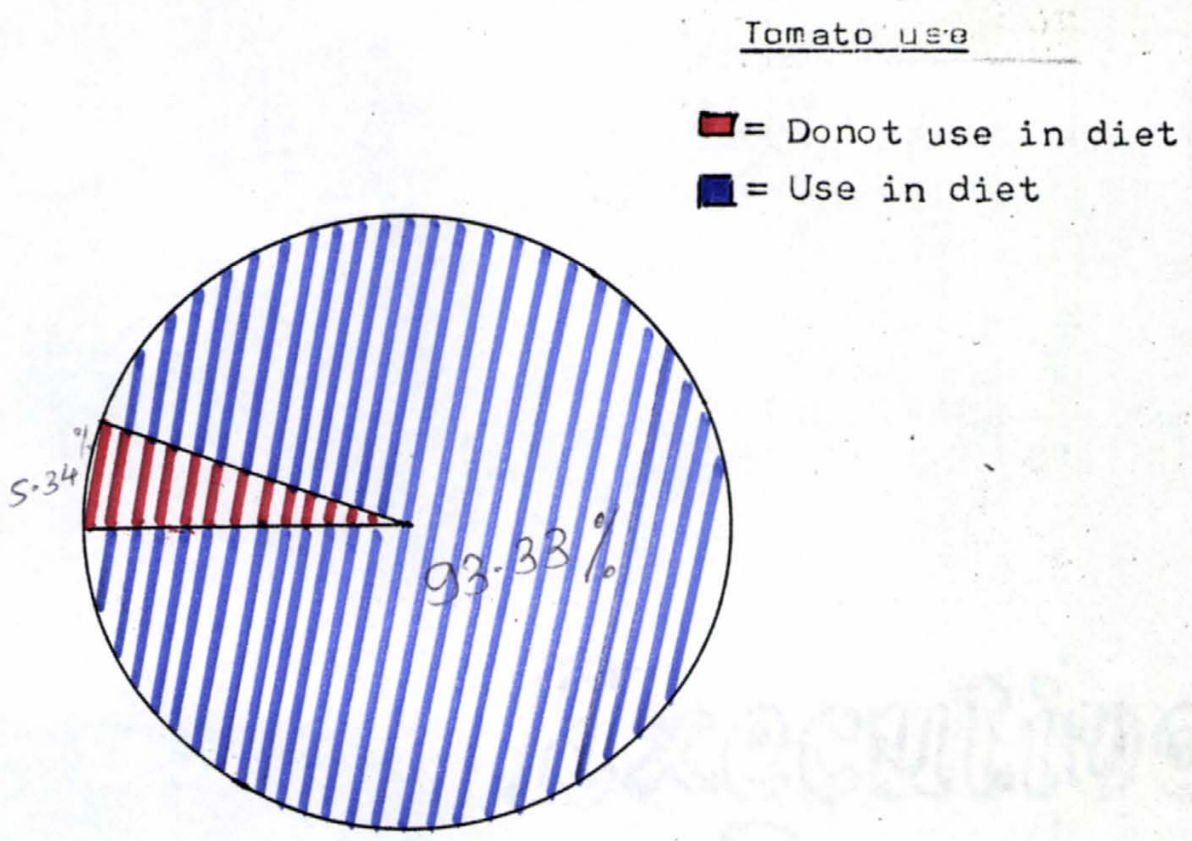

Fig.6 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THE USE OF TOMATO IN DIET.

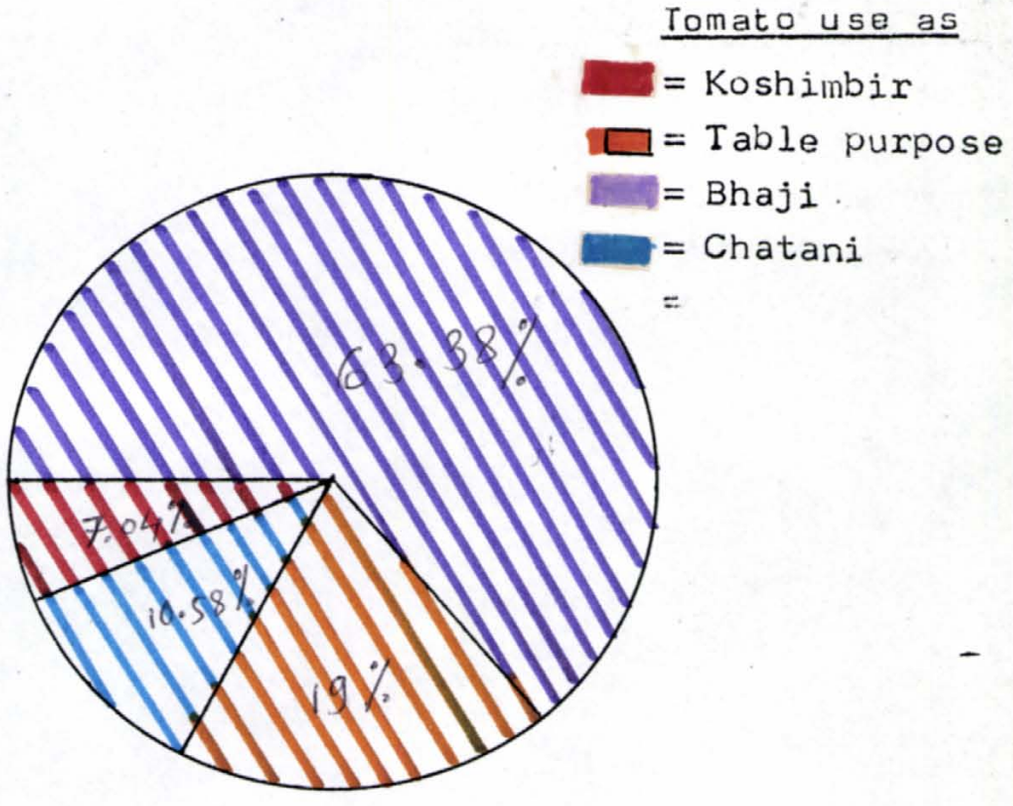

Fig.7 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THE TYPES OF RECIPE.

It appears from Table 11 that majority of the farmers (93.33 per cent) were found to use tomato in their diet. However, considerable number (5.34 per cent) was found to be not using the tomato as their food. Among users majority (63.38 per cent) were using tomato in their diet as a **Bhaji**, while 19.00 per cent, 10.58 per cent and 7.04 per cent farmers were using the tomato in their diet for table purpose, for preparing **Chatani** and **Koshimbir** respectively. Tomato can be used in diet in different forms. These forms may not be known to the growers. It implies that extension agents should educate them about the use in diet.

4.1.5. Knowledge about products and dietary importance of tomato

The information regarding the knowledge of the respondents about the products and dietary importance of tomato was obtained, analysed and presented in Table 12.

It is clearly indicated from Table 12 that majority of the farmers (73.33 per cent) were not having any knowledge about the products of tomato or processed food products,where 26.67 per cent farmers had knowledge about products of tomato.

This observation suggest that there is no development of food processing or tomato processing industry in the area so that farmers did not know about other products

of tomato. The above observation is in conformity with that of Patil *et al.* (1992).

Table 12. Distribution of tomato growers according to their knowledge about products and dietary importance

	Particulars	Frequency	Per cent
A.	**Products**		
	1. No knowledge about products	110	73.33
	2. Know the products	40	26.67
B.	**Dietary importance**		
	1. Knowledge about dietary importance	54	36.00
	2. Lack the knowledge	96	64.00

It is also revealed from Table 12 that majority of the tomato growers (64.00 per cent) were lacking in knowledge about dietary importance of tomato, only 36.00 per cent were known about the dietary importance of tomato.

From this we can say that though most of the farmers were using tomato in their diet, they were unaware about the nutritional importance of tomato. This observation is contrast with those of Rai et al. (1987) who reported that about one third of the respondents had high level of knowledge about nutrition of soybean.

This suggests that there is a need to educate the growers as well as consumers at large about the dietary importance of tomato as a food. Extension agents particularly

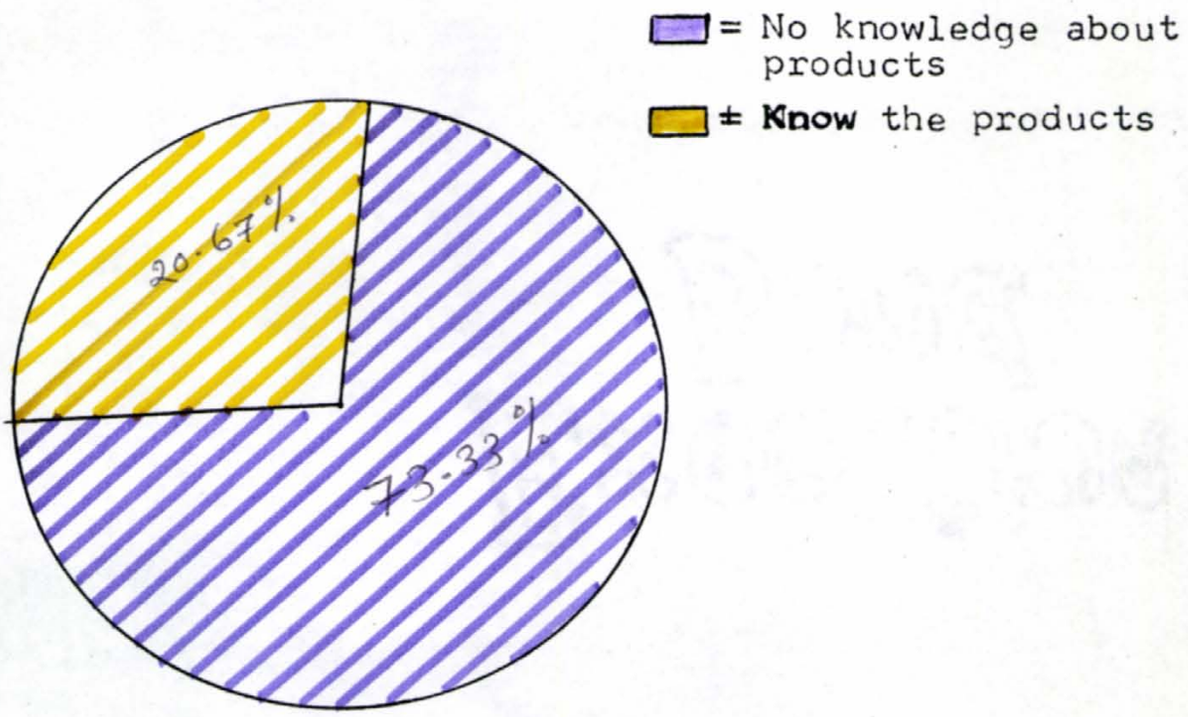

Fig.8 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THEIR KNOWLEDGE ABOUT PRODUCTS OF TOMATO.

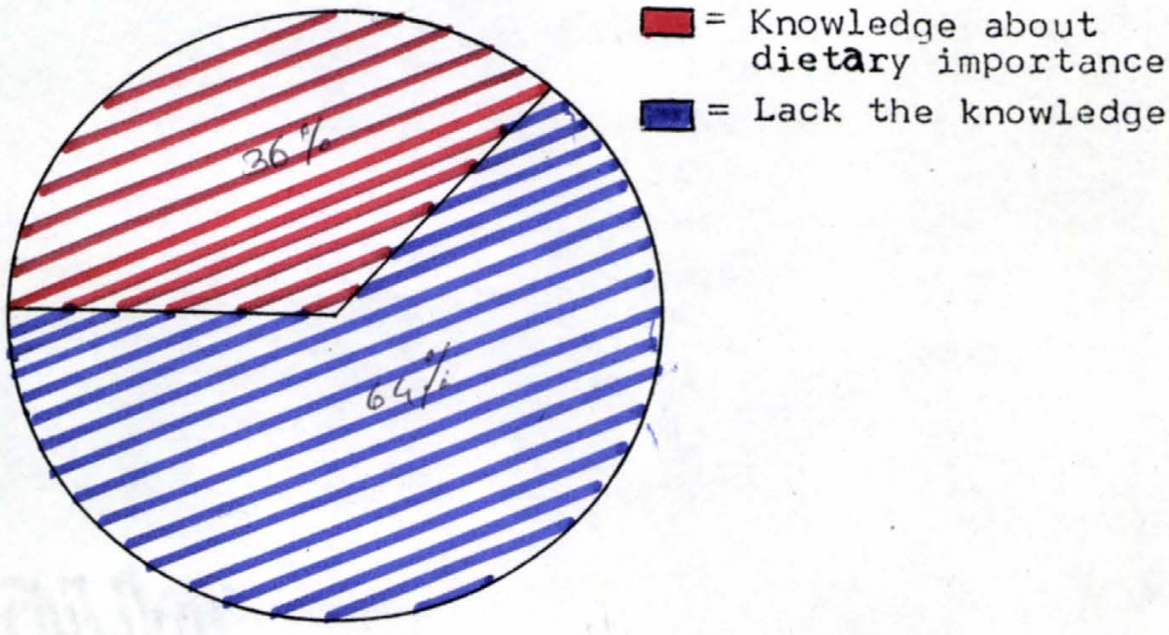

Fig.9 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THEIR KNOWLEDGE ABOUT DIETARY IMPORTANCE OF TOMATO.

mass media can be used effectively for this purpose. Increased demand from the consumers will enhance the cultivation of tomato.

4.2. Motivational sources.

In present investigation the source of motivation for tomato growers to go for tomato cultivation was studied for this purpose, the media/sources that influenced the tomato growers to go for tomato cultivation were considered. The relevant data are presented in Table 13.

Table 13. Distribution of tomato growers by their sources of motivation

	Source of motivation	Frequency	Per cent
1.	Self interest	71	47.33
2.	Village extension workers	33	22.00
3.	Family members	21	14.00
4.	Friends	8	5.35
5.	Progressive farmers	7	4.66
6.	Relatives	7	4.66
7.	Neighbours	3	2.00
	Total	150	100.00

The data in Table 13 reveal that personal interest of the tomato growers play important role in cultivation of tomato (47.33 per cent). Village Extension Workers (22.00 per cent) were also influencing sources to the tomato growers for motivating tomato cultivation. The family members (14.00 per

= Self interest
= Village extension
= Family members
= Friends
= Progressive farmers
= Relatives
= Neighbours

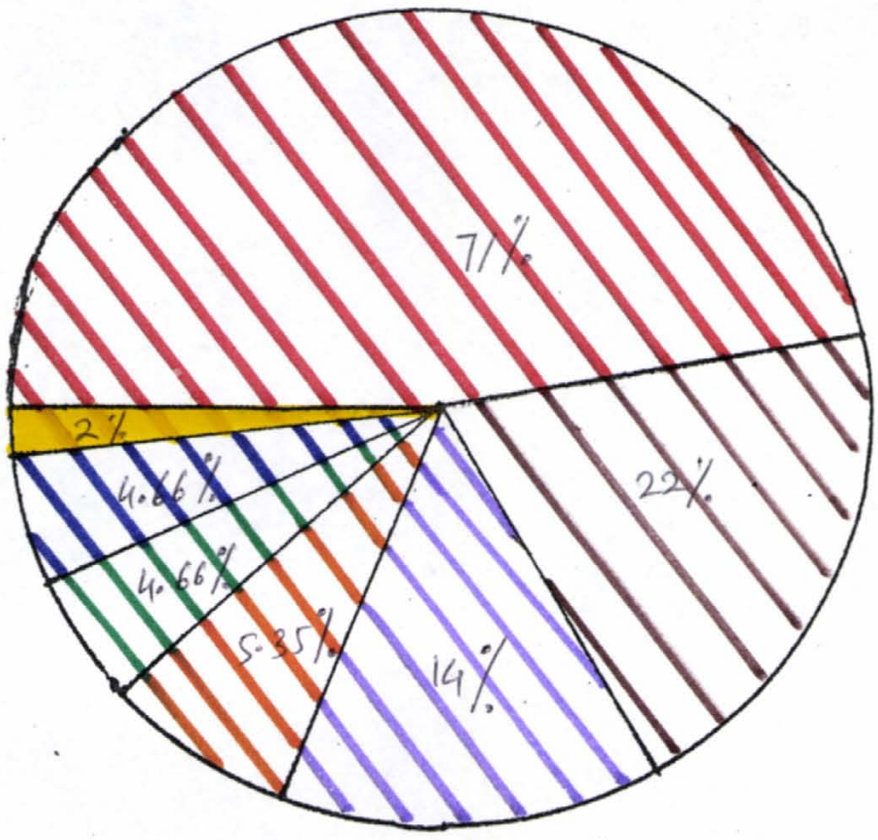

Fig. 10 : DISTRIBUTION OF TOMATO GROWERS BY THEIR SOURCE OF MOTIVATION.

cent), friends (5.35 per cent), progressive farmers (4.66 per cent), relatives (4.66 per cent) and neighbours (2.00 per cent) also influenced some of the tomato growers.

This shows that tomato growers themselves performed a paramount role in self motivation for tomato cultivation. The main source of motivation for tomato cultivation is the personal interest of the motivation by Village Extension Workers. Gaikwad (1992) while studying adoption behaviour of flower growers reported similar finding.

4.3 Independent and Dependent variables studied

4.3.1 Independent variables

Different personal, socio-economic, psychological and communication characteristics of tomato growers were studied. These were age, education, experience, size of family size of land holding, annual gross income, socio-economic status, risk orientation and source of information. A profile of tomato growers is presented in Table 14.

I) **Personal characteristics :**

A) Age : The data in Table 14(A) revealed that there was the highest proportion of tomato growers (46.66 per cent) belonged to middle age category of 36 to 50 years, whereas 30.68 per cent tomato growers were old farmers. The tomato growers below the age of 35 years i.e. younger were meagre in number (22.66 per cent).

Table 14. Distribution of tomato growers by their personal, socio-economic and psychological attributes

Attributes	Categories	Frequency	Per cent
1	2	4	5
I. Personal characteristics			
A) Age	1. Younger (upto 35 years)	34	22.66
	2. Middle age (36-50 years)	70	46.66
	3. Older (Above 50 years)	46	30.68
	Total	150	100.00
B) Education	1. Illiterate	22	14.68
	2. Primary education (upto 7th standard)	65	43.33
	3. Secondary education (8-10th standard)	36	24.00
	4. Higher sec. education (11th and 12th std.)	14	9.33
	5. College education (Above 12th standard)	13	8.66
	Total	150	100.00
C) Experience	1. Upto 9 years	36	24.00
	2. 10-23 years	66	44.00
	3. 23 years and above	48	32.00
	Total	150	100.00
II. Socio-economic characteristics			
D) Family education status	1. Low status (score upto 3)	6	4.00
	2. Medium status (score 4-10)	139	92.66
	3. High status (score above 10)	5	3.34
	Total	150	100.00

1	2	3	4	5
	E) Size of family	1. Small family (upto 5 members)	107	71.84
		2. Large family (Above 5 members)	43	28.66
		Total	150	100.00
	F) Type of family	1. Nuclear family	102	68.00
		2. Joint family	48	32.00
		Total	150	100.00
	G) Size of land holding	1. Small holding (upto 2 ha)	93	62.00
		2. Medium holding (2-4 ha)	44	29.33
		3. Large holding (above 4 ha)	13	8.68
		Total	150	100.00
	H) Annual gross income	1. Low income (upto Rs.41000)	20	13.33
		2. Medium income (Rs.41000-89000)	113	75.33
		3. High income (above Rs.89000)	17	11.34
		Total	150	100.00
	I) Socio-economic status	1. Low (socre upto 61)	26	17.33
		2. Medium (score 62-89)	96	64.00
		3. High (score above 89)	28	18.67
		Total	150	100.00
III. Psychological characteristics				
	J) Risk orientation	1. Low (score upto 14)	36	24.00
		2. Medium (score 15-20)	84	56.00
		3. High (score above 20)	30	20.00
		Total	150	100.00

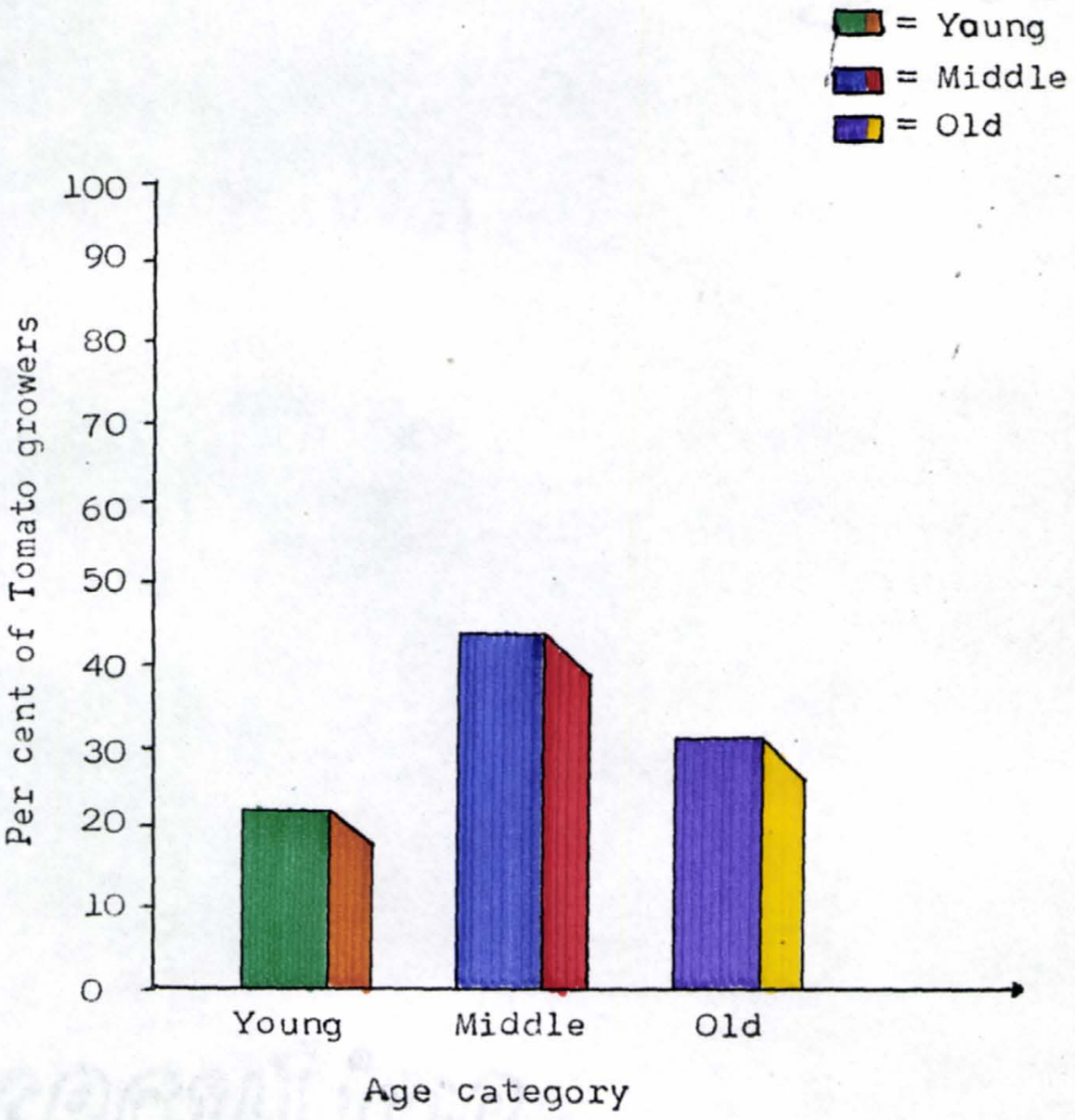

Fig. 11 DISTRIBUTION OF TOMATO GROWERS BY THEIR AGE.

