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RESEARCH ARTICLE

STUDY OF IMPROVED MANDARIN (*Citrus Reticulate Blanco*) ORCHARD MANAGEMENT PRACTICES IN MID HILLS OF GANDAKI PROVINCE, NEPAL

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ABSTRACT

A survey was carried out to collect information regarding orchard management practices from mandarin growers of mid hills of Gandaki province by taking representative sample size of 80, 25 each from Beni Municipality and Jaljala Rural Municipality and 30 from Kathekhola Rural Municipality of Myagdi,Parbat and Baglung respectively. Purposive selection of site was done, and sampling procedure was simple random sampling technique. Descriptive statistical tools, chi-square test and t-test were used to analyze the data. The study was carried out to know level of adoption of improved orchard management practices, relation between socio-economic characters and adoption of technology and to identify the constraints perceived by farmers during adoption. From the study it was found that majority of the respondents of mandarin growers were male, middle aged, had medium sized family, had medium farm size, most of them are literate and agriculture was the primary source of income. Majority of farmers had taken training. Most of the respondents were in frequent contact with extension agent seeking the required information. Out of major ten improved management practices, majority of respondents had adopted training and pruning while least adopted practices were micronutrient application. Majority of respondents had low adoption on recommended management practices. Gender, education level, training, land holding size, contact with extension agent had significant association with adoption. Major problems like irrigation, insect and disease, training, lack of labor and cost of input were encountered during the adoption of improved mandarin orchard management practices. It is recommended that, literacy program needed to be strengthened, training should be based on felt need and subsidy should be given to farmers to encourage them towards mandarin cultivation as well as adoption of improved orchard management practices.

KEYWORDS

citrus, mandarin, orchard management practices, farmers.

1. INTRODUCTION

In Nepal horticultural crops cover about 15% of total agricultural gross domestic product (AGDP). Among horticultural crops, fruits cover 7% of total AGDP (MoAD, 2014; Adhikari, 2016/17). These days the consumption of fruits is in increasing trend due to its high nutritive value. Among fruits, citrus is world's leading fruit crop (Bose & Mitra, Fruits: tropical and subtropical). It is a crop adapted in subtropical region and it is considered as high value crop in mid-hills of Nepal (Gautam and Bhattarai, 2006). This crop has gained a stature of huge industry which would be a step forward towards providing a nutritional security to the growing population (Srivastava and Singh, 2002; Banerjee, 2008). In climate, soil and cultivar types It is one of the indigenous fruit contributing 26.8% of total fruit production (NCRP, 2016).

In Nepal, citrus is grown at 800- 1400 meter above mean sea level. Citrus get most favorable climatic condition in the eastern and western mid hills of Nepal with annual mean temperature 17-20 degree Celsius and annual rainfall ranging from 1000-2800 mm (Srivastava ans Singh, 2002). There are about 140 major citrus producing countries according to UNCTAD. FAO estimated the world's citrus production to about 115.6 million tones in which Brazil, china, USA and Mexico are among the world's top citrus producing countries while Nepal produces only 0.22 million tons (NCDP, 2015/16). The productive area of citrus is 24,885 ha and production is 218,447.2 Mt with productivity of 8.78 Mt/ha (Paudyal, 2002). The total area of mandarin is 16,248 ha, and production is 146,690 Mt with productivity 9.03 Mt/ha. Mainly, three citrus species are grown commercially in Nepal i.e. Mandarin (*Citrus reticulate)*, sweet orange (*Citrus sinensis)* and lime (*Citrus aurantifolia).* Of the fruit area in Nepal, citrus shares nearly 32% of the total area among which the contribution of mandarin is nearly 21%.

Similarly, the share of citrus in total fruit production is 37%, in which mandarin is major commodity and its share in total production is nearly 25% (Fao, 2011). The demand of mandarin is very high because of its nutritive value. It is rich in vitamin C (Ascorbic acid), fruit sugar and vitamin A and B. There is high potential of mandarin cultivation in mid hills of Nepal. Major mandarin producing areas are Myagdi, Parbat, Baglung, Syangja, Gorkha, Solukhumbu, and Lamjung and so on. Orchard management is the major factor to enhance the total production of

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mandarin (Banerjee et al., 2008). Only having favorable climatic condition and improved variety don't ensure the good production as per the potentiality (Bose, 1985). There must be adoption of proper orchard management practices. Adoption of management techniques has a significant role in the production. There is low production due to non-adoption or poor adoption of management technology.

