KNOWLEDGE AND ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS OF SRIGANGANAGAR DISTRICT OF RAJASTHAN

THESIS

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(EXTENSION EDUCATION)

BY

HARDEV CHOUDHARY

2006

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This is to certify that this thesis entitled **"Knowledge and adoption of recommended kinnow production technology by the farmers of Sriganganagar district of Rajasthan"** submitted for the degree of **Master's of Science** in the subject of **Extension Education** embodies bonafide research work carried out by **Mr. Hardev Choudhary** under my guidance and supervision and that no part of this thesis has been submitted for any other degree. The assistance and help received during the course of investigation have been fully acknowledged. The draft of the thesis was also approved by advisory committee on ……..……..

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Place: Jobner **(HARDEV CHOUDHARY)**

Knowledge and adoption of recommended kinnow production technology by the farmers of Sriganganagar district of Rajasthan

Hardev Choudhary* **Dr. G.S. Bangarva****
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ABSTRACT

Fruits are great importance in human diet. India is the second largest producer of fruits in the world, its share in the world fruit production is 10 percent. Kinnow is one of the most important fruit crop in Rajasthan, but its productivity in state is low. The reason behind this might be the non adoption of recommended kinnow production technology of kinnow plantation and also might be due to certain constraints faced by the farmers in kinnow plantation.

Keeping this view in mind the present investigation entitled "Knowledge and adoption of recommended kinnow production technology by the farmers of Sriganganagar district of Rajasthan" was undertaken with the following specific objectives:

(i) To measure the knowledge level about recommended kinnow production technology by the farmers.
(ii) To find out the extent of adoption of recommended kinnow production technology by the farmers.
(iii) To find out the relationship between extent of adoption of recommended kinnow production technology by the farmers and selected independent variables.
(iv) To find out the constraints as perceived by the farmers in adoption of recommended kinnow production technology.

The present study was conducted purposely in Sriganganagar and Srikaranpur panchayat samities was selected on the basis of maximum area under kinnow cultivation. From these panchayat samities ten villages were selected on the basis of maximum area under kinnow cultivation. Similarly from the selected villages, 120 farmers were selected by simple random sampling technique for the study purpose. The data were collected by personal interview method.

The data so collected were classified, tabulated and statistically analyzed which led to the following findings:

1. Majority of the farmers had medium knowledge level about recommended kinnow production technology.
2. Majority of farmers had knowledge regarding "Recommended method of hoeing and weeding and "Recommended row to row distance" whereas, only

14.17 per cent farmers had knowledge about "Recommended growth regulators".

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3. Majority of the farmers had medium adopters about recommended kinnow production technology.
4. The highest adoption was recorded of recommended practices like "Plant population" and "Irrigation interval" whereas "Application of growth regulators was poorly adopted by the farmers.
5. The extent of adoption of farmers was found to be positively and significantly related with their knowledge level, education level, size of land holding and occupation whereas, it was negatively and significantly related with their market distance.
6. The constraints which were most perceived by the farmers in adoption of recommended kinnow production technology where "High initial cost in establishing of orchard", "Irregular water supply from the canal", "Lack of proper market" and "Lack of need based training".
7. Among technical constraints the "Irregular water supply from the canal" was the most perceived constraints, whereas the "Height cost in establishing of orchard" was the major economic constraints. The "Lack of proper market" was the most perceived storage and marketing constraints and the "Lack of need based training" was the most perceived general constraint in adoption of recommended kinnow production technology.

Recommendation

1. Trainings, demonstrations and visits should be organized frequently about recommended kinnow production technology in the study area.
2. Literacy programme need to be strengthened and primary education should be made compulsory for the children.
3. The farmers should be motivated to adopt the recommended kinnow production technology by providing subsidy on kinnow planting material and inputs.
4. Co-operative societies should be made effective in the study area which can provide inputs to the farmers as well as costly equipments on rental basis.
5. The farmers should be made aware about recommended propagation method which are stable and hardy to adverse climatic condition and resistant to insect-pest and diseases.
6. At least one cold storage should be established at panchayat samiti level.

1. INTRODUCTION

Fruits are of great importance in the field of human nutrition. Utilization of fruits has been inherent in the Indian way of life from ancient time. Medicinal use of fruits like anola, beal, citrus, ber, karronda, lemon, lime, wild fig, monkey jack, jamaun, mango, sour orange, banana, pomegranate, almond etc. have been mentioned in charak samhita and sushrut samhita. The use of mango, banana, beal, anola and coconut have been associated with the festivals and rituals in India. It is generally stated that the standard of living of the people of a country can be judged by its production and consumption of fruits per capita. At present, India is the largest producer of fruits *i.e.* 11 per cent. The country due to its various agro-climatic conditions, can produce a wide variety of fruits. India is the largest producer of mango and banana and is among the first 10 countries in the production of apple, papaya, citrus, grapes and pineapple. The major fruits grown in India are mango, banana, papaya, orange, mosumi, guava, grapes, apple, pineapple, sapota, ber, pomegranate, strawberry, litchi etc. The production of fruits in India raised from 44042.4 metric tonnes in 1998-99 to 45203.1 metric tonnes in 2002-03. The area and productivity of fruits increased many fold since 1998-99. The productivity of fruits in 1998-99 was 11.8 mt/ha which increased to 11.9 mt/ha in 2002-03. The major fruit growing states in the country includes Uttar Pradesh, Andhra Pradesh, Bihar, Karnataka, Tamil Nadu, Maharashtra, Kerala and West Bengal. The other states which have substantial area under fruit crops are Gujarat, Assam, Madhya Pradesh and Orrisa.

As per present scenario of fruits, the per capita availability of fruits in the country is only 46 g per day as against 92 g per day recommended by the Indian Council of Medical Research (Anonymous, 2002-03). This is largely because of the very low productivity of large number of unproductive old orchards and poor management of the orchards, especially in the rainfed area which constitutes over 60 per cent of the total area under fruits. Besides this, lack of quality planting material of improved varieties and several other production problems also contribute to this low productivity. Thus, there is a great scope of increasing the fruits production by increasing the productivity and bringing more area under fruit crops.

Another significant factor which contributes to low availability of fruits is considerably high post-harvest losses. According to the food ministry, the country wastes more fruits and vegetables than what the U.K. consumes every year. Almost 20-30 per cent of the fruits are spoiled at the post-harvest stages which can be saved by adoption of improved harvesting, packaging, handling and storage techniques. At present, only about 0.1 per cent of the fruits are used for processing against a demand of about 0.5 per cent in our country. There is considerable scope of increasing the supply of fruits in processed form.

Citrus is world's leading fruit crop. It is also known as "fancy fruit" and is eaten as a desert fruit. The demand for citrus fruits is very high because of its nutritive value. It is very rich in vitamins "C" (ascorbic acid), fruit sugar and in addition of this it also contains vitamins A and B. It provides vitamin P, which keeps the small blood vessels in healthy condition in our body.

Among various fruits, citrus occupies a very important position with a production of 775 lakh tonnes (Anonymous, 2002-03). Brazil topes in citrus production in the world *i.e.* 148.1 lakh tonnes. India is the sixth largest producer of orange in the world but has no place in the world trade. In India, citrus is grown on 5.63 lakh hectares with a production of 56.77 lakh tonnes. The most important commercial citrus cultivars in India are the mandarin, followed by sweet orange and acid lime with a total production of 13.4, 8.9 and 7.5 lakh tonnes, respectively. Commercially, kinnow mandarin is grown in states like Punjab, Haryana, Himachal Pradesh, North-Western part of Rajasthan and Uttar Pradesh.

The state of Rajasthan is considered to be the potential area for fruit growing. The fruits like mango, banana, orange, datepalm, ber, grape and guava are grown in various regions of the state. The climatic conditions of the state are also suitable for cultivation of these fruits. In Rajasthan, kinnow occupies 1783 hectares area under cultivation (Anonymous, 2002-03) and Ganganagar division (Bikaner, Churu, Hanumangarh, Sriganganagar) is well known for its area and production of kinnow. This is highly potential area for kinnow cultivation as compared to other regions of Rajasthan state.

Kinnow mandarin is a hybrid between King (*Citrus nobilis* Lourd parent) and Willowleaf (*Citrus deliciosa* Tenore as ♂ parent) mandarins developed by Dr. H.B. Frost at Citeus Experiment Station, California (USA) in 1915. It was first introduced in the form virus free budwood and raised on Jatti Khatti (*Citrus janmbheri*) rootstock in 1959 at the PAU Regional Research Station, Abohar from the University of California. It is cultivated in the Punjab, Haryana, lower hills and velly areas of Himachal Pradesh, Uttar Pradesh, Karnataka (Coorg, Hassan and Chikmangalore district), Kerala (Wynaad and Palghat district), Tamil Nadu (Ootacaund and Madurai districts). In north India, the cultivation of mandarins is limited due to the acidity and puffiness of the fruit. Kinnow has been proved promising in place of mandarins because kinnow has wide adaptability to variable agro-climatic conditions and also comparatively more resistant to insect pests and diseases. Incidence of fruit dropping due to hail storms or other reasons is also comparatively less. Kinnow is usually less prone to bird damage, as almost two thirds of the fruits are known to bear in the interior of the tree.

Kinnow mandarin grows vigoursly. Trees possess dense foliage and lush green in appearance. Kinnow fruit is medium in size and is globose to oblate in shape. The apex is flattened. The number of segments is 9-10. The axis is semi-hallow. The colour of fruit is attractive shining deep orange at ripening. The peel is thin glossy and also adherent, but can be peeled off easily by hand. Juice is abundant (50%) having good contents of TSS (15%) and sugar (11%) with good flavour. Seeds vary from 14-19 in number and are polyembryony.

In Sriganganagar district government agencies like ARS, Additional Director (Horticulture) and KVK are engaged in transfer of technical know-how of fruit cultivation. This area has a tremendous potential for orcharding with the present food production scenario of the country. We may not be able to cater the nutritional demands of ever increasing population. The ray of hope lies in exploring the potential area of the fruit growing and better management of unproductive orchards.

Looking to the importance for kinnow cultivation it is essential that farmers must be motivated to adopt the kinnow cultivation on a large scale. Further the obstacles in the way of adoption of kinnow cultivation by the farmers must properly be identified and removed. Very few studies have been made by the investigators in the past to know the farmers adoption level of kinnow cultivation and the reasons for non adoption as well, to suggest proper strategies for motivating the farmers for its adoption. With this consideration the study entitled "Knowledge and adoption of recommended kinnow production technology by the farmers of Sriganganagar district of Rajasthan" had been undertaken on the basis of area and production. The

findings of the present investigation would be of immense value for the extension administrators, extension field functionaries and farmers, in preparing suitable strategy for motivating the farmers to adopt kinnow cultivation on their fields.

Keeping all these view in mind, the present investigation has been undertaken with the following objectives :

(v) To measure the knowledge level about recommended kinnow production technology by the farmers.

(vi) To find out the extent of adoption of recommended kinnow production technology by the farmers.

(vii) To find out the relationship between extent of adoption of recommended kinnow production technology by the farmers and selected independent variables.

(viii) To find out the constraints as perceived by the farmers in adoption of recommended kinnow production technology.

Implications of the study

The requirement of fruits in the country is rapidly increasing because of increasing population and higher living standard of the people. The area of kinnow in India has increased over the time, but the productivity and production of kinnow is decreased. The improved production technology of kinnow cultivation has not been fully adopted by farmers and it is mainly grown in traditional manner. There is a need to fully adopt the improved production technology of kinnow so that the production and income of the farmers can be increased.

The present investigation is an effort to know and understand the clear picture of kinnow cultivation regarding the constraints faced by farmers, their knowledge and adoption of kinnow cultivation practices and the factors affecting their knowledge and adoption of kinnow cultivation practices.

The awareness of the knowledge gap and adoption gap will enable these agencies to fix up the priorities in understanding the activities and steps for research to improve productivity. The identification of the constraints in adoption of improved production technology of kinnow cultivation will enable the policy makers to prepare plans to rectify these hurdles for mobilizing the quick adoption of kinnow cultivation which in turn will increase in total agricultural production and will improve the socio-economic condition of farmers and there by will contribute towards over all national development.

Limitations of the study

The research studies in social sciences do face some limitations and the present research study is no exceptation of this. The study may have the following limitations : -

1. The study is limited to panchayat samiti Srikaranpur and Sriganganagar of Sriganganagar district, because of limited time and resources and hence the findings may not be generalized for other areas as such.
2. Instead of covering all the kinnow growing farmers, the investigation work was confined to only selected kinnow growing farmers.
3. As the entire investigation was based on the individual's perception and expressed opinion of the respondents under study and so the individual biases and prejudices on the part of respondents might have influenced the findings.

Organisation of thesis

The dissertation has been divided into six chapters. The first chapter narrates introduction, objectives, implications and limitations of the study. The second chapter reviews of relevant study made in the past. The third chapter deals

the theoretical orientation. Methodology consisting of measurement of variables, tools used and the statistical techniques followed have been presented in fourth chapter. The fifth chapter deals of findings of the investigation and discussion on them. A brief summary and conclusions of the dissertation have been presented in the sixth chapter followed by bibliography. The appendices appear at the end of the thesis.

Table 2. District wise area and production of kinnow (Area in Ha. and Prod. in Qtl.)

S. No.	Districts	Kinnow			
		2001-02		2002-03	
		Area	Prod.	Area	Prod.
1	Ajmer	-	-	-	-
2	Jaipur	-	-	2	442
3	Dausa	-	-	-	-
4	Jhunjhunu	-	-	-	-
5	Sikar	-	-	-	-
6	Alwar	3	50	-	38
7	Bharatpur	-	-	-	-
8	Dholpur	-	-	-	-
9	Swai-madhopur	-	-	-	-
10	Karuli	-	-	-	-
11	Bikaner	11	153	7	300
12	Churu	-	-	-	-
13	Hanumangarh	157	6350	165	32010
14	**Sriganganagar**	**1321**	**100506**	**1609**	**36261**
15	Kota	-	-	-	-
16	Baran	-	-	-	-
17	Bundi	-	-	-	-

18	Jhalawar	-	-	-	-
19	Tonk	-	-	-	-
20	Jodhpur	-	-	-	-
21	Jalore	-	-	-	-
22	Jaisalmer	-	-	-	-
23	Nagaur	-	-	-	-
24	Pali	-	-	-	-
25	Sirohi	-	-	-	-
26	Barmer	-	-	-	-
27	Bhilwara	-	-	-	-
28	Chittor	-	-	-	-
29	Rajsamand	-	-	-	-
30	Udaipur	-	-	-	-
31	Banswara	-	-	-	-
32	Dungarpur	-	-	-	-
	Total	**1492**	**107059**	**1783**	**69051**

Source : Vital Horticultural Statistics, Directorate of Horticulture, Pant Krishi Bhawan, Jaipur, 2002-03.

Table 1. Statewise area, production and productivity of fruits in India

State/UT's	Area (in 000 ha)			Production (in 000 mt)			Productivity (in mt/ha)		
	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03
Maharashtra	529.3	582.8	586.0	8680.8	8840.6	8400.8	16.4	15.2	14.3
Andhra Pradesh	448.0	582.8	609.5	5003.4	6157.4	7404.8	11.2	10.7	12.1
Uttar Pradesh	287.8	575.8	280.3	2713.0	2282.4	4313.8	9.4	7.9	15.4
Tamil Nadu	222.8	288.3	223.5	4005.8	4342.4	4014.0	18.0	19.1	18.0
Karnataka	326.9	227.5	254.9	4819.5	4028.9	4008.8	14.7	15.7	15.7
Bihar	258.4	257.1	294.8	3237.5	2877.0	3038.1	12.1	10.6	10.3
Gujarat	170.9	272.3	201.2	2268.2	2346.9	2957.5	13.3	15.7	14.7
West Bengal	133.7	149.0	152.2	1656.5	1985.5	7585.6	12.4	13.5	11.7
Orissa	215.4	147.6	234.6	1284.4	1362.9	1485.5	6.0	6.1	6.3
Assam	107.0	225.0	91.8	1293.8	1335.1	1126.5	12.1	12.0	12.3
Madhya Pradesh	63.2	110.8	47.6	1740.4	1143.8	1112.6	27.5	24.6	23.4
Jammu & Kashmir	140.9	46.6	119.6	837.3	1000.9	983.9	5.9	7.0	8.2
Kerala	234.5	142.2	164.4	1772.6	1772.6	837.3	7.6	7.6	5.1
Punjab	34.2	234.5	40.5	479.7	531.7	578.5	14.0	14.2	14.3
Himachal Pradesh	213.0	37.5	165.1	438.3	263.4	480.4	2.1	1.2	2.9
Tripura	28.0	223.0	28.4	450.8	452.1	459.9	15.6	16.0	16.2

Uttaranchal	191.8	28.3	55.6	541.0	376.1	458.1	2.8	1.9	8.2
Chhiattisgarh	11.8	14.4	16.0	154.3	203.1	382.0	13.1	14.1	23.9
Jharkhand	20.9	31.5	32.7	265.1	321.1	321.2	12.7	10.2	9.8
Haryana	30.7	31.3	31.9	232.0	235.2	237.3	7.6	7.5	7.4
Rajasthan	20.0	22.1	22.5	339.3	200.7	184.8	17.0	9.1	8.2
Meghalaya	24.1	24.0	15.3	186.9	186.9	153.3	7.8	7.8	10.0
Manipur	24.1	26.1	26.7	118.7	134.0	137.8	14.8	5.1	5.2
Arunachal Pradesh	51.1	41.6	40.8	123.1	124.9	82.1	2.4	3.0	2.0
Goa	10.5	10.7	10.1	71.5	64.7	72.8	6.8	6.0	7.2
Nagaland	24.7	25.0	8.5	290.4	302.0	65.9	11.8	12.1	7.8
Mizoram	18.0	19.0	17.2	66.7	63.4	65.0	3.7	3.3	3.2
Pondicherry	1.1	1.1	1.1	26.7	24.0	26.7	24.3	21.8	24.3
Andaman & Nicobar	3.7	3.7	3.7	16.7	16.7	16.7	4.5	4.5	4.5
Sikkim	9.4	12.3	10.0	10.0	10.3	8.1	1.1	0.8	0.8
Dadra & Hagar Havelp	0.7	0.7	0.7	7.1	7.1	7.1	10.1	10.1	10.1
Daman & Diu	0.4	0.4	0.4	3.4	3.4	3.4	8.5	8.5	8.5
Chandigarh	0.1	0.1	0.1	1.1	1.1	1.1	11.0	11.0	11.0
Lakshadeep	0.3	0.3	0.3	1.1	1.1	1.1	3.7	3.7	3.7
Delhi	0.1	0.1	0.1	1.0	1.0	1.0	10.0	10.0	10.0
Total	**3869.0**	**4010.2**	**3787.9**	**43138.1**	**43000.9**	**45203.1**	**11.1**	**10.7**	**11.9**

Sources : National Horticulture Board, website; hortibizindia.nic.in.