Thus it can be inferred that majority of the respondents of the study belonged to middle age group. This observation is in confirmity with that of patil *et al.* (1992) and Dhole (1995) regarding soybean and sunflower cultivation respectively.

B) **Education** : The level of formal education attained by an individual tends to influence the extent to which he is expressed to new ideas about improved cultivation practices. It is observed from Table 14(B) that considerable number of tomato growers (43.33 per cent) received primary education, followed by 24.00 per cent who received secondary education comparatively meagre per cent of tomato growers received higher secondary (9.33 per cent) and college education(3.66 per cent) and 14.68 per cent of the respondents were illiterate.

In other words, large proportion of tomato growers had education at primary level. This observation is similar with that of Gaikwad (1992) and Dhole (1995) in respect of flower growers and sunflower growers, respectively.

II) Socio-economic characteristics :

C) **Family education status** : Irrespective of the level of the education of farmer himself, the members of his family are now in better position to take formal education.

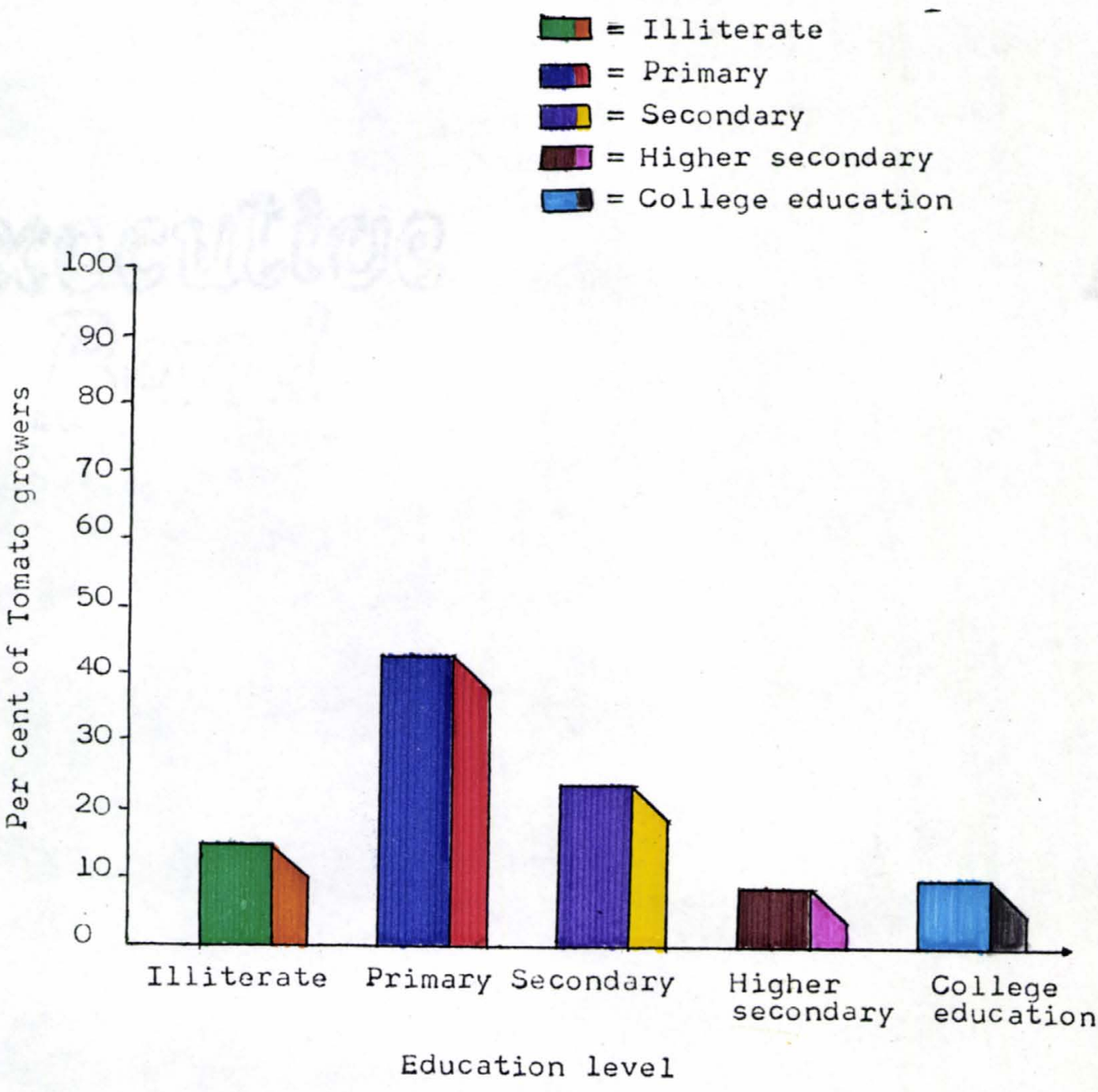

Fig.12 DISTRIBUTION OF TOMATO GROWERS BY THEIR EDUCATION.

Educated members of the family may contribute in the collective decision about the acceptance of farm technologies. In order to know the fact the family educational achievement of each member of the family was noted and scored as suggested by Pareekh and Trivedi (1964) in the item education of socio-economic status scale for rural area. The total score of the family was worked out and on the basis of this score farmers were grouped.

The data presented in Table 14(C) revealed that the highest proportion of tomato growers (92.66 per cent) had medium level of family educational status, while only 4.00 per cent and 3.34 per cent had low and high family educational status respectively.

From this we can say that majority of the tomato growing families had satisfactory level of education which reflects the progressiveness of farm families. More of the education in the family, provides better opportunity to the farmers to be in contact with outside world and hence absorb new ideas and information.

This observation is in the line with that of Choukidar and George (1973) and Pawar (1996) while studying the characteristics of adopters in soybean cultivation.

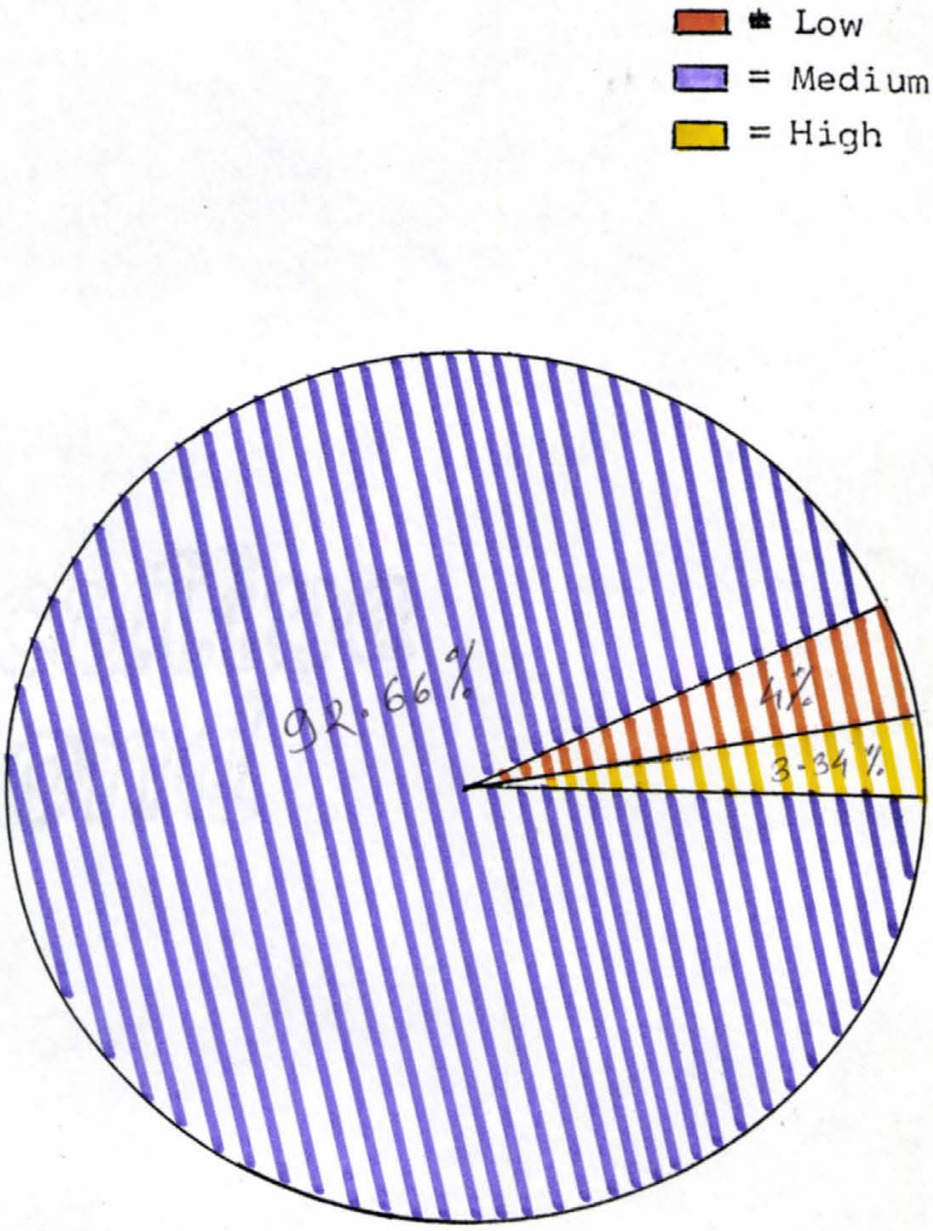

Fig. 13 DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THEIR FAMILY EDUCATION STATUS.

D) Experience of tomato cultivation : For the present investigation,farming experience was operationalized as the period spent by the farmer in cultivation of land. It can be inferred from the data presented in Table 14(D) that larger proportion of the tomato growers (44.00 per cent) were having experience between 10 to 23 years, while 32.00 per cent and 24.00 per cent had experience above 23 years and upto 9 years, respectively.

Past experience of an individual sometimes helps him to make the innovation adoption decision. More experienced farmers can take the decisions properly and quickly. This finding is in confirmity with the findings reported by Prasad (1983).

E) Size of family : The size of family refers to the total number of individuals having blood relations and living under common roof. It was felt that size of family might influence adoption of improved tomato cultivation practices as a larger family might provide more family labour.

The data presented in Table 14(E) indicate that the percentage of tomato growers in the category of small size of family (71.84 per cent) was observed to be more as compared to the percentage of large families (28.66 per cent).

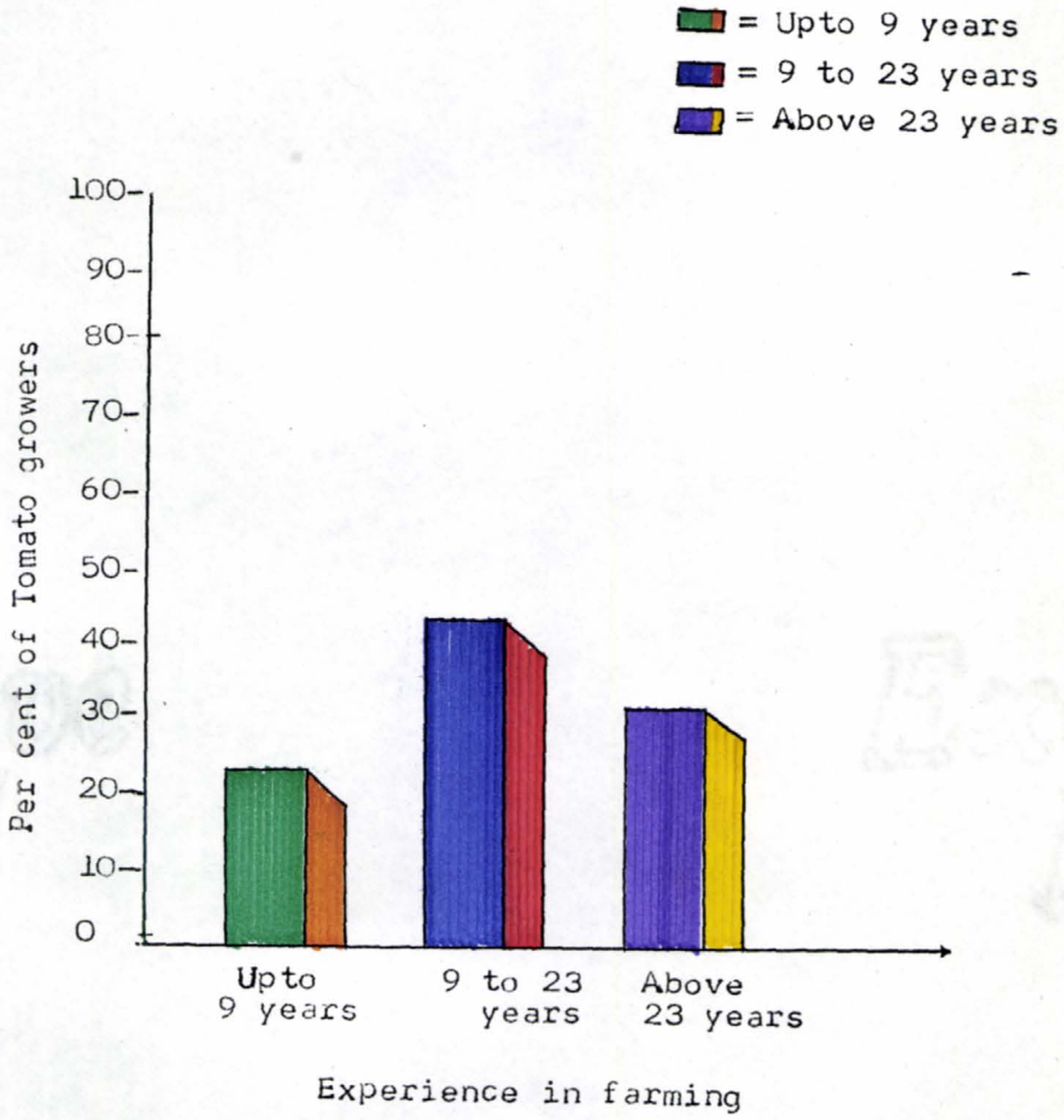

Fig. 14 DISTRIBUTION OF TOMATO GROWERS BY THEIR EXPERIENCE IN FARMING.

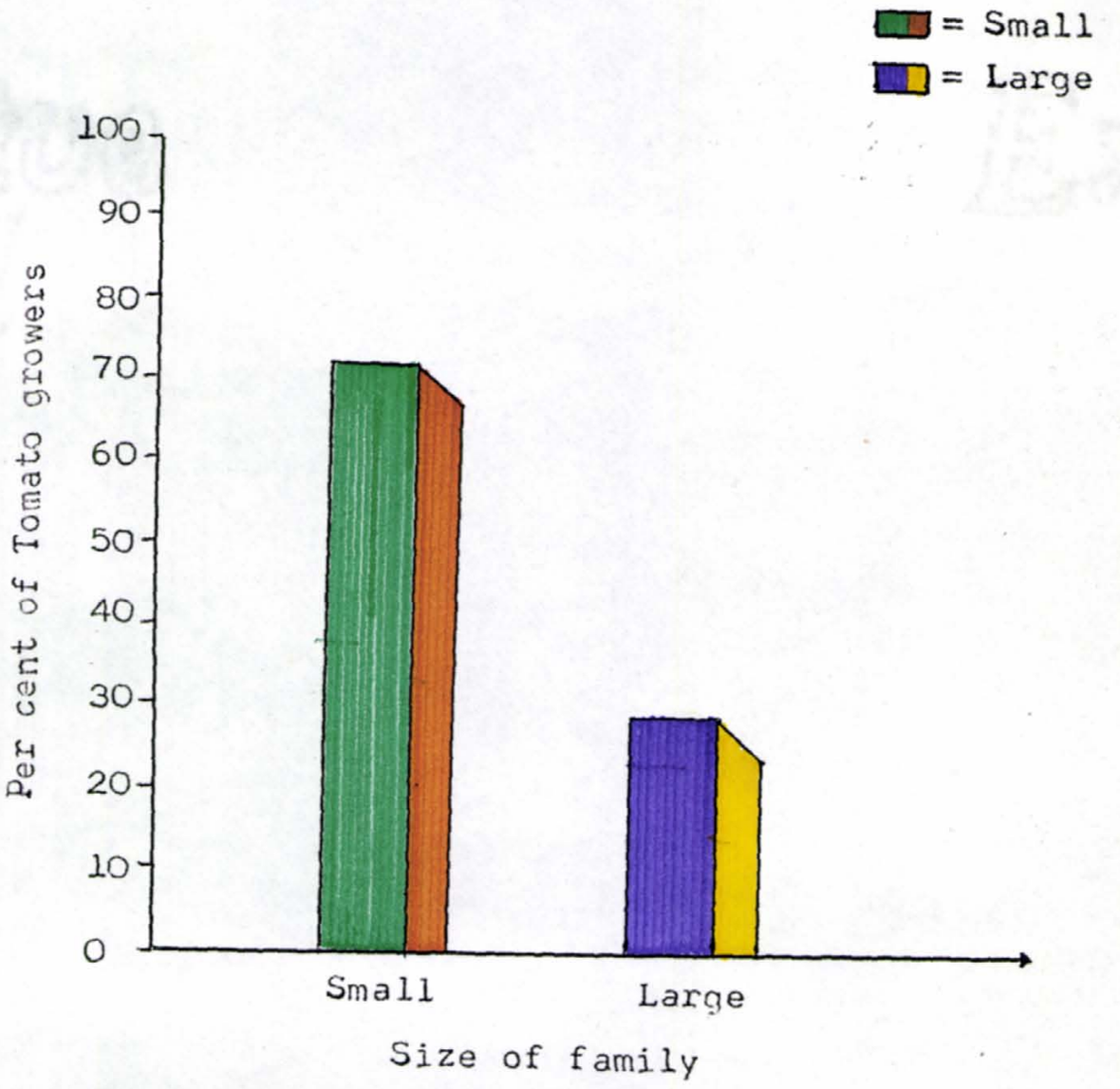

Fig. 15 DISTRIBUTION OF TOMATO GROWERS BY THEIR SIZE OF FAMILY.

This may be due to forward outlook of the farmers about the family planning thereby keeping the small family size. Secondly, it might be due to social changes and love for keeping individuality of new generation rather than to live together in joint family. This is also evidenced in the present study. This observation is similar to that of Shetay *et al.* (1990) and Kunjir (1993). They reported that ber and fig growers had small size of family.

