Study of Gaps in Adoption of Improved Orange Production Technology in Maharashtra

ABSTRACT

Orange is the second most important fruit crop of Maharashtra. However, the productivity of fruit is found to be dwindling which might be due to the gaps in adoption of recommended technical know-how. To assess the adoption gaps and influence of socio-economic characteristics on the adoption gap, the present study was conducted in Amravati and Nagpur districts of Maharashtra. A sample of 200 orange growers was selected randomly for the study. It was found that ~~the~~ most of the orange growers had gap in application of micro nutrient (44.76 %) followed by fruit drop measures (43.16 %) and plant protection measures (42.75%). The average gap was 31.89 per cent. Moreover, size of land, source of credit, annual income, experience in farming and knowledge level of the orange growers, knowledge of GAP practices, mass media exposure and socio-economic status had negative correlation with adoption gaps (P= .01) whereas size of land holding and knowledge level, knowledge of GAP practices and annual income had negative influence on adoption gaps (P= .01). The study recommends that efforts should be made to bridge the gap by intensive dissemination and reorientation of public as well as private extension support system to act more efficiently to provide necessary information about orange cultivation.

Key words:*Adoption gap, Orange, Knowledge, Good Agricultural Practices, Production*

INTRODUCTION

Mandarins (*Citrus reticulata*Blanco) are the largest commercial citrus group in India with 43 per cent share, followed by sweet orange (Citrus sinensisOsbeck) 25 percent, acid lime (Citrus aurantifoliaSwingle), lemons (Citrus limon) 25 per cent share and others sharing 7 per cent. Orange is the second most important fruit crop among all the fruits cultivated in Maharashtra [9]. It has an acreages of 116.09 thousand ha with the production of 940.65 thousand metric tons and having productivity of 8.10 MT/ha compared to Madhya Pradesh which has 130.67 thousand ha area with the production of 2208.18 thousand metric tons with the productivity of 16.89 MT/ha [9]. The orange is mostly concentrated in Vidarbha region and cultivated in around 80,000 ha area and production was 5 Lakh tons. In Maharashtra, Orange is cultivated in many districts like Amravati, Nagpur, Akola, Wardha and Yavatmal. However, the Amravati and Nagpur districts of Maharashtra contribute about 80 per cent of the total area under mandarin orchards in the state, sharing 48.88 per cent and 31.45 per cent, respectively. With regard to the production of mandarin, Amravati district occupies 37.36 per cent while Nagpur occupies 23.87 per cent share in the Vidarbha citrus market [14]. Oranges have brought indispensable glory to the

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region. Bante et al. [2] in their study of economics of orange production in Nagpur district of Maharashtra have found that per hectare establishment cost during five year and cost of cultivation during the year 2010-11 of orange orchard were Rs./ha 207604 and Rs./ha. 107824. Average gross return was Rs. 2042094. The highest net return obtained from the age group (II) of 11-15 year Rs. 165935. The benefit: cost ratio on the sample as a whole was 2.24. Thus, it can be inferred from their study that the orange fruit crop really has the potential to bring the glory to the farmers of vidarbha.

The *Nagpur Santra*is famous all over the world and fetches handsome money through its export. Owing to its sweet-sour appealing taste and easy ~~peelable~~ peelingquality of the rind, Nagpur mandarin is the most popular fruit among all the oranges in the country. It is available throughout the year and is not only delicious and refreshing to eat, but also provides vitamins, minerals and many other essential elements, which are required for human health. It is of particular interest because of high vitamin "C" content i.e.88 % and refreshing juice. Nagpur mandarin is one of the best mandarins in the world and is exported to distant market like Europe, Gulf and South East Asia.

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Nagpur mandarin received the Geographical Indicators (GI) tag 385 in the year 2014 under the Geographical Indication of Goods (Registration and Protection) Act, 1999[4]. The Geographical Indicators (GI) tag was accorded on the basis of the unique qualities of the fruit that can be attained only under specific soil and agro-climatic conditions of the Vidarbha region. The growers of Nagpur mandarin are able to brand their products under the GI tag, which protects their rights and fetches a premium price in the market for the unique variety.

The trend analysis of area production and productivity of orange showed that the area under orange crop was increasing and so was the production but the productivity and quality of oranges were found dwindling because of various problems in adoption of recommendedtechnologies. Comparative analysis of yield of orange fruit production showed that the orange fruit production per ha was very low (8.10MT/ha), in comparison to other state and also that of developed countries. The increase in productivity and production of orange depends mainly on the technical recommendation transferred from research institute, the extent of its use in production by the orange growers and extension programs on various technologies for transfer with the help of different departments. However, the gaps in yield and production have been found on farmers' field, though the latest technologies have been continuously developed and recommended for use by the orange growers. Despite these efforts, the productivity of orange in the state is still low. Therefore, very appropriately the study was designed to assess the gaps in adoption of recommended orange production practices and to assess the influence of the socio-economic profile characteristics on the gaps in the adoption of orange production technologies.