2. REVIEW OF LITERATURE

The review of literature regarding the similar studies conducted in past is of paramount importance. It gives a sound support to any noble research, it helps in defining the problem, formulating the objectives, deciding the methodology and discussing the findings. Although, a lot of work knowledge and adoption has been done during the past, an attempt has been made here to review the available relevant literature having direct or indirect bearing on the present study. The review of literature has been given in four major heads as follows :

(ix) To measure the knowledge level about recommended kinnow production technology by the farmers.

(x) To find out the extent of adoption of recommended kinnow production technology by the farmers.

(xi) To find out the relationship between extent of adoption of recommended kinnow production technology by the farmers and selected independent variables.

(xii) To find out the constraints as perceived by the farmers in adoption of recommended kinnow production technology.

I Knowledge of recommended kinnow production technology

Nainawat (1990) found that majority of farmers have moderate knowledge about recommended ber production technology.

Nimje *et al.* (1991) observed that there is a need to transfer the ber cultivation techniques to the ber growers. About 25 per cent ber growers did not have sufficient knowledge of various aspects of ber cultivation. Very simple aspects like digging pits, selection of bud grafts, selection of buds, grafting methods etc. were not known to the ber growers.

Urade *et al.* (1991) found that more than 98 per cent of the dry land fruit growers were aware about mango and Indian jujuba. This was followed by wood apple and corinda tree (60.8% and 59.5%) respectively. A sizeable percentage (56.8%) of farmers were aware about custard apple. The knowledge about pomegranate and jack fruit was found to be lacking among the respondents.

Chand (1993) found that majority of respondents had knowledge about recommended cultural management practices and establishment of plantation.

Reddy and Ratnakar (1993) observed that most of the mango growers has less knowledge regarding improved mango technology in the study area.

Sen (1995) found that there was significant difference in knowledge among the three categories of farmers regarding guava cultivation.

Mohammad and Punjabi (1997) reported that majority of mandarin growers (80%) were having medium level of knowledge of mandarin production technology while 20 per cent of them had low level of knowledge. In case of non mandarin growers, 70 per cent were of medium level of knowledge and about 30 per cent possessed low level of knowledge.

Sharma and Bangarwa (1997) concluded that majority of the respondents (about 60%) had medium knowledge level about tree plantation followed by 26.66 per cent who had moderate knowledge level. Only 8 per cent and 6 per cent of respondent had low and high knowledge level about three plantation, respectively.

Deshmukh *et al.* (1998) found that 93.33 per cent of the respondents had knowledge about the varieties and time of harvesting of custard apple. As much 92.90 per cent of the respondents had knowledge of recommended soil type for custard apple cultivation. Similarly the knowledge about the importance of digging pit and size of pit was possessed by 81.66 per cent and 65.85 per cent respondents, respectively.

Devi and Manoharan (1999) revealed that low (42.50%) to moderate (41.67%) was the knowledge level prevalent with guava cultivators. High level of knowledge was found with the category of big farmers.

Dayma (2000) concluded that majority of farmers has medium knowledge level (68%) about improved practices of aonla plantation.

Mohammad (2000) observed that guava orchard owners had maximum knowledge about fruit varieties (100%). It was followed by planting (67.22%), cultural practices (66.66%), harvesting and marketing

(65.33%) and propagation (55.55%). Comparatively less knowledge was reported in plant protection measures (47.91%) among the guava orchard owners.

Mohammad *et al.* (2001) found that the majority of mandarin growers 80 per cent were having medium level of knowledge regarding practices of mandarin cultivation whereas 20.00 per cent respondents were in high level of knowledge categories.

Padaria *et al.* (2002) revealed that the potential of crop regulation technology in orchard growers but also highlighted the useful implications. Firstly, participating in trials, growers gained knowledge about the technology which they can adopt and disseminate among fellow growers. Secondly, the participatory trails at different locations provided opportunity for the growers to develop their capability for on farm experimentation and also build up their confidence in designing, implementating and evaluating the on farm experimentation along with scientists.

Poonia (2002) found that majority of respondents (65.00%) had medium level of knowledge of improved kinnow cultivation practices. However, respondents found in high and low knowledge category were (18.33%) and (16.67%), respectively.

Choudhary and Punjabi (2002) concluded that more than half of the respondents possessed medium knowledge while remaining respondents were in low and high knowledge groups. The knowledge gap in various social forestry practices ranged from 15.56 to 62.09 per cent in the study area.

Singh *et al.* (2003) revealed that farmer's mean knowledge level was 57.7 per cent about improved ber production technology.

II Extent of adoption of recommended kinnow production technology by the farmers

Nainawat (1990) reported that 57.84, 83.43, 50.00, 50.43, 80.62, 53.31 and 4.12 per cent of respondents adopted the recommended improved variety, spacing, soil treatment, manure and fertilizer application, irrigation, intercultural operations and plant protection measures of ber cultivation, respectively.

Urade *et al.* (1991) observed that majority of respondents (87.80%) planted mango orchard followed by Indian jujuba (44.66%) on their farm. Only 4.00 per cent farmers have planted pomegranate orchard.

Chiprikar and Khupse (1992) reported that a majority of grape growers were medium to low adopters of grape production technology. The information on adoption and production, reported that with favourable adoption behaviour, there was an increase in productivity of the grape commodity.

Liambika and Nikhade (1993) concluded that higher proportion of pineapple growers do not adopt the recommended practices like flowering induction, seed treatment, plant protection measures, fertilizers application and spacing. The poor adoption of such practices resulted in low yields.

Bhujbal and Kadam (1995) observed that 35.49 per cent of the fig cultivators were in high adopters category whereas 34.83 per cent and 26.68 per cent of them were found in medium and low adoption categories, respectively.

Sen (1995) found that the maximum percentage of adoption of production technology of guava was about planting (70.37%).

Bhople *et al.* (1996) found that 62 per cent of the orange growers had adopted recommended cultivation practices of orange to medium extent. Only 16 per cent of them were found to be higher adopters. It was also noted that 22 per cent of orange growers were found to be low adopters.

Manjula (1996) found that over all adoption of farm women about recommended mulberry cultivation practices revealed that 39.58 of the farm women had medium level of adoption with respect of recommended mulberry cultivation practices.

Thakare *et al.* (1996) stated that the majority of orange growers had medium level of adoption of recommended orange cultivation practices (60.50 per cent), while 25.50 per cent of the respondents were in low level of adoption and only 14 per cent of respondents were having high level of adoption.

Mohammad and Punjabi (1997) reported that majority of mandarin growers 71.70 per cent had medium level of adoption followed by 20 per cent of them with low and 8.33 per cent having high level of adoption.

Chikala and Deshmukh (1998) revealed that the practices which were adopted by the respondents in majority were tillage operations in orchards (72.00%), application of fertilizers to plants (80.00%), providing support to fruits bearing trees (80.00%) and harvesting of fruits as recommended (85.00%). However, majority of respondents did not adopt the improved cultural practices measures (80.00%), training and pruning (82.00%).

Deshmukh *et al.* (1998) found that (59.16 %) of the respondents were having medium level of adoption while 26.66 per cent and 14.66 per cent of the respondents had high and low extent of adoption of recommended cultivation practices of custard apple, respectively.

Wakle *et al.* (1998) revealed that 59.16 per cent of the respondents had medium level of adoption while 26.66 per cent and 14.68 per cent of them had high and low level of adoption of recommended cultivation practices of custard apple, respectively.

Devi and Manoharan (1999) observed that 39.71 per cent of the respondents had medium level of adoption followed by low 33.33 per cent and high 27.50 per cent level of adoption of guava.

Agarwal (2000) reported that adoption of improvement cultivation of pea by the farmers was not upto mark in soil treatment (13.50%), fertilizers application (19.75%), weed management (31.66%) and plant protection measures (33.20%), whereas they had high adoption regarding recommended spacing (66.93%).

Mohammad (2000) found that maximum adoption of guava production technology was reported in varieties (100%), pit digging of recommended size to plant seedling in orchard (89.44%), irrigation interval as per the suggested irrigation schedule (88.88%) and scientific method of irrigation for higher water use efficiency (83.33%). On the other hand, comparatively less adoption was found in the use of plant protection measures as per advise of experts (33.88 %), grading of fruits after harvesting (36.11 %) and use of suitable methods of propogation (10.55 %) among the guava growers.

Jangid (2001) reported that in general 67 per cent chilli growers were in the medium adoption group and 17 per cent respondents were in the low adoption group, while only 16 per cent farmers were in the group of high adopters.

Meena (2002) reported that 64 per cent tomato growers were in the medium adoption group and 21 per cent farmers were in the high adoption group, while only 15 per cent farmers were in the group of low adoption.

Poonia (2002) found that 60 per cent respondents had medium level of adoption and 22.50 per cent respondents having low and 17.50 per cent having high level of adoption of recommended kinnow production technology.

Meena (2004) observed that 58.33 per cent of the respondents had medium level of adoption followed by high 25.00 per cent and low 16.67 per cent level of adoption of guava.

III Relationship between adoption level of recommended kinnow production technology and the personal characteristics of the farmers

Nainawat (1990) observed that adoption level of respondents was positively and significantly associated with the level of education, irrigation potentiality, while social participation and size of land holding of respondents was non significantly associated with the adoption level of improved technology of ber plantation.

Dangi and Intodia (1992) reported that a significant association between the income of the farmers, size of land holding and adoption level of recommended package of practices.

Parewa (1992) found that the education, social participation, socio-economic status, irrigation potentiality and knowledge level of farmers were positively and significantly associated with the adoption of farmers about recommended packages of practices of vegetables.

Malpure and Bhople (1994) reported that the adoption of recommended cultivation practices of ber by the farmers was found to be positively and significantly correlated with size of land holding, annual income, socio-economic status, extension participation, consultancy pattern and infra-structural facilities.

Shekhawat (1996) concluded that size of land holding, socio-economic status, level of education, knowledge about pesticides, attitude towards pesticides, economic motivation and social participation exerted a definite and positive influence on use of pesticides to a particular extent.

Lal (1997) reported that attitude of farmers towards jojoba cultivation was found significantly associated with socio-economic status, education, market distance and extent of adoption of jojoba cultivation.

Rajput (1997) observed a significant association between factors affecting adoption of opium production technology and education, size of land holding and occupation of the farmers. While a non-significant association was found between the factors affecting adoption of opium production technology and family type and age of respondents.

Yadav (1997) found that education, socio-economic status, irrigation potentiality and knowledge level were positively and significantly associated with adoption level of farmers about recommended package of practices of onion cultivation whereas, market distance was found negatively and significantly associated with the adoption level of the farmers about the recommended package of practices of onion cultivation. While, the social participation, size of land holding, farm information sources utilized were found non-significantly associated with adoption level of farmers about recommended package of practices of onion cultivation.

Farpat and Kulkarni (1998) concluded that education, annual income, economic motivation and attributes of innovation had significantly and positively relationship with knowledge and adoption, while significantly negative relationship with constraints in banana cultivation.

Gomase and Patil (1998) revealed that education, socio-economic status, land holding, annual income, social participation and innovativeness were significantly correlated with the extent of adoption of recommended practices of kagzi lime.

Joshi (1998) reported a significant association between adoption of improved farm practices and literacy level, age and socio-economic status of the farmers.

Choudhary (1999) found that four independent variables *viz.*, educational level, social participation, size of land holding and farm information sources, were positively and significantly related with adoption level of farmers about improved practices of mothbean cultivation whereas, the independent variables *viz.*, age, family type and size of family were non-significantly related with adoption level of farmers.

Kadian (1999) observed significant association of adoption level of improved horticultural practices with independent variables *viz*., age, education and extension contact.

Agarwal (2000) reported that the extent of adoption of improved pea cultivation practices by the farmers was found positively and significantly associated with their education level, social participation, size of land holding, market distance, knowledge about pea cultivation, cosmopolite source of information and localite source of information.

Dayma (2000) reported that the level of education and knowledge level of farmers were positively and significantly associated with adoption level of farmers about the

improved practices of aonla plantation. Whereas, age, caste, farm size, social participation, proximity to marketing facility and sources of information utilized were found non significantly associated with adoption level of farmers about improved practices of aonla plantation.

Naruka (2000) found that education, size of land holding, social participation, irrigation potentiality and sources of information utilized were positively and significantly related with adoption level of farmers about biofertilizers by the farmers.

Meena (2003) reported that the adoption of recommended cultivation practices of rose by the farmers was found to be positively and non-significantly associated with their social participation and irrigation potentiality.

Meena (2004) observed that adoption level of respondents was negatively and significantly related with their market distance and was positively and significantly related with their knowledge level, education level, size of land holding and sources of information utilized, whereas their social participation and irrigation potentiality were non significantly associated with the adoption of improved practices of guava plantation.

Jhajharia (2005) reported that the adoption of improved production technology of ber cultivation by the farmers was found positively and significantly related with their educational level, market distance, source of information utilized and knowledge about ber cultivation, while irrigation potentiality was negatively and significantly related. Their social participation and size of land holding were non-significantly related with the extent of adoption of improved production technology of ber cultivation.

Kumawat (2005) reported that the educational level, caste, occupation, training received and marketing distance of farmers were positively and significantly associated with adoption level of farmers about the recommended cultivation practices of onion. Whereas their economic motivation was non-significantly with their adoption level of farmers about recommended cultivation practices of onion.

IV Constraints in adoption of recommended kinnow production technology

Lokhande and Wangikar (1991) observed that about 79.16 per cent respondents expressed the problem about unavailability of cuttings of improved varieties in time, 76.66 per cent of the respondents did not receive know-how about improved varieties of

grape, while 70.83 per cent respondents expressed the problems about less resistance of varieties to diseases.

Urade *et al.* (1991) reported difficulties in successful plantation are want of technical guidance, untimely supply of information and difficulty in procurement of bank loan, non-availability of protective irrigation and trampling by stray cattle. Difficulty in selection of dry land, fruit crop, lack of knowledge of pests and their control measure were also reported as problems by them.

Pandey (1993) reported that in cultivation of mango, guava, pomegranate, aonla and other fruit plants, there was a great problem of unavailability of reliable plant material. Plants were purchased in discriminatory from nearby states, from private nurseries who have no pedigree records of their mother plants. He further added that many of plants die during transit period.

Singh (1993) reported that in case papaya, mosaic disease had restricted the farmers for cultivation of this profitable fruit crop having tremendous potentiality. Non-availability of seeds of reliable varieties to the common cultivator was a great problem.

Kanbid and Sharma (1994) revealed that the constraints in the adoption of scientific horticultural technology were constraints pertaining to inputs, constraints pertaining to production aspects, constraints pertaining to marketing and constraints pertaining to lack of technical guidance.

Malapure and Bhople (1994) observed that important constraints faced by the ber growers were non availability of truck load produce, non-availability of subsidy in time, costly plant protection chemicals and lengthy procedure for getting loan from financial institution.

Bhople *et al.* (1996) found that orange growers faced marketing constraints like costly packaging material (80.00%), non-availability of processing unit (76.77%) and high transportation charges for transport of fruits from orchards to nearby market (54.90%).

Mohammad and Punjabi (1997) found that important constraints perceived by the mandarin growers *viz.*, lack of storage facility, lack of preservation industry, perishable nature resulted in economic losses, chances of theft, high mortality of plants during initial stages and lack of technical know-how.

Sharma (1997) reported that provision should be made for adequate and timely supply of essential inputs such as grafted mango plants of regular bearing varieties, fertilizers etc. He further added that timely finance and credit facilities should be provided to mango growers at low interest rate.

Sutar *et al*. (1997) observed that the major constraints in adoption of selected scientific technologies in grape cultivation are the high cost of cuttings of required varieties and fertilizers as well as non-availability of improved varieties, fertilizers and credit to over come these constraints in the adoption of modern grape cultivation.

Handiganur *et al*. (1998) revealed that 90 per cent farmers expressed the problem of scarcity of water and non-availability of labour were the main problems viewed by 67.50 per cent of the farmers expressed the problems of severity of pests and diseases.

Shrestha *et al.* (1998) found that the lack of technical know-how was the main constraints for trying the technology followed by low production and low economic status for cellar store in mandarin orange fruit.

Gomase and Patil (1998) revealed that major constraints perceived by the kagzi lime growers that inadequacy of irrigation water, irregular power supply, non-availability of labour, lack of knowledge and insect-pest and diseases and its control measures and high wages of labour.

Kulkarni *et al.* (1998) reported that majority of respondents expressed their desire to get chemical fertilizers, insecticides and equipments in time and that too on subsidized rate (73.60%). About 55.00 per cent respondents had suggested that loan alongwith admissible subsidy should be made available in time. The other important suggestion offered was that the sale of banana produce should be organized through cooperatives.

Shrestha *et al.* (1998) found that the lack of technical know-how was the main constraint for trying the technology followed by low production and low economic status for cellar store in mandarin orange fruit.

Devi and Monoharan (1999) revealed that low price obtained for the produce in the market, lack of quick transport facilities, lack of storage facilities, non availability of middle-men where the major constraints faced by the guava cultivators that high cost of fertilizers, soil and water problems, non availability of credits and lack of input availability are the areas where guava farmers requires the external agency assistance.

Mohammad (2000) concluded that high intensity constraints regarding aspects of orchard development with their relative position in the hierarchy as expressed by the orchard owners were; lack of technical know

how, long juvenile period perishable nature of commodity, a very high cost of establishment of orchards, lack of storage facility in the area, malpractices of the middle men, problematic soil, erratic rainfall, sub-division and fragmentation of land and lack of need based training programme.