F) Type of family : It is clear from Table 14(F) that majority of the tomato growers (68.00 per cent) had nuclear family while thirty two per cent had joint family In fact joint family system provides family labour force for farm operations being the large families. Nuclear family system affected the availability of labour from the family.

As a result the farmers now required to be dependent on hired labours. Availability of such labours depends on the area and situations. Sometimes, timely availability of labour remains a constraint in performing farm operations.

Love of individualism, increasing inflation, migration towards urban areas might be the reason of replacing joint family system by nuclear family system. This observation is in confirmity with those of Mahajan and Bajaj (1983)

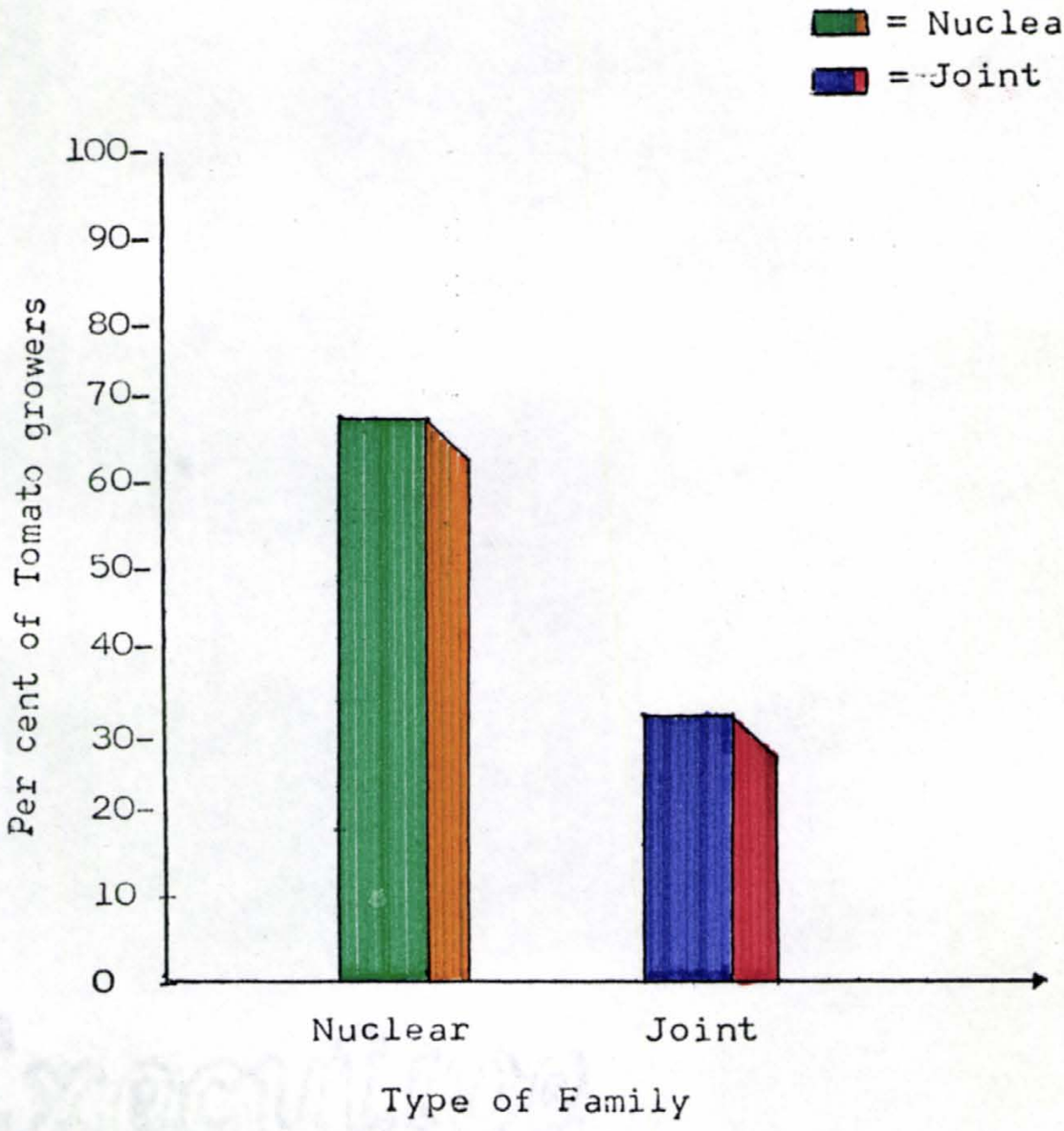

Fig. 15 DISTRIBUTION OF TOMATO GROWERS BY THEIR TYPE OF FAMILY.

regarding nutrition programme and Pawar (1996) regarding soybean cultivation.

G) Size of land holding : Size of land holding refers to the land possessed by individual tomato growers. It largely determines both economic and social status of family in rural areas.

Data in Table 14(G) indicate that majority of the tomato growers (62.00 per cent) had small size of holding followed by 29.33 per cent having medium sized farms. Only 8.68 per cent had large size of holding.

It can be stated that majority of the tomato growers had small to medium sized operational land holding. Fragmentation of holding might have compelled them to operate small sized farms. This finding is similar to those of Patil *et al.* (1992) and Pawar (1996) regarding soybean cultivations respectively.

H) Annual gross income : Annual gross income refers to the total income of farmer from main and secondary occupations. It is an important variable which influences the adoption of improved agricultural practices by allowing the farmers to invest more amount of inputs needed for the adoption of improved practices.

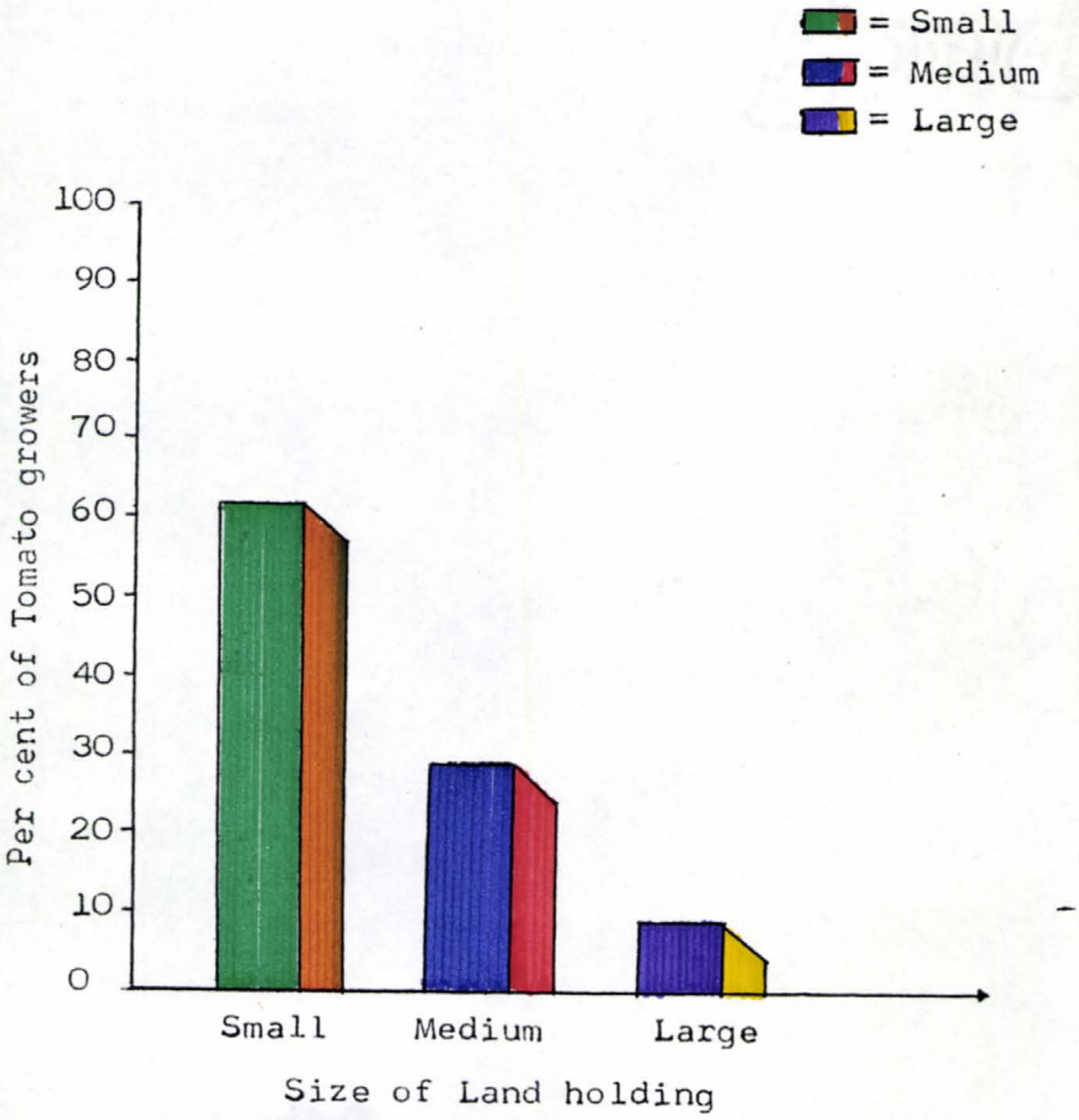

Fig.17 DISTRIBUTION OF TOMATO GROWERS BY THEIR SIZE OF LAND HOLDING.

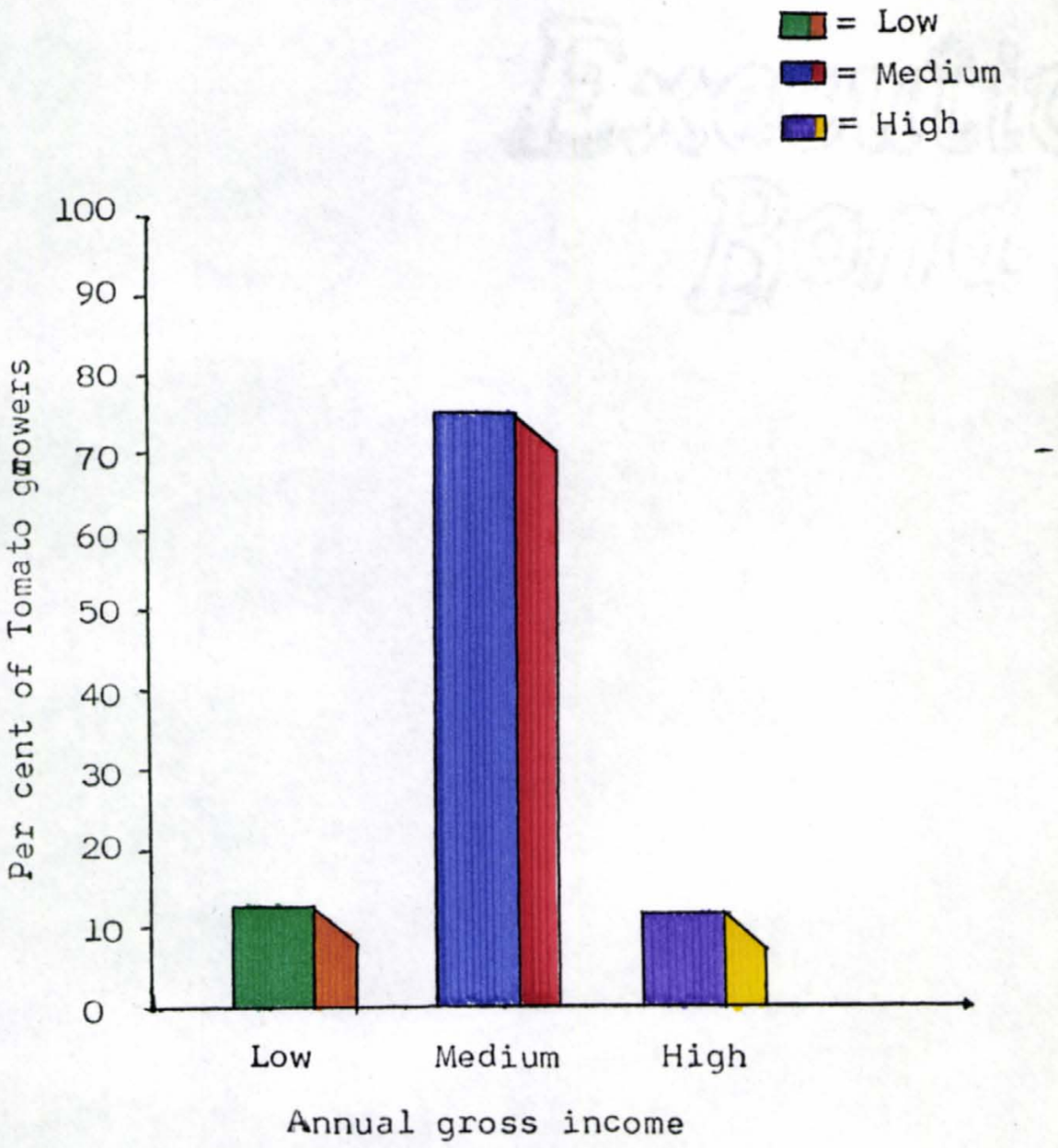

Fig.18 DISTRIBUTION OF TOMATO GROWERS BY THEIR ANNUAL GROSS INCOME.

It is observed from Table 14(H) that large majority (75.33 per cent) of tomato growers had medium level of annual gross income followed by considerable number of tomato growers 13.33 per cent and 11.34 per cent who had low level of annual gross income and high level of annual gross income. In other words it can be stated that highest percentage (75.33 per cent) of tomato growers were from medium level of income group. In the present study it has also been revealed that majority of growers were from medium socio-economic status group. This supports the observation about income level. Similar observation was recorded by Tuwar (1989) regarding sunflower growers.

I) **Socio-economic status :** Socio-economic status means the social and economic ranking of an individual in a society. The socio-economic status scale developed by Chorge (1985) was used for measurement of socio-economic status of the tomato growers.

It was noticed from Table 14(I) that nearly two third (64.00 per cent) tomato growers had medium socio-economic status followed by few in number (18.67 per cent and 17.33 per cent) had high and low socio- economic status respectively. It is inferred that majority of the tomato growers were belonging to medium level of socio-economic

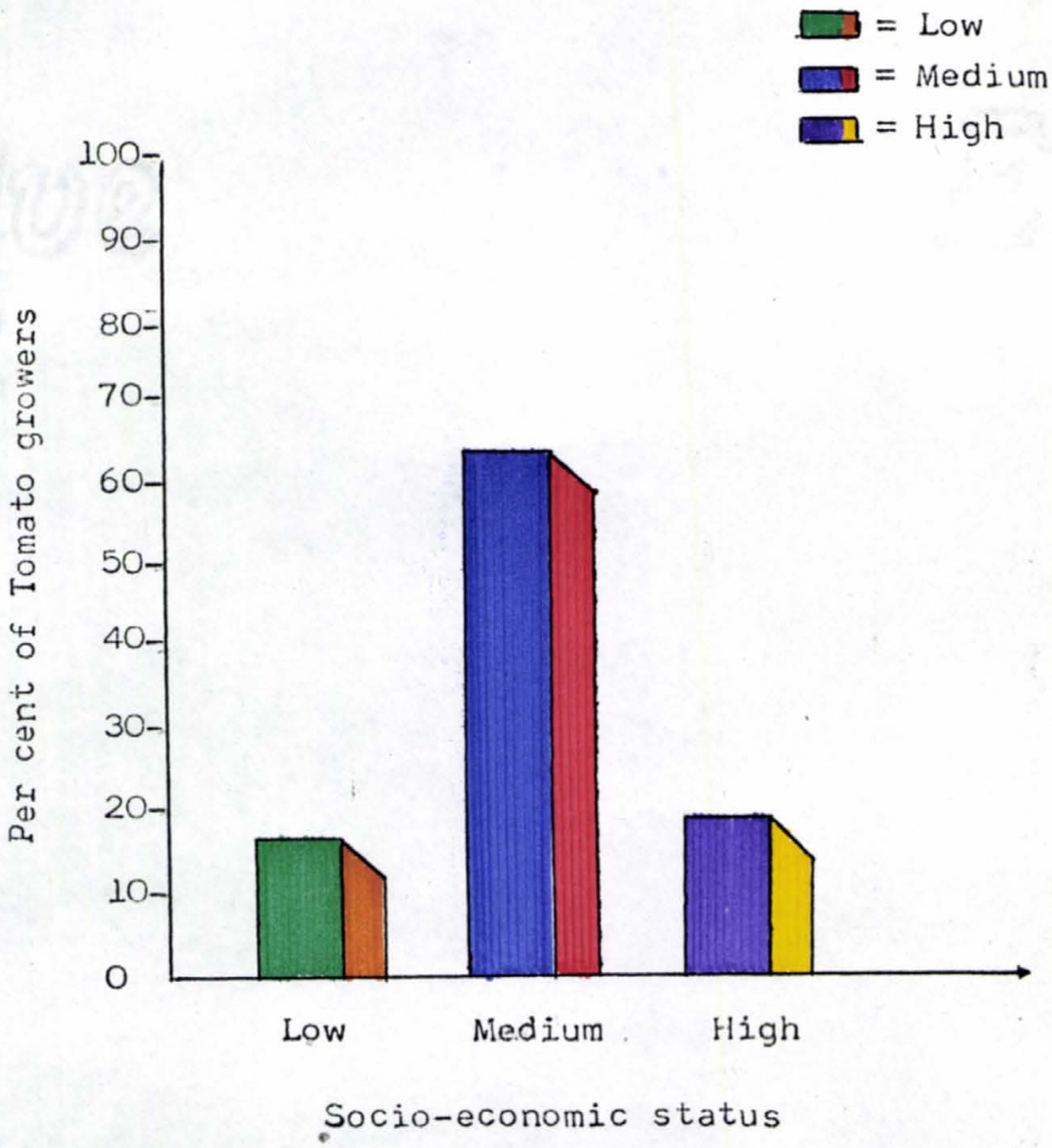

Fig. 19 DISTRIBUTION OF TOMATO GROWERS BY THEIR SOCIO-ECONOMIC STATUS.

status. Similar findings were recorded by Gaikwad (1992) and Pawar (1996) in respect of flower and soybean growers respectively.

III) Psychological characteristics :

J) Risk orientation : Risk orientation is the degree to which farmers are oriented towards risk and uncertainly and have courage to face the problems in farming. These farmers may have courage to face difficult situation, when they take risk in adopting innovation. Measurement technique used has been explained in the chapter of methodology. It is observed from Table 14(J) that 24.00 per cent tomato growers belonged to low risk orientation category, 56.00 per cent belonged to medium risk orientation category and 20.00 per cent tomato growers belonged to high risk orientation category.

Thus, it is concluded that more than half (56.00 per cent) of the tomato growers belonged to medium risk orientation category. Similar findings were recorded by Pandya & Vekaria (1994) and Patil (1995) in respect of banana growers.

IV) Communication characteristics :

K) Sources of information : Attempt was made to know the channels and sources through which the participant farmers received the information regarding improved practices

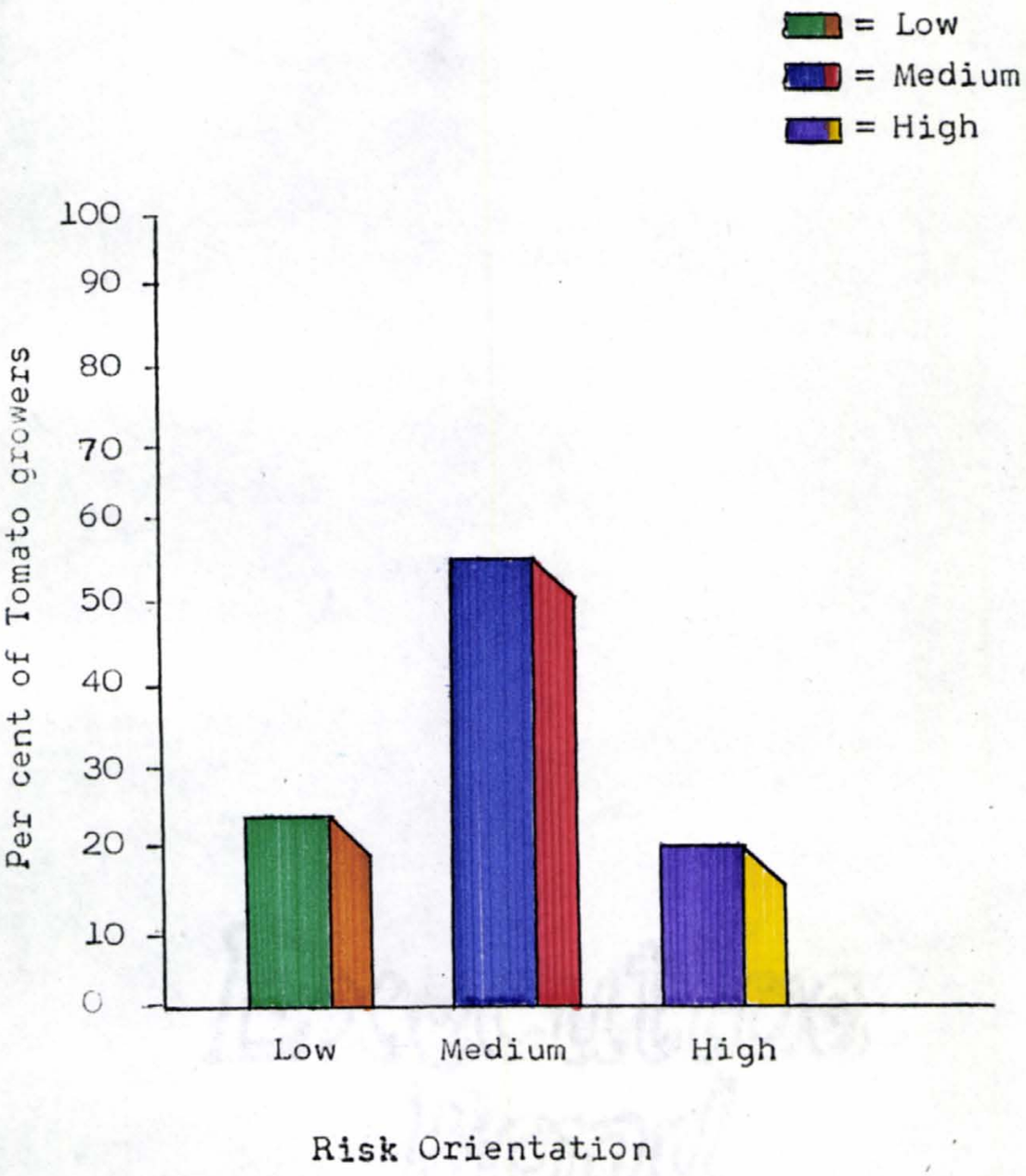

Fig.20 DISTRIBUTION OF TOMATO GROWERS BY THEIR RISK ORIENTATION.

of tomato cultivation, open end questions were asked to the growers and the data in this respect are presented in Table 15

Data presented in Table 15(K) indicate that personal cosmopolite and inter personal sources of information namely Agricultural Extension Officer (73.33 per cent), relatives (51.33 per cent), progressive farmers (44.66 per cent) and friends (39.33 per cent) played an important role in communication of tomato production technology. Electronic and print media channels namely television (30.00 per cent), Radio (28.00 per cent), News papers (24.66 per cent) and farm magazines (20.66 per cent) were also used by considerable number of growers for the knowledge of improved farming.

