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Study on Relationship between Socio-economic Status and Adoption Behaviour of Mandarin Growers of Upper Subansiri District of Arunachal Pradesh

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ABSTRACT

A study was conducted to know the 'Adoption Behaviour Index' of mandarin orange (*citrus reticulata*) growers of Arunachal Pradesh, India. In this study, 100 mandarin farmers from tribal community were purposively included as respondents from 5 selected blocks of Upper Subansiri distric of Arunachal Pradesh. Data were collected with the help of interview schedule. For analysis of data frequency, percentage, mean, standard deviation and correlation were followed. It was found that majority of the farmers of the study area had medium level of 'adoption behaviour index'. Majority of the mandarin growers of the study area were aware about crop management and cultivation practices of mandarin cultivation but the adoption level were extremely low or even not adopted. Farmers of the study area were well acquainted with the extension agents but they were not accessing services and consultancies from government extension system regularly. Study also proves that socio-economic characteristics of mandarin growers such as education, Size of operational land holding, Accessibility of the village of the study area, Land under mandarin cultivation, Number of trees in the orchard, Material possession, Income from agricultural sector, Income from mandarin cultivation, Annual income, Source of communication, Extension Contact and Training exposure have positive and significant correlation with the 'Adoption Behaviour Index'.

Keywords: Adoption behaviour index, awareness, mandarin orange, socio-economic characteristics

INTRODUCTION

Since time immemorial, the significance of Citrus fruits for providing nutrients and as medicine has been accepted and recognised worldwide. Citrus fruits belong to the genus '*Citrus'* with various species of the family 'rutaceae'. C*itrus reticulata* is commonly known as Mandarin orange and is a large, distinctive and highly varied group that includes some of the finest and most highly reputed citrus fruits. It is not only famous due to its gorgeous appearance, pleasant taste but also for seed-lessness and easy peeling characters. The term *tangerine* and *mandarin* are used interchangeably and indicate easy peelers only (Ladaniya, 2008).

Citrus and related genera mainly originated from Hindustan Centre of Origin including tropical and subtropical region of Asia (Vavilov, 1950). Production of citrus fruits spread to all tropical and subtropical zones of the world from these regions. Mandarins were transported from Asia to Europe much later than other citrus (Webber, 1967). A numerical taxonomic study

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of different mandarin oranges using morphological characters confirmed North Eastern Hill Regions (NEHR) of India as Centre of Origin for mandarin orange (Ray and Deka, 2000). In India, according to Srivastava and Singh (2002) there are mainly four major and well-recognized zone in respect of mandarin cultivation viz. North and North West India, East and North-East India, Central India and South India. North Eastern Himalayan Region is one of the cultivation zone of mandarin orange, where, it is distributed over 9 States i.e. Assam, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, Sikkim, Tripura and the Darjeeling District of West Bengal and supporting the economic sustainability of the region (Ghosh and Singh, 1993).

In India, mandarin constitutes about 41 per cent of the total citrus produced (Das *et al.* 2005). Though it is grown in most of the States of India, certain belts have emerged as the leading producers. Satpura hills of central India, hilly slopes of Darjeeling and Coorg, Punjab, Rajasthan, Haryana, Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, Nilgiri, Palney, Shevroy Hills and NEHR are major mandarin growing belts.

Arunachal Pradesh is one of the States of NEHR. It has an area of 83,743 sq. km and characterized by lofty mountainous terrain crisscrossed by number of turbulent rivers and rivulets and sub-divided into 17 districts and Upper Subansiri is one of the Districts of Arunachal Pradesh where mandarin is growing abundantly and majority of the farming community are involved in its cultivation. Arunachal Pradesh is situated in the extreme North Eastern tip of India in the Trans-Himalayan region, located between the latitude of 26ˆ28' north and 29ˆ33' north and longitude of 91ˆ31' east and 97ˆ30' east. According to 2011 census, the State has about 13, 82,611populations. More or less, entire state is having favourable climatic condition for mandarin cultivation and it has been present in certain extent in all the districts. According to unpublished official document of Directorate of Horticulture, Government of Arunachal Pradesh, during the year 2010-11, acreage under citrus was 38,296 ha, the production in the same year was 1,64,673 MT with average productivity of 4.3 MT/ha. In India mandarin is being grown over 323.8 thousand hectares with an estimated production of 3,255.2 thousand MT. The average productivity of mandarin orange for the year 2011 was recorded as 10.1 MT/ Ha in the country (Indian horticulture database, 2011).