MATERIAL AND METHODS

For this investigation, *ex-post-facto* design was used. The study was carried out purposively in the Vidarbha region of Maharashtra where the maximum area of orange production is concentrated. Two districts were selected purposively for the study from the Vidarbha region named as Amravati and Nagpur. From each district, two blocks and from each block two villages were selected randomly. Thus, a total of four blocks and eight villages were selected for the study having high concentration of orange production.

Since there was not much variation in the number of orange growers in each village therefore, from each village 25 orange growers were selected randomly following the criterion that selected farmers should have at least five years of experience in orange cultivation. Thus, a total number of 200 respondents were identified for the study.

Adoption gap had been conceived as the difference between the packages of practices of orange cultivation recommended by NRCC, Nagpur and the College of Agriculture Nagpur. The extent of adoption of these recommended practices at farmers' level was worked out. The package of practices included the recommendations on following 13 major cultivation practices such as:

i) Soil
ii) Seedling/Root stock use
iii) Spacing
iv) Inter crop
v) Application of manures
vi) Application of fertilizer
vii) Application of micro nutrients
viii) Bahar treatment (Blooming stage)
ix) Irrigation management
x) Fruit drop control measure
xi) Plant Protection measures
xii) Pruning and Training
xiii) Harvesting

Under each of the above mentioned major practices, sub-practices were identified. The gap for each major practice was calculated by deducting the number of sub practices adopted by the respondents from the total number of sub-practices recommended. To measure the adoption gap, an index was worked out with help of following formula:

$$\text{Adoption Gap Index} = \frac{\text{Recommended}^{1} - \text{Applied}^{2}}{\text{Recommended}} \times 100$$

1. Recommended orange production technology for the area.
2. Technology applied by the client system (with time consideration).

Gap analysis for particular practice

$$\text{Say, N fertilizer} = \frac{\text{Kg/ha recommended} - \text{Kg/ha applied}}{\text{Kg/ha recommended}} \times 100$$

$$\text{Mean adoption Gap} = \frac{\text{Total gap for the practices of an orange crop}}{\text{Total number of practices recommended for crop}}$$

The respondents were grouped in five categories i.e. very low adoption gap, low adoption gap, medium adoption gap, high adoption gap and very high adoption gap. The class intervals were generated through proportion of the difference between the maximum and the minimum obtained score and the desired numbers of classes (i.e. 5). A well structure interview schedule was developed for data collection and appropriate statistical tools like frequency, percentage, mean, median; correlation and regression, and ranking technique were used for analysis of data.

RESULTS AND DISCUSSION

1. Knowledge level of orange growers

The distribution of the orange growers according to practice wise knowledge about orange production technology is presented in Table 1, which shows that the orange growers had a high level of knowledge about the soil type and P^H (52.5%) followed by planting distance/plant density (47.5%), irrigation schedule (42.5 %) and method of fertilizer application (41.5 %). Also it was found that a majority of the orange growers had medium level of knowledge about flowering and harvesting (62.0 %) and equal percentage of the orange growers had medium knowledge about size of pit and ingredient required to fill the pit followed by knowledge about the improved varieties of orange (55.5 %).

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Table1. Distribution of orange growers according to practice-wise knowledge about orange production technology

N = 200

S. No.	Knowledge Level	High	Medium	Low

		F	%	*F*	%	*F*	%
1	Soil type and P^H	105	52.5	71	35.5	24	12.0
2	Size of pit and ingredient for filling it	86	43.0	112	56.0	2	01.0
3	Planting distance/plant density	95	47.5	96	48.0	9	4.50
4	Bordeaux paste preparation and application	64	32.0	96	48.0	40	20.0
5	Improved varieties	60	30.0	111	55.5	29	14.5
6	FYM doses /plant/year	89	44.5	71	35.5	40	20.0
7	Fertilizer doses at the time of planting/plant	79	39.5	99	49.5	22	11.0
8	Fertilizer doses at full growth/plant	56	28.0	112	56.0	32	16.0
9	Method of fertilizer application	83	41.5	85	42.5	32	16.0
10	Intercrops	78	39.0	76	38.0	46	23.0
11	Irrigation method and schedule	85	42.5	92	46.0	23	11.5
12	Inter culture operation	58	29.0	107	53.5	35	17.5
13	Time of thinning and pruning	80	40.0	100	50.0	20	10.0
14	Major insect, pest and diseases	60	30.0	61	30.5	78	39.0
15	Plant protection measures	69	34.5	101	50.5	30	15.0
16	*Bahar* treatment	74	37.0	87	43.5	39	19.5
17	Flowering and harvesting	60	30.0	124	62.0	16	08.0
18	Improved mechanical harvester	49	24.5	119	59.5	32	16.0
19	Post harvest management practices	65	32.5	91	45.5	44	22.0