Table 15. Distribution of tomato growers according to the sources of information used

Information sources	Frequency	Per cent
I. Mass media channels		
A) Electronic media		
1. Television	45	30.00
2. Radio	42	28.00
3. Video	2	1.33
B) Print media		
1. Newpapers	37	24.66
2. Farm magazines	31	20.66
3. Farm diaries	20	13.33
II. Interpersonal sources		
A. Personal localite		
1. Relatives	77	51.33
2. Progressive farmers	67	44.66
3. Friends	59	39.33
4. Neighbours	54	36.00

= Television
= Radio
= Video
= Newspapers
= Farm magazines
= Farm diaries
= Relatives
= Progressive farmers
= Friends
= Neighbours
= Agril.Extension Officers
= Gramsevak
= Agril. Officers
= Village Extension Workers

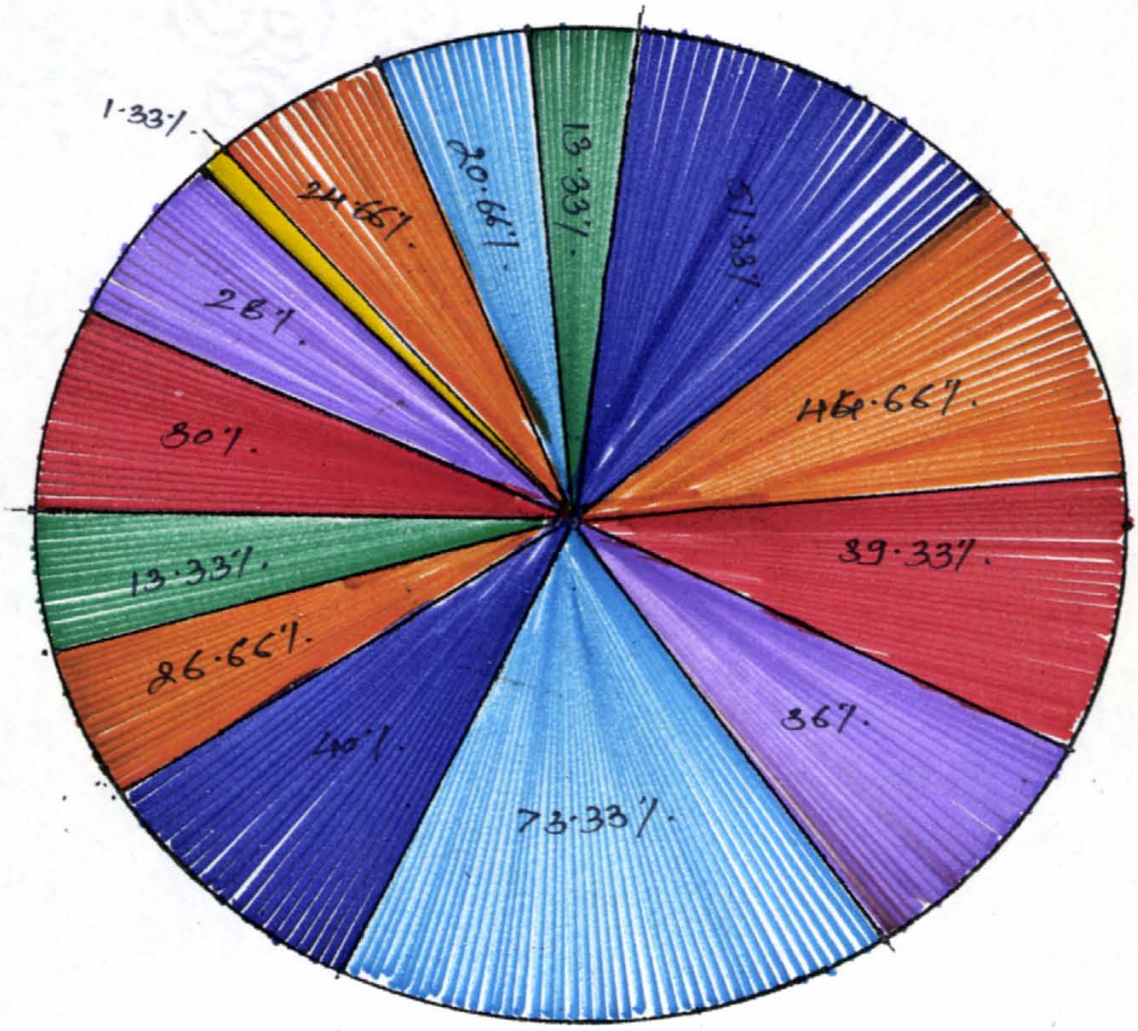

Fig. 21 : DISTRIBUTION OF TOMATO GROWERS ACCORDING TO THE SOURCES OF INFORMATION USED.

B. Personal-cosmopolite

1.	Agril. Extension Officers	110	73.33
2.	Gramsevaks	60	40.00
3.	Agricultural Officers	40	26.66
4.	Village Extension Workers	20	13.33

4.3.2 Dependent variables

4.3.2.1 Knowledge of tomato growers about improved tomato cultivation practices

Knowledge leads to produce change in skill, attitude, understanding of an individual. The term knowledge was operationalised as the body of functional information possessed by the tomato growers about the tomato production. Knowledge about an innovation is the first stage that initiates the process of its adoption. The knowledge of respondents towards recommended tomato cultivation practices was determined by asking questions regarding recommended cultivation practices. The measurement technique used has been discussed in methodology. On the basis of total knowledge score, the tomato growers were classified into three groups viz., low, medium and high knowledge level by using the statistics mean $\pm$ S.D. The results are presented in Table 16.

It is observed from the Table 16 that the highest percentage (78.00 per cent) of tomato growers was observed to be in medium followed by low (9.33 per cent) and high (12.67 per cent) knowledge level.

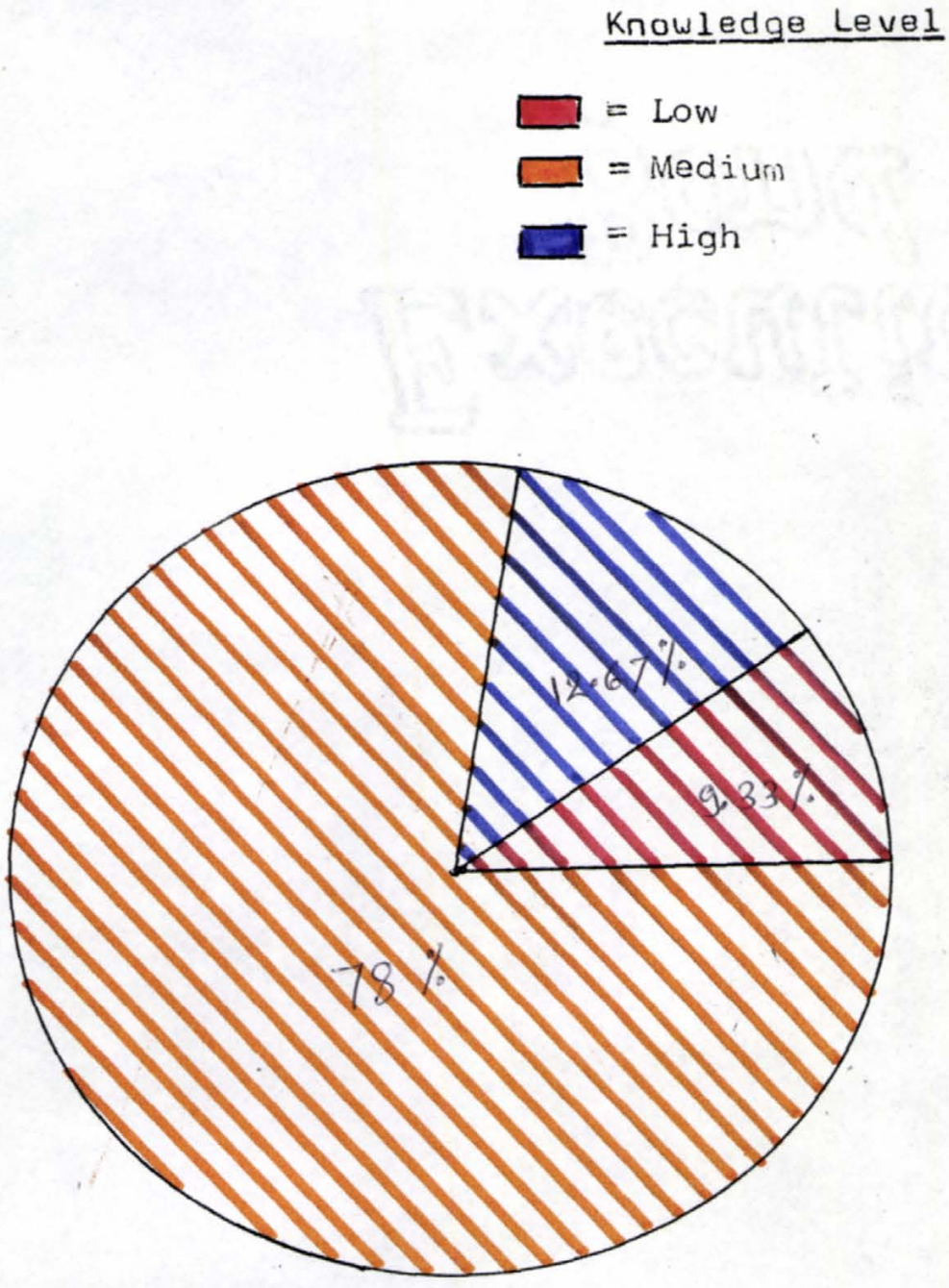

Fig.22 DISTRIBUTION OF TOMATO GROWERS BY THEIR KNOWLEDGE LEVEL ABOUT TOMATO PRODUCTION.

Table 16. Distribution of tomato growers by their knowledge level about tomato cultivation

S.N.	Level of knowledge	Frequency	Per cent
1.	Low (score upto 45)	14	9.33
2.	Medium (score 46 to 57)	117	78.00
3.	High (score above 57)	19	12.67
	Total	150	100.00

It can be said that the knowledge level of majority of tomato growers was satisfactory. The medium knowledge level of majority of tomato growers might be due to the fact that farmers might have exposed to different information sources. Most of the practices were generally known to majority of the farmers. This might also be particularly due to the better socio-economic status of the respondent farmers as evidenced in the study.

Information pertaining to the practicewise knowledge of tomato growers is presented in Table 17.

It is observed from Table 17 that all the farmers had the knowledge about recommended soil type (100.00 per cent), ploughing (100.00 per cent) harrowing (100.00 per cent). While majority of the respondents had knowledge about FYM application (90.66 per cent).

Table 17. Practicewise knowledge of tomato growers

Recommended practices	Knowledge (N=150)					
	Complete		Partial		No	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
1 2	3	4	5	6	7	8
I) Soil type and primary tillage						
a) Soil type (Medium, well drained)	150	100.00	-	-	-	-
b) One ploughing	150	100.00	-	-	-	-
c) 2-3 harrowings	150	100.00	-	-	-	-
d) 20-25 C.L. FYM application	136	90.66	12	8.00	2	1.34
II) Knowledge about varieties/ hybrids						
1. Recommended						
a) Pusa Early Dwarf (IARI)	56	37.33	-	-	94	62.67
b) Pusa ruby (IARI)	52	34.66	-	-	98	65.34
c) Money Maker (IARI)	40	26.66	-	-	110	73.34
d) Dhanashree (MPKV,Rahuri)	22	14.66	-	-	128	85.34
e) Bhagyashree(MPKV,Rahuri)	22	14.66	-	-	128	85.34
f) Rajashree (MPKV,Rahuri)	-	-	-	-	150	100.00
2. Non-recommended						
a) Rupali (Indo-American Seeds Ltd.)	142	94.66	-	-	8	5.34
b) Rashmi -"-	132	88.00	-	-	18	12.00
c) Rohini -"-	25	16.66	-	-	125	83.34
d) Ramya -"-	41	27.33	-	-	109	72.67
e) Avinash-2 (Sandoz India Ltd.)	72	48.00	-	-	78	52.00
f) Rasika -"-	18	12.00	-	-	132	88.00
g) Lerika -"-	23	15.33	-	-	127	84.67
h) Apurva (Proagro Seeds)	47	31.33	-	-	103	68.67
i) Namdhari-812 (Namdhari Seeds Ltd.)	39	26.00	-	-	111	74.00
j) Namdhari-815 -"-	36	24.00	-	-	114	76.00

Table 17. Contd.....

1	2	3	4	5	6	7	8
III)	Seed rate/planting/spacing						
	1. Seed rate						
	a) Varieties (0.4-0.5 kg/ha)	97	64.66	53	35.34	-	-
	b) Hybrids (0.100-0.150 kg/ha)	84	56.00	66	44.00	-	-
	2. Seed treatment						
	a) Thirum 3 g/kg	86	57.33	30	20.00	34	22.67
	3. Time of planting						
	a) Kharif (June-July)	150	100.00	-	-	-	-
	b) Rabi (Sept.-Oct.)	117	78.00	25	16.67	8	5.33
	c) Summer (Jan.-Feb.)	140	93.33	10	6.67	-	-
	4. Method of planting						
	(Ridges and Furrow Method)	150	100.00	-	-	-	-
	5. Spacing						
	a) Kharif (90 x 30 cm) (60 x 45 cm)	107	71.34	43	28.66	-	-
	b) Rabi and Summer (60x60cm)	103	68.66	47	31.34	-	-
IV)	Fertilizer management						
	a) Nitrogen (100 kg/ha)	103	68.66	47	31.34	-	-
	b) Phosphorus (50 kg/ha)	74	49.34	58	38.66	18	12.00
	c) Potassium (50 kg/ha)	72	48.00	61	40.67	17	11.33
V)	Interculture						
	a) Weeding (7-8 times)	133	88.67	17	11.33	-	-
	b) Support (Emergence of flower bud)	150	100.00	-	-	-	-

Table 17. Contd.....

1	2	3	4	5	6	7	8
VI)	Irrigation management						
	a) Kharif (10-12 days)	116	77.34	34	22.66	-	-
	b) Rabi (07-10 days)	107	71.34	43	28.66	-	-
	c) Summer (04-07 days)	150	100.00	-	-	-	-
VII)	Plant Protection Management						
	a) [illegible] and whitefly (Endosulphan 35 EC or Metacystox 0.1%)	71	47.33	56	37.34	23	15.33
	b) Fruit borer (Endosulphan 0.05%)	72	48.00	70	46.67	8	5.33
	c) Top shoot borer (Phorate 25-30 g)	55	36.66	41	27.34	54	36.00
	d) Leaf eating caterpiller (Dust Carbyrl 20 kg/ha)	68	45.33	48	34.00	34	22.67
	d) Powdery mildew (300 mesh sulphur 20 kg/ha)	74	49.33	38	25.33	38	25.34
	e) Wilt (Dithane Z-78)	80	53.33	38	25.33	32	21.34
	f) Cracking of fruits (Timely irrgation)	46	30.66	87	58.00	17	11.34
VIII)	Harvesting						
	(4-8 days after every picking)	150	100.00	-	-	-	-

Very few farmers were knowing about the recommended varieties namely Pusa Early Dwarf (37.33 per cent), Pusa ruby (34.66 per cent), Money Maker (26.66 per cent), Dhanashree (14.66 per cent), Bhagyashree (14.66 per cent). None of the respondents was knowing about the recommended hybrid Rajashree.

Majority of the growers were knowing about the non-recommended hybrids of private seed producers. They were knowing about Rupali (94.66 per cent), Rashmi (88.00 per cent), Avinash-2 (48.00 per cent), Apurva (31.33 per cent), Ramya (27.33 per cent), Namdhari-812 (26.00 per cent), Namdhari-815 (24.00 per cent), Rohini (16.66 per cent), Lerika (15.33 per cent) and Rasika (12.00 per cent).

More than half of the respondets (64.66 per cent) had knowledge about recommended seed rate of varieties while 56.00 per cent had knowledge about seed rate of hybrids. Seed treatment of thirum had known to 57.33 per cent respondents.

All the farmers had knowledge about kharif planting (100.00 per cent), while 93.33 per cent and 78.00 per cent had knowledge about summer and rabi planting of tomato respectively. All the farmers had knowledge about method of planting (100.00 per cent).

Nearly two third respondent had knowledge about kharif spacing (71.34 per cent) while 68.00 per cent had knowledge about rabi and summer spacing of tomato.

More than half of the respondents (68.66 per cent) had knowledge about nitrogen application while 49.34 per cent and 48.00 per cent had knowledge about phosphorus and potassium application.

All the respondents had knowledge about supporting to the tomato (100.00 per cent), while majority of the respondents had knowledge about weeding (88.67 per cent).

All the tomato growers had knowledge about summer irrigation, while 77.34 per cent and 71.34 per cent had knowledge about kharif and rabi irrigation, respectively.

Majority of tomato growers were lacking knowledge about insect pest like fruit fly and white fly (47.33 per cent), fruit borer (48.00 per cent), top shoot borer (36.66 per cent), leaf eating caterpillar (45.33 per cent) and diseases like powdery mildew (49.33 per cent), wilt (53.33 per cent), cracking of fruits (30.66 per cent).

All the farmers had knowledge about proper time of harvesting of tomato (100.00 per cent). Patil *et al.* (1992) and Pawar (1996) also reported the similar observations while studying the soybean growers.

4.3.2.2 Adoption of improved tomato cultivation practices by tomato growers

The term adoption was operationalised as continuous use of recommended practices of tomato cultivation. Technique used for measurement of adoption has been explained in methodology. The adoption score of individual tomato grower was the criterion for classifying them into three categories viz., low, medium and high levels of adoption by using statistics mean ± S.D. The results are presented in Table 18.

Table 18. Distribution of tomato growers by their adoption level of improved cultivation practices of tomato

	Level of adoption	Frequency	Per cent
1.	Low (score upto 36)	10	6.67
2.	Medium (score 37 to 52)	128	85.33
3.	High (score above 52)	12	8.00
	Total	150	100.00

From the above table, it is obivious that the highest percentage (85.33 per cent) of tomato growers had medium level of adoption of recommended package of practices. Very few had low (6.67 per cent) and high (8.00 per cent) level of adoption.