2. METHODOLOGY

2.1 Area of study

The study was carried out in the mid hills of Gandaki province. Beni municipality (28.3685° N, 83.5390° E), Kathekhola rural municipality (28.2624° N, 83.5393° E), and Jaljala rural municipality (28.3351° N, 83.5768° E) of Myagdi, Baglung and Parbat districts were chosen respectively.

2.2 Data collection

2.2.1 Pretesting

The interview for the data collection was pre-tested prior to household survey for checking the reliability and validity through the selection of respondents near to the study area (Chattopadhayay, 2012). Then, necessary adjustments were done as per the requirements in the interview schedule.

2.2.2 Interview

An interview schedule was designed for primary data collection. For the construction of interview schedule, a coordination schema was prepared with the objectives of the study (Chaudhary et al., 2013). Based on co-ordination scheme different variables were included in the interview schedule.

2.2.3 Key informant interview

The major key informants were farmers, stakeholders and District Agriculture Development officers. They were asked a series of question about present scenario of mandarin cultivation and status of orchard management.

2.2.4 Household survey

The detail information about the socio-economic status, recommended practices adopted, household information was discussed in interview schedule (Choudhary, 2006). The interview schedule was used to collect the information from the randomly selected farmers of mandarin zone area.

2.2.5 Focus group discussion

Focus group discussion was conducted at the study area after completing interview schedule with the help of checklist to verify the result obtained from household survey and discuss about the strategies to increase adoption of improved practices in mandarin zone area (CIMMYT, 1993).

3. RESULTS AND DISCUSSION

3.1 Socio- economic characteristics of respondents

The socio- economiccharacteristics of respondents includes age, gender, ethnicity, education level, religion, family size, land holding size, mandarin cultivation area, source of income, other extension related factors were training and contact with extension agents (Dangol, 2004). The descriptive analysis of their characteristics is mentioned below:

3.2 Age

The study revealed that the middle age group (40-60) belongs to high adopter of improved orchard management. Age was found to be statistically insignificant (p-value 0.905) to level of adoption. Thus, we conclude that there is no relationship between age and level of adoption. Similar result was also found conducted similar research in rice (Dangol 2004).

Table 1: Distribution of respondents by their age and adoption level of farmers on improved mandarin orchard management practices (N=80)

Variables (Age in years)	Low adopters	High adopters	Total	Chi-square value	p-value
<40	9(20.9)	9(24.32)	18(22.5)	0.199ns	0.905 at 2df
40-60	22(59.45)	19(51.35)	41(51.25)		
>60	12(27.9)	9(24.32)	21(26.25)		

Figures in parenthesis () indicate percentage

3.3 Gender

From the study, males (83.8%) were found to be higher adopter than female (16.2%). Since the P-value (0.022) is less than the significance level (0.05), we cannot accept the null hypothesis. Thus, we conclude that there is a relationship between gender and adoption level.

Table 2: Distribution of respondents by their gender and adoption level of farmers on improved mandarin orchard management practices (N=80)

Variables	Low adopter	High adopter	Total	Chi-square value	p-value
Male	26(60.5)	31(83.8)	57(71.3)	5.27**	0.022 at 1df
Female	1739.5)	6(16.2)	23(28.7)		

Figures in parenthesis () indicate percentage
Note: ** indicates significant at 5% level

3.4 Level of education

The study revealed that the farmers belonging to informal education level were likely to be higher adopter (Dhifal, 2010). Since the P-value (0.00) is less than the significance level (0.01), we cannot accept the null hypothesis. Thus, we conclude that there is a relationship between education and adoption level (Feder et al., 1990; Yadav, 2006). He reported that education is one of factor determining the adoption of technology by farmers.