Poonia (2002) found that lack of technical know-how, irregular water supply from the canal, perishable nature of commodity, high cost of insecticides and pesticides, lack of storage and preservation industry in the area and unfavourable weather condition were the constraints in the adoption of kinnow orchard by the owners.

Vasava and Pandya (2003) found the following constraints in mango cultivation :

(i) High price of FYM and chemical fertilizers.

(ii) Lack of knowledge regarding plant protection measures and fertilizer practices.

(iii) Lack of storage facilities at village level.

(iv) Lack of processing unit.

(v) Lack of knowledge about storage and processing.

(vi) Lack of road facility at village level.

(vii) Low prices of produces.

Waman and Girase (2003) found that the present study implied that cent per cent pomegranate growers had adopted grading and packing of fruits in card board boxes of standard sizes. Majority of the growers preferred to sale fruits in other states than selling of fruits in local market to fetch attractive prices. They faced many problems in marketing, it is recommended that the government may establish markets at nearly place and to create infrastructure facilities to preserve and process the fruits. This may enable them to fetch remunerative prices, stabilize rates, to reduce transportation charges and to assure timely receipt of payments.

3. THEORETICAL ORIENTATION

It is essential that the theoretical concept of study must be made clear before generalizing the new concept of the research study. After going through the past research findings related to the objectives of the present investigation knowledge of farmers, adoption level of farmers and constraints perceived by the farmers as presented in the preceding chapter, a basis for theoretical frame work of the present study was formulated. It is well understood that development of conceptual frame work makes research more meaningful. It also helps in developing sound scientific approach of the study. With this realization a separate chapter on 'Theoretical orientation' has been included in the present thesis. This chapter has been presented to clarify the following concepts :

1. Conceptual frame work of the study
    (a) Concept of knowledge
    (b) Concept of adoption
2. Concept of constraints
3. Theoretical model of the study
4. Operationalization of terms and abbreviations used in the study
5. Derivation of empirical hypotheses

1. CONCEPTUAL FRAME WORK OF THE STUDY

(a) Concept of knowledge

"Knowledge is of two kinds, we know as a subject over-selves, know where we confined information upon it" (Samuel Johnson).

Wilkening (1953) said "Farmers decision to adopt a recommended practice may be considered as a process first, then discuss its advantages and disadvantages with other farmers or with agricultural experts and at last makes decision to adopt the practice and obtain specific information to carryout the practice. This period may occur over a period of few days, weeks or a period of years".

Bloom *et al.* (1956) defined knowledge as "The behaviour and test situation which emphasized remembering either by recognition or recall ideas, material or phenomena."

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

Rogers and Shoemaker (1971) while describing the model of the innovation decision process considered "Knowledge as the function or a stage of the decision process when the individual is exposed to an innovation and gains some understanding of how it functions".

(b) Concept of adoption

The adoption has been recognised as learning theory which was conceived by Dewey (1933) and Mead (1956). In learning theory, learning is defined as "relatively enduring change in response to stimulus". Adoption is regarded as very similar to the learning process, as it also belongs to relatively

enduring behavioural change in the individual, but the adoption as a process was not recognised in the early period.

Wilkening (1953) rephrased the earlier version to adoption of an innovation as the process composed of learning, deciding and acting over a period of time. The adoption of a specific practice into the result of single decision to act but of a series of actions, thoughts and decisions. He considered this process as composed of four stages *i.e.* awareness, obtaining information, communication and trial and adoption.

A committee of rural sociologists (North Central Rural Sociology Sub Committee, 1955) recommended the stages suggested by Wilkening (1953) with slight variations. The committee suggested five stages instead of four. These were awareness, interest, evaluation, trial and adoption. Emery and Oeser (1958) viewed adoption of a farm practice as a "Consequence of communication".

Ramsey *et al.* (1958) had a different approach to the concept. They conceptualized that adoption involves critical evaluation of practice by farmers and is of two types behavioural adoption and cognitive adoption. Behavioural adoption is observed by the number of practices actually put into practice. The cognitive adoption involves a complex of decisions and changes including obtaining knowledge, critically evaluating the practice in terms of the individual situation.

Rogers and Shoemaker (1971) termed adoption as innovation decision process through which an individual passes from first knowledge of innovation to a decision of adopt or reject to later confirmation of this decision. There are four functions in this process, *i.e.* knowledge, persuation, decision and confirmation.

It appears from the various studies on adoption that adoption is both a process involving some stages of decision making and a stage in the process where the farmers begin the full use of an innovation.

2. CONCEPT OF CONSTRAINTS

The simplest dictionary meaning of constraint are to compel, to force, to confine, to restrain, to violate, to straighten to contract, to distress, to limit, to press, restriction of liberty, affection, restricted to avoid or perform same action.

In behavioural research, there were difficulties in conceptualizing the constraints as variable because they did not tend themselves easily to abstractions. Such notions as adoption behaviour and acceptance of practices innovations suffered from vague and contradictory formulation to such an extent that there was little concerning the adoption and acceptance of such segments of technologies, their degrees, directionality and the problem of their measurement (Bhatangar, 1974). Constraints exists primarily in terms of how they are defined and conceived in organization

(Bhople and Agarwal, 1987). Constraints are projections of collective sentiments rather than simple mirror of objective conditions (Bora, 1990).

According to some author, there exists interaction among the different constraints (Harshim, 1989). It is argued that many constraints exists simultaneously in several stages of development and patterns of progression from one stage to another depending upon time, place and other sets of conditions (Bhatnagar, 1974).

Bhople and Agarwal (1987) defined constraints as "The state or quality of sense being restricted to a given course of action or constraints are nothing but the problems that come in the way of adoption of technology".

3. THEORETICAL MODEL OF THE STUDY

For the successful completion of present research work a theoretical model of the study has been developed on which the entire study is based (Fig. 1).

The final conclusion of this theoretical model has been presented at the end of dissertation under chapter "Results and discussion" where the investigator has presented the information on knowledge and adoption of recommended production technology of kinnow cultivation by the farmers and the significant factors associated with them.

4. OPERATIONALISATION OF TERMS AND ABBREVIATIONS USED IN THE STUDY

In order to give operational meaning and to facilitate clarity in expression the terms which have been most frequently used in this research report are explained below :

1. Adoption

Adoption is defined for the purpose of this study as a "stage of acceptance leading to the continued used of improved production technology of kinnow cultivation in future".

2. Knowledge

Knowledge is a body of understood information about recommended production technology possessed by farmers with regard to kinnow cultivation.

3. Educational level

It is the level of literacy of kinnow growers who may be illiterate, literate or educated.

4. Social participation

It refers to the degree of participation or involvement of kinnow growers in formal organisation.

5. Kinnow growers (farmer)

Kinnow grower is the farmer who grows kinnow crop for commercial purposes (minimum land < 0.25 ha).

6. Size of land holding

It refers to total cultivable land in hectares which a kinnow grower (farmer) possess.

7. Constraints

It refers to the forcible restrictions in confinement of action. In this study constraints are operationalized as impediment or obstacles in the

successful adoption of recommended improved production technology of kinnow cultivation.

8. Panchayat samiti

It is a kind of local government working at block level in Panchayati Raj. It was occupied the second tier inter-linking the village panchayat and zilla parishad.

9. Random sample

A random sample is one where every item of the universe has an equal opportunity of being selected in the sample. Thus neither the investigator nor the sampling unit can decide which items will be included in the sample and which are not.

10. Respondents

A person whose, response, feelings and opinion is used to fill the schedule by the investigator. It is the individual who supplies information for drawing conclusion about the study.

11. Independent variable

Independent variables are the conditions or characteristics that the researcher manipulates to ascertain their relationship to the observed phenomena. An independent variable is the presumed "Cause" of the dependent variable.

12. Dependent variable

The dependent variables are the conditions or characteristics that appear, disappear or change as the experimental manipulates the independent variables. The dependent variable is presumed "Effect" and is predicted from the independent one. In this study the adoption of the respondents is used as a dependent variables.

ABBREVIATIONS USED IN THE SCRIPT

A.A.O. = Assistant Agriculture Officer

A.E.O. = Agricultural Extension Officer

B.D.O. = Block Development Officer

d.f. = Degree of freedom

et al. = (et alibi) and else where

Ext. Edu. = Extension Education

FYM = Farm Yard Manure

H_0 = Null hypothesis

H_1 = Alternative hypothesis

ha = Hectare

HE = High extent

i.e. = That is

Jr. = Journals

kg = Kilogram

LE = Low extent

M.S. = Mean score

ME = Medium extent

M.P.S. = Mean per cent score

mt = Metric tonnes

N = Number of respondents

NS = Non-significant

Qtl = Quintal

r = Correlation coefficient

R.A.U. = Rajasthan Agricultural University

S.D. = Standard deviation

S.E. = Standard error

S.No. = Serial Number

t = tonnes

Unpub. = Unpublished

V.E.W. = Village extension worker

Viz., = (Videlicet) namely

5. DERIVATION OF HYPOTHESES

According to George A. Lindberg "A hypothesis is a tentative generalization, the validity of which remains to be tested". In its most elementary stage the hypothesis may be any hunch, guess and imaginative idea, which becomes the basis for our investigation.

Considering the importance of the factors selected in the study along with the reference to the objectives of the present investigation

mentioned in chapter 1, the hypotheses framed for this investigation are as follows :

$H_{1.1}$ There is positive and significant association between the adoption of recommended production technology of kinnow cultivation by the farmers and independent variables *viz.*, knowledge level, educational level, social participation, size of land holding, market distance, irrigation potentiality and occupation by the farmers.

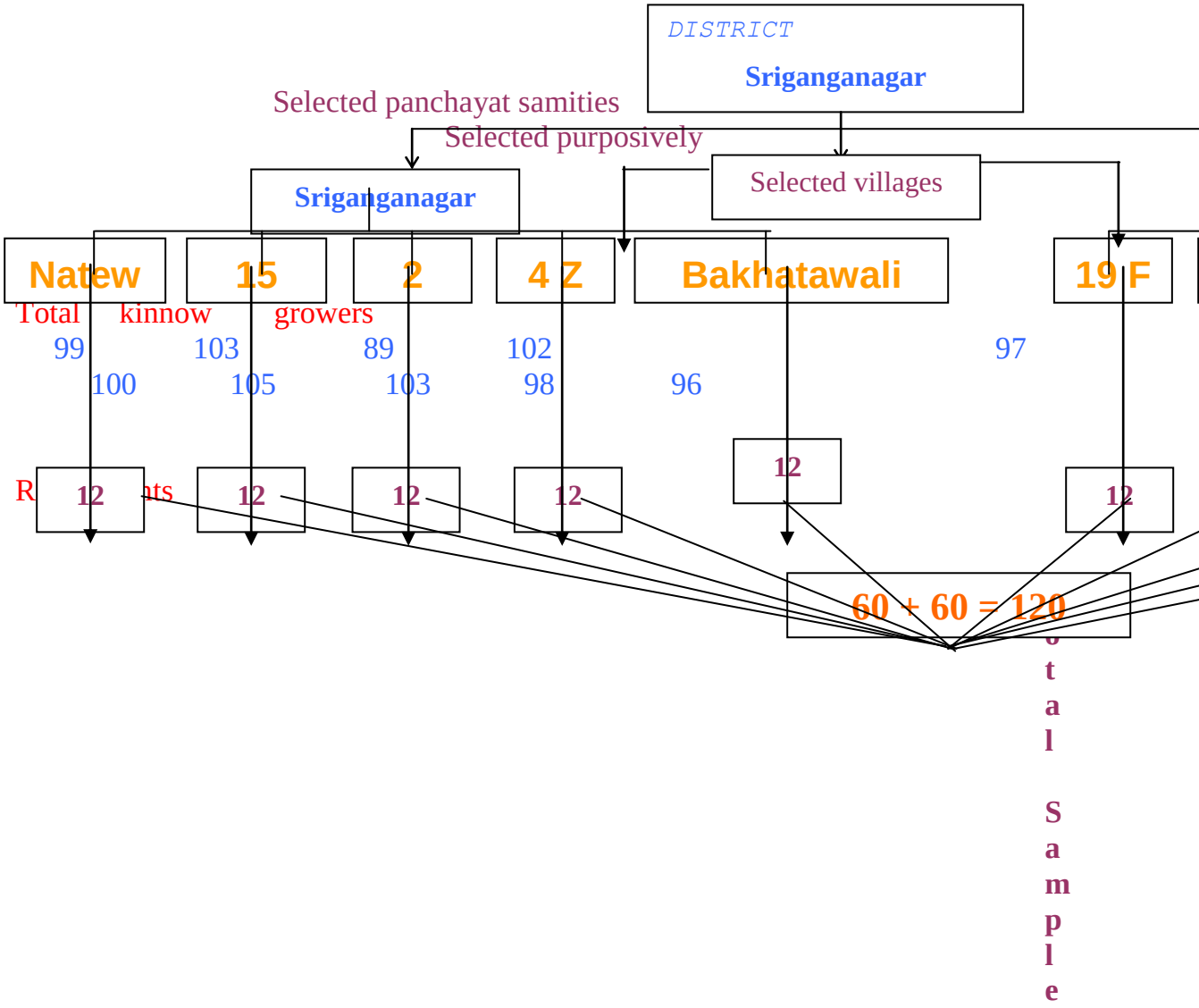

Fig. 3. Selection of locale and respondents under study

4. RESEARCH METHODOLOGY

This chapter describes the methods and procedures used for measuring the dependent and independent variables and also collecting and analysis the data.

This chapter has been presented under the following sections :

1. Locale of the study and selection of sample
2. Selection of recommended kinnow production technology
3. Variables and their measurement
   - (A) Measurement of dependent variable
   - (B) Measurement of independent variables
4. Measurement of constraints
5. Tools and techniques of data collection
6. Statistical measures used
7. Derivation of empirical hypotheses

4.1 LOCALE OF THE STUDY AND SELECTION OF SAMPLE

A. Selection of district

Rajasthan state is comprises of 32 districts. The present study was conducted in Sriganganagar district of Rajasthan. The Sriganganagar district was selected purposively for the present course of investigation. The added reasons behind the selection of Sriganganagar district are :

1. The kinnow is major fruit crop of Sriganganagar district having more area and production under the kinnow cultivation as compared to other fruits crops.
2. In the proposed district a number of government organization and agencies like additional director (Horticulture), KVK, ARS are involved in transferring technical know-how related to kinnow production technology to the farmers.
3. The area has great efficiency and potentiality for kinnow production due to favourable climatic condition and irrigation facilities for kinnow cultivation. There is fluctuation in production due to irregular and insufficient water supply from the canal.

B. Selection of panchayat samities

Sriganganagar district comprises of nine panchayat samities out of these two panchayat samities *viz.,* Sriganganagar and Srikaranpur were selected at having the maximum area and production of kinnow fruit crop (Table 3).

Table 3. Area and production of kinnow in various panchayat samities of Sriganganagar district (2004-05)

S. No.	Panchayat samities	Area (ha)	Production (qtl)
1.	Sriganganagar	571.0*	12367*
2.	**Srikaranpur**	313.3*	7551.56*
3.	Padampur	135.4	3043
4.	Raisinghnagar	165.0	3717

5.	Anupgarh	134.0	3020
6.	Suratgarh	78.0	1758
7.	**Sadulshahar**	95.0	2139
8.	**Srivijaynagar**	70.3	1583
9.	**Gharsana**	48.0	1081
	Total	1609	36261

(**Source** : Record of Additional Director's Office (Horticulture) Sriganganagar (2004-05)

* Selected panchayat samities

C. Selection of villages

The next stage of sampling procedure was the selection of villages. To do so a sample of five villages from each selected panchayat samities was drawn for the study purpose. The criterion in the selection of villages were same as followed in the selection of panchayat samities *i.e.* maximum area and production under kinnow fruit crop. Thus in all, 10 villages were included in the study for investigation work (Table 4).

Table : 4. Area and production of kinnow in selected villages of each panchayat samities *i.e.* Sriganganagar and Srikaranpur during 2004-05

S.No.	Name of villages	Area in (ha)	Production (Qtl)
A.	Sriganganagar		
1.	**Natewali**	96	2162.88

2.	**15 LNP**	72	1622.53
3.	2 ML	84	1892.52
4.	4 Z	48	1081.44
5.	**Bajthanwali (19 ML)**	34	766.02
	Total	**334**	**7535.39**
B.	**Srikaranpur**		
6.	19 F	47	1057.50
7.	**22 F**	38	855.00
8.	18 N	42	945.00
9.	6 U	20	450.00
10.	10 FF	15	337.50
	Total	**162**	**3645.00**

Source : *Zinswari,* 2004-05 (Tehsil Head Quarter)

D. Selection of respondents

To select a sample of kinnow growers, a comprehensive list of all kinnow growers of the selected villages were prepared in consultation with the patwari and agriculture supervisor of the villages concerned. The help of Assistant Agriculture officer of the respective panchayat samiti was also taken in preparing the list of kinnow growers (Table 5). Then after 12 kinnow growers from each of the selected villages was selected by employing a simple random sampling technique. In this way a sample of 120 orchard owners were selected. The sampling procedure adopted for the present investigation is presented through a flow chart (Fig. 3).

4.2 Selection of recommended kinnow production technology

To measure the knowledge level and adoption level of farmers, there was a need to select recommended practices pertaining to kinnow plantation. In the present study the recommended practices of kinnow plantation were selected by counseling the scientists of Department of Horticulture, S.K.N. College of Agriculture, Jobner, K.V.K. Sriganganagar, the package of practices recommended for Sriganganagar district by Agricultural Research Station and Extension Advisory Committee (ZREAC). List of package of practices .