It can be said that the level of adoption of tomato cultivation practices of majority of growers was satisfactory. The medium level of majority of tomato growers might be due to

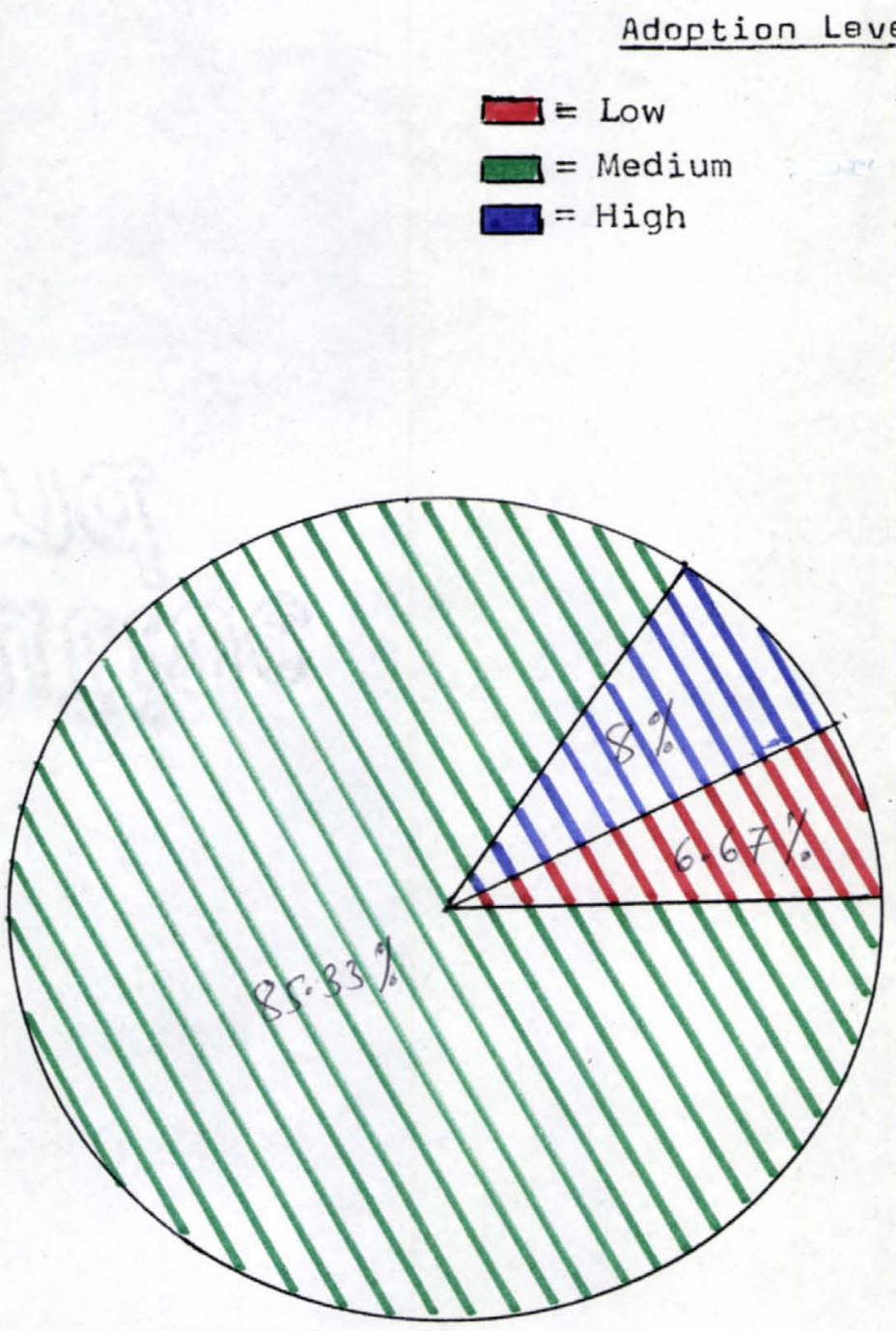

Fig.2 DISTRIBUTION OF TOMATO GROWERS BY THEIR ADOPTION LEVEL OF IMPROVED CULTIVATION PRACTICES OF TOMATO.

the fact that the farmers might have been exposed to the different information sources. This might also be due to higher educational level and factor such as socio-economic status of farmer. This findings is in confimatory with Patil *et al.* (1992) and Pawar (1996) regarding soybean cultivators.

Information regarding to practicewise adoption of tomato cultivation technology is presented in Table 19. It is observed Table 19 that all the farmers adopted the recommended soil type (100.00 per cent). While 81.33 per cent and 36.67 per cent were adopted the harrowing and FYM. application respectively.

Very few number of farmers adopted the recommended varieties namely Pusa early dwarf (0.66 per cent) and Money Maker (3.33 per cent). None of farmers adopted the recommended varieties like Pusa ruby, Dhanashree, Bhagyashree and hybrid Rajashree.

Considerable number of farmers were adopting the non-recommended hybrids namely Rupali (14.66 per cent), Rashmi (13.33 per cent), Avinash-2 (26.67 per cent), Apurva (6.00 per cent), Ramya (6.66 per cent), Namdhari-812 (10.00 per cent), Namdhari-815 (8.66 per cent), Rohini (3.33 per cent), Lerika (4.00 per cent), Rasika (2.66 per cent).

Table 19. Practicewise adoption of tomato growers

Recommended practices	Adoption (N=150)					
	Complete		Partial		No	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
1 2	3	4	5	6	7	8
I) Soil type and primary tillage						
a) Soil type (Medium, well drained)	150	100.00	-	-	-	-
b) One ploughing	150	100.00	-	-	-	-
c) 2-3 harrowings	122	81.33	28	18.66	-	-
d) 20-25 C.L. FYM application	55	36.67	92	61.33	3	2.00
II) Varieties/hybrids						
1. Recommended						
a) Pusa Early Dwarf (IARI)	1	0.66	-	-	149	99.34
b) Pusa ruby (IARI)	-	-	-	-	150	100.00
c) Money Maker (IARI)	5	3.33	-	-	145	96.67
d) Dhanashree (MPKV,Rahuri)	-	-	-	-	150	100.00
e) Bhagyashree(MPKV,Rahuri)	-	-	-	-	150	100.00
f) Rajashree (MPKV,Rahuri)	-	-	-	-	150	100.00
2. Non-recommended						
a) Rupali (Indo-American Seeds Ltd.)	22	14.66	-	-	128	85.34
b) Rashmi -"-	20	13.33	-	-	130	86.67
c) Rohini -"-	5	3.33	-	-	145	96.67
d) Ramya -"-	10	6.66	-	-	140	93.34
e) Avinash-2 (Sandoz India Ltd.)	40	26.67	-	-	110	73.33
f) Rasika -"-	4	2.66	-	-	146	97.34
g) Lerika -"-	6	4.00	-	-	144	96.00
h) Apurva (Proagro Seeds)	9	6.00	-	-	141	94.00
i) Namdhari-812 (Namdhari Seeds Ltd.)	15	10.00	-	-	135	90.00
j) Namdhari-815 -"-	13	8.66	-	-	137	91.34

Table 19. Contd....

1	2	3	4	5	6	7	8
III)	Seed rate/planting/spacing						
	1. Seed rate						
	a) Varieties (0.4-0.5 kg/ha)	6	4.00	-	-	144	96.00
	b) Hybrids (0.100-0.150 kg/ha)	84	56.00	60	40.00	6	4.00
	2. Seed treatment						
	a) Thirum 3 g/kg	86	57.34	30	20.00	34	22.67
	3. Time of planting						
	a) Kharif (June-July)	98	65.34	-	-	52	34.66
	b) Rabi (Sept.-Oct.)	16	10.66	-	-	134	89.34
	c) Summer (Jan.-Feb.)	36	24.00	-	-	114	76.00
	4. Method of planting						
	(Ridges and Furrow Method)	150	100.00	-	-	-	-
	5. Spacing						
	a) Kharif (90 x 30 cm) (60 x 45 cm)	98	65.34	-	-	52	34.66
	b) Rabi and Summer (60x60cm)	52	34.66	-	-	98	65.34
IV)	Fertilizer management						
	a) Nitrogen (100 kg/ha)	100	66.67	44	29.33	6	4.00
	b) Phosphorus (50 kg/ha)	54	36.00	76	50.67	20	13.33
	c) Potassium (50 kg/ha)	39	26.00	73	48.67	38	25.33
V)	Interculture						
	a) Weeding (7-8 times)	133	88.67	17	11.33	-	-
	b) Support (Emergence of flower bud)	150	100.00	-	-	-	-

Table 19. Contd....

1	2	3	4	5	6	7	8
VI)	Irrigation management						
	a) Kharif (10-12 days)	98	65.34	-	-	52	34.66
	b) Rabi (07-10 days)	16	10.66	-	-	134	89.34
	c) Summer (04-07 days)	36	24.00	-	-	114	76.00
VII)	Plant Protection Management						
	a) Aphids and whitefly (Endosulphan 35 EC or Metacystox 0.1%)	47	31.33	26	17.3	77	51.34
	b) Fruit borer (Endosulphan 0.05%)	43	28.66	61	40.67	46	30.66
	c) Top shoot borer (Phorate 25-30 g)	33	22.00	33	22.00	84	56.00
	d) Leaf eating caterpiller (Dust Carbyrl 20 kg/ha)	32	21.34	55	36.66	63	42.00
	d) Powdery mildew (300 mesh sulphur 20 kg/ha)	68	45.34	41	27.33	41	27.33
	e) Wilt (Dithane Z-78)	71	47.34	41	27.33	38	25.33
	f) Cracking of fruits (Timely irrgation)	19	12.66	93	62.00	38	25.34
VIII)	Harvesting						
	(4-8 days after every picking)	150	100.00	-	-	-	-

More than half of the farmers adopted the recommended seed rate of hybrids (56.00 per cent), while only 4.00 per cent adopted the recommended seed rate of varieties. More than half of the farmers adopted the Thirum seed treatment.

Majority of the tomato growers (65.34 per cent) adopted kharif planting of tomato while 10.66 per cent and 24.00 per cent adopted rabi and summer planting of tomato, respectively. All the farmers adopted ridges and furrow method of planting (100.00 per cent) for tomato. Most of the respondents (65.34 per cent) adopted the kharif spacing of tomato, while 34.66 per cent adopted the rabi and summer spacing of tomato.

Majority of the farmers (66.67 per cent) adopted the nitrogen application, while 36.00 per cent and 26.00 per cent adopted the phosphorus and potassium application respectively. All the farmers adopted the practice of supporting to tomato (100.00 per cent). While 88.67 per cent adopted the weeding.

Majority of the farmers had adopted the kharif irrigation (65.34 per cent), while 10.66 per cent and 24.00 per cent were adopting rabi and summer irrigation respectively.

Considerable number of farmers adopted the practices of insect pest control like fruit fly and white fly (31.33 per cent), fruit borer (28.66 per cent), top shoot borer (22.00 per cent), leaf eating caterpillar (21.34 per cent) and diseases like (45.34 per cent), wilt (47.34 per cent), cracking of fruits (12.66 per cent).

4.4 Adoption of varieties/hybrids and information about different aspects

One of the emphasised aspects of the study was about the adoption behaviour of the farmers towards different varieties and hybrids released by the S.A.U., ICAR institutions and private firms. Number of varieties and hybrids are sold in the market by the seed producers in private sector. Inorder to know the farmers' responses towards these varieties and hybrids, information on certain aspects of adoption of hybrids and varieties of tomato was obtained from the growers.

4.4.1.A) Varieties adopted

It is seen from Table 20(A) that only 0.66 per cent and 3.33 per cent tomato growers used Pusa Early Dwarf and Money Makers as a recommended varieties. Other tomato growers used non-recommended hybrid viz., Rupali (14.66 per cent), Rashmi (13.33 per cent), Avinash-2 (26.66 per cent), Apurva

Table 2v. Information about different aspects related to varieties/hybrids cultivated by the farmers

Varieties/hybrid used	Frequency (N=150)	Seed purchased from		Recommended seed rate (kg/ha)			Availability of seed		Germination (%)	
		Private	Friend	Used	Below	More than	Timely	Untimely	70-80%	80-90%
I) Recommended										
1. Pusa Barly Dwarf (IARI)	1 [0.66]	1 [0.66]	-	1 [0.66]	-	-	1 [0.66]	-	1 [0.66]	-
2. Honey Maker (IARI)	5 [3.33]	3 [2.00]	2 [1.33]	5 [3.33]	-	-	5 [3.33]	-	5 [3.33]	-
II) Non-recommended										
1. Rupali (Indo-American Seeds Ltd.)	22 [14.66]	22 [14.66]	-	20 [13.33]	-	2 [1.33]	20 [13.33]	2 [1.33]	17 [11.33]	5 [3.33]
2. Rashmi -"-	20 [13.33]	19 [12.66]	1 [0.66]	17 [11.33]	-	3 [2.00]	20 [13.33]	-	16 [10.66]	4 [2.66]
3. Rohini -"-	5 [3.33]	5 [3.33]	-	5 [3.33]	-	-	3 [2.00]	2 [1.33]	-	5 [3.33]
4. Ramya -"-	10 [6.66]	10 [6.66]	-	7 [4.66]	3 [2.00]	-	7 [4.66]	3 [2.00]	-	10 [6.66]
5. Avinash-2 (Sandoz India Ltd.	40 [26.66]	40 [26.66]	-	40 [26.66]	- -	- -	40 [26.66]	- -	7 [4.66]	33 [22.00]
6. Rasika -"-	4 [2.66]	4 [2.66]	-	4 [2.66]	-	-	4 [2.66]	-	-	4 [2.66]
7. Lerika -"-	6 [4.00]	6 [4.00]	-	6 [4.00]	-	-	6 [4.00]	-	-	6 [4.00]
8. Apurva (Proagro Seeds Ltd.	9 [6.00]	9 [6.00]	-	9 [6.00]	-	-	9 [6.00]	-	-	9 [6.00]
9. Nandhari-812 (Nandhari Seed Ltd.)	13 [8.66]	13 [8.66]	-	8 [5.33]	2 [1.33]	3 [2.00]	13 [8.66]	-	-	13 [8.66]
10. Nandhari-815 -"-	15 [10.00]	15 [10.00]	-	9 [6.00]	4 [2.66]	2 [1.33]	15 [10.00]	-	3 [2.00]	12 [8.00]

Table 20. Contd....

Varieties/hybrid used	Cultivated for no.of times			Yield per hectare (t/ha)			Level of expect.of yield			Market price received (Rs/kg)		
	1-2	2-4	Above 4	20-30	30-40	Avove 40	Below	Expt.	More than	Upto 4	4-10	Above 10
I) Recommended												
1. Pusa Early Dwarf (IARI)	1 [0.66]	-	-	1 [0.66]	-	-	-	1 [0.66]	-	1 [0.66]	-	-
2. Money maker (IARI)	2 [1.33]	3 [2.00]	-	1 [0.66]	4 [2.66]	-	1 [0.66]	4 [2.66]	-	-	5 [3.33]	-
II) Non-recommended												
1. Rupali (Indo-American Seeds Ltd.)	6 [4.00]	11 [7.33]	5 [3.33]	4 [2.66]	15 [10.00]	3 [2.00]	12 [8.00]	10 [6.66]	-	5 [3.33]	17 [11.33]	-
2. Rashmi -"-	2 [1.33]	13 [8.66]	5 [3.33]	4 [2.66]	15 [10.00]	1 [0.66]	5 [3.33]	15 [10.00]	-	6 [4.00]	14 [9.33]	-
3. Rohini -"-	5 [3.33]	-	-	-	5 [3.33]	1 [0.66]	1 [0.66]	4 [2.66]	-	-	5 [3.33]	-
4. Ramya -"-	5 [3.33]	-	-	2 [1.33]	8 [5.33]	-	-	7 [4.66]	3 [2.00]	-	7 [4.66]	3 [2.00]
5. Avinash-2 (Sandoz India Ltd.	30 [20.00]	2 [1.33]	8 [5.33]	-	22 [14.66]	18 [12.00]	6 [4.00]	27 [18.00]	7 [4.66]	5 [3.33]	29 [19.33]	6 [4.00]
6. Rasika -"-	-	4 [2.66]	-	-	1 [0.66]	3 [2.00]	-	4 [2.66]	-	-	2 [1.33]	2 [1.33]
7. Lerika -"-	3 [2.00]	3 [2.00]	-	-	3 [2.00]	3 [2.00]	4 [2.66]	2 [1.33]	-	-	4 [2.66]	2 [1.33]
8. Apurva (Proagro Seeds Ltd.	9 [6.00]	-	-	-	9 [6.00]	-	-	9 [6.00]	-	4 [2.66]	5 [3.33]	-
9. Nandhari-812 (Nandhari Seed Ltd.)	9 [6.00]	4 [2.66]	-	-	10 [6.66]	3 [2.00]	4 [2.66]	9 [6.00]	-	2 [1.33]	8 [5.33]	3 [2.00]
10. Nandhari-815 -"-	10 [6.66]	5 [3.33]	-	-	12 [8.00]	3 [2.00]	-	12 [8.00]	3 [2.00]	6 [4.00]	8 [5.33]	1 [0.66]

Table 20. Contd....

Varieties/hybrid used	Suitability for transport		Keeping quality (days)		Maturing period		Insect-pest incidence	
	Suitable	Unsuitable	Upto 3 days	3-6 days	65 days	70 days	Less	Severe
I) Recommended								
1. Pusa Early Dwarf (IARI)	1 [0.66]	-	1 [0.66]	-	-	1 [0.66]	1 [0.66]	-
2. Money Maker (IARI)	5 [3.33]	-	3 [2.00]	2 [1.33]	-	5 [3.33]	4 [2.66]	-
II) Non-recommended								
1. Rupali (Indo-American Seeds Ltd.)	20 [13.33]	2 [1.33]	18 [12.00]	4 [2.66]	-	22 [14.66]	20 [13.33]	2 [1.33]
2. Rashmi -"-	20 [13.33]	-	20 [13.33]	-	-	20 [13.33]	18 [12.00]	2 [1.33]
3. Rohini -"-	5 [3.33]	-	5 [3.33]	-	-	5 [3.33]	5 [3.33]	-
4. Ramya -"-	10 [6.66]	-	10 [6.66]	-	-	10 [6.66]	10 [6.66]	-
5. Avinash-2 (Sandoz India Ltd.	40 [26.66]	-	40 [26.66]	-	3 [2.00]	37 [24.66]	33 [22.00]	7 [4.66]
6. Rasika -"-	2 [1.33]	2 [1.33]	4 [2.66]	-	-	4 [2.66]	1 [0.66]	3 [2.00]
7. Lerika -"-	6 [4.00]	-	6 [4.00]	-	2 [1.33]	4 [2.66]	4 [2.66]	2 [1.33]
8. Apurva (Proagro Seeds Ltd.	9 [6.00]	-	9 [6.00]	-	4 [2.66]	5 [3.33]	9 [6.00]	-
9. Mamdhari-812 (Mamdhari Seed Ltd.)	10 [6.66]	3 [2.00]	13 [8.66]	-	-	13 [8.66]	11 [7.33]	2 [1.33]
10. Mamdhari-815 -"-	15 [10.00]	-	15 [10.00]	-	5 [3.33]	10 [6.66]	13 [8.66]	2 [1.33]

Figures in parentheses indicate the percentages to the total number of respondents.

(6.00 per cent), Namdhari-812 and Namdhari-815 (8.66 per cent and 10.00 per cent respectively), Few farmers were using Rohini (3.33 per cent), Ramya (6.66 per cent), Rasika (2.66 per cent) and Lerika (4.00 per cent).

Source of seed is also important aspects of improved cultivation in view of the purity of the seeds. It was noticed that the farmers who have cultivated recommended varieties like Money Maker and Pusa Early Dwarf purchased the seed from the private seed sellers. Only Money Maker (1.33 per cent) and Rashmi (0.66 per cent)cultivating the farmers purchased the seed from the friends. All the remaining farmers who have cultivated non-recommended varieties purchased the seed from the private seed sellers.

4.4.2. **Other aspects**

B) Seed rate : It is seen from the Table 20(:) farmers using recommended varieties Pusa Early Dwarf of and Money Maker used the recommended seed rate of 0.4 to 0.5 kg per hectare.

It is also seen that the farmers who were cultivating the non-recommended varieties were using the recommended seed rate of 0.10 to 0.15 kg per hectare. Those were Rupali (13.33 per cent), Rashmi (11.33 per cent), Avinash-2 (26.66 per cent), Apurva (6.00 per cent), Namdhari-

815 (6.00 per cent), Namdhari-812 (5.33 per cent) and Ramya (4.66 per cent).

A few farmers using the seed rate below than recommended which was about Namdhari-812 (1.33 per cent), Namdhari- 815 (2.66 per cent) and Ramya (2.00 per cent). Some of the farmers cultivating non-recommended varieties using the more than recommended seed rate which was mainly about Rupali (1.33 per cent), Rashmi (2.00 per cent), Namdhari-812 and Namdhari-815 (2.00 per cent and 1.33 per cent respectively).

It is revealed from the Table 20(B) that many of the respondents cultivating recommended and non recommended varieties using the recommended seed rate. They reported that the germination of these varieties was good.

C) **Availability of seed** : Timely availability of the seed of desired cultivars helps the farmers to enhance their crop production. Information about this aspect was collected.

Information presented in Table 20(C) clearly indicated that there was no problem of availability of the seeds of improved varieties/hybrids of tomato desired by the farmers as most of them (95.34 per cent) reported timely availability of seeds.

This may be because of marketing network of the private seed producing firms and other sources at village level.