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~~A~~ The majority of growers expressed that they had low level of knowledge about the improved mechanical harvester (59.5 %) and major insect pest and diseases (39%).

The distribution of the orange growers according to their overall knowledge level is presented in the Table 2.

Table2. Distribution of orange growers according to their overall knowledge level

N = 200

Sl. No	Level of knowledge	Frequency	Percentage
1	Very low (score <35)	22	11.00
2	Low (score 35- 39)	32	16.00
3	Medium (score 40-44)	75	37.50
4	High (score 45-49)	46	23.00
5	Very high (score > 49)	25	12.50
	Total	**200**	**100.00**
	Mean = 41.53	**SD = 4.69**	

It could be seen from Table 2 that a majority of the orange growers (37.5 %) had medium level of knowledge followed by high level (23 %) and low level (16 %). About 13 per cent of the growers expressed that they had a very high level of knowledge about improved orange cultivation practices whereas 11 per cent revealed that they had a very low knowledge about the improved cultivation practices of orange. The average knowledge score was 41.53 with standard deviation of 4.69.It can be concluded from the results presented in above table that the orange growers had medium to high level of knowledge about the improved orange cultivation practices. This might be due to easy access of news papers, extension initiatives in the area, access to information and good education level of the orange growers.The result of the study invites greater attention of extension agencies to motivate the orange growers to adopt the technology by furnishing more information by citing case studies of successful growers. The results of the study are in tune with the study of with the Gedam and Singh [6] and Rathod and Rathod[13].

2. Adoption gaps in orange production technology

The gaps in adoption of orange production technology are presented in the Table 3, which shows that the highest gap was found in application of micro nutrients (44.76 %) followed by fruit drop control measures (43.16 %) and plant protection measures (42.75 %). The gaps in harvesting and application of fertilizer were 39.78 per cent and 38.52 per cent, respectively. The lowest gap was found in the practices like use of root stock (19.25 %) and plant spacing (20.35 %), intercultural operations (20.67 %) and application of manure (22.60 %). Almost similar percentages of gaps were found in irrigation management (26.31 %) and *Bahar* treatment (26.04 %). The average gap was 31.89 per cent.

Table 3. Distribution of orange growers according to practice-wise adoption gap

S. No.	Orange cultivation practices	Average adoption gap
1	Soil needed	28.24
2	Seedling/Root stock use	19.25
3	Spacing	20.35
4	Inter crop	20.67
5	Application of manures	22.60
6	Application of fertilizer	38.52
7	Application of micro nutrient	44.76
8	Bahar treatment (Blooming stage)	26.04
9	Irrigation management	26.31
10	Fruit drop control measure	43.16
11	Plant Protection measures	42.75
12	Pruning and Training	27.44
13	Harvesting	39.78
	Average gap of all practices	**31.89**

Author's calculation

It could be inferred from the above that major gaps were found in practice of application of micro nutrient and fruit drop control measures. Bandare et al.[3], Deshmukh et al [1] and Hiwarale et al. [7] in his study of constraints faced by sweet orange growers in adoption of recommended cultivation practices of sweet orange found that costly inorganic fertilizer and costly insecticides and pesticides were the major constraints faced by the orange growers in adoption of recommended technologies. That could be the

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cause for the gaps in adoption of practice of micro nutrient application and fruit drop measures. Moreover, the gaps in adoption might be due to unawareness of growers about importance of micro nutrient application, lack of information about its availability and also due to less visibility of its results. The gaps in plant protection measures might be due to lack of knowledge about itsdoses and application methods.The results of the study are in line with Gedam and Singh [6] Rai et al.[10] and Rathod and Rathod[13] and Das et al. [11].