The District 'Upper Subansiri' is named after the mighty Subansiri River, and district has an area of 7,032 sq. km. It is bounded by China on the north, Lower Subansiri on the south, West Siang on the east and Kurung Kumey on the west. Upper Subansiri District is inhabited by three major tribes with different percentage of population and they are Tagin, Nyishi and Galo, respectively. As per 2011 census, it has 551 villages, population of 83,205 and literacy rate of 63.96 per cent. Agriculture is their mainstay for livelihood and farmers of the District are mostly practising subsistence farming, which is characterized by Jhum cultivation. The major and commonly growing crops in the district are rice, millet, maize, mandarin orange, pear, pineapple, cardamoms etc.

This District comes under the belt of centre of origin of mandarin. However, the farmers of the study area have economically yet not reached upto the desirable level. Various influential factors or reasons may be there for this condition, but yet not identified and documented proper way.

However, extent and degree of impact by influential factors related to mandarin cultivation are not recognized and is relatively less explored. Taking into consideration all the issues, present research work was carried out with the objective: To identify the relationship between various factors and present status of mandarin cultivation.

METHODOLOGY

The State of Arunachal Pradesh has a beautiful landscape and consists of 17 administrative districts. More or less, entire state having favourable climatic condition for mandarin cultivation and it is almost

same in certain extent in all the districts. Upper Subansiri is one of the Districts of the State where mandarin is grown abundantly and majority of the farming community are involved in its cultivation. As a result, 'Upper Subansiri' district was purposively selected for this study. This district comprises with nine Blocks and out of which five blocks were selected for the study, viz. *Baririjo, Daporijo, Dumporijo, Puchigeko and Taliha*. Experience of growing mandarin and area under mandarin cultivation of the farmers were taken into considerations for selection of respondents. Accordingly, 20 mandarin growers from each of the selected Block were considered as respondent and all together 100 farmers were included as respondents.

To accomplish the study an interview schedule was prepared in consultation with the experts in the field of agricultural extension and horticulture keeping in view of the objectives of the study and pre tested to finalize it; followed by data were collected with the help of interview schedule.

To know the socio-economic status of the farmers, various independent variables/factors, viz., Age, Experience in mandarin cultivation, Accessibility to village (It is the extent and availability of means to move to and fro to the particular village), Education, Occupation, Size of the land holding, Size of operational land holdings, Land under mandarin cultivation, Number of trees in the orchard, Material possession, Type of house, Annual income, Income from agricultural sector, Income from Mandarin farming,

Table 1: Distribution of respondents according to their Socio-economic status

n=100

Variable	Category	Frequency	Percentage
Age	Upto 30 years	9	9
	31 – 45 years	35	35
	46 years and above	56	56
Experience in mandarin cultivation	Upto 5 years	16	16
	6 to 10 years	1	1
	11 to 15 years	4	4
	Above 15	71	71
Educational Qualification	Illiterate	45	45
	Upto class V	14	14
	Upto class VII	17	17
	Upto class X	7	7
	Upto class XII	9	9
	Graduate	8	8
Occupation	Farming	75	75
	Government Employee	18	18
	Business	7	7
Type of House	Kutcha house	67	67
	Pucca house	31	31
	RCC house	2	2
Material Possession	Television	84	84
	Two wheelers	39	39
	Light motor vehicles	6	6
Number of mandarin trees in the orchard	Upto 500	45	45
	501 to 1000	30	30
	Above 1000	25	25
Accessibility to the village	Good	27	77.1
	Poor	5	14.3
	Very poor	3	8.6

Source of communication, Extension Contact and Training exposure were included and interpreted accordingly (Brief socio-economic profile of the respondents is presented in Table 1 where communication, extension contact and training exposure are presented in 2-4, respectively). The empirical measures of various socio-economic factors were done by frequency and percentage. The empirical measures for size of total land holding, operational holding and holding under mandarin cultivation was done by classification into six categories viz. landless, marginal, small, semi-medium, medium and large (Table 1).