1. Use of recommended propagation method
2. Plantation depth
3. Plant population
4. Planting pit size
5. Filing the pit
6. Irrigation method
7. Application of N
8. Application of P
9. Application of K
10. Application of FYM
11. Plant protection measures
12. Application of growth regulators

TABLE 5. SELECTION OF PANCHAYAT SAMITI, VILLAGES AND RESPONDENTS FOR THE PRESENT STUDY

S.NO.	NAME OF THE PANCHAYAT SAMITIES	NO OF VILLAGES SELECTED	NAME OF SELECTED VILLAGE	TOTAL NO. OF KINNOW GROWERS	NO. O RESPONI SELECT
1.	**SRIGANGANAGAR**	5	1. NATEWALI	99	12
			2. 15 LNP	103	12
			3. 2 ML	89	12
			4. 4 z	102	12
			5. BAKTHANWALI (19 ML)	97	12
2.	**SRIKARANPUR**	5	6. 19 F	100	12
			7. 22 F	105	12
			8. 18 H	103	12
			9. 6 U	98	12
			10. 10 FF	96	12
	TOTAL	**10**		**992**	120

4.3 Variables and their measurement

This section of the chapter deals with the procedure employed in the measurement of various dependent and independent variables selected for study (Table 6).

(A) Measurement of dependent variables

(i) Extent of adoption of recommended kinnow production technology

The extent of adoption of recommended kinnow production technology was measured by means of adoption index developed by S.K. Sharma (1989). Twelve practices were selected for the study of extent of adoption. To fix weightage based on the intrinsic difficulty of adoption of practices, 15 judges comparing of experts of Horticulture Department of S.K.N. College of Agriculture, Jobner, A.R.S., Durgapura and Directorate of Horticulture, Jaipur were contacted inperson with a request to indicate the degree of difficulty of adoption of selected recommended kinnow production technology. The scoring procedure followed for quantifying the response was :

1.Extremely difficult	7
2. Quite difficult	6
3. Rather difficult	5
4. Neither difficult nor easy	4
5. Rather easy	3

6. Quite easy 2

7. Extremely easy 1

The mean score from the judges responses were rounded to nearest whole number for each practice and assigned weightage for the respective practice. The procedure adopted in the quantification of extent of adoption is presented in Table 7.

The formula for calculating the adoption index was as follows:-

$$\text{Adoption index of recommended kinnow production technology} = \frac{\text{Total score}}{\text{Total weightage}} \times 100$$

(B) Measurement of independent variables

After reviewing some of the studies and other relevant literature the knowledge, educational level, social participation, size of land holding, market distance, irrigation potentiality and occupation by the farmers were selected as the independent variables which might influence the extent of adoption of recommended kinnow production technology.

(i) Knowledge level : Knowledge of respondents about recommended kinnow production technology was measured with the help of knowledge test developed by M.C. Dayma (2000) in the light of suggestions of experts from the department of Horticulture, S.K.N. College of Agriculture, Jobner for the study purpose. As require for the

measurement of knowledge on all aspects of the recommended kinnow production technology, in the knowledge test 26 question were included in the schedule for measuring the knowledge level of farmers about recommended kinnow production technology in schedule. One score was given to every correct answer and zero for wrong answer. The mean and standard deviation from the respondents score were computed for classifying the knowledge in different categories (Appendix- I Part-A).

(ii) **Education :** Educational level of farmers was measured by using the modified-socio-economic status scale developed by G. Trivedi (1963) and the scoring was done as per the scale (Appendix-I Part-C).

(iii) **Social participation :** The social participation of farmers was also measured by the modified socio-economic status scale developed by G. Trivedi (1963) and scoring was done accordingly (Appendix- I Part-C).

(iv) **Size of land holding:** It was also measured by the modified socio-economic status scale of G. Trivedi (1963) and scoring was done accordingly (Appendix- I Part-C).

(v) **Market distance:** In this study the market distance has been defined as the distance from the village of the farmer to the market, where, the

kinnow fruits are sold. The distance was measured in terms of Kilometers (Appendix- I Part-C).

(vi) Irrigation potentiality : It was measured in percentage by using following formula (Appendix- I Part-C).

$$\text{Irrigation potentiality} = \frac{\text{Total irrigated area}}{\text{Total size of land holding}} \times 100$$

(vii) Occupation : It refers the way of livelihood of respondents under study, in other words it is the act or work preformed by the farmers. This variable was quantified on the basis of scoring system used in the modified scale of G. Trivedi (1963) in to labour, system occupation and agriculture (Appendix- I Part-C).

4.4 Measurement of constraints

For the purpose of the study, the constraints were defined as the bottlenecks, obstacles or pressing reasons which are technical, economic, storage and marketing and general constraints in the recommended kinnow production technology.

The constraints faced by the respondents were categorized into four major categories namely :

(i) Technical constraints (ii) Economic constraints

(iii) Storage and marketing constraints (iv) General constraints

For measuring these constraints a scale was developed by investigator and further discussed with concerned agricultural scientists of Horticulture, Department of S.K.N. College of Agriculture, Jobner and Government of Rajasthan.

The scale was having three categories *viz.*, upto high extent, upto medium extent and upto low extent for that scores 3, 2 and 1 were awarded respectively. The total score of a constraint was summed up and them divided by total number of respondents to obtain the mean score. The constraints were then ranked in descending order on the basis of these mean scores. For getting the constraint score of an individual respondent, the scores of all the constraints that the individual faced were summed up.

4.5 Tools and techniques of data collection

An interview schedule for collecting data of the respondents, measuring devices of dependent and independent variables and schedule for identification of constraints perceived by the farmers in adoption of recommended kinnow production technology was prepared for the investigation. The entire schedule was subjected to pre-testing before administering it to the actual respondents. The usual care and precautions for interviewing the respondents were duly taken to establish rapport for obtaining factual information. The respondents were personally interviewed by the researcher himself.

4.6 Statistical measures used:-

The following statistical methods were used for interpreting the data and testing the hypothesis:-

(I) FREQUENCY AND PERCENTAGE:

Simple comparisons were made on the basis of frequency and percentage.

(ii) Mean score: Mean score for each variable was obtained by adding all the scores and by dividing this sum by the numbers of respondents.

$$\overline{X} = \frac{\sum Xi}{N}$$

(iii) Mean per cent score (MPS) : Mean per cent scores were obtained by multiplying total obtained score of the respondents by hundred and divided by the maximum obtained score under each practice.

(iv) Standard deviation: The standard deviation (S.D.) measures the absolute dispersion of variability of distribution. Here mean and standard deviation were used in categorization of respondents in different categories.

$$S.D. = \sqrt{\frac{\Sigma_{xi}^2}{N} - \frac{(\Sigma_{xi})^2}{N}}$$

Where,

Σ_{xi}^2 = Sum of squares of the variables

Σ_{xi} = Sum of values of the variables

N = Number of respondents

(v) Correlation: The correlation coefficient (r) is a measure of the degree of association. To study the relationship between any two variables, correlation technique was frequently used in this study. Correlation coefficient between dependent variable Y and selected independent variables X_1, X_2, X_3, X_4, X_5 , X_6 and X_7 were calculated by using the following formula:

$$r = \frac{\Sigma_{xiyi} - (\Sigma x_i)(\Sigma y_i)/N}{\sqrt{\Sigma x_i^2 - (\Sigma x_i)^2/N}\sqrt{\Sigma yi^2 - (\Sigma yi)^2/N}}$$

Where,

r = Correlation coefficient

N = Number of paired observations

x_i = Value of x Variable for i^{th} pair

y_i = Value of y variable for i^{th} pair

The significance of correlation coefficient was tested by 't' value which was measured by using following formula:

$$t = \frac{r - \sqrt{N-2}}{\sqrt{1-r^2}}$$

d.f. = N – 2

(vi) Regression analysis: Regression is a measure of average relationship between two variables. With its help we can know the average probable change in one variable due to a unit change in other variable. For the purpose of the study the relationship between dependent variable 'Y' and the selected

independent variables (X_1, X_2 ----------X_7) a multiple linear regression equation was fitted as follows:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7.$$

Where,

Y = Predicted value of dependent variable

a = Intercept constant, calculated in the following manner

$$a = y + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7$$

BI = PARTIAL REGRESSION COEFFICIENT WHICH REPRESENTS THE AMOUNT OF CHANGE IN 'Y' THAT CAN BE ASSOCIATED WITH A UNIT CHANGE IN ANY ONE OF THE X_I WHEN THE REMAINING INDEPENDENT VARIABLES HOLD FIXED. THE SIGNIFICANCE OF PARTIAL REGRESSION COEFFICIENT CAN BE TESTED BY 'T' TEST.

$$T = \frac{B_I}{S.E.\ (B_I)}$$

WITH D.F. = N – K – 1

WHERE,

K = NO. OF INDEPENDENT VARIABLES

BI = PARTIAL REGRESSION COEFFICIENT

S.E. (BI) = STANDARD ERROR OF PARTIAL REGRESSION COEFFICIENT

(VII) MULTIPLE CORRELATION COEFFICIENT :

MULTIPLE CORRELATION COEFFICIENT (R) WAS CALCULATED BY THE FORMULA:

$$R = \sqrt{\frac{\text{REGRESSION S.S.}}{\text{S.S. (Y)}}}$$

REGRESSION S.S. = B_1. SP (X_1Y) +
B_2.SP(X_2Y)+B_3.SP(X_3Y)+B_4.SP(X_4Y)+B_5.SP(X_5Y) +
B_6.SP(X_6Y)+B_7.SP(X_7Y)

S.S. = $\Sigma X_I^2 - (\Sigma Y_I)^2/N$

SP (X_IY) = $\Sigma_{XIY} - (\Sigma_{XI})(\Sigma_Y)/N$

I = 1, 2, 3, ----------7

SIGNIFICANCE OF MULTIPLE CORRELATION COEFFICIENT (R) WAS TESTED BY USING 'F' TEST BY THE FORMULA:

EMPIRICAL HYPOTHESES (STATED IN NULL FORM):

(I) HYPOTHESIS PERTAINING TO THE ASSOCIATION BETWEEN THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY FARMERS AND THE SELECTED INDEPENDENT VARIABLES

$H_{o1.1}$ There is no association between the extent of adoption of recommended kinnow production technology by the farmers and their knowledge level.

$H_{o1.2}$ There is no association between the extent of adoption of recommended kinnow production technology by the farmers and their education level.

$H_{o1.3}$ There is no association between the extent of adoption of recommended kinnow production technology by the farmers and their social participation

$H_{o1.4}$ There is no association between the extent of adoption of recommended kinnow production technology by the farmers and their size of land holdings.

$H_{o1.5}$ There is no association between the extent of adoption of recommended kinnow production technology by the farmers and their market distance.

$H_{o1.6}$ There is no association between the extent of adoption of recommended kinnow production technology by the farmers and their irrigation potentiality.

$H_{o1.7}$ There is no association between the extent of adoption of recommended kinnow production technology by the farmers and their occupation.

Table : 6. Measurement of variables

S.No.	Variables	Tools used for measurement
A.	**Dependent variable**	
1.	Extent of adoption of recommended kinnow production technology	Adoption scale developed by S.K. Sharma (1989)
B.	**Independent variables**	
1.	Knowledge level	Knowledge test developed by M.C. Dayma (2000) was modified
2.	Educational level	Modified socio-economic status scale developed by G. Trivedi (1963)

3.	Social participation	-do-
4.	Size of land holding	-do-
5.	Market distance	Structured schedule developed by investigator
6.	Irrigation potentiality	-do-
7.	Occupation	G. Trivedi (1963)

TABLE : 7. WEIGHTAGE PROCEDURE FOR THE ADOPTION OF VARIOUS SELECTED RECOMMENDED KINNOW PRODUCTION TECHNOLOGY

S.No.	Practice	Weight	Weightage procedure
1.	Use of recommended propagation method	2	Actual area / Potential area x weight
2.	Plantation depth	3	Actual depth of plantation / Rec. depth of plantation x weight
3.	Plant population	5	Actual plant population/ha / Rec. plant population /ha x weigh
4.	Planting pit size	2	Actual pit size / Rec. pit size x weight

5.	Filling the pit	2	Actual quantity of mixture ---------- x weigh Rec. quantity of mixture
6.	Irrigation intervals	4	Actual interval of irrigation ---------- x wei Rec. interval of irrigation
7.	Application of N	2	Actual quantity of N/ha ---------- x weigh Rec. quantity of N/ha
8.	Application of P	4	Actual quantity of P./ha ---------- x weight Rec.quantity of P/ha
9.	Application of K	4	Actual quantity. of K/ha ---------- x weigh Rec. quantity of K/ha
10.	Application of FYM	2	Actual quantity of FYM/ha ---------- x weight Rec. quantity of FYM/ha
11.	Plant protection measures	5	Actual dose applied /ha ---------- x weight Rec. dose applied/ha
12.	Application of growth regulators	4	Actual qnt. of growth regulator applied ---------- x wei Rec. qnt. of growth regulator applied/h

5. results and discussion

THIS CHAPTER DEALS WITH THE OUTCOMES OF THE RESEARCH STUDY FOLLOWED BY LOGICAL DISCUSSION. FOR THE

PURPOSE OF CLARITY THE FINDINGS HAVE BEEN PRESENTED IN THE FOLLOWING HEADS:

5.1 To measure the knowledge level about recommended kinnow production technology by the farmers.

5.2 To find out the extent of adoption of recommended kinnow production technology by the farmers.

5.3 To find out the relationship between extent of adoption of recommended kinnow production technology by the farmers and selected independent variables

5.4 To find out the constraints as perceived by the farmers in adoption of recommended kinnow production technology.

5.1 KNOWLEDGE LEVEL OF FARMERS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY:

THE ADOPTION LEVEL OF FARMERS TOWARDS RECOMMENDED KINNOW PRODUCTION TECHNOLOGY IS DIRECTLY OR INDIRECTLY RELATED TO KNOWLEDGE LEVEL OF FARMERS ABOUT DIFFERENT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. HENCE, IT WAS CONSIDERED NECESSARY TO ASSESS THE KNOWLEDGE LEVEL OF THE FARMERS ABOUT KINNOW PRODUCTION TECHNOLOGY.

THE KNOWLEDGE ABOUT THE TECHNOLOGY HAD INFLUENCE ON THE DECISION MAKING ABOUT ITS ADOPTION. WITH THIS VIEW IN MIND THE KNOWLEDGE TEST WAS APPLIED TO THE KINNOW GROWERS TO KNOW THEIR KNOWLEDGE ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY.

AS IT HAS BEEN MENTIONED EARLIER IN THE CHAPTER "METHODOLOGY" THAT A KNOWLEDGE TEST DEVELOPED BY M.C. DAYMA (2000) WAS SLIGHTLY MODIFIED TO MEASURE THE KNOWLEDGE LEVEL OF FARMERS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THE RESPONDENTS WERE ASSIGNED SCORES BASED ON THEIR PERFORMANCE. THE RANGE OF KNOWLEDGE SCORES WHICH A RESPONDENT COULD RECEIVE VARY FROM 0 TO 26. THIS RANGE WAS DIVIDED INTO THREE CATEGORIES BASED ON THE MEAN (13.69) AND STANDARD DEVIATION (3.78) AS PRESENTED BELOW:

(I) THE RESPONDENTS WHO OBTAINED KNOWLEDGE SCORES BELOW 9.91 WERE CATEGORISED AS HAVING LOW KNOWLEDGE LEVEL.

(II) THE RESPONDENTS WHO OBTAINED KNOWLEDGE SCORES FROM 9.91 TO 17.46 WERE CATEGORISED AS HAVING MEDIUM KNOWLEDGE LEVEL.

(III) THE RESPONDENTS WHO OBTAINED KNOWLEDGE SCORES ABOVE 17.46 WERE CATEGORISED UNDER HIGH KNOWLEDGE LEVEL.

THE STATISTICAL DATA REGARDING THE KNOWLEDGE LEVEL OF RESPONDENTS ABOUT KINNOW PRODUCTION TECHNOLOGY HAVE BEEN PRESENTED IN TABLE 8.

TABLE : 8 DISTRIBUTION OF FARMERS UNDER DIFFERENT KNOWLEDGE LEVELS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY

N = 120

S.NO.	KNOWLEDGE LEVEL CATEGORIES	NUMBER OF FARMERS	PER CENT OF FARMERS
1.	LOW KNOWLEDGE (SCORES BELOW 9.91)	14	11.67
2.	MEDIUM KNOWLEDGE (SCORES FROM 9.91 TO 17.46)	82	68.33
3.	HIGH KNOWLEDGE (SCORES ABOVE 17.46)	24	20.00
	TOTAL	120	100.00

$\overline{X}$ = 13.69 σ = 3.78

The data in Table 8 state that the whole 68.33 per cent of kinnow growers were having medium knowledge level about recommended kinnow production technology, whereas 20.00 per cent respondents were having high

knowledge level and 11.63 per cent farmers were having low knowledge level about recommended kinnow production technology (Fig. 4).

FURTHER MORE THE PER CENT OF FARMERS HAVING KNOWLEDGE ABOUT DIFFERENT ASPECTS OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY WAS ALSO ANALYSED SEPARATELY. THE RELATIVE IMPORTANCE OF ALL THE 26 ASPECTS OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY WAS HIGHLIGHTED BY RANKING THEM ON THE BASIS OF THE PER CENT OF FARMERS HAVING KNOWLEDGE ABOUT THESE RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THE DATA HAS BEEN PRESENTED IN TABLE 9 (FIG. 5).

From the data in table 9 is evident that 94.17 per cent farmers had knowledge about "Recommended method of hoeing and weeding" and was ranked first. About 91.67 per cent farmers had knowledge about the recommended kinnow production technology like "Recommended row to row distance" and was ranked second followed by "Plant protection measures" (87.50 per cent) which was ranked third.

About 85.83 per cent farmers had knowledge about the "Advantages of intercropping" and ranked was fourth, followed by "Recommended season or month for planting" (84.17 per cent) was ranked fifth.

About 82.50 per cent had knowledge about “Name of intercrop” and “Average harvest from a kinnow tree of 4 to 5 years age in the season” and were jointly ranked sixth, followed by “Recommended marketing channels” (81.67 per cent), it was ranked seventh.

The practices of kinnow plantation like “Recommended method of propagation” (77.50 per cent) and “Recommended irrigation interval in different season”, which were jointly ranked eighth, followed by “Suitable marketing channel is more beneficial” (75.00 per cent), “Recommended month of propagation” (74.17 per cent), “Recommended method of harvesting” (71.67 per cent), “Recommended irrigation method” (70.83 per cent) which were ranked ninth, tenth, eleventh and twelth, respectively.