Table 3: Distribution of respondents by their level of education and adoption level of farmers on improved mandarin orchard management practices (N=80)

Variables	Low adopters	High adopters	Total	Chi-square value	p-value
Illiterate	14(32.55)	5(13.51)	19(23.75)	15.701***	0.00 at 3df
Informal	27(62.9)	18(48.64)	45(56.25)		
Below SLC	2(4.65)	6(16.21)	8(10)		
SLC or above	0	8(21.62)	8(10)		

Figures in parenthesis () indicate percentage
Note: *** Highly significant at 1% level

3.5 Land holding size

The study revealed that the farmers having medium farm size were likely to be high adopters. Since the P-value (0.03) is less than the significance level (0.05), we cannot accept the null hypothesis. Thus, we conclude that there is a relationship between land holding size and adoption level (Negash, 2010). He found that land holding size is significant with adoption technology in bean production.

Table 4: Distribution of respondents by their land holding size and adoption level of farmers on improved mandarin orchard management practices (N=80)

Variables	Low adopters	High adopters	Total	Chi-square value	p-value
Small (<0.15 ha)	7(16.27)	1(2.7)	8(10)	6.98**	0.03 at 2df
Medium (0.15-1.11 ha)	31(72.09)	25(67.56)	56(70		
Large (>1.11 ha)	5(11.62)	11(29.72)	16(20)		

Figures in parenthesis () indicate percentage
Note: ** indicates significant at 5% level

3.6 Family size

The study revealed that majority of adopters belonged to medium family size. Since the p-value (0.16) is more than the significance level (0.1), we can accept the null hypothesis. Thus, we conclude that there is no relationship between family size and adoption level (Dorji et al., 2016). The result indicated that there was no significant association between family size and adoption level of improved mandarin orchard management practices (Pyakuryal, 1985). He reported that family size was not associated with adoption level of recommended technology of cauliflower production.

Table 5: Distribution of respondents by their family size and adoption level of farmers on improved mandarin orchard management practices (N=80)

Variables	Low adopters	High adopters	Total	Chi-square	p-value
Small	17(39.5)	9(24.32)	26(32.5)	3.58	0.16 at 2 df
Medium	8(18.6)	15(40.54)	23(28.75)		
Large	18(41.8)	13(35.13)	31(38.75)		

Figures in parenthesis () indicate percentage

3.7 Training obtained by respondents

The farmers who received training were likely to be highly high adopters (75.67%) than who didn't receive training (24.3). Since the p-value (0.001) is less than the significance level (0.1), we cannot accept the null hypothesis (NCRP, 2016). Thus, we conclude that there is a relationship between training received and adoption level (Mwangi and Kariuki, 2016). He reported that training is one of the determinants of adoption of new technology by small holder farmers in developing countries.

Table 6: Distribution of respondents based on training obtained and adoption level of farmers on improved mandarin orchard management practices (N=80)

Variables	Low adopters	High adopters	Overall	Chi-square	p-value
Training received	15(34.9)	28(75.67)	43(53.75)	13.31***	0.001 at 2df
Training not received	28(65.1)	9(24.3)	37(46.25)		

Figures in parenthesis () indicate percentage
Note: *** indicates significant at 1% level

3.8 Contact with extension agent

The study revealed that the farmers who were in frequent contact with extension agents were found to be highly higher adopter of improved orchard management practices. Since the P-value (0.002) is less than the significance level (0.1), we cannot accept the null hypothesis. Thus, we conclude that there is a relationship between contact with extension agent and adoption level (Reddy and Reddy, 1998). He reported that contact with extension agents had association with knowledge and adoption of improved paddy cultivation practices.

Table 7: Distribution of respondents based on contact with extension agent and adoption level of farmers on improved mandarin orchard management practices (N=80)

Variables	Low adopter	High adopter	Total	Chi-square value	p-value
Never	10(23.25)	3(8.1)	13(16.25)	12.87***	0.002 at 2df
Seldom	20(46.51)	8(21.62)	28(35)		
Frequently	13(30.23)	26(70.27)	39(48.75)		

Figures in parenthesis () indicate percentage
Note: *** indicates significant at 1% level

3.9 Income from mandarin

From the study it was found that the income from mandarin is associated with the adoption of management practices. Since, p-value (0.002) is less than 0.05 there is significant different between income and adoption level.