Adoption is a decision to make full use of an innovation as the best course of action available. To know the adoption behaviour of the farmers, a correlation study was conducted to know the relationship between independent and dependent variables. To accomplish this, an index *i.e.*, 'Adoption Behaviour Index' was developed and considered as dependent variable. 'Adoption Behaviour Index' was obtained with the help of ratio of awareness level and ratio of adoption level. The formula employed for calculation of 'Adoption Behaviour Index' was-

$$\text{'Adoption Behaviour Index'} = \frac{\text{Ratio of awareness level + Ratio of adoption level}}{2} \times 100$$

To find out the ratio of awareness, 16 'awareness level' questions from 9 selected crop management practices/fields related to planting materials, variety, method of planting, manures and fertilizers, weed management, insect control and disease control and harvesting, were asked to the respondents. To each question, a score of '1' was assigned in case of 'aware' and '0' for 'not aware'. In this way maximum achievable score of respondent was 16 and minimum being 0. Further, the total score achieved by the respondents was divided by total achievable score i.e. 16 and outcome was considered as ratio of 'awareness level'.

Table 2: Distribution of respondents according to the influence of mass media on mandarin cultivation

n=100

Sources of information	Often		Sometimes		Never	
	Frequency	Percentage	Frequency	percentage	Frequency	Percentage
Radio	0	0	0	0	100	100
Exhibition	0	0	12	12	88	88
Print media (poster, folder, leaflet etc)	0	0	14	14	86	86

Table 3: Distribution of respondents according to influence of personal localite channel on mandarin cultivation

n=100

Sources of information	Often		Sometimes		Never	
	Frequency	Percentage	Frequency	percentage	Frequency	Percentage
Friends	0	0	89	89	11	11
Relatives	9	9	89	89	2	2
Neighbors	0	0	85	85	15	15
Progressive farmers	5	5	80	80	15	15

Table 4: Distribution of respondents according to frequency of visit to extension agents

n=100

Extension agents	Often		Sometimes		Never	
	Frequency	Percentage	Frequency	percentage	Frequency	Percentage
Village Level Worker	2	2	89	89	9	9
Agricultural Development Officer	2	2	77	77	21	21
Horticulture Development Officer	22	22	71	71	7	7

Table 5: Distribution of respondents according to acquaintance with extension agents and degree of visit of extension agents to farmers' place

n=100

Extension agents	Acquaint with extension agents		Degree of visit of extension agents to farmers' place					
			Often		Sometime		Never	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
VLW	100	100	0	0	61	61	39	39
ADO	100	100	0	0	12	12	88	88
HDO	98	98	0	0	35	35	65	65

$$\text{Ratio of awareness level} = \frac{\text{Total scored awareness in adoption level}}{\text{Total achievable score in awareness level}}$$

Similarly, to find out the ratio of adoption, 16 'adoption level' questions from earlier mentioned 9 selected practice/fields were asked to the respondents. For each question, a score of '1' was assigned in case of 'adopted' and '0' for not adopted. This way, maximum achievable score of respondent was 16 and minimum being 0. The total score achieved by the respondent in 'adoption level' questions was further divided by total achievable score i.e. 16 and outcome was considered as ratio of 'adoption level'.

$$\text{Ratio of adoption level} = \frac{\text{Total scored achieved in adoption level}}{\text{Total achievable score in adoption level}}$$

With the help of Score of farming index, farmers were further distributed into three categories, viz., high, medium and low by using the following formula- Low = d" (Mean - SD); Medium = between mean ± SD and High = >Mean + SD, respectively.

Table 6: Distribution of respondents according to participation in training

N=100

Category	Frequency	Percentage
Training attained	31	31
Training not attained	69	69

RESULTS AND DISCUSSIONS

The results of the investigation are presented and discussed in this chapter with the help of appropriate statistical analysis. These are presented according to specific objective of the study.

Awareness of respondents about the recommended practice of mandarin cultivation and its adoption in the study area by the mandarin growers are presented below according to major areas of crop management practices.