The practices of kinnow production technology like “Recommended pit size” and “Recommended quantity of manures and fertilizers at the planting time” (68.33 per cent) were jointly ranked thirteenth followed by “Suitable method of training” and “Recommended time of pruning” (67.50 per cent) were jointly ranked fourteenth, about 65.85 per cent had knowledge about “Recommended quantity of manure and fertilizer to be applied per plant” and ranked was fifteenth, followed by “Recommended one suitable another method of irrigation” (64.17 per cent), “Recommended precaution taken in vegetative propagation” (57.50 per cent), “Recommended time of application for manure and fertilizers” (50.83 per cent), “Recommended plant to plant spacing” (42.50

per cent) and “Where from the get the reliable plants” (39.17 per cent), which were ranked sixteenth, seventeenth, eighteenth, nineteenth and twentieth, respectively.

About 25.83 per cent farmers had knowledge about the “Recommended herbicide” and ranked at second last place. Only 14.17 per cent farmers were having knowledge about the “Recommended growth regulators” and this was ranked last because of being kinnow of minimum numbers of farmers.

Discussion

From the findings it is clear that majority of the respondent (88.33 per cent) had medium (68.33 per cent) to high (20.00 per cent) knowledge about recommended kinnow production technology because most of the farmers were literate, due to which they might have read literature regarding recommended kinnow production technology. Most of the farmers were using more sources of information and hence were gaining more knowledge. Also they were participating more in social organizations due to which they might have gained more knowledge by discussing with other farmers, group members about recommended kinnow production technology. A few of the farmers were having low knowledge which might be attributed due to the fear among the farmers about the new innovations. Only 11.67 per cent farmers were having low knowledge, which might be due to lack of specialized trainings about recommended kinnow production technology.

From the findings it is also evident that majority of the farmers were having high knowledge about the “Recommended method of hoeing and

weeding", "Recommended row to row distance", "Plant protection measures", "Advantages of the intercropping", "Recommended month or season for planting" and "Name of intercrop". This might be due to the reason that majority of farmers were regularly growing kinnow for market purpose and these practices are most critical from the point of view of the kinnow production. A slight carelessness in these practices may reduce the production of kinnow drastically, so that the farmers remain most careful about these practices. Also for producing good quality kinnow, they mostly remain in contact with the extension agencies, sales agents etc. resulting the gain in knowledge about these recommended kinnow production technology. Also most of the farmers under study were literate hence they might know about these practices by reading the related literature. They also remain in contact with the neighbours, friends, progressive farmers and with subject mater specialists etc. Farmers due to their experience usually able to indicate the flowering and fruiting time by seeing size and colour of the kinnow fruits.

The farmers had low knowledge about "Recommended growth regulators" and "Recommended herbicide". This might be due to the reason that the farmers might not understand the instructions written on the pack of chemicals because of its complex language, as the instructions are mostly written in English or in typical Hindi language or in the language of the particular state where the growth regulators, herbicide are manufactured.

The findings of the study are in conformity with the findings of Nainawat (1990), Dayma (2000) and Poonia (2002). However the findings are in contradiction of the findings of Nimje *et al.* (1991).

5.2.1 Extent of adoption of recommended kinnow production technology by the farmers :

As stated in the chapter "Methodology", that the extent of adoption of recommended kinnow production technology by the farmers was calculated by means of an adoption index developed by S.K. Sharma (1989) with slightly modification. Based on the adoption scores obtained by the respondents the mean score (21.02) and standard deviation (5.26) were computed for the purpose of classifying the adoption level of farmers about recommended kinnow production technology into three categories namely, low level, medium level and high level. In this way the respondents were categorized in three groups as follows:

(i) Respondents who obtained adoption scores below 15.76 were categorised as low adopters

(ii) Respondents who obtained adoption scores from 15.76 to 26.27 were categorised as medium adopters.

(iii) Respondents who obtained adoption scores more than 26.27 were categorised as high adopters.

The statistical data regarding the extent of adoption of recommended kinnow production technology by the farmers have been presented in Table 10 (Fig. 6).

TABLE : 10 DISTRIBUTION OF FARMERS UNDER DIFFERENT ADOPTION CATEGORIES TOWARDS RECOMMENDED KINNOW PRODUCTION TECHNOLOGY

N = 120

S.NO.	ADOPTION CATEGORIES	NUMBER OF FARMERS	PER CENT OF FARMERS
1.	LOW ADOPTERS (SCORES BELOW 15.76)	20	16.67
2.	MEDIUM ADOPTERS (SCORES FROM 15.76 TO 26.27)	78	65.00
3.	HIGH ADOPTERS (SCORES ABOVE 26.27)	22	18.33
	TOTAL	**120**	**100.00**

$\overline{X}$ = 21.02 σ = 5.26

A CLOSE LOOK AT THE TABLE 10 EXPLAINS THAT ON THE WHOLE 65.00 PER CENT OF THE FARMERS WERE FOUND TO BE MEDIUM ADOPTERS, WHILE 18.33 PER CENT FARMERS WERE HIGH ADOPTERS AND ONLY 16.67 PER CENT OF THE RESPONDENTS WERE LOW ADOPTERS.

FURTHER MORE THE EXTENT OF ADOPTION ABOUT DIFFERENT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY WAS ALSO ANALYSED SEPARATELY. THE

RELATIVE ADOPTION OF ALL THE TWELVE PRACTICES OF KINNOW PLANTATION WAS HIGHLIGHTED BY RANKING THEM IN DESCENDING ORDER ON THE BASIS OF THEIR EXTENT OF ADOPTION IN PERCENTAGE. THE DATA HAVE BEEN PRESENTED IN TABLE 11 (FIG. 7).

Table : 11Extent of adoption of recommended kinnow production technology by the farmers

N = 120

S. No.	Aspects of adoption	Extent of adoption (per cent)	Rank
1.	Recommended method of propagation	65.83	V
2.	Plantation depth	88.06	IV
3.	Plant population	96.00	I
4.	Planting pit size	37.92	IX
5.	Filling the pit	33.75	X
6.	Application of N	57.08	VII
7.	Application of P	61.88	VI
8.	Application of K	53.96	VIII
9.	Application of FYM	92.08	III
10.	Irrigation intervals	94.38	II
11.	Plant protection measures	13.17	XI
12.	Application of growth regulators	6.67	XII
	Overall adoption	56.39	-

It is apparent from the data presented in Table 11 that the over all extent of adoption of improved practices of kinnow plantation was 56.39 per cent. Out of 12 selected practices, the extent of adoption of "Plant population" was 96.00 per cent which was highly adopted by the farmers and was ranked first in the adoption of recommended kinnow production technology. The adoption of "Irrigation interval" (94.38 per cent) was ranked second. The third rank was accorded to the adoption of "Application of FYM" which was adopted by kinnow growers to the extent of 92.08 per cent.

The extent of adoption of "Plantation depth" was 88.06 per cent and was ranked fourth, followed by "Recommended method of propagation" (65.83per cent) and "Application of phosphorus" (61.88 per cent) and were placed at fifth and sixth position, respectively.

The practices like "Application of N" and "Application of potash", were moderately adopted as their extent of adoption was 57.08 per cent and 53.96 per cent and were ranked seventh and eight. The low adoption was found in the practices of "Planting pit size" (37.92 per cent) and "Filling the pit" (33.95 per cent) and were ranked ninth and tenth.

THE VERY LOW ADOPTION WAS FOUND IN THE PRACTICE OF "PLANT PROTECTION MEASURES" (13.17 PER CENT) AND WAS RANKED ELEVENTH. THE "APPLICATION OF GROWTH REGULATORS" WAS THE LEAST ADOPTED PRACTICES

BY THE KINNOW GROWERS AND WAS ADOPTED ONLY TO EXTENT OF 6.67 PER CENT AND WAS RANKED LAST.

Discussion

It was found that the majority of the respondents (65.00 per cent) were medium adopters, 18.23 per cent of the kinnow growers were high adopters and only 16.67 per cent respondents were low adopters of recommended kinnow production technology. It might be due to the various extension activities like demonstrations, trainings, inspection of fields and the suitable solution of the individual problems of kinnow growers which were provided on the field by the experts of insecticide, pesticide companies, sales dealers etc. which may have helped the farmers in increasing the adoption of these recommended kinnow production technology by the farmers. But still there is an increasing recognition of the need to convert these medium adopters (65.00 per cent), therefore, all the essential supplies and services for transfer of technology through extension activities and through other sources should be made available to the farmers and intensive efforts to convince the farmers about recommended kinnow production technology is needed.

The adoption of "Plant population", "Irrigation intervals", "Application of FYM", "Plantation depth", "Recommended method of propagation" and "Application of phosphorus" were appropriate as they might have got good return due to the adoption of these practices. As these practices

neither require any extra investment, nor complicated in adoption and the crop would give better results.

The farmers had inadequately adopted the practices like "Application of nitrogen" and "Application of potash". The probable reason for low adoption of above practices might due to the reason that the lack of knowledge about adequate quantity of nitrogen and potash fertilizers application in kinnow orchard.

The low adoption of "Plant protection measures" which might be due to the reason that most of the kinnow growers were not using insecticides. It might also be due to the need of special equipments for spray or their hazardous effect on human beings and non-availability of suitable insecticides and fungicides.

The very low adoption of "Application of growth regulators" might be due to the reason that the farmers do not had good knowledge about suitable growth regulators for kinnow and lack of proper technical guidance by the supervisor about this aspect.

The findings of the present study are in line with the findings of Nainawat (1990), Deshmukh (1998), Meena (2002) and Meena (2004).

5.3 Relationship between adoption of farmers about recommended kinnow production technology and selected independent variables:

Adoption process is not a snap decision. It consists of certain phases or steps, after passing through which an individual decides whether to adopt or reject the particular innovation. It is also true that the innovation itself is not the only thing which causes adoption or rejection. Certain other factors are there, which directly and indirectly affect the adoption process. Thus, it was tried to trace-out those factors by finding-out relationship between adoption levels of farmers about recommended kinnow production technology and different independent variables.

THE ASSOCIATION BETWEEN THE ADOPTION LEVEL OF FARMERS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY AND SELECTED INDEPENDENT VARIABLES NAMELY, "KNOWLEDGE LEVEL", "EDUCATION LEVEL", "SOCIAL PARTICIPATION", "SIZE OF LAND HOLDING", "MARKET DISTANCE", "IRRIGATION POTENTIALITY" AND "OCCUPATION" WAS MEASURED BY COMPUTING "COEFFICIENT OF CORRELATION (R) ". THE DATA HAVE BEEN PRESENTED IN TABLE12 (FIG. 8).

Table : 12. Relationship between selected independent variables and extent of adoption of recommended kinnow production technology

N=120

S.No.	*Independent variables*	**Coefficient of**

		correlation
1.	Knowledge level	0.2119*
2.	Education level	0.2892**
3.	Social participation	0.0193
4.	Size of land holding	0.242*
5.	Market distance	-0.2961**
6.	Irrigation potentiality	0.169
7.	Occupation	0.221*

* Significant at 0.05 level of probability

** Significant at 0.01 level of probability

A CRITICAL EXAMINATION OF THE DATA PRESENTED IN TABLE 12 REVEALS THAT THE KNOWLEDGE LEVEL, SIZE OF LAND HOLDING AND OCCUPATION BY THE FARMERS WERE POSITIVELY AND SIGNIFICANTLY CORRELATED WITH THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY AT 0.05 LEVEL OF PROBABILITY. THE FARMER'S EDUCATION LEVEL WAS POSITIVELY AND SIGNIFICANTLY CORRELATED, WHILE THE MARKET DISTANCE WAS NEGATIVELY AND SIGNIFICANTLY CORRELATED WITH THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY AT 0.01 LEVEL OF PROBABILITY. THE SOCIAL PARTICIPATION AND IRRIGATION POTENTIALITY OF FARMERS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY WERE POSITIVELY AND NON SIGNIFICANTLY ASSOCIATED.

THESE FINDINGS REJECT THE HYPOTHESES $HO_{1.1}$, $HO_{1.2}$, $HO_{1.4}$, $HO_{1.5}$ AND $HO_{1.7}$ THAT "THERE WAS NO ASSOCIATION BETWEEN THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS AND THEIR KNOWLEDGE LEVEL, EDUCATION LEVEL, SIZE OF LAND HOLDING, MARKET DISTANCE AND OCCUPATION. IT MEANS THAT THESE FACTORS EXTERTED A HIGHLY SIGNIFICANT EFFECT ON THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THE OBSERVATION CONFIRM THE HYPOTHESES $HO_{1.3}$ AND $HO_{1.6}$ THAT "THERE IS NO ASSOCIATION BETWEEN SOCIAL PARTICIPATION AND IRRIGATION POTENTIALITY OF THE RESPONDENTS AND THEIR EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY.

DISCUSSION

1. KNOWLEDGE LEVEL

AS AGAINST THE NULL HYPOTHESIS $HO_{1.1}$ THE KNOWLEDGE LEVEL OF FARMERS WAS POSITIVELY AND SIGNIFICANTLY ASSOCIATED WITH THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THIS MIGHT BE DUE TO THE FACT THAT THE ADOPTION OF ANY RECOMMENDED KINNOW PRODUCTION TECHNOLOGY DEPENDS UPON ACCURATE AND UPTO DATE KNOWLEDGE ABOUT IT THE

FARMERS HAVE. A FARMER CAN NOT BE MOTIVATED FOR ADOPTION OF ANY RECOMMENDED KINNOW PRODUCTION TECHNOLOGY UNLESS HE HAS SUFFICIENT KNOWLEDGE OF THE RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. HENCE, IT IS QUITE OBVIOUS THAT KNOWLEDGE HAS EXERCISED A CONSPICUOUS ROLE IN THE ADOPTION BEHAVIOUR OF THE FARMERS.

THE FINDINGS OF STUDY ARE IN CONFORMITY WITH THE FINDINGS OF PAREWA (1992), YADAV (1997) AND AGARWAL (2000).

2. EDUCATION LEVEL

AS AGAINST THE NULL HYPOTHESIS $HO_{1.2}$ THE LEVEL OF EDUCATION OF FARMERS WAS POSITIVELY AND SIGNIFICANTLY RELATED WITH THEIR EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. IT MEANS THAT THE FARMERS WITH HIGHER EDUCATION WERE SUBJECTED TO HIGHER ADOPTION OF THE RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THIS MIGHT BE DUE TO THE FACT THAT AS THE LEVEL OF EDUCATION INCREASE, THE FARMERS GET EXPOSED TO VARIOUS PRINTED MATERIALS RELATED TO RECOMMENDED KINNOW PRODUCTION

TECHNOLOGY. THEY COULD READ THE WRITTEN MATERIALS REGARDING RECOMMENDED KINNOW PRODUCTION TECHNOLOGY WHICH WOULD HAVE CONVINCED THEM ABOUT IT, WHICH WILL LEAD TO ADOPTION OF THESE PRACTICES. IT ALSO HELPED IN FORMING THE POSITIVE ATTITUDE TOWARDS THE RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. IT MIGHT ALSO BE DUE TO THE REASON THAT A FARMERS HAVING HIGH EDUCATION CAN BETTER MANAGE THE PROBLEMS AND HENCE CAN GET MORE PROFIT RESULTING IN MORE ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY.

THE FINDINGS OF STUDY ARE IN CONFORMITY WITH THE FINDINGS OF AGARWAL (2000), JANGID (2001) AND MEENA (2004).

3. SOCIAL PARTICIPATION

AS PER THE NULL HYPOTHESIS $HO_{1.3}$ THE DEGREE OF SOCIAL PARTICIPATION OF FARMERS WAS FOUND POSITIVELY AND NON-SIGNIFICANTLY RELATED WITH THEIR EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. IT MEANS IT DO NOT HAVE MUCH SIGNIFICANT ROLE IN ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THIS MIGHT BE DUE TO THE FACT THAT THE

FARMERS WHO HAD HABIT OF PARTICIPATION IN SOCIAL ACTIVITIES MIGHT BE DISCUSSING MORE ABOUT POLITICAL OR OTHER MATTERS INSTEAD OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. IT MAY ALSO BE DUE TO THE REASON THAT THE FARMERS WHO SPEND THEIR MOST OF TIME IN SOCIAL PARTICIPATION, MAY NOT HAVE MUCH TIME FOR ATTENDING THE TRAININGS, DEMONSTRATIONS ETC. ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY.

THE FINDINGS OF STUDY ARE IN CONFORMITY WITH THE FINDING OF YADAV (1997), DAYMA (2000) AND MEENA (2004). HOWEVER THE FINDINGS ARE IN CONTRADICTION OF THE FINDINGS OF BHUJBAL AND KADAM (1995).

4. SIZE OF LAND HOLDING

AS AGAINST THE NULL HYPOTHESIS $HO_{1.4}$ THE SIZE OF LAND HOLDING OF FARMERS WAS FOUND POSITIVELY AND SIGNIFICANTLY ASSOCIATED WITH THEIR EXTENT OF ADOPTION RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. IT MEANS THIS VARIABLE HAD EXERTED A SIGNIFICANT INFLUENCE ON THE ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. HENCE, SIZE OF LAND HOLDING WAS AN IMPORTANT FACTOR FOR THE

ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THE RESULTS SEEMS TO BE QUITE NATURAL BECAUSE OF THE FACT THAT BIG FARMERS CAN TAKE THE RISK OF ADOPTION OF NEW AND IMPROVED TECHNOLOGY.

THE FINDINGS OF THE STUDY ARE IN CONFORMITY WITH THE FINDINGS OF AGARWAL (2000), NARUKA (2000) AND MEENA (2004). HOWEVER THE FINDINGS ARE IN CONTRADICTION OF THE FINDINGS OF JHAJHARIA (2005).

5. MARKET DISTANCE

AS AGAINST THE NULL HYPOTHESIS $HO_{1.5}$ THE MARKET DISTANCE WAS NEGATIVELY AND SIGNIFICANTLY RELATED WITH THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS. IT MEANS LESS THE MARKET DISTANCE MORE IS THE ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THE FINDINGS MIGHT BE SO DUE TO THE REASON THAT THE FARMERS WHO LIVE NEAR TO MARKET MAY ADOPT MORE IMPORTANT PRODUCTION TECHNOLOGY DUE TO BEING MARKET MINDED AND MAY ADOPT THE CROPS ACCORDING TO THE MARKET TREND.