D) Germination : It is seen from Table 20(½) that the varieties like Pusa Early Dwarf (0.66 per cent), Money Maker (3.33 per cent), Rupali (11.33 per cent), Rashmi (10.66 per cent), Avinash-2 (4.66 per cent) and Namdhari-815 (2.00 per cent) were having 70-80 per cent germination i.e. desired level of germination percentage.

Improved and recommended varieties namely Money Maker and Pusa Early Dwarf were having germination percentage between 70 to 80 per cent as reported by the farmers. This is some what below the desired level of germination percentage. Germination percentage of some of the hybrids (Rupali and Rashmi) were also reported to be between 70 and 80 per cent.

E) Varieties cultivated more than once :

It was also tried to know whether the farmers have continued the adoption of tomato varieties and if so far how many times they have cultivated that particular variety.

It is seen from the Table 20(c) that improved varietoes or hybrids which were adopted by the farmers for 2 to 4 times were Money Maker (2.00 per cent), Rupali (7.33 per cent), Rashmi (8.66 per cent), Avinash-2 (1.33 per cent),

Namdhari-812 and Namdhari-815 (2.66 and 3.33 per cent respectively) and Ramya, Rasika, Lerika (3.33 per cent,2.66 per cent, 2.00 per cent respectively).

The hybrids like Rupali (3.33 per cent), Rashmi (3.33 per cent) and Avinash-2 (5.33 per cent) were adopted for more than four times.

It was concluded from the above information that Rupali Rashmi and Avinash-2 hybrids were adopted continuously by the tomato growers though they were not recommended.

F) Yield obtained : Information about per hectare yield of tomato obtained by the farmers is presented in Table 20(F). Productivity of particular variety determines its adoption continuity.

It is observed from the Table 20( ) that large majortiy of the varieties had productivity at medium level (30-40 T/ha). Recommended variety Pusa Early Dwarf cultivated by only one farmer reported the yield around 30 MT/ha followed by the variety Money Maker procured the yield between 30 to 40 MT/ha i.e. medium level of productivity. Most of the hybrids namely Avinash-2, Rupali, Rashmi, Namdhari-812 and Namdhari-815, Rohini, Ramya, Rasika and Lerika were having yields above 40 MT/ha as reported by the farmers.

In other words it can be stated that majority of the non-recommended hybrids were having yields between high and medium levels. This might be the reason as most of the respondents prefer the non-recommended hybrids.

G) Level of expectation of yield : The information regarding the farmers' level of expectation of yield that is whether they have got the expected yield or not is collected from the tomato growers.

It is seen from the Table 20(G) that the hybrids namely Avinash-2, Namdhari-815 and Ramya given more yield than expectation of the tomato growers. Recommended improved variety Money Maker and some of the hybrids namely, Rupali, Rashmi, Avinash-2, Namdhari-812 and Rohini given yield below than the expectation of the tomato growers.

It can be stated that majority of the hybrids given expected yield followed by the improved varieties. The varieties given yield below than the expectation of tomato growers may be because of lack of fertilizer application and non-availability of plant protection measures and such other cultivation factors.

H) Market price received : Data in Table 20(H) indicate that the hybrids like Avinash-2, Namdhari 812, Namdhari 815,Ramya, Rasika and Lerika received the high market

prices i.e. Above Rs.10/- Recommended varieties like Pusa Early Dwarf and hybrids namely, Rupali, Rashmi, Apurva, Avinash-2, Namdhari-812 and Namdhari-815 received the low market price i.e. around Rs. 4/-.

From this we can say that most of the non-recommended varieties received medium market price i.e. from Rs.4 to 10. This is due to that hybrids have attractive colour, good size and shape.

I) **Suitability for transport** : It is seen from Table 20( ) that very few number of varieties were not suitable for transport those were Rupali (1.33 per cent) Namdhari-812 (2.00 per cent), Rasika (1.33 per cent). Recommended improved varieties Pusa Early Dwarf and Money Maker were suitable for transport. Remaining varieties were suitable for transport.

It can be stated that all the recommended and non-recommended varieties were suitable for transport as reported by the tomato cultivators.

J) **Keeping quality** : It is seen from Table 20( ) that very few varieties remain in good condition after harvesting i.e. for 3-6 days. Those were namely Money Maker and Rupali. Hybrids such as Rupali, Rashmi, Avinash-2, Apurva, Namdhari-812, Namdhari-815, Rohini, Ramya, Rasika and Lerika

were remained in good condition for upto 3 days from the harvesting.

It is revealed from Table 20(J) that most of the varieties remain in good conditon for upto 3 days. Keeping quality of improved varieties is more than that of hybrids'.

K) Maturity period : It is clear from the Table 20(·) that very few varieties matured within 65 days namely Namdhari-815 Apurva and Avinash-2. Variety Pusa Early Dwarf and hybrids such as Rupali, Rashmi, Apurva, Avinash-2, Namdhari-815, Namdhari-812, Ramya, Rasika and Lerika were matured within 70 days. We can say that 90.68 per cent recommended and non-recommended varieties were matured within 70 days.

L) Insect-pest incidence : It is clear from the Table 20( ) that large majority of the varieties having less insect pest incidence those were Avinash-2 (22.00 per cent), Rupali (1.33 per cent) Rashmi (12.00 per cent), Namdhari-812 (8.66 per cent), Namdhari-815 (7.33 per cent) Ramya (6.66 per cent), Apurva (6.00 per cent) and Money Maker (2.66 per cent). Very few varieties having severe insect pest incidence namely Avinash-2 (4.66 per cent), Rasika (2.00 per cent), Rupali, Rashmi, Lerika, Namdhari-812 and Namdhari-815 (1.33 per cent), respectively.

It can be concluded that there is less insect pest incidence on the recommended and non-recommended hybrids. There is more insect-pest incidence in the summer season than the kharif so the respondents cultivate the varieties in kharif season.

4.5 Relationship between selected independent and dependent variables

In the present investigation an attempt was made to find out the nature of relationship between the selected attributes of the tomato growers with their level of knowledge and adoption to ascertain the relationship, co-efficient of correlation (r) was worked out. The data on this aspect are presented in Table 21 and discussed in the subsequent pages.

I) Relationship of knowledge level with characteristics of tomato growers :

Knowledge or awareness about the innovation is considered as the first step in its adoption. Therefore, knowledge about farm technology is of prime importance in enhancing the rate of adoption of farm technology. However, knowledge of an individual is governed by his characteristics. Data in this respect are presented in Table 21.

a) Age and knowledge : Age of the tomato growers was found to have no relationship with their knowledge about cultivation of tomato (r = 0.153). Nimje *et al.* (1990) in

respect of cotton cultivators and Gaikwad (1992) regarding flower cultivators also observed the same type of relationship.

Table 21. Relationship between selected independent and dependent variables

Independent variables	Dependent variables	
	Knowledge	Adoption
	Correlation co-efficient	Correlation co-efficient
1. Age	0.153 NS	0.101 NS
2. Education	0.614 **	0.607 **
3. Experience	0.230 **	0.268 **
4. Size of family	-0.236 **	-0.172 *
5. Size of land holding	0.581 **	0.546 **
6. Annual gross income	0.354 **	0.339 **
7. Socio-economic status	0.491 **	0.444 **
8. Risk orientation	0.500 **	0.489 **
9. Source of information	0.742 **	0.710 **

* = Significant at 0.05% level of probability.
** = Significant at 0.01% level of probability.
NS = Non-significant.

As the age increases the experience of the farmers increases giving them more knowledge. Therefore, it was presumed that older farmers might have higher level of knowledge about improved tomato cultivation practices. However, the study has not proved this hypothesis meaning thereby that there is no relationship between age and knowledge level of tomato growers. It might be due to the fact that tomato growers irrespective of their age level might have

possessed more or less similar knowledge. All the farmers irrespective of their age, as young, middle or old would thrive to get more knowledge on tomato to increase yields and thereby more returns, which is a function of economic motivation.

b) Education and knowledge :

Education of tomato growers observed to be highly significant and positively related with their knowledge level ($r = 0.614$). Gaikwad (1992) regarding the knowledge of flower growers and Kunjir (1993) while studying fig cultivation reported that farmers education was having significant relationship with farmers' knowledge.

It is, thus, clear that more the education of farmers more is the knowledge of farmers about improved farm practices. An educated farmer has more urge for new information, more exposure to media, moreover has ability to understand new knowledge. That is why strong relationship might have been observed between education and level of knowledge of tomato growers.

c) Experience and knowledge : It was found that experience of tomato growers was highly significant and positively related with their knowledge level ($r = 0.230$).

It is believed that more the experience in any occupation better the knowledge and mastery over skills. It indicates that increase in experience, increase the knowledge level of tomato growers. This finding confirms this proposition.

d) Size of family and knowledge : It was found that family size of tomato growers and their knowledge level were negatively but significantly correlated with each other (r = 0.236). The findings are in line with those of Deshmukh (1991) regarding knowledge level of Kisan Nursery Growers. It might be due to reason that family might have good knowledge of improved cultivation practices of tomato and have more number of knowledgeable members in his family.

e) Size of land holding and knowledge : It was found that farm size of tomato growers was highly significant and positively related with their knowledge level (r = 0.581). Finding is in line with those of Nimje *et al.* (1991) regarding ber growers and Kote (1992) regarding pomegranate cultivators. It might be due to reason that big farmers might be more prone to get information about agricultural technology. Morever, such a group of farmers might have higher economic status which facilitates in acquiring knowledge of improved cultivation of tomato.

f) Annual gross income and knowledge : The relationship between annual income and knowledge level of tomato growers was observed to be statistically significant (r = 0.354). This finding is in the confirmity of findings of Nimje *et al.* (1990) and Javale *et al.* (1994) regarding ber growers and mango and citrus growers, respectively.

Farmers with better economic positions are capable of making investment in the improved farm technology, which is capital intensive and probably this might be the reason that they were found to have more knowledge about the recommended practices of tomato.

g) Socio-economic status and knowledge : The socio-economic status of tomato growers exhibited positive and highly significant relationship with their level of knowledge about improved practices of tomato cultivation (r = 0.491). The studies by Deshmukh (1991) regarding Kisan nursery growers and Patil (1992) regarding banana growers indicated positive and significant relationship of socio-economic status of individual with their knowledge level.

This might be due to the fact that well todo farmers have more exposure to information sources and channels which enables them to seek more information on modern agriculture.

h) Risk orientation and knowledge : There was positive and highly significant correlation (r = 0.500) between risk orientation and knowledge of improved practices of tomato cultivation among the tomato growers.

The finding is in confirmatory with the findings of Reddy and Reddy (1988) and Pandya and Vekaria (1994) regarding paddy cultivators and banana growers, respectively.

Those respondents who had high risk orientation are psychologically prepared to try new innovations with a view to make progress in farming. These factors might have stimulated them to gain knowledge about improved technology. This indicates that higher the risk orientation higher is the knowledge of improved practices of crop production.

i) Information source and knowledge : It was observed that information sources of tomato growers was highly significant and positively related with their knowledge level (r = 0.742).

Majority of farmers were having good socio-economic status. Such type of factors might have facilitated them to have more facilities and use of information sources for gaining the knowledge.

The finding is in confirmatory with the findings of Waghmare *et al.* (1988) and Thakur *et al.* (1991).

II) Relationship of adoption levels with selected characteristics of tomato growers :

An attempt was made to know whether the adoption level of tomato growers had relationship with their characteristics. It was felt that the understanding about this aspect would help in identifying the farmers whose adoption still need to be increased their knowledge level about improved tomato cultivation practices through different methods and communication media. The data in this regard are presented and discussed in following paras (Table 21).

a) Age and adoption : It was observed that relationship between the age of tomato growers and their level of adoption of tomato cultivation practices was non-significant ($r = 0.101$). Patil and Waghdare (1989) while studying adoption behaviour of banana cultivation found that age had non-significant relationship with the adoption level of respondents.

From the present study, it is inferred that age of the tomato growers did not influence their adoption behaviour pertaining to tomato cultivation practices. This may be due to the fact that young men are enthusiastic, energetic, creative and progressive in nature. The farmers who are older in age are likely to be orthodox, conservative and traditional

minded. In this study relatively more respondents are from middle aged group and therefore, they may not be giving favourable responses to new farming ideas.

b) Education and adoption : Relationship between education and adoption level of tomato growers was found to be positively significant (r = 0.607). Kadam and Jagtap (1991) while studying the adoption of improved banana technology, Kote (1992) in the case of pomegranate cultivation reported similar findings.

This means that the higher the level of education higher is the adoption level. Education helps an individual to acquire more knowledge, understand better and inclined to get correct information for use in farming. The farmers orientation towards scientific farming may increase due to education which leads them to acquire greater production by adopting modern agricultural production techniques. Education makes man to believe in science and technology and thereby modernise his way of thinking and acting. This might be the reason for higher educated farmers having higher adoption.

c) Experience and adoption : Experience of the tomato growers exhibited highly significant and positive relationship with the adoption of improved cultivation practices of tomato (r = 0.268). Karale (1985) and Takate

(1987) reported similar findings while studying the groundnut adoption behaviour. It is believed that more the experience in any occupation better is the knowledge and mastery over skills and thereby better adoption. This hypothesis has been proved by this study.

d) Size of family and adoption : It was observed from the data that the family size had negative and significant relationship with adoption level (r = -0.172).This finding is confirmity of the findings of Deshmukh (1991) regarding Kisan nursery growers.

Number of members in a family can provide more labour force for adoption of farm practices. In fact improved farm implements reduces the requirement of labour. This may be a reason of no relationship. So that family size is not very important aspect for adoption of tomato cultivation practices. Positive hypothesis stated has been refuted.

e) Size of land holding and adoption : Relationship between farm size and adoption level of various cultivation practices of tomato was found to be highly significant and positive (r = 0.546). Nalwade (1989) while studying potato cultivation and Kote (1992) in the case of pomegranate cultivation reported the similar findings.

It can be inferred that farmers with large farm size have high level of adoption. Farmers with large holding may be having better income level and may be having more risk orientation. Size of holding also decides the economic position of a farmer. This might have lead to more adoption.

f) **Annual gross income and adoption :** The annual gross income of tomato growers exhibited positive and highly significant relationship with their adoption level of improved cultivation practices of tomato (r = 0.339). This finding is in line with the findings reported by Nimje *et al.* (1990) in the case of ber cultivators, Kadam and Jagtap (1991) while studying potato growers adoption behaviour.

The reason behind this might be that tomato growers with sound economic position might be more capable to procure inputs needed for the adoption of improved practices of tomato, cultivation and the farmers having high levels of income offered to take risk of accepting the recommended farm techniques.

g) **Socio-economic status and adoption:** Relationship between socio-economic status and adoption level was found to be highly significant (r = 0.444). Chiprikar (1988) and Kote (1992) also reported the similar findings while studying grape and pomegranate growers adoption behaviour. The socio-economic

status has greater influence on the adoption of improved agriculture technology. The farmers with high socio-economic status are usually a ahead in adoption of improved agriculture practice and have more exposure to electronic and print media than rest of the farmers. Higher socio-economic status provides better environment to a farmer to adopt an innovation by seeking needed information from credible sources.

h) Risk orientation and adoption : Relationship between risk orientation and adoption level of various cultivation practices of tomato was found to be highly significant and positive (r = 409). Similar findings were recorded by Kadam and Jagtap (1991) and Pandya and Vekaria (1994) while studying potato and banana growers adoption behaviour, respectively.

Those respondents who had high risk are psychologically prepared to try new innovations with a view to make progress in farming. They have foresight and rational thinking. These facts might stimulate them to adopt improved technology. Thus, this indicates that higher the risk orientation, higher the adoption of improved practices of tomato cultivation.

i) Sources of information & adoption : Relationship between the sources of information of tomato growers and

adoption is found to be positive and highly significant (r = 0.710). This finding is in confirmatory with the findings of Waghmare *et al.* (1988) in respect of fruits and vegetable growers.

Sources of information is one of the important aspects for adoption of improved practice. It reveals that with increased use of sources of information by farmers, there is increase in their adoption level.

4.6 Multiple regression analysis of dependent variables with independent variables among tomato growers

To explain the extent of variability caused by the set of independent variables in dependent variables,regression analysis was done. The dependent variables of the study were knowledge and adoption of recommended practices of tomato. A set of nine variables were selected to explain the variation in the dependent variables.

The multiple regression analysis was done and the results are presented in Table 22.

A) Multiple regression of the dependent variable 'Knowledge':

It is seen from the data presented in Table 22(A) that the nine independent variables namely age, education, experience, size of family, size of land holding annual income, socio-economic status, risk orientation and source of

Table 22A. Multiple regression analysis of knowledge of farmers about recommended practices of tomato

Independent variables	'b' value	Standard error	Calculated 't' value	R^2
1. Age	0.0760*	0.0322	2.36	
2. Education	0.5915**	0.1687	3.51	
3. Experience	-0.0025NS	0.0949	-0.03	
4. Size of family	0.3211**	0.1649	1.95	
5. Size of land holding	0.8879*	0.3514	2.53	
6. Annual gross income	-0.0229NS	0.0240	-0.95	0.70
7. Socio-economic status	-0.0323NS	0.0326	0.99	
8. Risk orientation	-0.1739NS	0.1775	-0.98	
9. Source of information	1.3115**	0.1659	7.91	

Table 22B. Multiple regression analysis of adoption of farmers about recommended practices of tomato

Independent variables	'b' value	Standard error	Calculated 't' value	R^2
1. Age	0.0309NS	0.0354	0.87	
2. Education	0.6932**	0.1857	3.73	
3. Experience	0.1473NS	0.1045	1.41	
4. Size of family	-0.1273NS	0.1815	-0.70	
5. Size of land holding	-0.8590*	0.3869	2.22	
6. Annual gross income	-0.0103NS	0.0264	-0.39	0.64
7. Socio-economic status	-0.0046NS	0.0359	0.13	
8. Risk orientation	-0.2823NS	0.1955	-1.44	
9. Source of information	1.2430**	0.1827	6.80	

*, ** = Significant at 0.05 and 0.01 level of probability, respectively.
NS = Non-significant.

information have explained 70 per cent of the total variation in the dependent variable, 'knowledge'.

Independent variable sources of information contributed significantly more (b value = 1.3115) as compared to other independent variables. Amongst the other independent variables namely age, education and size of land holding exhibited positive and significant contribution in variation of knowledge of tomato growers.

The variable size of family was found to have negative and significant contribution. The contribution of four other variables namely, annual gross income, socio-economic status, risk orientation and experience were found to be statistically non-significant.

In other words it can be said that the sources of information available to the farmers for enriching their knowledge about crop production technologies play an important role besides the other aspects such as age and education of the farmers. This suggests that the extension agencies need to concentrate their efforts in media use for transfer of technology.

B) Multiple regression of the dependent variable 'Adoption':

It is seen from the Table 22(B) that nine variables have explained 64 per cent of the total variation of the

dependent variables. It is seen from table that sources of information (b value = 1.2430) contributed significantly. Other variables namely education, and size of land holding had positive and significant contribution in variation of the dependent variable. The variables namely age, size of family, annual gross income, socio-economic status, risk orientation and experience were found to be statistically non-significant.

Like that of contribution of sources of information in knowledge it has also shown maximum contribution in adoption aspect of the respondents. Thus, it can be said that source of information or `media' play an important role both in knowledge gain of the farmers as well as adoption of improved farm technologies by them. This findings is in confirmatory with the findings of Gogoi *et al.* (1989).

4.7 Other related aspects studied

4.7.1 Constraints in tomato production and marketing

Eventhough the farmers knew the technology and had adopted on their farms, they face many problems in production and marketing of their produce. With this view, the information regarding constraints faced by tomato growers is presented in Table 23 and discussed in following paras.

I) Availability of farm yard manures (FYM) :

More than half of the farmers (55.33 per cent) expressed the non-availability of FYM for applying to their

Table 23. Constraints experienced by tomato growers in cultivation and marketing of tomato

Constraints	Frequency	Per cent (N-150)
1	2	3	4
I)	Availability of farm yard manure		
	1. Non-availability of FYM	83	55.33
	2. No possession of animals	12	8.00
	3. Lack of money to purchase FYM	8	5.33
II)	Seed and seed treatment :		
	1. High cost of seed	99	66.00
	2. Less germination of seed	34	22.66
	3. Lack of technical knowledge about seed treatment	23	15.33
	4. Non-availability of fungicide for seed treatment	17	11.33
III)	Raising of seedlings		
	1. Trace of water in summer	57	38.00
	2. Non-availability of phorate	27	18.00
	3. Late mansoon causes delay in transplanting of seedlings	22	14.66
IV)	Fertilizer application		
	1. Higher cost of fertilizer	140	93.33
	2. Non-availability of needed fertilizers	87	58.00
	3. Lack of knowledge about the application of inorganic fertilizers	34	22.66

Table 23. Contd.....