Table 7 showed the level of awareness and status of adoption of major crop management practices. Table 7 shows that 99 per cent of respondents were aware about selection of healthy planting material. Majority of mandarin growers (97%) informed that they had adopted healthy planting material in their orchard. Study also reveals that 94 per cent of the respondents were aware about selection of improved variety for high yield. Study further reveals that 91 per cent of the mandarin growers had adopted improved variety. However a negligible i.e. 6 per cent of respondents had not adopted improved variety in their orchard.

Study further reveals that 89 per cent of the mandarin growers were aware about necessary and importance of proper pit size for planting of mandarin saplings. It is clear from the study that, 81 per cent of the respondents were aware about proper time of planting. Similarly, 98 per cent of the respondents were also aware about importance of proper spacing for healthy orchard. However, only 11 per cent of the farmers had planted the saplings as per recommended pit size and 51 per cent of the farmers had adopted proper time of planting. In case of proper spacing, majority of the farmers (*i.e.*, 66%) had maintained proper spacing in their mandarin farm.

It is also clear from the study that 98 per cent of the mandarin growers were aware about importance of

Table 7: Level of awareness and status of adoption related to major areas of crop management practices by mandarin growers

n=100

Crop management practice/fields	Level of awareness/ adoption	Frequency	Percentage
Quality planting material	Aware about importance of healthy planting Material for planting	99	99
	Adopted healthy planting Material	97	97
Improved variety of mandarin	Aware about selection of improved variety for high yield	94	94
	Adopted improved variety	91	91
Proper planting method	Awareness of proper pit size of planting	89	89
	Awareness of proper time of planting	81	81
	Awareness of proper spacing	98	98
	Planted at proper pit size	11	11
	Planted at proper time	51	51
	Planted at proper spacing	66	66
Lay out of planting	Awareness of proper layout of orchard	98	98
	Adopted proper layout of orchard	57	57
Manure and fertilizer	Awareness about manure	100	100
	Awareness about fertilizer	90	90
	Adopted manure	1	1
	Adopted fertilizer	0	0
Plant protection measures (related to Weed/herbicide)	Aware about harmful effect of weed to orchard	100	100
	Aware about chemical control	85	85
	Adoption of weed control measures	39	39
	Adoption of herbicide	18	18
Plant protection measures (related to Insect/insecticide)	Aware about harmful effect of insects to mandarin plant	100	100
	Aware about its chemical control	89	89
	Adoption of insect control measures	22	22
	Adoption of insecticide	10	10
Plant protection measures (related to disease/fungicide)	Aware about harmful effect of diseases to orchard	97	97
	Awareness about its chemical control	43	43
	Adoption of disease control measures	6	6
	Adoption of chemical control	0	0
Harvest index	Awareness on right time of harvesting	100	100
	Awareness on harvesting index	100	100
	Adoption of right time of harvest	100	100
	Following harvesting index during harvesting	100	100

proper layout of planting in the orchard. However, only 57 per cent of the growers informed that they had maintained proper layout of planting in orchard and their practice were square system.

Further, study show that 100 per cent of the mandarin growers were aware about manures and 90 per cent of the growers were aware about fertilizers. However, adoption of manures and fertilizer in mandarin cultivation was not taken place.

Similarly, Table 7 contains information related to level of awareness and status of adoption of plant protection measures. Study shows that 100 per cent of the respondents were aware about harmful effect of weeds on mandarin orchard and majority of the farmers (85%) were also aware about chemical control of weeds. However, 39 per cent of growers adopted weed control

measures in their mandarin orchard/cultivation and only 18 per cent of growers were using herbicide. It is also clear from the study that, 100 per cent of the growers were aware about harmful effect of insects on commercial cultivation of mandarin and majority of the farmers (*i.e.* 89%) were aware about chemical control of insects. Whereas, 22 per cent of growers adopted insect control measures and only 10 per cent adopted insecticides to control insect infestation and to protect their orchard. Further, study shows that (97%) of the growers were aware about harmful effect of diseases on mandarin orchard. Considerable percentages *i.e.* 43 per cent of growers were aware about chemical control of diseases, but only a few *i.e.*, 6 per cent of the growers adopted disease control measures and none of them adopted chemical control to protect their orchard from disease infestation. Thangngnew (1994), reported similar type of findings; he found that the extent of adoption of improved mandarin orange cultivation practice by mandarin growers of North Cachar Hills District of Assam was very low. Trivedi and Patel (1996) stated that inadequate crop protection, lack of inputs and irrigation facilities were the major constraints associated with technological gap among tribal farmers.