ALSO THE FARMERS LIVING NEAR MARKET MIGHT BE MORE CAUTIOUS TO CONTACT THE EXTENSION AGENCIES AND MAY ADOPT MORE RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THEY MIGHT GROW THE FRUITS FOR MARKET SALE, WHERE THEY CAN SELL KINNOW FRUIT MORE EASILY. IT MIGHT ALSO DUE TO THE REASON THAT THE PURCHASING AGENCIES THEMSELVES REACH THOSE FARMERS FOR BUYING KINNOW FRUITS WHO ARE TO MARKET AND THESE AGENCIES MIGHT MOTIVATE THESE FARMERS TO GROW MORE KINNOW FRUITS AND ADOPT ITS IMPROVED PRODUCTION TECHNOLOGY. THE RESULTS ARE IN ACCORDANCE WITH FINDINGS OF YADAV (1997) AND MEENA (2004). HOWEVER THE FINDINGS ARE IN CONTRADICTION OF THE FINDINGS OF DAYMA (2000).

6. IRRIGATION POTENTIALITY

AS PER THE NULL HYPOTHESIS $HO_{1.6}$ THE IRRIGATION POTENTIALITY WAS POSITIVELY AND NON-SIGNIFICANTLY ASSOCIATED WITH THE ADOPTION LEVEL OF FARMERS ABOUT THE RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. HENCE, THE HYPOTHESIS $HO_{1.6}$ THAT "THERE IS NO ASSOCIATION BETWEEN THE ADOPTION LEVEL OF FARMERS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY AND THEIR IRRIGATION POTENTIALITY" WAS THEREFORE,

ACCEPTED. IT MEANS IRRIGATION POTENTIALITY EXERTED A NON SIGNIFICANT EFFECT ON THEIR ADOPTION LEVEL ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY.

THE RESULTS ARE IN ACCORDANCE WITH FINDINGS OF mEENA (2003). HOWEVER THE FINDINGS ARE IN CONTRADICTION OF THE FINDINGS OF GOMASE AND PATIL (1998).

7. OCCUPATION

AS PERUSAL OF DATA IN TABLE 12 INDICATES THAT THE OCCUPATION OF KINNOW GROWERS WAS FOUND POSITIVELY AND SIGNIFICANTLY RELATED WITH EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. HENCE, THE HYPOTHESIS ($H_{01.7}$) STATED THAT NULL FROM THAT "THERE IS NO ASSOCIATION BETWEEN THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS AND THEIR OCCUPATION" WAS THEREFORE, REJECTED. IT MEANS OCCUPATION OF FARMERS EXERTED ITS INFLUENCE ON THE ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY. THIS MIGHT BE DUE TO THE FACT THAT MAJORITY OF THE RESPONDENTS CULTIVARS ADOPTING

RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BECAUSE FARMING WAS MAIN OCCUPATION FOR THEIR LIVELIHOOD. THE FINDINGS OF THE STUDY ARE IN CONFORMITY WITH THE FINDINGS OF RAJPUT (1997) AND KUMAWAT (2005).

MULTIPLE REGRESSION ANALYSIS OF THE INDEPENDENT VARIABLES WITH THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS

Besides finding out the relationship between each of the independent variables and the extent of adoption of recommended kinnow production technology by the farmers, it was felt essential to analyse critically the relative influence of different selected independent variables on the extent of adoption of improved practices of kinnow plantation by the farmers, separately as well as combindly. For this purpose "Multiple regression technique" was used.

All the seven independent variables viz., "Knowledge level", "Education level", "Social participation", "Size of land holding", "Market distance", "Irrigation potentiality" and "Occupation" were fitted with the extent of adoption of farmers in the multiple regression equation. The findings have been presented in Table 13.

Table : 13. Multiple regression analysis of the independent variables with extent of adoption of recommended kinnow production technology by the farmers

N=120

S.No.	*Independent variables*	b. value (R. Coff.)	S. error of b. value	't' value
1.	Knowledge level	0.055	0.024	2.291*
2.	Education level	1.177	0.302	3.897**
3.	Social participation	-0.214	0.148	1.445
4.	Size of land holding	7.568	1.329	5.695**
5.	Market distance	-0.136	0.064	2.125*
6.	Irrigation potentiality	0.0508	0.034	1.495
7.	Occupation	0.086	0.037	2.324*

** Significant at 0.01 level of probability

* Significant at 0.05 level of probability

Coefficient of determination (R^2) = 0.665

Multiple correlation (R) = 0.816**

A CLOSE STUDY OF THE DATA IN TABLE 13 ELUCIDATES THAT ALL THE SEVEN INDEPENDENT VARIABLES TAKEN TOGETHER EXPLAINED TO THE EXTENT OF 66.5 PER CENT OF THE VARIATION IN THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS. THUS, THE RESULTS IMPLIED THAT ALL THE SEVEN INDEPENDENT VARIABLES WOULD ACCOUNT FOR A SIGNIFICANT AMOUNT OF VARIATION IN THE EXTENT OF ADOPTION OF FARMERS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY.

FURTHER, THE 'T' TEST OF SIGNIFICANCE EXPRESSED THE COEFFICIENT OF REGRESSION ('B' VALUE) WAS FOUND POSITIVELY SIGNIFICANT FOR EDUCATION LEVEL AND SIZE OF LAND HOLDING AT 0.01 LEVEL OF PROBABILITY. HENCE, THESE VARIABLES WERE HIGHLY IMPORTANT IN PREDICTING THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS. THE KNOWLEDGE LEVEL, MARKET DISTANCE AND OCCUPATION WERE ALSO FOUND POSITIVELY SIGNIFICANT AT 0.05 LEVEL OF PROBABILITY. IT MEANS THESE WERE ALSO IMPORTANT FOR PREDICTING THE EXTENT OF ADOPTION OF RECOMMENDED KINNOW PRODUCTION TECHNOLOGY BY THE FARMERS. ON THE CONTRARY, COEFFICIENT OF REGRESSION (B-VALUE) WAS NON SIGNIFICANT FOR SOCIAL PARTICIPATION AND IRRIGATION POTENTIALITY. HENCE, THESE VARIABLES WERE NOT MUCH IMPORTANT IN PREDICTING THE EXTENT OF ADOPTION OF FARMERS ABOUT RECOMMENDED KINNOW PRODUCTION TECHNOLOGY.

THE RESULTS ARE IN ACCORDANCE WITH FINDINGS OF AGARWAL (2000) AND MEENA (2004).

5.3 Constraints in adoption of recommended kinnow production technology by the farmers

In this part an attempt was made to measure the intensity of constraints faced by the kinnow growers in adoption of recommended kinnow production technology. For this purpose a schedule was developed by the investigator which was having three response categories namely “Up to high extent”, “Up to medium extent” and “Upto low extent”. The scores awarded to these response categories were 3, 2 and 1 respectively. The mean scores of individual constraints were computed and were ranked in descending order. The constraints encountered by the respondents were categorized into four categories namely, “Technical constraints”, “Economical constraints”, “Storage and marketing constraints” and “General constraints”. The findings regarding these constraints have been presented in Table 14 (Fig. 9, 10).

It is evident from the table that the constraint “High initial cost in establishing of orchards” (2.93 MS) was the most perceived constraint among all the constraints faced by the farmers in adoption of recommended kinnow production technology, as it was perceived by 92.50 per cent farmers upto high extent and by 7.50 per cent farmers upto medium extent and hence it was awarded first rank. The second most perceived constraints by the farmers in adoption of recommended kinnow production technology was “Irregular water supply from the canal” (2.92 MS), followed by “Lack of proper market” (2.85 MS) and “Lack of need based training” (2.84 MS) which were ranked third and fourth, respectively. The constraints “Poor quality irrigation water” (2.80 MS) and “High mortality of plant during initial year” (2.78 MS) which were ranked fifth and sixth, respectively.

The constraint “Lack of storage facility in the area” (1.51 MS) was the least perceived constraint by the farmers as it was perceived by only 13.34 per cent

farmers upto high extent, by 24.17 per cent farmers upto medium extent and by 62.50 per cent farmers upto low extent, where as the "Unsuitable soil for orcharding" (1.54 MS) was perceived as the second least ecounted constraint and was ranked at second last position.

The problem of "High initial cost in establishing orchard" might be due to the fact that for starting the establishment of orchard require more investment. It might also be due to the long juvenile period i.e. unproductive period.

A. Technical constraints in adoption of recommended kinnow production technology :

The data in Table 14 depicted that the constraint "Irregular water supply from the canal" (2.92 MS) was the most perceived technical constraint by the farmers and it was perceived by 92.50 per cent farmers upto high extent and by 6.67 per cent farmers upto medium extent. The second rank was awarded to the constraint "Poor quality irrigation water" (2.80 MS), which was perceived by 72.50 per cent farmers upto high extent, by 12.50 per cent farmers upto medium extent and by 10.00 per cent farmers upto low extent.

The third rank was occupied by the constraint "High mortality of plants during initial year" (2.78 MS), followed by "Lack of knowledge about modern irrigation system (drip irrigation)" (2.46 MS), "Long vegetative period *i.e.* unproductive period" (2.43 MS) and "Disease sensitive" (2.32 MS), which obtained fourth, fifth and sixth ranks, respectively.

The last rank was awarded to constraint "Unsuitable soil for orcharding" (1.54 MS) which was perceived by only 27.50 per cent farmer upto high extent, by 40.83 per cent farmers upto medium extent and by 31.67 per cent farmers upto low extent (Fig. 9).

Discussion

The problem of "Irregular water supply fro m the canal" might be because of the reason that the uncontrol flooding of irrigation water and lack of knowledge about recommended irrigation system. The problem of "Poor quality irrigation water" might be due to the reason that the high salinity in the water reduce the quality of irrigation water and it reduced the yield ultimately. The farmers did not know about the quality of water and its harmful effects.

The findings was the line with the findings of Sharma (1997), Mohammad (2000) and Poonia (2002). However the findings are in contradiction of the findings of Shrestha *et al.* (1998).

B. Economic constraints in adoption of recommended kinnow production technology

The data in Table 14 depicted that the constraint "High initial in establishing of orchards" (2.93 MS) was the most important economic constraint faced by the farmers as it was perceived by 92.50 per cent farmers upto high extent and by 7.50 per cent farmers upto medium extent and was ranked first. The constraint "Labour intensive affair" (2.67 MS) was perceived by farmers as the second most important constraint as it was perceived by 74.17 per cent farmers upto high extent, by 18.33 per cent farmers upto medium extent and 7.50 per cent farmers upto low extent and was ranked second.

The third rank was awarded to the problem "Lack of credibility in the area" (2.52 MS). The constraint "High cost of transport of fruits and plant materials" (2.46 MS), "High existence of grading practice in the fruit in the area" (2.41 MS), "High cost of plant materials" (2.40 MS), "Costly labour" (2.38 MS) and Perishable nature of commodity results in economic loss" which obtained fourth, fifth, sixth, seventh and eighth rank, respectively. The last economic constraint was "High cost of insecticides and pesticides" (2.06 MS) which was perceived 26.67 per cent farmers upto

high extent, by 29.17 per cent farmers upto medium extent and 26.17 per cent farmers upto low extent and was ranked last (Fig. 9).

Discussion

Regarding the economical constraints it was found that "High initial cost of establishing of orchards", "Labour intensive affair", "Lack of credibility in the area" and "High cost of transport of fruits and plant materials" which were the major economical constraints faced by the respondents. This might be due to the fact that average farmers can not afford these expenses. More over farmers can get return from kinnow plant after 3 to 6 years. Till then he can not wait so he did not want to invest money in such interprise, where the return was not possible for 3 to 6 years. The problem of "Labour intensive affair" might be due to the reason that the there was lack of manual labour and it costs the labour intensive affair.

Finding was in the line with the findings of Pandey (1993), Sutar (1997) and Mohammad (2000). However the findings are in contradiction of the findings of Vasava and Pandya (2003).

C. Storage and marketing constraints in adoption of recommended kinnow production technology

It is revealed from Table 14 that "Lack of proper market" (2.85 MS) which was perceived by 90.83 per cent farmers upto high extent, by 3.33 per cent farmers upto medium extent and by 5.83 per cent farmers upto low extent and was awarded first rank among the storage and marketing constraint. The second most perceived storage and marketing constraint "High fluctuation in the market prices" (2.72 MS) was perceived by 82.50 per cent farmers upto high extent, by 6.67 per cent farmers upto medium extent and by 10.83 per cent farmers upto low extent and it occupied second rank.

The third rank was awarded to constraint "Mal practices of middlemen" (2.61 MS), followed by "Lack of preservation industry in the area" (2.51 MS) and "Unpopular co-operative marketing system and general unawareness about kinnow by products and their nutritional value (1.66 MS)" and were accorded fourth fifth and sixth rank, respectively. The constraint "Lack of storage facility in the area" (1.51 MS) was perceived as the least important constraint by the farmers as it was perceived by 13.34 per cent farmers upto high extent, by 24.17 per cent farmers upto medium extent and by 62.50 per cent farmers upto low extent and was ranked seventh and last (Fig. 10).

Discussion

The main storage and marketing constraint "Lack of proper market" might be due to the reason that the local consumption of kinnow fruits is less than the production and the quality inferior of export. The problem of "High fluctuation in the market price" might be due to the fact that the black marketing and higher interference of middlemen. The problem "Malpractice of middlemen", might be due to the reason that there was major problem of illiteracy of farmers in the study area.

The findings supported the findings of Mohammad and Punjabi (1997) and Poonia (2002). However the findings are in contradiction of the findings of Devi and Manoharran (1999).

D. General constraints in adoption of recommended kinnow production technology

The data in Table 14 shows that the constraint "Lack of need based training" (2.84 MS) was considered as the most important general constraint by the farmers, as it was perceived by 84.17 per cent farmers upto high extent, by 15.83 per cent farmers upto medium extent and was ranked first. The problem "Lack of reliable source of plant material" (2.76 MS) was perceived as the second most important general constraint by the farmers, as it was perceived by 85.83 per cent farmers upto high extent, by 4.17 per cent farmers upto medium extent and by 10.00 per cent farmers upto low extent and was ranked second.

The third most important constraint was "Unfavourable weather conditions (frost, drought, erratic rainfall etc." (2.67 MS) which was perceived by 80.83 per cent farmers upto high extent, by 7.50 per cent farmers upto medium extent and by 11.67 per cent farmers upto low extent and was ranked third. The constraint which was perceived least important by the farmers was "Threat from wild and stray animals" (1.65 MS) which was perceived by only 17.50 per cent farmers upto high extent, by 52.50 per cent farmers upto medium extent and by 75.00 per cent farmers upto low extent and was ranked at eight and last (Fig. 10).

Discussion

The main general constraints "Lack of need based training", might be due to reason that there was large gap of communication between extension workers and kinnow growers. The problem of "Lack of reliable source of plant material" might be due to fact that these was lack of registered nursery which may provide better plant material and lack of knowledge about improved propagation and protection methods. The problem "Unfavourable weather conditions" might be due to the reason of geographical situation of that area, uncertainty of climate and these conditions are uncontrolled to human being.

The findings supported the findings of Sharma (1997) and Meena (2004). However the findings are in contradiction of the findings of Urade *et al.* (1991).

Table : 9. Per cent of farmers having knowledge about different aspects of recommended kinnow production technology

N= 120 (multiple response)

S.No.	Knowledge aspects of recommended kinnow production technology	No. of farmers	Per cent of farmers	Rank
1.	Recommended method of	93	77.50	VIII

	propagation			
2.	Recommended month of propagation	89	74.17	X
3.	Recommended precaution taken in vegetative propagation	69	57.50	XVII
4.	Where from get the reliable plants	47	39.17	XX
5.	Recommended pit size	82	68.33	XIII
6.	Recommended quantity of manure at the planting time	82	68.33	XIII
7.	Recommended season or month for planting	101	84.17	V
8.	Recommended plant to plant spacing	51	42.50	IXX
9.	Recommended row to row distance	110	91.67	II
10.	Recommended irrigation interval	93	77.50	VIII
11.	Recommended irrigation method in kinnow orchard	85	70.83	XII
12.	Recommended suitable another method of irrigation during intercropping	77	64.17	XVI
13.	Name of intercrop	99	82.50	VI
14.	Advantages of the intercropping	103	85.83	IV

Contd ……

S.No.	Knowledge aspects of recommended kinnow production technology	No. of farmers	Per cent of farmers	Rank
15.	Recommended quantity of manure and fertilizers to be applied per plant	79	65.83	XV
16.	Recommended time of application for manure and fertilizers	61	50.83	XVIII

17.	Suitable method of training	81	67.50	XIV
18.	Recommended time of pruning	81	67.50	XIV
19.	Recommended method of hoeing and weeding	111	94.17	I
20.	Recommended herbicide	31	25.83	XXI
21.	Recommended growth regulators	17	14.17	XXII
22.	Recommended plant protection measures	105	87.50	III
23.	Recommended method of harvesting	86	71.67	XI
24.	Recommended marketing channels	98	81.67	VII
25.	Suitable marketing channel is more beneficial	90	75.00	IX
26.	Average harvest from a kinnow tree of 4-5 years age in the season	99	82.50	VI

Table : 14. Constraints faced by the farmers in adoption of recommended kinnow production technology

N= 120 (multiple response)

S.No.	Constraints	Most severe	Severe	Least severe	Mean score	Rank	Overall rank
A.	**Technical constraints**						
1.	Long vegetative period *i.e.* unproductive period	71 (59.17)	29 (24.17)	20 (16.67)	2.43	V	14
2.	Irregular water supply from the canal	111 (92.50)	9 (6.67)	1 (0.83)	2.92	I	2
3.	Poor quality irrigation water	93 (77.50)	15 (12.50)	12 (10.00)	2.80	II	5
4.	Lack of technical know-low	29 (24.17)	47 (39.17)	44 (36.67)	1.88	VII	23
5.	Unsuitable soil for orcharding	33 (27.50)	49 (40.83)	38 (31.67)	1.54	VIII	27
6.	High mortality of plant during initial years	101 (84.17)	11 (9.17)	8 (6.67)	2.78	III	6
7.	Disease sensitive	61 (50.83)	36 (30.80)	23 (19.17)	2.32	VI	18
8.	Lack of knowledge about modern irrigation system (drip irrigation)	72 (60.00)	31 (25.83)	17 (14.17)	2.46	IV	13
B.	**Economic constraints**						
1.	Perishable nature of commodity resulted in economic loss	39 (32.50)	67 (55.83)	14 (11.67)	2.21	VIII	19
2.	Labour intensive affair	89 (74.17)	22 (18.33)	9 (7.50)	2.67	II	9
3.	High cost of transport of fruits and plant materials	73 (60.83)	29 (24.17)	18 (15.00)	2.46	IV	13
4.	Lack of credit facility in the area	69 (57.50)	44 (36.67)	7 (5.83)	2.52	III	11
5.	High initial cost in establishing orchard	69 (57.50)	9 (7.50)	0 (0.00)	2.93	I	1
6.	High cost of insecticides and pesticides	111 (92.50)	53 (44.17)	35 (29.17)	2.06	IX	20
7.	High cost of plant material	32 (26.67)	46 (38.33)	13 (10.83)	2.40	VI	16
8.	Non-existence of grading practice in the fruits in	61 (50.83)	21 (17.50)	25 (20.83)	2.41	V	15

	the area						
9.	Costly labour	74 (61.67)	39 (32.50)	18 (15.00)	2.38	VII	17

Contd..