1	2	3	4
V)	Irrigation water		
	1. Non-availability of water at the time of various stages of crop	52	34.66
	2. Irregular supply of electricity	32	21.33
VI)	Plant protection		
	1. Non-availability of pesticides and insecticides at proper time	80	53.33
	2. High cost of insecticides and pesticides	116	77.33
	3. Lack of knowledge about plant protection schedule	70	46.66
	4. Lack of guidance from extension agencies	58	38.66
	5. Lack of quality and effective pesticides	17	11.33
VII)	Marketing constraints		
	1. Commission agents charge more	140	93.33
	2. Cheating by middlemen	126	84.00
	3. Low market price than expected	125	83.33
	4. Non-availability of labour for picking tomato	90	60.00
	5. Lack of knowledge about proper grading	40	26.66
	6. Inadequate storage facility	32	21.33
	7. Lack of proper marketing place for tomato	24	16.00
	8. Inadequate transport facilities	16	10.66
VIII)	Credit		
	1. Lack of timely credit availability	72	48.00

tomato crop. Possession of limited number of animals may be the reason of low production of organic manure like FYM. It suggested that farmers should prepare their own manures like compost.

II) Seeds and seed treatment :

As regards seed and seed treatment, it is observed that (66.00 per cent) tomato growers reported that the price of seed is very high. Similarly, considerable number of farmers (22.66 per cent) reported the problem of low germination. Prices of hybrid seeds are generally high compared to recommended varieties and farmers under study had used the hybrids produced by private firms.

III) Raising of seedlings :

Trace of water at the time of seedlings growing during summer was the problem faced by sizable number of farmers (38.00 per cent). This problem can be solved by farmers themselves by using the water conservation and water saving technologies like sprinkler & drip irrigation systems.

IV) Fertilizer application :

Large majority of farmers (93.33 per cent) reported that the prices of inorganic fertilizers were very high followed by non-availability of needed fertilzers (58.00 per cent) at the time of their application.

V) Irrigation water management :

Constraints with regards to water management which was experienced by the respondent was non-availability of water at the time of various stages of crops (34.66 per cent). Irregular supply of electricity (21.33 per cent) was the other problem faced by tomato growers.

VI) Plant protection :

With regards to plant protection first ranked constraint as expressed by more than three fourth (77.33 per cent) of tomato growers was high cost of insecticides and pesticide and the same was followed by lack of knowledge about plant protection schedule (46.66 per cent), non-availability of insecticides and pesticide at proper time (53.33 per cent) and lack of guidance from extension agency (38.66 per cent).

VII) Marketing constraints :

Farmers expressed their problems regarding marketing of tomato and these were mostly related to role of middlemen in marketing transactions.

According to them commission agents charge commission more towards marketing (93.33 per cent) and majority of growers also expressed that the middlemen are cheating (84.00 per cent). This indicates that farmers should have proper marketing net work.

Other constraints experienced were regarding non-availability of labour (60.00 per cent) for picking which was faced by the majority and low market prices (83.33 per cent) experienced by majority of tomato growers.

VII) Credit :

Around half of the respondents (48 per cent) expressed that the credit was not available when it is needed.

It can be summarised from the data presented and discussed above that non-availability of FYM, high cost of seed, trace of water in summer, higher cost as well as non-availability of needed fertilizers, high cost of insecticides and pesticides, more charges by commission agents, low sale prices of tomato were the problems expressed by larger number of tomato growers. However, the problems pertaining to no possession of animals, lack of money to purchase FYM, lack of know-how about seed treatment and non-availability of seed treatment fungicides, non-availability of phorate, lack of knowledge about fertilizer application, irregular supply of electricity, lack of knowledge about proper grading, inadequate storage and transport facilities and untimely credit availability were faced by comparatively less number of tomato growers.

4.7.2 Suggestions of the tomato growers to overcome the constraints

Considering the constraints faced by the tomato growers in cultivation of tomato crop, they were asked to suggest the probable solution in order to overcome the constraints and increase the productivity of crop. They made very useful suggestions for increasing yield of tomato. These suggestions are collected and presented in Table 24.

Large number of the tomato growers made the suggestions which are mostly related to marketing aspects. According to them there is a need to have a effective marketing net work in order to fetch the reasonable and remunerative prices for their crop produce.

For the purpose, farmers should have their strong organisations or co-operativeness through which they can perform all the functions from seed to marketing. Such farmers co-operatives for vegetable and fruit crops have been emerged in the State of Maharashtra.

Extension agencies particularly T & V functionaries can concentrate their efforts towards these aspects.

Table 24. Suggestions of tomato growers to overcome the constraints

	Suggestions	Frequency	Per cent (N=150)
1.	Creating effective and efficient marketing system	134	89.33
2.	Providing fertilizers and pesticides with subsidised rates	130	86.66
3.	Assured and reasonable selling price of tomato	129	86.00
4.	Availability of timely and sufficient credit	72	48.00
5.	Timely availability of quality insecticides and pesticides	68	45.33
6.	Making timely availability of seeds of improved varieties/hybrids	50	33.33
7.	Creation of cold storage facilities	47	31.33
8.	Farmers rallies, exhibition on tomato crop	36	24.00
9.	Organisation of method demonstration on plant protection	32	21.33
10.	Timely guidance by the village extension workers	19	12.66

SUMMARY, CONCLUSIONS AND IMPLICATIONS

5. SUMMARY, CONCLUSIONS AND IMPLICATIONS

In an agrarian country like India national income is born by agricultural industries. In the near future farmers will be required to harvest more vegetable crops to fulfil the need of increasing population. On the other hand they will also be required to produce more vegetable crops for supplying them as a raw material to the vegetable based agro-industries and for export marketing. Under these circumstances, it is essential to plan a strategy for increasing the vegetable production, the success of which depends on the farmers' share in such strategy of increasing vegetable production.

The adoption of improved technology by the farmers therefore, becomes imperative, to increase agricultural production. However, it is well known that there persists a gap between pace of research and the readiness with which farmers accept its findings.

Tomato is one of the important vegetable crops in India. However its total production is not sufficient to fulfil the existing need of the people. Hence in India there is wide scope and need to increase the production of tomato and make it available to the masses at a cheaper rate.

In India tomato has become popular during the last five decades. The fruit is cultivated throughout the country. In India it is grown over an area of 30,8653 hectares with the production of 48,49,568 metric tonnes with an average yield of 15.71 t/ha. In Maharashtra, tomato is grown on an area of 22,125 hectares with the production of 5,53,125 metric tonnes with an average yield of 25 t/ha. Two third of this area is concentrated in Nasik, Ahmednagar, Sangli, Satara and Pune districts (Source : DATABASE, National Horticultural Board, Ministry of Agriculture, Govt. of India, 1992-93).

Though the hectarages under this crop is increasing, per hectare yield of tomato has not reached to its maximum. It can be increased only by efficient use of available resources and adoption of improved package of practices. Tomato growers might be facing certain problems in cultivation of the crop. The present study was attempted in this direction.

The research study entitled "A study of tomato growers from Ahmednagar district with particular reference to adoption of improved varieties" was undertaken with the following specific objectives.

1. To study the personal and socioeconomic background of tomato growers.

2. To study the level of knowledge and adoption of improved practices of tomato cultivation by tomato growers.

3. To know the adoption of different varieties of tomatoes by the farmers.

4. To understand the constraints encountered by tomato growers in securing seed of improved varieties, cultivation and marketing of tomato.
5. To find out the relationship between selected characteristics of the tomato growers and their knowledge and adoption of improved package of practices of tomato.

On the basis of maximum area under tomato, Sangamner tahsil of the Ahmednagar District was selected for the study. Two stage random sampling technique was applied for selection of farmers. The findings of this study are based on the data collected by interviewing 150 respondents from 10 villages of Sangamner tahsil of Ahmednagar district. The data collected were processed and statistically analysed. The data are presented and discussed by using the frequencies, percentages and ranking. The "coefficient of correlation" (r) was computed for finding out the relationship between the selected characteristics of tomato growers with their level of knowledge and adoption of tomato cultivation as dependent variables. To explain the extent of variability caused by the set of independent variables in dependent variables multiple regression analysis was used. The summary of the important findings is given in following paras.

5.1 Summary

5.1.1 Personal, socio-economic, psychological and communication characteristics of tomato growers

The study pointed out that 46.66 per cent, tomato growers belonged to middle age group, while 30.68 per cent and 22.66 per cent of tomato growers belonged to old and young age group respectively.

Most of the tomato growers (43.33 per cent) had primary education, 24.00 per cent of them received secondary education, whereas 14.68 per cent of them were illiterate. However 9.33 per cent and 8.66 per cent of them had higher secondary and college level education, respectively. Most of the tomato growers (44.00 per cent) had 10 to 23 years experience in farming. Around one third (32.00 per cent) were having maximum experience that is more than 23 years. Large number of tomato growers (71.84 per cent) had small sized family followed by those having large size of family (28.66 per cent).

Majority of the tomato growers (62.00 per cent) had small size of land holdings while 29.33 per cent and 8.68 per cent of them had medium and large size of land holding, respectively.

Three-fourth of the tomato growers (75.33 per cent) had medium level of annual income followed by 13.33 per cent

and 11.34 per cent who had low and high annual gross income respectively.

Nearly, two third of the tomato growers (64.00 per cent) had medium level of socio-economic status followed by those having high (18.67 per cent) and low level of socio-economic status (17.33 per cent).

Two-third of tomato growers (66.00 per cent) had medium level of risk orientation capacity, while 24.00 per cent and 20.00 per cent of them had low and high risk orientation capacity.

Personal cosmopolite and interpersonal sources of information namely Agricultural Extension Officer (73.33 per cent), relatives (51.33 per cent), progressive farmers (44.66 per cent) and friends (39.33 per cent) played an important role in communication of tomato cultivation technology. Electronic and print media channels namely, Television (30.00 per cent), Radio (28.00 per cent), Newspapers (24.66 per cent) and Farm Magazines (20.66 per cent) were also used by considerable number of growers for the knowledge of improved farming.

5.1.2. Other information about tomato growers

Of the 150 tomato growers under study, the highest proportion of them (92.66 per cent) had medium level of family

education status, while only 4.00 per cent and 3.34 per cent had low and high family educational status respectively. Large number of tomato growers (68.00 per cent) had nuclear family, while 32.00 per cent tomato growers had joint family.

The majority of the tomato growers (82.67 per cent) as well as the main source of irrigation only 17.33 per cent of them had canal as a source of irrigation. More than half of the tomato growers (60.00 per cent) were having round the years irrigation availability, while 40.00 per cent growers had seasonal irrigation availability.

As the area under tomato was concerned, majority of the tomato growers (70.67 per cent) had grown tomato on an area upto 0.5 ha, while 26.00 per cent, 2.00 per cent and 3.00 per cent growers had taken tomato on 0.5 to 1.00 ha, 1.00 to 1.ha and above 1.5 ha, respectively. More than half of the tomato growers (57.34 per cent) had taken tomato for 6 to 12 seasons, whereas 20.66 per cent and 22.00 per cent had taken tomato for 6 seasons and more than 12 times continuously.

Large majority of the tomato growers (93.33 per cent) were using tomato in their diet. In users 63.38 per cent were using tomato for preparation of Bhaji, while 19.00 per cent, 10.56 per cent and 7.04 per cent using for table purpose such as preparation of *Chatani* and *Koshimbir*, respectively.

Nearly two third of tomato growers (73.33 per cent) had no knowledge about the products of tomato whereas 26.67 per cent had knowledge about the products of tomato.

More than half of tomato growers (64.00 per cent) had no knowledge about the dietary importance of tomato, while 36.00 per cent knew about it.

5.1.3. Knowledge of tomato growers about improved tomato cultivation practices

It was observed that large number of tomato growers (78.00 per cent) had medium level of knowledge about tomato cultivation practices. While 12.67 per cent had high level of knowledge and 9.33 per cent low level of knowledge about tomato cultivation practices.

All the farmers had the knowledge about recommended soil type (100.00 per cent), ploughing (100.00 per cent) harrowing (100.00 per cent). While majority of the respondent knew about FYM application (90.66 per cent).

Very few farmers were knowing about the recommended varieties namely Pusa Early Dwarf (37.33 per cent), Pusa Ruby (34.66 per cent), Money Maker (26.66 per cent), Dhanashree (14.66 per cent) and Bhagyashree (14.66 per cent). None of the respondents was knowing about the recommended hybrid Rajashree.

Majority of the tomato growers were knowing about the non-recommended hybrids of private seed producers. They were knowing about Rupali (94.66 per cent), Rashmi (88.00 per cent), Avinash-2 (48.00 per cent), Apurva (31.33 per cent), Ramya (27.33 per cent), Namdhari-812 (26.00 per cent), Namdhari-815 (24.00 per cent), Rohini (16.66 per cent), Lerika (15.33 per cent) and Rasika (12.00 per cent).

More than half of the respondents (64.66 per cent) had knowledge about recommended seed rate of varieties, while 56.00 per cent had knowledge about seed rate of hybrids. Seed treatment of thirum had known to 57.33 per cent respondents.

All the farmers had knowledge about kharif planting (100.00 per cent), while 93.33 per cent and 78.00 per cent had knowledge about summer and rabi planting of tomato respectively. All the farmers had knowledge about method of planting. Nearly two third respondents had knowledge about kharif spacing (71.34 per cent), while 68.00 per cent had knowledge about rabi and summer spacing of tomato.

More than half of the respondents (68.66 per cent) had knowledge about nitrogen application, while 49.34 per cent and 48.00 per cent had knowledge about phosphorus and potassium application.

All the respondents had knowledge about supporting method to the tomato (100.00 per cent), while majority of the respondents had knowledge about weeding (88.67 per cent).

All the tomato growers had knowledge about summer irrigation, while 77.34 per cent and 71.34 per cent had knowledge about kharif and rabi irrigation, respectively.

The practices which were known to considerably less number of tomato growers were control of insect pest like fruit fly and white fly (47.33 per cent), fruit borer (48.00 per cent), top shoot borer (36.66 per cent), leaf eating caterpillar (45.33 per cent) and diseases like powdery mildew (49.33 per cent), wilt (53.33 per cent) and cracking of fruits (30.66 per cent).

All the farmers had knowledge about proper time of harvesting of tomato (100.00 per cent).

5.1.4. Adoption of improved tomato cultivation practices by tomato growers

From the study it was observed that large majority of tomato growers (85.33 per cent) had adopted the recommended tomato cultivation practices to the medium extent, while 8.00 per cent and 6.67 per cent of them had adopted the practices to high and low extent, respectively.

All the farmers adopted the recommended soil type (100.00 per cent). While 81.33 per cent and 36.67 per cent adopted the harrowing and FYM application respectively.

Very few number of farmers adopted the recommended varieties namely Pusa Early Dwarf (0.66 per cent) and Money Maker (3.33 per cent). None of the farmers adopted the recommended varieties like Pusa ruby, Dhanashree, Bhagyashree and hybrid Rajashree.

Considerable number of farmers were adopting the non-recommended hybrids namely Rupali (14.66 per cent), Rashmi (13.33 per cent), Avinash-2 (26.67 per cent), Apurva (6.00 per cent), Ramya (6.66 per cent), Namdhari-812 (10.00 per cent), Namdhari-815 (8.66 per cent), Rohini (3.33 per cent), Lerika (4.00 per cent) and Rasika (2.66 per cent).

More than half of the farmers adopted the recommended seed rate of hybrids (56.00 per cent), while only 4.00 per cent adopted the recommended seed rate of varieties. More than half of the farmers adopted the thirum seed treatment.

Majority of the tomato growers (65.34 per cent) adopted kharif planting of tomato, while 10.66 and 24.00 per cent adopted rabi and summer planting of tomato, respectively. All the farmers adopted ridges and furrow method of planting (100.00 per cent) for tomato.

Most of the respondents (65.34 per cent) adopted the recommended spacing for kharif tomato, while 34.66 per cent adopted the recommended spacing for rabi and summer tomato.

Majority of the farmers (66.67 per cent) adopted the nitrogen application, while 36.00 per cent and 26.00 per cent adopted the phosphorus and potassium application respectively. All the farmers adopted the practice of supporting to tomato (100.00 per cent), while 88.67 per cent adopted the weeding.

Majority of the farmers were adopting the kharif irrigation (65.34 per cent), while 10.66 per cent and 24.00 per cent were adopting rabi & summer irrigation respectively.

Considerable number of farmers adopted the practices insects pest to control like fruit fly and white fly (31.33 per cent), fruit borer (28.66 per cent), top shoot borer (22.00 per cent), leaf eating caterpillar (21.34 per cent) and diseases like (45.34 per cent), wilt (47.34 per cent) and cracking of fruits (12.66 per cent).

5.1.5. Adoption of improved varieties/hybrids and information about different aspects

Major focus of the study was on varietal adoption by the tomato growers, since number of varieties and hybrids

have been released by the agencies both in government and private sectors.

It is seen that only 0.66 per cent and 3.33 per cent tomato growers under study used Pusa Early Dwarf and Money Makers as a recommended varieties. Other tomato growers used non-recommended hybrids of private seed producers viz., Rupali (14.66 per cent), Rashmi (13.33 per cent), Avinash-2 (26.66 per cent), Apurva (6.00 per cent), Namdhari-812 and Namdhari-815 (8.66 per cent and 10.00 per cent respectively). Few farmers used Rohini (3.33 per cent), Ramya (6.66 per cent), Rasika (2.66 per cent) and Lerika (4.00 per cent).

It was noticed that the farmers who have cultivated recommended varieties like Money Maker and Pusa Early Dwarf purchased the seed from the private seed sellers seed of Money Makers (1.33 per cent) and Rashmi (0.66 per cent) was purchased from their friends. All the remaining farmers who have cultivated non-recommended varieties purchased the seed from the private seed sellers.

It was seen farmers using recommended varieties namely Pusa Early Dwarf and Money Maker used the proper seed rate i.e. 0.4 to 0.5 kg per hectare. The farmers who were cultivating the non-recommended hybrids were using the recommended seed rate of 0.10 to 0.15 kg per hectare.

Few farmers were observed to be using the seed rate below the recommended seed rate. This was in respect of Namdhari-812 (1.33 per cent), Namdhari-815 (2.66 per cent) and Ramya (2.00 per cent). Some of the farmers were using more than recommended seed rate of hybrids in respect of Rupali (1.33 per cent), Rashmi (2.00 per cent), Namdhari-812 and Namdhari-815 (2.00 per cent and 1.33 per cent, respectively).

It was clearly noticed that there was no problem of availability of the seeds of varieties/hybrids of tomato desired by the farmers as most of them (95.34 per cent) reported timely availability of seeds.

It was reported by the growers that the varieties like Pusa Early Dwarf (0.66 per cent), Money Maker (3.33 per cent), Rupali (11.33 per cent), Rashmi (10.66 per cent), Avinash-2 (4.66 per cent) were having 70-80 per cent germination percentage i.e. the desired level of germination percentage. Improved and recommended varieties namely Money Maker and Pusa Early Dwarf were having germination percentage between 70-80 per cent as reported by the farmers. This is somewhat below the desired level of germination percentage. Germination percentage of some of the hybrids (Rupali and Rashmi) was also reported to be between 70 and 80 per cent.

It was noticed that the hybrids namely Rupali, Rashmi and Avinash-2 of private seed producers were adopted continuously by the tomato growers.

It was reported by the farmers that the hybrids namely Rupali, Rashmi, Avinash-2, Namdhari-815 and Ramya are giving expected yields followed by the improved varieties.

Non-recommended hybrids received medium market prices i.e. from Rs. 4 to 10/kg. All the recommended and non-recommended varieties were reported to be suitable for transport.

It was noticed that very few varieties remained in good condition after harvesting i.e. for 3-6 days. Those were namely Money Maker (1.33 per cent) and Rupali (2.66 per cent) hybrids such as Rupali, Rashmi, Avinash-2, Apurva, Namdhari-812, Namdhari-815, Rohini, Ramya, Rasika, Lerika remained in good condition upto 3 days after the harvesting. There is less insect pest incidence on the varieties/hybrids.

Large majority of the tomato growers (85.34 per cent) had no knowledge about the varieties released by the Mahatma Phule Krishi Vidyapeeth, Rahuri.

5.1.6 Relationship of characteristics of tomato growers with their level of knowledge and adoption

The characteristics viz., education, size of land holding, annual gross income, socio-economic status, risk

orientation, experience and source of information exhibited positive and highly significant relationship with the knowledge and adoption level of tomato growers, while size of family found to have negative and significant relationship with knowledge and adoption level of tomato growers. However, age of the growers was found to have no significant relationship with their knowledge as well as adoption level of the tomato growers.

5.1.7. Multiple regression analysis of knowledge and adoption of recommended practices of tomato Knowledge :

It was observed that nine variables under study namely, age, education, experience, size of family, size of land holding, annual gross income, socio-economic status, risk orientation and source of information could cause 70 per cent variation in the dependent variable `Knowledge' of the tomato growers. Independent variables namely age, education, size of land holding and source of information exhibited significant and positive contribution in dependent variables. Study pointed out that the independent variable sources of information alone could cause highest contribution (b value = 1.3115) in dependent variables as compared to other independent variables under study.

Adoption :

It was observed that nine independent variables under study namely age, education, experience, size of family, size of land holding, annual gross income, socio-economic status, risk orientation and source of information could cause 64 per cent variation in the dependent variable `Adoption' of the tomato growers. Independent variables namely education, size of land holding, socio-economic status, experience and source of information exhibited significant and positive contribution in dependent variable. Study pointed out that the independent variable sources of information alone could cause highest contribution (b value = 1.2430) in dependent variable as compared to other independent variables under study.