Table 6 also showed the level of awareness and status of adoption about proper harvesting time and harvest index. It is clear from the study that all the respondents were aware about right time of harvesting and harvesting index. Study also reveals that 100 per cent of the mandarin growers were harvesting their crop at the right time of maturity.

Table 7: Distribution of respondents according to their adoption behaviour index

n=100

Category	Score range	Population
Low	≤ (Mean - SD)	19
Medium	Mean ± SD	67
High	>Mean + SD	14

Table 7 showed that the distribution of respondents according to their 'adoption behaviour index' score. It was found that, 19 per cent of the farmers belonged to low score category of 'adoption behaviour index' and 67 per cent of respondents were under medium category of 'adoption behaviour index'. Study also shows that, 14 per cent of the mandarin growers were under high score category of 'adoption behaviour index'. The 'adoption behaviour index' was ranged from 43.80 to 87.50. Mean and standard deviation score was 68.72 and 10.48 respectively.

Table 8: Relationship between various factors and farming index/present status of mandarin cultivation

Variables	Value of 'r'	
Age	-0.112011	NS
Experience in mandarin farming	-0.209401	NS
Accessibility to the village of the study area	0.238098	**
Educational status of the respondents	0.304221	**
Occupation of the respondents	-0.26478	NS
Total size of Land Holding	0.070468	NS
Size of operational Land Holding	0.207104	*
Land under mandarin cultivation	0.387224	**
Number of trees in the orchard	0.435859	**
Type of house	0.152712	NS
Material possession	0.203094	*
Annual income	0.478894	**
Income from agricultural sector	0.302156	**
Income from mandarin cultivation	0.417978	**
Source of communication	0.308004	**
Extension Contact	0.597461	**
Training exposure	0.449205	**

* Significant at 5% level; ** Significant at 1% level; NS – not significant

Here attempt has been made to test whether any relationship was present between 'adoption behaviour index' of mandarin growers and other socio-economic characteristics of the growers. Study (Table 8) shows the result of significant correlation between various socio-economic variables and 'adoption behaviour index' of mandarin growers.

The correlation value between accessibility to the village of the respondents and 'adoption behaviour index' was 0.238098. The result was statistically significant at 1 per cent. So, the good accessibility of the village of growers has a strong relationship with 'adoption behaviour index' *i.e.*, improved mandarin cultivation by growers.

The correlation value between education of the mandarin farmers and 'adoption behaviour index' of mandarin growers was 0.304221. The result is statistically significant at 1 per cent. So, higher educational status of the growers has a higher 'adoption behaviour index' of mandarin cultivation i.e., modern farming. Raghavendra (1997) found that education has significant correlation with adoption level of areca nut growers.

The correlation value between Size of operational land holding of the respondents and 'adoption behaviour index' was 0.207104. The result was statistically significant at 5 per cent. So, larger area of operational land holding of mandarin growers has positive relationship with 'adoption behaviour index' *i.e.*, improved mandarin farming.

The correlation value between Land under mandarin cultivation of the respondents and 'adoption behaviour index' was 0.387224. The result was statistically significant at 1 per cent. So, larger area of land under mandarin cultivation of farmers has positive relationship with 'adoption behaviour index' of mandarin growers *i.e.*, improved mandarin cultivation by growers.

The correlation value between Number of mandarin trees in the orchard of the growers/respondents and 'adoption behaviour index' was 0.435859. The result was statistically significant at 1 per cent. So, large number of mandarin trees in the orchard has positive relationship with 'adoption behaviour index' and improved mandarin cultivation by growers.

The correlation value between Material possession of the respondents and farming index was 0.203094 and the result was statistically significant at 5 per cent. So, possession of modern and sophisticated material by mandarin growers/respondents has positive relationship with 'adoption behaviour index' and status of mandarin cultivation.