S.No.	Constraints	Most severe	Severe	Least severe	Mean score	Rank	Overall rank
C.	**Storage and marketing constraints**						
1.	Lack of storage facility in the area	16 (13.34)	29 (24.17)	75 (62.5)	1.51	VII	28
2.	Lack of preservation industry in the area	79 (65.83)	23 (19.17)	18 (15.00)	2.51	IV	12
3.	Un-popular cooperative marketing system	33 (27.50)	61 (50.83)	26 (21.67)	2.06	V	20
4.	Lack of proper market	109 (90.83)	4 (3.33)	7 (5.83)	2.85	I	3
5.	General unawareness about kinnow by-products and their nutritional importance	23 (19.16)	33 (27.50)	64 (53.34)	1.66	VI	25
6.	High fluctuation in the market prices	99 (82.50)	8 (6.67)	13 (10.83)	2.72	II	8
7.	Mal-practices by middlemen	93 (77.50)	7 (5.83)	20 (16.67)	2.61	III	10
D.	**General constraints**						
1.	Threat from wild and stray animals	21 (19.50)	36 (30.00)	63 (52.50)	1.65	VIII	26
2.	Chance of theft	24 (20.00)	40 (33.33)	56 (46.67)	1.73	VII	24
3.	Jealously of neighbour's	33 (27.50)	53 (44.17)	34 (38.33)	1.99	VI	22
4.	General carelessness towards orchards.	51 (42.50)	23 (19.17)	46 (38.33)	2.04	V	21
5.	Lack of motivating agencies in the area	76 (63.66)	14 (11.67)	30 (25.00)	2.38	IV	17
6.	Lack of need based training	101 (84.17)	19 (15.83)	0 (0.00)	2.84	I	4
7.	Lack of reliable source of plant material	103 (85.83)	5 (4.17)	12 (10.00)	2.76	II	7
8.	Unfavourable weather conditions (frost, drought, erratic rainfall etc.)	97 (80.83)	9 (7.50)	14 (11.67)	2.67	III	9

* The figures in parentheses indicate percentage

6. Summary and conclusion

Kinnow is the most important sub tropical fruit crops of India after mango, banana and apple. In north India, the cultivation of mandarins is limited due to the acidity and puffiness of the fruit. Kinnow has been proved promising in place of mandarins because kinnow has wide adaptability to variable agro-climatic conditions and also comparatively more resistant to insect pests and disease. Incidence of fruit due to hailstorms or other reasons is also comparatively less. Kinnow is usually less prone to bird damage, as almost tow thirds of fruits are to bird damage, as almost tow thirds of fruits are known to bear in the inferior of the tree. Kinnow mandarin grows vigoursly. Kinnow mandarin is a hybrid between King (*Citrus nobilis* Lourd parent) and Willowleaf (*Citrus deliciosa* Tenore as ♂ parent) mandarins developed by Dr. H.B. Frost at Citeus Experiment Station, California (USA) in 1915. It was first introduced in the form virus free budwood and raised on Jatti Khatti (*Citrus janmbheri*) rootstock in 1959 at the PAU Regional Research Station, Abohar from the University of California. It is cultivated in the Punjab,

Haryana, lower hills and velly areas of Himachal Pradesh, Uttar Pradesh, Karnataka (Coorg, Hassan and Chikmangalore district), Kerala (Wynaad and Palghat district), Tamil Nadu (Ootacaund and Madurai districts) and North-Western parts of Rajasthan.

The low productivity of large number of unproductive old orchards, poor management of the orchards, irregular water supply, lack of good quality planting material and several other production problems also contribute to the low productivity.

Another significant factor which contribute to low availability of fruit due to the high post harvest losses. There for, it is very necessary to know the knowledge level, adoption level and constraints responsible for non adoption of various recommended kinnow production technology by the farmers and efforts should be made to reduce the constraints for speedly adoption of recommended kinnow production technology.

Keeping these points in mind the present study entitled "Knowledge and Adoption of Recommended Kinnow Production Technology by the Farmers of Sriganganagar District of Rajasthan" was under undertaken with following specific objectives :

(xiii) To measure the knowledge level about recommended kinnow production technology by the farmers.

(xiv) To find out the extent of adoption of recommended kinnow production technology by the farmers.

(xv) To find out the relationship between extent of adoption of recommended kinnow production technology by the farmers and selected independent variables.

(xvi) To find out the constraints as perceived by the farmers in adoption of recommended kinnow production technology.

Methodology

The present study was concluded in Sriganganagar and Srikaranpur panchayats samiti of Sriganganagar district from two selected panchayat samities ten villages were selected purposively on the basis of highest area and production. From the selected villages a sample of 120 kinnow growing respondents was selected by simple random sampling techniques for the study purpose interview schedule consisting of measuring devices of dependent and independent variables along with the face to farmers was used for collecting respondents of the farmers. The knowledge level of the farmers about kinnow production technology was measured by a knowledge test development by M.C. Dayma (2000) was slightly modified and used. The adoption level of farmers about recommended kinnow production technology was measured by an adoption developed by S.K. Sharma (1989), whereas the constraints faced by farmers in adoption of recommended kinnow production technology was measured by a schedule developed by investigator in light of the suggestion of experts. The independent variables like education level, social participation, size of land holding and occupation were measured by the modified socio-economic status scale of G. Trivedi (1963), where as the market distance and irrigation potentiality were measured by a schedule prepared by investigator in the light of the suggestion of experts. The data were classified, tabulated and inference were drawn after subjecting the data to appropriate statistical analysis which led to the following major findings.

Findings

1. Knowledge level of farmers about recommended kinnow production technology

(i) It was found that 58.33 per cent farmers were categories in medium knowledge level, 20.00 per cent farmers were in high knowledge level and 11.67 per cent farmers were in low knowledge level about recommended kinnow production technology.

(ii) About 94.17 per cent farmers had knowledge regarding the "Recommended method of hoeing and weeding" about 91.67 per cent farmers were well aware about the "Recommended row to row distance" and 87.50 per cent farmers had knowledge regarding the "Plant protection measures" followed by "Advantages of the intercropping" (85.83 per cent) and "Recommended season or month for planting" (84.17 per cent). About 82.50 per cent farmers had knowledge about the "Name of intercrop" and "Average harvest from a kinnow tree of 4-5 years age in the season" followed by "Recommended marketing channels" (81.67 per cent). Only 14.17 per cent farmers had knowledge about "Recommended growth regulators".

2. Extent of adoption of recommended kinnow production technology by the farmers

(i) It was found that 65.00 per cent of kinnow growers were found to be medium adopters and 18.33 per cent were high adopters and 16.67 per cent of the respondents were low adopters.

(ii) The adoption of “Plant population” was highest (96.00 per cent) among all the kinnow growers followed by “Irrigation interval” (94.38 per cent), “Application of FYM” (92.08 per cent), “Plantation depth” (88.06 per cent), “Recommended method of propagation” (65.83 per cent), “Application of P” (57.08 per cent), “Application of K” (53.96 per cent), “Planting pit size” (37.92 per cent), “Filling the pit” (33.75 per cent) “Plant protection measures” (13.17 per cent) and “Application of growth regulators” (6.67 per cent) by the farmers.

3. Relationship between the independent variables and adoption level of farmers about recommended kinnow production technology

(i) The extent of adoption of recommended kinnow production technology by the farmers was found negatively and significantly related with their market distance and was positively and significantly related with their knowledge level, education level, Size of land holding and occupation, where as their social participation and irrigation potentiality were non significantly associated with their adoption level.

(ii) The knowledge level, education level, size of land holdings and occupation by the farmers were highly important variables for predicting the extent of adoption of recommended kinnow production technology. Though all the seven independent variables to explained to the extend of 66.50 per cent of the variation in the extent of adoption of recommended kinnow production technology by the farmers.

4. Constraints in adoption of recommended kinnow production technology by the farmers

(i) As for as over all constraints are concerned, the most perceived constraints by the farmers in recommended kinnow production technology were “High initial cost in establishing of orchards” (2.93 MS), followed by “Irregular water supply from the canal” (2.92 MS), “Lack of proper market” (2.85 MS), “Lack of need based training” (2.84 MS), “Poor quality irrigation water (2.80 MS), and “High mortality of plant during initial year” (2.78 MS).

(ii) The major technical constraints in adoption of recommended kinnow production technology were “Irregular water supply from the canal” (2.92 MS), “Poor quality irrigation water” (2.80 MS), “High mortality of plants during initial year” (2.78 MS), “Lack of knowledge about modern irrigation system” (2.46 MS) and “Long vegetative period *i.e.* unproductive period” (2.43 MS).

(iii) The major economic constraints faced by the kinnow growers were “High initial cost in establishing of orchards” (2.93 MS), “Labour intensive affair” (2.67 MS), “Lack of credit facility in area” (2.52 MS) and “High cost of transport of fruits and plant materials” (2.46 MS).

(iv) The major storage and marketing constraints in adoption of recommended kinnow production technology were “Lack of proper market” (2.85 MS), “High fluctuation in the market price” (2.72 MS) and “Malpractice of middlemen” (2.61 MS).

(v) The major general constraints as perceived by the farmers were “Lack of need based training” (2.84 MS) and “Lack of reliable source of plant material” (2.76 MS).

CONCLUSION

The main findings found in the dissertation leads to following conclusion:

1. Majority of the kinnow growers had medium knowledge level about the recommended kinnow production technology.
2. Among the various aspects of different recommended kinnow production technology, majority of the farmers had knowledge about “Recommended method of hoeing and weeding”, “Recommended row to row distance”, “Plant protection measures”, “Advantages of the intercropping”, “Recommended month or season for planting” and “Name of intercrop”. Only a few farmers had knowledge regarding “Recommended growth regulators” and “Recommended herbicide”.
3. Majority of the kinnow growers had medium adopters of recommended kinnow production technology.
4. The adoption of the recommended kinnow production technology like “Plant population”, “irrigation intervals”, “Application of FYM”, “Plantation death” “Recommended method of propagation” and “Application of phosphorus”, was high (More than 70 per cent). The practices which were appropriately adopted were “Application of N” “Application of

potash", "Planting pit size" and "Filling the pit". Where as they had un-appropriate adoption regarding "Plant protection measure" and "Application of growth regulators".

5. The knowledge level, education level, size of land holding and occupation were positively and significantly associated where as their market distance was negatively and significantly associated, while social participation and irrigation potentiality were positively and non significantly related with the adoption level of farmers about recommended kinnow production technology.
6. The major constraints for poor adoption of recommended kinnow production technology by the farmers were "High initial cost in establishing of orchard", "Irregular water supply from the canal", "Lack of proper market", "Lack of need based training", "Poor quality irrigation water" and "High mortality of plants during initial year".
7. The most perceived technical constraint was "Irregular water supply form the canal", economic constraint was "High initial cost in establishing of orchards", storage and marketing constraint was "Lack of proper market" and the general constraint was "Lack of need based training" was most perceived by the farmers.

Recommendations

1. The present investigation reveals that majority of the respondents fall into the medium category of knowledge level about recommended kinnow production technology. Therefore, training and visits of demonstrations etc. should be organized to equip the farmers about recommended kinnow production technology so that their knowledge level may be increased from medium to high knowledge level.
2. Since majority of farmers fall in to medium adopter category so efforts should be made to motivate the farmers by providing subsidy on kinnow seedlings and inputs for adoption of recommended kinnow production technology.
3. Since the present investigation showed that education was significantly related with adoption of recommended kinnow production technology by the farmers. Therefore, literacy programme needed to be strengthened and primary education. Farmers should be motivated to send their children for school education.
4. Results of study show that irregular water supply from the canal was creating hindrance in adoption of recommended kinnow production technology. So it is suggested that orchard owners should be proved water from canal timely and specially for orchards. Orchards owners should be motivated for adoption of water harvesting techniques and water use efficient methods of irrigation by the concerned agencies working in the study area.

5. Orchard development is costly. The establishment of orchard demands a very heavy amount especially at the initial stage. In order to encourage and motivate the kinnow growers about kinnow plantation, Government should keep adequate provision of credit to small and marginal fruits growers who are ready to develop orchards in their fields.
6. The major storage and marketing constraints like lack of proper market and high fluctuation in the market price. There should be co-operative system of marketing which will safeguard the interests of its members in disposal of their products (fruits).
7. It was observed from findings that the kinnow seedlings, plant protection chemicals and fertilizers were costly from the view point of the farmers. Therefore, it is recommended that subsidy may be provided to the farmers. Simultaneously the farmers should be educated about these constraints.
8. During investigation it was found that lack of storage facility was the constraints affecting the orchard development, fruits being a perishable commodity require proper storage facility. Therefore, the government should come forward to save the interest of fruit growers and establish storage facilities.
9. Farmers should be motivated to increase their frequency of contact with extension personnel and also the efforts should be made to give more exposure to make available more sources of information to the farmers like news papers, radio, television and bulletins by establishing farmers libraries, radio forum and television forum.

10. There is an urgent need for the establishment of preservation industry in this area that too from government agency so that the farmers can get proper benefit of their produce.
11. During natural calamities and epidemics government should come forward to help the farmers financially. It is further suggested that orchard insurance in line with the central government policy should be given wide publicity to save the orchard owners from economics loss due to natural calamities.

Suggestion for future research

1. Further, studies may be conducted in each Tehsil of Sriganganagar district of Rajasthan as well as in other important kinnow growing areas of the Rajasthan state and country so that over all picture of kinnow plantation can be projected.
2. Similar studies may also be carried out in other fruit crops.
3. Constant efforts may be made to improve upon and develop the standardized tools and techniques for an objective and correct measurement of dependent and more independent variables.
4. A detailed study of various constraints responsible for non-adoption, partial adoption and slow adoption rate of recommended kinnow production technology may be conducted.