5.1.8 **Other related aspects studied about tomato growers**

i) **Constraints** : More than half of the farmers (55.33 per cent) expressed the non-availability of FYM for applying to their tomato crop. Possession of limited number of animals may be the reason of low production of organic manure like FYM.

As regards seed and seed treatment, its observed that (66 per cent) tomato growers reported that the price of seed is very high. Similarly, considerable number of farmers (22.66 per cent) reported the problem of low germination.

Trace of water at the time of seedlings growing during summer was the problem faced by sizable number of farmers (30 per cent).

Large majority of farmers (93.33 per cent) reported that the prices of inorganic fertilizers were very high followed by non-availability of needed fertilizers (58.00 per cent) at the time of their application.

Constraint with regards to water management which was experienced by the respondents was non-availability of water at the time of various stages of crops (34.66 per cent). Irregular supply of electricity (21.33 per cent) was the other problem faced by tomato growers.

With regards to plant protection first ranked constraint as expressed by more than three fourth (77.33 per cent) of tomato growers was high cost of insecticides and pesticide followed by lack of knowledge about plant protection schedule (46.66 per cent), non-availability of insecticides and pesticide at proper time (53.33 per cent) and lack of guidance from extension agency (38.66 per cent).

Commission agents charge their commission more towards marketing (93.33 per cent) and majority of growers also expressed that middlemen are cheating (84.00 per cent). Other constraints experienced were regarding non-availability

of labour (60.00 per cent) for picking which was faced by the majority and low market prices (83.33 per cent) experienced by majority of them.

Around half of the respondents (48 per cent) expressed that the credit was not available when it was needed.

ii) Suggestions by tomato growers : Large number of the tomato growers made the suggestions which were mostly related to marketing aspects. According to them there is a need to have a effective marketing network in order to get remunerative prices for their crop produce.

For the purpose, farmers should have their strong organizations or co-operativeness through which they can perform all the functions from seed to marketing. Such farmers' Co-operatives for vegetable and fruit crops have been emerged in the State of Maharashtra.

Extension agencies, particularly T & V functionaries can concentrate their efforts towards these aspects.

5.2 Conclusions

5.2.1 General information about tomato growers

The highest proportion of tomato growers (92.66 per cent) were having medium level of education status. More than half of the tomato growers (68.00 per cent) were from nuclear

family. Majority of the growers (82.87 per cent) had wells as main source of irrigation and 60 per cent had round the year irrigation availability. More than half of tomato growers (70.67 per cent) had grown tomato on area upto 0.5 ha. More than half of tomato growers (57.34 per cent) taking tomato for 6 to 12 seasons. Large majority of the tomato growers (93.33 per cent) were using tomato in their diet for preparation of Bhaji, Chatani. Very few (26.67 per cent) tomato growers had knowledge about the products of tomato. Large number of tomato growers (64.00 per cent) were not having knowledge about the dietary importance of tomato.

5.2.2 Personal, socio-economic, psychological and communicational characteristics of tomato growers

Majority of the respondents were from middle age group, educated between primary and secondary school level, from small farmers category, having small size of family, medium annual gross income, medium socio-economic status, medium risk orientation capacity, ten to twenty third year experience in the farming and were using inter personal and cosmopolite sources of information for the knowledge of tomato cultivation practices.

5.2.3 Knowledge and adoption of improved tomato cultivation practices

It was observed that large majority of the tomato growers (78.00 per cent) had medium level of knowledge about improved cultivation practices of tomato. Similarly, large majority of the tomato growers (85.33 per cent) had medium level of adoption of improved cultivation practices of tomato.

5.2.4 Adoption of improved varieties

It was found that almost all the respondents used non-recommended varieties, the seeds of which were purchased from private dealers. Most of the growers were lacking in knowledge about recommended varieties and hybrids. However, most of the farmers who were cultivating hybrids of tomato expressed that the germination of these hybrids was optimum, have a good keeping quality upto eight days, give yields at expected level and fetching satisfactory market prices.

5.2.5 Relationship between tomato growers'characteristics with their knowledge and adoption of improved cultivation practices of tomato

It is concluded that with the increased level of education, family size, size of land holding, annual income, socio-economic status, risk orientation, experience and source of information of tomato growers, their level of knowledge and adoption of tomato cultivation practices also increased. The

variable age was found to have no relationship with the knowledge and adoption level of tomato growers. It is also concluded that source of information could contribute more variation in knowledge and adoption of tomato growers.

5.2.6 Other related aspects studied

The important constraints reported by considerable number of the respondents with respect to cultivation and marketing of tomato were non-availability of FYM, high cost of seed, trace of water in summer, higher cost of fertilizer, non-availability of needed fertilizer, high cost of insecticides and pesticides, non-availability of pesticides and insecticides at proper time more charges by commission agents, cheating by middlemen, low market price than expected and non-availability of labour.

Effective and efficient marketing system was one of the important suggestions made by majority of tomato growers. The other suggestions were providing, fertilizers and pesticides at subsidised rates, assured and reasonable selling prices of tomato, availability of timely and sufficient credit, timely availability of insecticides and pesticides and creation of cold storage facilities.

It was observed that most of the tomato growers were self motivated to take up the cultivation of the crop

followed by those who were motivated by the Village Extension Workers.

5.3 Implications

The author hopes that this research study would be highly useful in understanding the personal characteristics of the tomato growers and the constraints faced by them, while adopting the tomato production technology. Moreover, the results of this study would provide a guideline to policy makers, executors and the extension agents associated with the olericulture development for promoting future activities and for bringing about desirable changes in the Olericulture development. Suggestions made by the tomato growers would be useful to overcome the constraints in adoption of tomato cultivation technology. On the basis of the results of the study, following implications are drawn.

5.3.1 Action implications

1. It was found that majority of tomato growers were ignorant about plant protection measures and fertilizer mamagement. This shows that the extension agencies concerned with Olericulture need to orient their programmes towards educating the farmers regarding these practices of tomato cultivation and management by giving training, organising field tour and conducting demonstrations.

2. The study pointed out that majority of tomato growers were facing problems pertaining to marketing of tomato, high cost of fertilizers and pesticides, low selling prices of tomato, which resulted into lowering the profit margin to them. It implies establishing, strengthening or re-organising, "Tomato Growers' Co-operative Marketing Societies" so that they may get appropriate share from marketing of tomato.

3. As Olericulture is a capital intensive, majority of the tomato growers had undertaken it on a small scale. Arrangement of credit supply at low interest rates and for longer duration of loan repayment and subsidised production inputs are needed to meet the farmers' need through banks and other such institutions so that the interested farmers can establish big farms with high productivity.

4. Horticulture Development Department and extension agencies which are concerned with olericulture development have to make conscious efforts for rapid diffusion of olericulture innovations to the tomato growers. This can be done by arranging tours, exhibitions, shows, demonstrations, contact with progressive tomato growers and local leaders.

5. Some of the tomato growers had suggested to make technical information available and hence it is recommended

that the necessary information of tomato cultivation need to be given through mass media like newspapers, radio, television and extension publications.

6. Large number of tomato growers under study were ignorant and were not knowing about varieties/hybrids recommended and released by the State Agricultural University. This implies effective media use for making awareness and knowledge among the farming community about the innovations.

5.3.2 **Research implications :**

The present study being of exploratory type, the findings will have to be tested to a greater depth in other parts of the State to judge its validity on larger scale. All aspects of tomato growers in relation to their knowledge, adoption, constraints, production and marketing could not be studied. Therefore, characteristics other than included in this study, need to be studied to a greater depth. However, this study will be useful as a "bench mark" to probe into the studies of similar type in the future.

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APPENDIX

7. APPENDIX

"A STUDY OF TOMATO GROWERS FROM AHMEDNAGAR DISTRICT WITH PARTICULAR REFERENCE TO ADOPTION OF IMPROVED VARIETIES"

PART-I

1. Name of the farmer :

2. Village : Tal. Sangamner Dist. Ahmednagar

3. Age : 4. Experiencing in tomato cultivation :

5. Education :

a) Literate ( )/ Illiterate ( )

b) If literate ( )
i) 1 to 4th std. ( )
ii) 5 to 7th std. ( )
iii) 8 to 10th std. ( )
iv) 11 to 12th std. ( )
v) College ( )

6.a) Size of family :
i) Small family : upto 5 members ( )
ii) Big family : 6 and above members ( )

b) Type of family
i) Nuclear ( )
ii) Joint ( )

7. Information of family members

Sr. No.	Name of the family member	Relation with head of the family	Age	Education	Occupation

8. Land holding :

i) Irrigated _____ ha.
ii) Dryland _____ ha.
iii) Fallow _____ ha.
iv) Total _____ ha.

9. Source of irrigation

a) Well ( )
b) Canal/Lift ( )
c) Tube well ( )

Availability : All the Year ( ) Seasonal ( )

10. Total annual income (Rs.)

a) From agriculture Rs.
b) From subsidiary occupation Rs.
c) From service Rs.
d) Total Rs.

11. Information about tomato crop

i) Since how long you are growing tomato?
ii) What was the area under tomato last year?
iii) How many times you have taken tomato ?
iv) What was the production of tomato for the last year? (Q/ha)
v) How much was the profit or loss per ha ?
vi) Which crop had been taken in that field before tomato?
vii) From where you got the seed?
viii) Other than tomato, which vegetables you have taken in your field?

	Name	Area (ha)
1.		
2.		

ix) Who motivated you to take up the tomato cultivation?

i) Self ( ) vi) Local leader ( )
ii) Family member ( ) vii) Progressive farmer ( )
iii) Friends ( ) viii) Agril.Extn.Officer ( )
iv) Neighbours ( ) ix) Others ( )

x) Reason for taking up tomato cultivation

i) To get more returns		( )
ii) Taking tomato as a new crop		( )
iii) Crop rotation		( )
iv) Other		( )

12. Socio-economic status

A) Occupation	Score	
i) Labour	1	( )
ii) Balutedar	2	( )
iii) Service Class 3 & 4	3	( )
iv) Service Class 1 & 2	4	( )
v) Agriculture	5	( )
vi) Independent profession	6	( )
vii) Service + Agriculture	7	( )
viii) Occupation + Agriculture	8	( )
Number of members in family doing Service :		
i) One	1	( )
ii) Two	2	( )
iii) Three	3	( )

B) Annual gross income

i) Upto Rs. 1500	1	( )
ii) Rs. 1500 to 3000	2	( )
iii) Rs. 3000 to 6000	3	( )
iv) Rs. 6000 to 12000	4	( )
v) Rs. 12000 to 18000	5	( )
vi) Rs. 18000 to 24000	6	( )
vii) Rs. 24000 to 36000	7	( )
viii) Rs. 36000 to 48000	8	( )
ix) Rs. 48000 to 60000	9	( )
x) Above 60000	10	( )

C) Land holding

1. Irrigated

i) No land	0	( )
ii) Upto 0.5 ha	1	( )
iii) 0.6 to 1.00 ha	2	( )
iv) 1.1 to 2.00 ha	3	( )
v) 2.1 to 4.00 ha	4	( )
vi) 4.1 to 6.00 ha	5	( )
vii) More than 6.00 ha	6	( )

2. Unirrigated

i) No land	0	( )
ii) Upto 0.5 ha	1	( )
iii) 0.6 to 1.00 ha	2	( )
iv) 1.1 to 2.00 ha	3	( )
v) 2.1 to 4.00 ha	4	( )
vi) 4.1 to 6.00 ha	5	( )
vii) More than 6.00 ha	6	( )

D) Education

1) Head of the family

i) Illiterate	0	( )
ii) Adult education	1	( )
iii) Primary education	2	( )
iv) Secondary education	3	( )
v) Diploma holder	4	( )
vi) Graduate and above	5	( )

2) Children

i) Illiterate	0	( )
ii) Adult education	1	( )
iii) Primary education	2	( )
iv) Secondary education	3	( )
v) Diploma holder	4	( )
vi) Graduate and above	5	( )

3) Number of family members who have completed graduate and above education

i) One	1	( )
ii) Two	2	( )
iii) Three	3	( )

E) Farm power/appliances

1) Farm power

i) No power	0	( )
ii) One bullock	1	( )
iii) Pair of bullocks	2	( )
iv) Two pair of bullocks	3	( )
v) More than two pairs of bullock	4	( )
vi) Oil engine/electric motor	5	( )
vii) Tractor	6	( )

2) Farm applicances/power
   a) Traditional

i) Implements for primary tillage	2	( )
ii) Implements for intercultural tillage operations	2	( )
iii) Implements for harvesting & threshing	3	( )

   b) Improved

i) Implements for primary tillage	2	( )
ii) Implements for interculture operation	2	( )
iii) Implements for harvesting & threshing	3	( )

3) Machinery

i) Sprayers and dusters	1	( )
ii) Bullock cart	2	( )
iii) Tractor trailer	3	( )

F) Acquired property
   1) Furnitures

i) Chair	1	( )
ii) Teapoy	1	( )
iii) Table	1	( )
iv) Cot	1	( )
v) Dinning table	1	( )
vi) Sophaset	2	( )
vii) Shelf	2	( )
viii) Wooden cot	2	( )

2) Vehicle

i) Cycle	1	( )
ii) Motorcycle	2	( )
iii) Jeep/car	3	( )
iv) Truck	4	( )

3) Entertainment media

i) Radio	1	( )
ii) Tape recorder	1	( )
iii) T.V. set	2	( )

4) Cooking material

i) Pots	a) Bronze	1 ( )
	b) Steel	2 ( )
ii) Cooker		2 ( )
iii) Mixer		2 ( )
iv) Gas		2 ( )
v) Refregerator		3 ( )

5) Other material

i) Fan	1 ( )
ii) Matress	1 ( )
iii) Table	1 ( )

G) Primary needs

1) Food

i) Cereals + legumes + vegetables	1 ( )
ii) Cereals + legumes + vegetables + milk	2 ( )
iii) Cereals + legumes + vegetables + milk + fruits	3 ( )
iv) Cereals + legumes + vegetables + milk + meat/fish/eggs	4 ( )
v) Cereals + legumes + vegetables + milk + meat/fish/eggs + fruits	5 ( )

2) Clothes

a) Pairs

i) Two	1 ( )
ii) Three	2 ( )
iii) More than three	3 ( )

b) Type

i) Cotton	1 ( )
ii) Terelyne	2 ( )

H) Shelter

a) Type

i) Cottage	1 ( )
ii) Kaccha building	2 ( )
iii) Pakka building	3 ( )
iv) Wada	4 ( )
v) Bunglow	5 ( )

b) Size of house (area)

i) Upto 200 sq.ft.	1 ( )
ii) 200 to 500 sq.ft.	2 ( )
iii) 500 to 1000 sq.ft.	2 ( )
iv) 1000 sq.ft. and above	2 ( )

c) Health and cleanliness

i) Do you wash your hands before taking dinner?	Yes/No
ii) Do you brush your tooth in the morning?	Yes/No
iii) Do you take bath every morning?	Yes/No
iv) Do you cut your nails at proper time?	Yes/No
v) Do you wash your clothes regularly?	Yes/No
vi) Do you take injections?	Yes/No
vii) Do you take medical help in time?	Yes/No
viii) Do you take care of food poisioning?	Yes/No
ix) Do you take care for pure water?	Yes/No
x) Do you take care of drainage for proper disposal of waste water?	Yes/No
xi) Do you take care of mosquitoes and flies?	Yes/No
xii) Do you clean your house and court yard?	Yes/No

I) Social participation

i) Member of one organization	1 ( )
ii) Member of more than one organization	2 ( )
iii) Attendance for meeting	1 ( )
iv) Committee member	2 ( )
v) Office bearer	3 ( )

13. Risk orientation

Sr. No.	Statement	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1.	If we don't have capital, there is no harm in taking loan for development of loan					
2.	If other farmers are adopting improved technology succesfully in farming then we should adopt that technology					
3.	It is profitable to invest money for adoption of improved production technology					
4.	If business is profitable than tomato cultivation there is no harm in selling the land for raising capital for that business					
5.	A farmer should grow large number of crops to avoid greater risk involved in growing one or two crops					
6.	Tomato is perishable commodity hence tomato should not be cultivated on large scale					

14. Sources of information
    A) Mass media channels
        a) Electronic media

            i) Radio
            ii) Television
            iii) Video
            iv) Others

        b) Print media

            i) Newspaper
            ii) Farm magazines
            iii) Farm diaries
            iv) Other

    B) Inter-personal sources
        a) Personal-localite

            i) Neighbours
            ii) Friends
            iii) Progressive farmers
            iv) Relatives

        b) Personal-cosmopolite

            i) Gramsevaks
            ii) Agril.Extension Officers
            iii) Agril. Officers
            iv) Village Extnsion Workers
            v) Others

Adoption of varieties/hybrids

Sr. No.	Varieties/hybrids used	Seed purchased from	Seed rate (kg/ha)	Availability of seed	Germination percentage
1	2	3	4	5	6
	I) Recommended				
	I) Recommended				
	i) Pusa Early Dwarf				
	ii) Pusa ruby				
	iii) Money Maker				
	iv) Dhanashree				
	v) Bhagyashree				
	vii) Rajshree (Hybrid)				
	II) Non-recommended				
	1.				
	2.				
	3.				

Cultivated for no. of times	Yield per ha	Level of expectation of yield	Market price received	Suitability for transport	Keeping quality	Maturity period	Insect pest incidence
7	8	9	10	11	12	13	14

PART-II

Knowledge and adoption of improved tomato cultivation practices

Sr. No.	Recommended practice	Knowledge			Adoption		
		Complete	Partial	No	Complete	Partial	No
1	2	3	4	5	6	7	8
I)	Soil type (medium, well drained)						
II)	Primary tillage						
	a) One ploughing						
	b) 2-3 harrowings						
	c) 20-25 CL FYM						
III)	Varieties						
	1. Recommended						
	i) Pusa Early Dwarf						
	ii) Pusa ruby						
	iii) Money Maker						
	iv) Dhanashree						
	v) Bhagyashree						
	vii) Rajshree (Hybrid)						
	2) Non-recommended						
	i) Others						
	1.						
	2.						
IV)	Seed rate						
	i) Improved variety 0.4 to 0.5 kg/ha						
	ii) Hybrid variety 0.100 to 0.150 kg/ha						
V)	Seed treatment						
	i) Thirum 3 gm/kg						

1	2	3	4	5	6	7	8
VI)	Time of planting						
	i) Kharif (June-July)						
	ii) Rabi (Sept.-Oct.)						
	iii) Summer (Jan.-Feb.)						
VIII)	Method of planting (Ridges and furrow)						
VIII)	Spacing						
	i) Kharif 90 x 30 cm						
	60 x 45 cm						
	ii) Rabi and Summer						
	60x60 cm						
IX)	Inorganic fertilizer						
	i) Nitrogen (100 kg/ha)						
	ii) Phosphorous (50 kg/ha)						
	iii) Potassium (50 kg/ha)						
X)	Interculture						
	i) Weeding (7-8 times)						
	ii) Supporting (Emergence of flower bud)						
XI)	Irrigation management						
	i) Kharif (10-12 days)						
	ii) Rabi (7-10 days)						
	iii) Summer (4-7 days)						
XII)	Plant protection						
	i) Fruitfly and whitefly (Endosulphan 35 EC) or metacytox 0.1%)						
	ii) Fruit borer (Endosulphan 0.05%)						
	iii) Top shoot borer (Phorate 25-30 gm)						
	iv) Leaf eating caterpiller (Dust carbyrel 20 kg/ha)						
	v) Powdery mildew (300 mesh sulphur 200 kg/ha)						
	vi) Wilt (Dithane Z-78)						
	vii) Cracking of fruits (Timely irrgation)						

XIV) Harvesting ((4-8 days
after every picking

14. Use of tomato in diet

i) Do you use tomato in diet? Yes/No

ii) If yes? What type of products do you prepare?

iii) In what proportion?

a) Every day b) Often c) or otherwise

iv) Do all the family members like tomatoes? Yes/No

15. Knowledge about products of tomato

a) Do you know the eatable products of tomato? Yes/No
b) If yes? which are they?
c) What is importance of tomato in diet?

16. What are the constraints regarding the production of tomato in respect of the following aspects?

a) Preparatory tillage
b) Seed
c) Planting
d) Seed treatment
e) Inorganic fertilizer
f) Irrigation
g) Plant protection
h) Harvesting
i) Marketing

i) Transport
ii) Market
iii) Middle man
iv) Selling price
v) Keeping quality
vi) Intime payment
vii) Others

j) Raising of seedlings
k) Use in diet
l) Labour
m) Credit supply
n) Others

17. What are your suggestions regarding improving tomato cultivation and removing constraints?

18.a) Do you know the varieties and hybrids of tomato released by Mahatma Phule Krishi Vidyapeeth, Rahuri? Yes/No

b) If yes, which are those?

i)
ii)
iii)

19.a) Out of these varieties which variety/varieties you have cultivated?

b) How many times you have cultivated these varieties?

VITA

8. V I T A

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