The correlation value between Annual income of the respondents and 'adoption behaviour index' was 0.478894. The result was statistically significant at 1 per cent. So, higher annual income of mandarin growers has positive relationship with his 'adoption behaviour index' *i.e.*, improved mandarin cultivation by growers. Raghavendra (1997) found that annual income has significant correlation with adoption level of areca nut growers.

The correlation value between Income from agricultural sector of the respondents and 'adoption behaviour index' was 0.302156. The result was statistically significant at 1 per cent. So, higher income from agricultural sector of mandarin growers has positive relationship with 'adoption behaviour index' *i.e.*, improved mandarin cultivation by growers.

The correlation value between income from mandarin cultivation of the respondents and 'adoption behaviour index' was 0.417978. The result was statistically significant at 1 per cent. So, higher annual income from mandarin cultivation has positive relationship with 'adoption behaviour index' of the growers *i.e.*, improved mandarin cultivation by growers.

The correlation value between communication and 'adoption behaviour index' was 0.308004. The result was statistically significant at 1 per cent. So, higher the access of the communication and information by the mandarin growers has higher the 'adoption behaviour index' *i.e.*, improved mandarin cultivation by growers.

The correlation value between extension contact of the mandarin growers/respondents and 'adoption behaviour index' was 0.597461. The result was statistically significant at 1 per cent. So, higher degree of contact between extension agent and mandarin growers and vice versa, has positive impact on 'adoption behaviour index' *i.e.*, the improved farming of mandarin cultivation.

The correlation value between Training exposure of the respondents and 'adoption behaviour index' was 0.449205. The result was statistically significant at 1 per cent. So, more participation in training programme by growers had positive impact on the improved farming of mandarin cultivation. Suranse *et al.* (2011), also stated that socio-economic characteristics of mandarin growers such as education, experience in mandarin cultivation, annual income, land holding, area under mandarin

cultivation have positive and significant correlation with the Training Needs about Improved Cultivation Technology.

The correlation value between age of the respondents and 'adoption behaviour index' was -0.112. The correlation value between experience in mandarin farming and 'adoption behaviour index' of mandarin growers was -0.2094 and statistically not significant. Study also shows that, the correlation value between occupations of the respondents and 'adoption behaviour index' of the farmers was -0.26478. The result was statistically non-significant. Further, the correlation value between land holding size of the respondents and 'adoption behaviour index' was 0.070468 and the result was statistically not significant. Similarly, the correlation value between Type of house of the mandarin growers and 'adoption behaviour index' was 0.152712. The result is not statistically significant.

CONCLUSION

On the basis of the present investigation, the following conclusion and recommendation may be made in respect of socio-economic status and adoption behaviour of mandarin growers of Upper Subsansiri District of Arunachal Pradesh, India.

Study explored that influence of mass media on mandarin cultivation in the study area is very weak. So, Radio talk, Community Radio, TV programme and literature regarding mandarin cultivation may be initiated and distributed from Department of Horticulture and Agriculture of the State.

Farmers of the study area were well acquainted with the extension agents but they were not accessing services and consultancies from government extension system regularly. Study also found that visit of the extension personnel to their client system was not upto the mark. Hence, emphasis may be given to reduce the gap between the farming community and extension agents in order to achieve better transfer of technology.

Majority of the mandarin growers of the study area were aware about crop management and cultivation practices of mandarin cultivation viz., quality planting material, improved variety, planting method, proper layout of planting, manures and fertilizers, plant protection measures and about harvest index but the adoption level were extremely low or even not adopted. So, needful action may be taken from the concerned department/ authority for adoption of crop management and cultivation practices of mandarin cultivation.

It was found that majority of the farmers of the study area had medium level of 'adoption behaviour index'. Independent variables such as accessibility to the village of the study area, educational status of the respondents, land under mandarin cultivation, number of trees in the orchard, annual income, income from agricultural sector, income from mandarin cultivation, training exposure exhibited positive and significant relationship with 'adoption behaviour index'. So, proper attention may be given in these respects from the concerned departments/ stakeholders.

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