Table 8: Comparison between income and adoption level

Variables	Adoption level		Mean difference	t- value	p-value
	Low adopter	High adopter			
Income from mandarin	423756.76	114906.98	308849.78	3.131**	0.002

Note: ** indicates significant at 5%

3.10 Major problems perceived by respondents during adoption of improved orchard management practices

The major problems perceived by respondents during adoption of improved orchard management practices addressed in the study area were ranked below:

Table 9: Constraints regarding the adoption of improved practices of Orchard management by farmers

Problems	1	0.8	0.6	0.4	0.2	Total	weight	index	rank
Labour	2	7	13	28	30	80	32.6	0.4075	IV
Irrigation	49	9	5	10	7	80	64.6	0.8075	I
Cost of input	1	8	12	22	37	80	30.8	0.385	V
Lack of trainings	4	26	37	13	0	80	52.2	0.6525	III
Insect and Disease	25	29	13	7	6	80	60	0.75	II

It is evident from the table that the constraint 'irrigation' was the most perceived constraint among all the constraints faced by the farmers in adoption of recommended orchard management practices and hence it was awarded first rank. The second most perceived constraints by the farmers in adoption of recommended practices was insect and disease problem followed by lack of training and shortage of labor which were ranked third and fourth respectively. Similarly, the constraint 'cost of input' was ranked in fifth position (Negash, 2010). The problem of irrigation might be because of the reason that the farmers were unable to pull water from the river via motor as it costs much which is beyond their capacity and lack of knowledge about the rainwater harvesting. Similarly, the problem of insects-pest was because they lack knowledge about orchard sanitation and on control measures to be taken.

This implies that there should be proper training about the insects-pest

and disease management. Likewise, 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 mandarin growers. The problem of labor is due to the shortage of manual workers and brain drain was the main reason behind this. In the study area, it was found that most of the young members of household were in foreign countries or moved in other cities in search of jobs. The constraint cost of input was because the seedlings of mandarin, fertilizers, chemical pesticides, micronutrients etc. require more cost and sinceaverage farmers cannot afford these expenses.

3.11 Problem of Disease

In the study site, from the study it was found that there was high infestation of powdery mildew followed by sooty mould which was ranked first and second respectively.

Table 10: Diseases found in the study sites

Types of disease	1	0.83	0.66	0.49	0.32	0.15	Total	weight	Index	Rank
Root rot	0	7	22	17	3	31	80	34.27	0.428	III
sooty mould	2	50	8	1	1	18	80	52.29	0.653	II
Citrus canker	1	2	8	15	22	32	80	27.13	0.339	V
Powdery mildew	64	2	2	1	0	11	80	69.12	0.864	I
Foot rot	2	3	10	15	22	28	80	29.68	0.371	IV

Table 11: Insects occurrence in study sites

Types of insects	1	0.83	0.66	0.49	0.32	0.15	Total	weight	index	rank
Leaf miner	0	17	28	15	0	20	80	42.94	0.536	II
Fruit fly	16	21	14	8	1	20	80	49.91	0.623	I
Aphid	1	4	9	22	24	20	80	31.72	0.396	IV
Stem borer	0	10	7	13	32	18	80	32.23	0.402	III
lemon butterfly	1	4	8	23	24	20	80	31.55	0.394	V

3.12 Problem of Insects

The study revealed that high occurrence of fruit fly in the study area and hence ranked first. Similarly, leaf miner, stem borer, aphid and lemon butterfly were ranked second, third, fourth and fifth respectively.

4. Conclusion

Majority of the respondents of mandarin growers were male, middle aged, belonged to Janajati ethnic group, followed Hinduism, had medium sized family, had medium farm size, most of them are literate and agriculture was the primary source of income. Majority of farmers had taken training. Most of the respondents were in frequent contact with extension agent seeking the required information. Out of major ten improved management, majority of respondents had adopted training and pruning while least adopted practices was micronutrient application. Majority of respondents had low adoption on recommended management practices. Gender, education level, training, land holding size, contact with extension agent had significant association with adoption. Major problems like irrigation, insect and disease, training, lack of labor and cost of input were encountered during the adoption of improved mandarin orchard management practices

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