Table4. Distribution of respondent according to their overall average adoption gaps

S. No.	Particular	Frequency	Percentage
1	Very low (Score < 28.16)	10	5
2	Low (28.17-31.89)	51	25.5
3	Medium (31.90-33.75)	81	40.5
4	High(33.76-0.35.6)	41	20.5
5	Very High(> 35.6)	17	8.5
	Total	**200**	**100**
	Mean = 31.89		**SD = 1.85**

The overall gap in adoption of improved orange cultivation practices is presented in Table 4, which depicts that a majority (40.5%) of the orange growers had medium adoption gap followed by low adoption gap (25.5 %) and high adoption gap (20.5 %). Only 5 per cent of the orange growers fell under the category of very low adoption gap, while nearly 9 per cent of the orange growers had very high adoption gap.

It could be concluded from the table that the orange growers had medium to low adoption gap. This might be due to their good contact with village level workers, high exposure to mass media, use of progressive farmers and input dealers for seeking the information. Gedam and Padaria[5] in their study of Information Needs of Orange Growers of Maharashtra found out that the information need of the orange growers was medium to high. The lack of specific information about the practices may have caused the gaps in the adoption of improved orange production technologies. However, the extent of gaps present pressing needs to pay attention for the program of technology transfers, therefore extension support system i.e. public and private, needs to be reoriented to disseminate appropriate technology and information to fill these gaps. The results of the study are in conformity with Gedam and Singh [6], Rai et al. [10], Rathod and Jayabhaye[12] and Das et al. [11]however, Rathod and Rathod[13] in their study found that the technology adoption was from medium to high. The results of the study were contrary to this study.

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3. Correlation of profile characteristic of orange growers with adoption gap

The correlation analysis presented in the Table 5 shows that size of land, source of credit, annual income, experience in farming, knowledge level and knowledge about GAP of the orange growers had highly significant negative correlation with adoption gap (P<0.01) whereas mass media exposure and socio-economic status had significant negative correlation (P = 0.05). But age, education, family size, labor availability, occupation, economic motivation, social participation, extension contacts, risk orientation, source of credit and infrastructure facilities haven't shown any association with the adoption gaps.The results of the study are in consonance with the results of Gedam and Singh [6], Rai et al.[10],Rathod and Rathod[13] and Hiwarale et al. [8]

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Table 5. Correlation of profile characteristics with adoption gap

S. No.	Variables	Correlation coefficientsValue r
1	Age	-0.38
2	Education	0.118
3	Size of land	-0.284**
4	Family size	0.098
5	Labor availability	0.098
6	Occupation	0.006
7	Source of credit	-0.286**
8	Annual income	-0.271**
9	Economic motivation	0.031
10	Experience in orange farming	-0.315**
11	Social participation	0.31
12	Extension contact	-0.008
13	Mass media exposure	-0.229*
14	Risk orientation	-0.094
15	Socio-economic status	-.0220*
16	Source of credit	0.113
17	Infrastructure facilities	-0.09

18	Knowledge level	-0.548**
19	Knowledge of GAP practices	-0.36**

** -significance level (P<0.01)
* - significance level (P=0.05)

4. Regression analysis of profile characteristics with adoption gap

Regression analysis of the profile characteristic with the adoption gap revealed that near about 70 per cent variation in the adoption gap was contributed by the 19 variables (Table 6). Among these variables, size of land holding, knowledge level and knowledge of GAP had highly significant negative influence on the adoption gap (P<0.01), whereas the annual income had significantly negative influence on adoption gap (P = 0.05).

Table6. Regression of profile characteristic with adoption gap

S. No.	Independent variable	Standardized Coefficients Beta	"t" value
1	Age	-.187	-1.014
2	Education	.095	.473
3	Size of land holding	-0.316	-2.713**
4	Family size	-.098	-1.048
5	Labor availability	.279	1.676
6	Occupation	-.071	-.605
7	Source of credit	.008	.089
8	Annual income	-0.183	-2.444*
9	Economic motivation	.029	.292
10	Experience in orange farming	-.088	-.965
11	Social participation	.075	.501
12	Extension contact	.135	.846
13	Mass media exposure	.038	.257
14	Risk orientation	.014	.114
15	Socio-economic status	-.143	-.792
16	Source of credit	.029	.209

17	Infrastructure facilities	-.052	-.664
18	Knowledge level	-0.350	-3.783**
19	Knowledge of GAP practices	-0.43	4.18**

** -significance level (P<0.01) $R^2 = 0.698$ F = 2.883**
* - significance level (P = 0.05)

CONCLUSION

The study concludes that the major adoption gaps were found in application of micro-nutrients, fruit drop control measure and plant protection measures. Therefore, efforts should be made to bridge the gap by intensive dissemination and reorientation of public as well as private extension support system to act more efficiently to provide necessary information about orange cultivation. The feedback centers should be established at village/block levels and adoption of production technology should be monitored through farmers' group. The training program about the application of micro-nutrients and plant protection measures should be intensively carried out.

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