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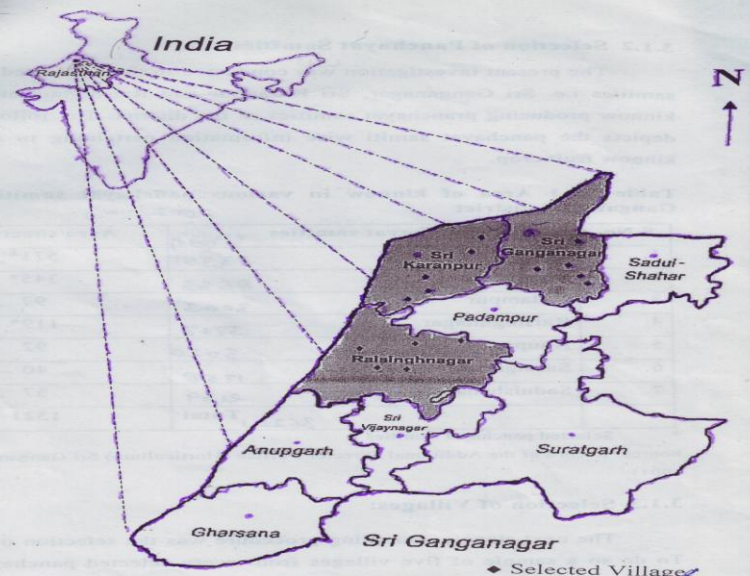
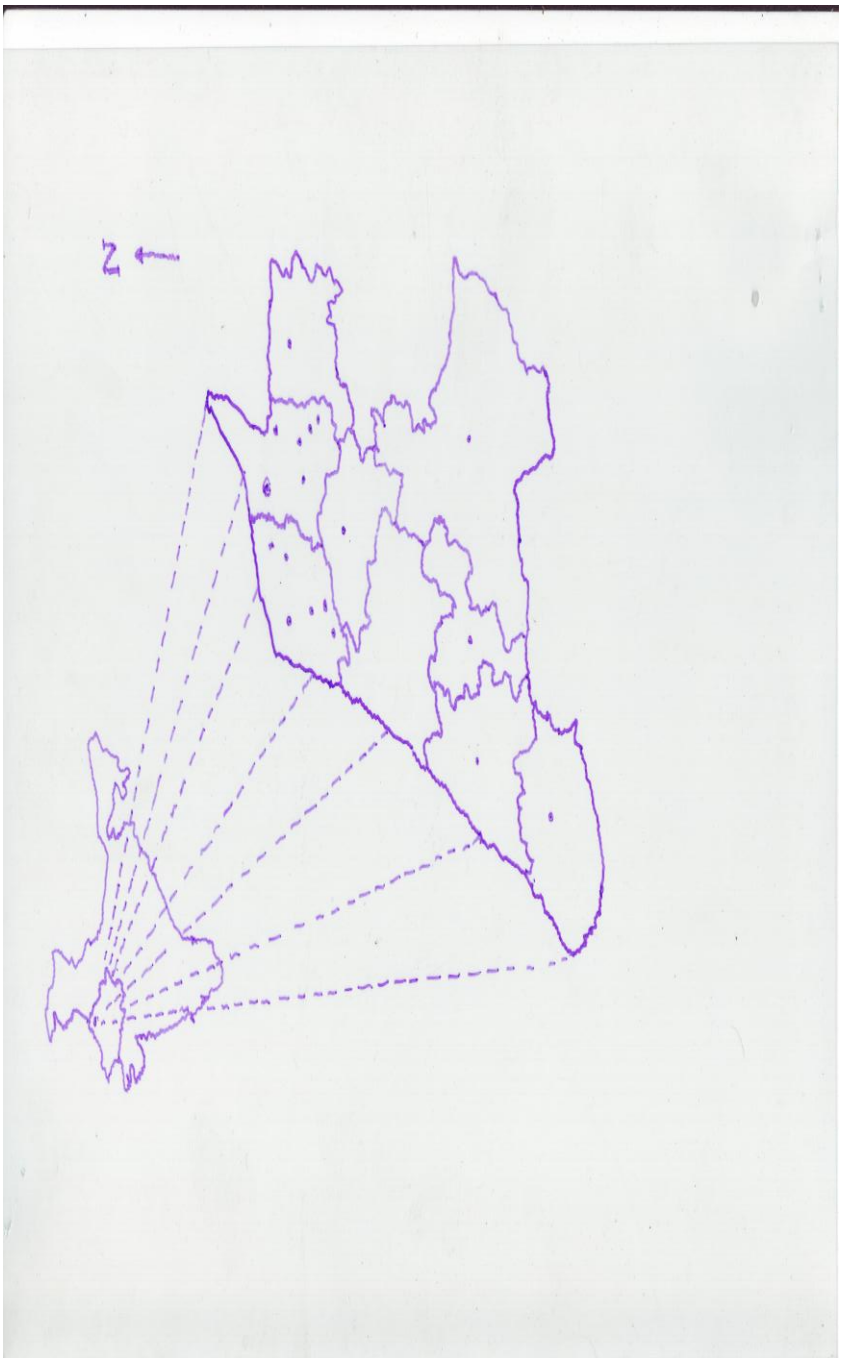
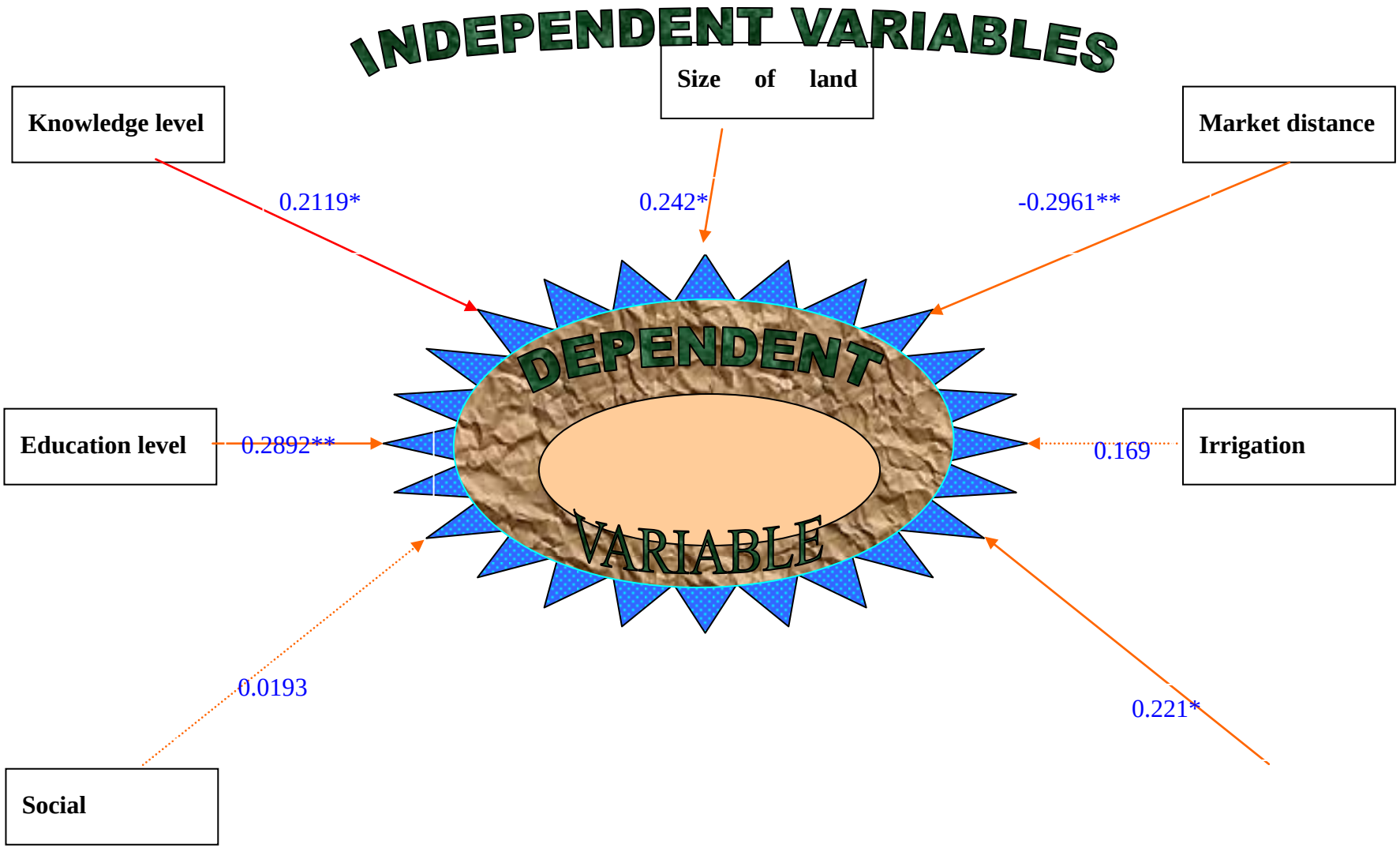


Fig.1: Map showing location of study


N


INDEPENDENT VARIABLES
Size of land
Knowledge level
Market distance
0.2119*
0.242*
-0.2961**
DEPENDENT
VARIABLE
Education level
0.2892**
0.169
Irrigation
0.0193
0.221*
Social

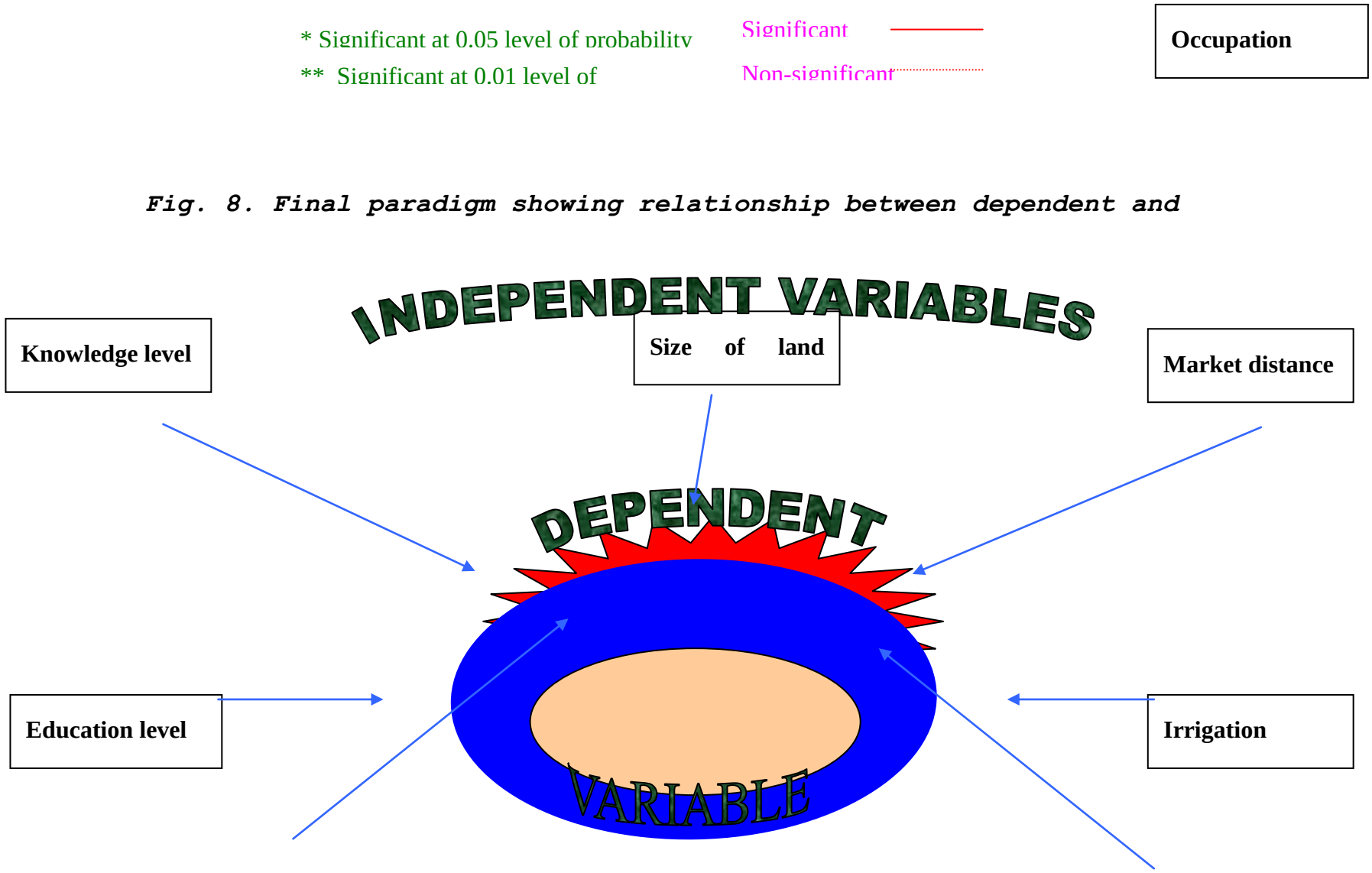


Fig. 8. Final paradigm showing relationship between dependent and

Fig. 1. Tentative paradigm showing relationship between dependent and

(COVERING LETTER SENT TO THE EXPERTS)

From : Dr. G.S. Bangarva
Assoc. Professor
Deptt. of Extension Education
S.K.N. College of Agriculture
Jobner, (Jaipur) Rajasthan

No. Ext/SKN/2006
Date :……/2006

To

……..

……..

Dear Sir /Madam,

I hereby, draw your attention to my student **Mr. Hardev Choudhary** who is conducting research on the problem entitled, **"Knowledge and Adoption of Recommended Kinnow Production Technology by the Farmers of Sriganganagar District of Rajasthan"** towards M.Sc. (Ag.) degree. We are trying to develop a comprehensive schedule for measuring various objectives of the said problem. The statements in the schedule have been developed on the basis of relevant literature reviewed, personal experience, discussion held with subject matter specialists and extension personnel.

In this context, we want to take advantage of your experience and knowledge. Kindly spare some time and go through the schedule very critically and feel free to comment upon or modify the statements if necessary, so that the final schedule can be developed for study purpose.

Kindly mail the schedule after your necessary comments in the self addressed stamped envelop attached to the schedule.

Thanking you for kind cooperation

Your's sincerely

(G.S. Bangarwa)

APPENDIX –I

Interview Schedule

Title of thesis : "Knowledge and adoption of recommended kinnow production technology by the farmers of Sriganganagar district of Rajasthan".

1. Respondent No. …….. 2. Date of interview ……..

3. NAME OF FARMER …… 4. TELEPHONE NO. …….

5. Father's/Husband name……. 6. Caste ……..

7. Village …….……. 8. Panchayat samiti ……

9. Total area under kinnow ……..

Part – A

Extent of knowledge of kinnow production technology

S.No.	Particulars	Knowledge	
		Right (1)	Wrong (0)
1.	How should be propagated ? …….		
2.	**NAME THE MONTHS WHEN PROPAGATION SHOULD BE DONE IN KINNOW ?**		
3.	**…….** What precaution one should take in vegetative		

4.	propagation of kinnow ? 1. …… 2. ……. From where can we get the reliable plants ? …….		
5. 6. 7. 8. 9.	What is the recommended size of pit for planting kinnow in orchards ? **…….** **WHAT IS THE RECOMMENDED QUANTITY OF MANURE PER PIT FOR KINNOW PLANTATION ?** **…….** What is the suggested season or month for planting kinnow plants in orchards ? **…….** How much distance should be kept between kinnow plants ? **…….** What is the recommended row to row distance in kinnow ? …….		

S.No.	**Particulars**	**Knowledge**

		Right (1)	Wrong (0)
10.	**WHAT IS THE IRRIGATION INTERVAL RECOMMENDED FOR KINNOW CULTIVATION ORCHARDS ?** (i) Winter …… (ii) Summer ……		
11.	Name of the method of irrigation commonly used in kinnow orchards ? …….		
12.	Which is the suitable method of irrigation during intercropping ? …….		
13.	Name the crop suitable for inter-cropping in kinnow orchard during initial year ? …….		
14.	What are the advantages of the inter cropping ? 1. ……2. …….		
15.	What is the recommended quantity of fertilizer and manure to be applied to kinnow plants every year ?		

Fertilizers (kg^{-1})	**I year**	**II year**	**III year**	**IV year**	**V year**	**VI year**	

	FYM Super phosphate MOP Urea								
16.	What is the time of application of manure and fertilizers ? …….								

S. No.	Particulars	Knowledge	
		Right (1)	Wrong (0)
17	Name the suitable method of training kinnow plants ? …….		
18.	Why kinnow plants are trained/pruned ? …….		
19.	**HOW HOEING AND WEEDING ARE BENEFICIAL IN KINNOW ORCHARDS ?**		

<table>
<tr><td>20.</td><td>…….
Which herbicide should be used ?
…….</td><td></td><td></td></tr>
<tr><td>21

22.</td><td>What are the commonly used of growth regulators in kinnow orchard.
1. ……
2. . …….
Recommended plant protection measures
<table>
<tr><th>Name of insects-pests</th><th>Recommended control measures</th><th>Quantity of chemical used</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Disease</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>23.

24</td><td>What is the recommended method of harvesting kinnow fruits for your area ?
…….
WHAT ARE THE COMMON MARKETING CHANNELS OF KINNOW FRUITS IN YOUR AREA ?
1. ……2. …….</td><td></td><td></td></tr>
</table>

25 26	**WHICH MARKETING CHANNEL IS MORE BENEFICIAL TO THE KINNOW GROWERS ?** ……. What is the average harvest from a kinnow tree of 4-5 year age in the season? …….		

PART-B

Schedule for measuring the extent of adoption of recommended kinnow production technology

1. Area under the recommended method of propagation in kinnow ……
2. Depth of kinnow plantation ……..
3. Plant population per hectare ……..
4. Planting pit size …….
5. Mixture of filling the pit ……..
6. Fertilizers N application / plant after bearing ……..
7. Fertilizers P application / plant after bearing ……
8. Fertilizers K application / plant after bearing ……
9. FYM application / plant after bearing …….

10. Irrigation intervals ……

(i) In summer season ……

(ii) In winter season ……

11. Name of insects, pests, diseases and control measures with quantity of chemical used.

Name of insects-pests	Recommended control measures	Quantity of chemical used
Name of diseases	Control measures	Quantity of chemical used

12. Name of the growth regulators used

Growth regulator	**Quantity used**
(i)	
(ii)	
(iii)	

Part – C

Constraints faced by the kinnow orchard owners

S. No.	Particulars	Most severe (3)	Severe (2)	Least severe (1)
1.	Technological constraints (a) Long vegetative period *i.e.* unproductive period (b) Irregular water supply from the canal (c) Poor quality irrigation water (d) Lack of technical know-low (e) Unsuitable soil for orcharding (f) High mortality of plant during initial years (g) Disease sensitive (h) Lack of knowledge about modern irrigation system (drip irrigation)			
2.	Economic constraints (a) Perishable nature of commodity resulted in economic loss (b) Labour intensive affair (c) High cost of transport of fruits and plant materials (d) Lack of credit facility in the area (e) High initial cost in establishing orchard (f) High cost of insecticides and pesticides (g) High cost of plant material (h) Non-existence of grading practice in the fruits in the area (i) Costly labour			

3.	Storage and marketing constraints (a) Lack of storage facility in the area (b) Lack of preservation industry in the area (c) Un-popular cooperative marketing system (d) Lack of proper market (e) General unawareness about kinnow bioproducts and their nutritional importance (f) High fluctuation in the market prices (g) Mal-practices of middlemen			
4.	General constraints (a) Threat from wild and stray animals (b) Chance of theft (c) Jealously of neighbour's (d) General carelessness towards orchards. (e) Lack of motivating agencies in the area (f) Lack of need based training (g) Lack of reliable source of plant material (h) Unfavourable weather conditions (frost, drought, erratic rainfall etc.)			

Part-D

Schedule for measurement of independent variables
Socio-economic status scales

(Modified scale developed by G. Trivedi, 1963)

S. No.	Contents	Weight
1.	**Education**	

i	Illiterate	1
ii	Can read only	2
iii	Can read and write	3
iv	Primary	4
v	Middle	5
vi	High School	6
vii	Graduate	7
viii	Above graduate	8
2.	**Social participation**	
i	Member of one organisation	1
ii	Member of more than one organisation	2
iii	Office holder	3
iv	Public leader /MLA/MP	4
3.	**Size of land holding**	
i	No land	0
ii	Less than 1 ha	1
iii	1 to 2.5 ha	2
iv	2.6 to 5 ha	3
v	5.1 to 7.5 ha	4
vi	7.6 to 10 ha	5
vii	More than 10 ha	6
4.	**Market distance**	
i	1-5 km	1
ii	5-10 km	2
iii	10-20 km	3

iv	Above 20 km	4
5.	**Occupation**	
i	Labour	1
ii	Caste occupation	2
iii	Dairy/Agriculture	3
iv	Business	4
v	Service	5

6. Irrigation potentiality

S.No.	Sources	Area under irrigation (ha)	Total area (ha)
i	Well		
ii	Tube well		
iii	Canal		
iv	Other		