Adoption of Improved Orchard Management Practices of Mandarin in Gorkha, Nepal

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ABSTRACT: The citrus in Nepal is cultivated in small as well as commercial scale at an altitude range of 650 to 1400 m above the mean sea level. A survey study was done in Gorkha Municipality and Sahid Lakhan Rural municipality with the objective to assess adoption level of improved orchard practices of mandarin in Gorkha on 2020. Sample size of 120 respondents was selected using simple random sampling and ten improved orchard management practices were selected. Out of which, weed management practice was highly adopted (100%) while irrigation was the least adopted practice (6.7%). The medium level of adoption of improved orchard management practices was found in 49% out of the total respondents. Among the socio-demographic parameters observed, significant relationship was found in case of age, education, and membership in farmer's group/organizationwith the adoption of improved orchard management practices of mandarin. Lack of knowledge and irrigation facilities, problems of insects-pests and diseases and climatic uncertainty were the major problems for mandarin production in Gorkha municipality and Sahid Lakhan rural municipality of Gorkha.

I. INTRODUCTION

Citrus is the most important fruit crop of hilly areas of Nepal which is widely grown throughout the mid hills (600-1,400 masl) from east to west across the country [1]. Gorkha is one of the commercial citrus producing districts of mid-hills of Nepal. The citrus, specifically mandarin possess enormous potential to generate income, employment opportunities and nutrition to rural poor people. In Nepal most of the citrus orchards are either poorly managed or neglected resulting to citrus decline in great extent, low productivity in general and mandarin in particular. So, there is a wide scope of increasing productivity and quality of citrus fruits in Nepal which can be achieved by utilizing better varieties and improved orchard management practices.

Gorkha is one of the commercial citrus producing districts of mid-hills of Nepal but the production and quality of mandarin in Gorkha are decreasing every year despite the fact that the cultivated area has increased in recent years [2]. Most of the mandarin orchards in are left unmanaged and farmers have particular focus on harvest only. The health status of orchard is degrading along with declining production and quality. Although the lists of orchard management practices have been recommended, they have not been adopted properly by farmers. Also, there has been very less works related to mandarin and solutions for many problems arising are still lacking behind. Under such conditions it is quite necessary to study and identify the existing challenges of problems of orchard management practices faced by farmers. It is true that improved practices are not only the things, which cause adoption or rejection, but certainly other factors are also directly or indirectly responsible for technological gap.

There is a wide scope of increasing productivity and quality of citrus fruits in Nepal, which can be achieved by utilizing better varieties and improved orchard management practices [3]. Since, lack of proper orchard management has restricted the productivity and quality in these areas, these problems can be overcome. With the assessment of association between socio-demographic characters and level of adoption, the target group for information dissemination can be finds out and transfer of information can be made stronger. The relation of farmers to practices adopted by them helps to ensure the problems and sustainable way of adoption. It will enable concerned stakeholders for appropriate resource allocations so that improved cultivation practices can be adopted by farmers overcoming the traditional one. Identification of problems in the way of mandarin production and developing a solution seems to be pre-requisite for commercialization of mandarin. The study is done with the motive of helping farmers and entrepreneurs involved into this sub-sector. Study is carried out with the broad objectives of assessing the adoption of improved orchard management practices of mandarin in Gorkha Municipality and Sahid Lakhan Rural Municipality of Gorkha district and with following specific objectives:
- To assess the orchard management practices of mandarin

- To identify the major influencing factors on adoption of improved orchard management practices
- To identify major problems pertaining to mandarin production

II. MATERIALS AND METHODS

The study was conducted in command area of PM-AMP citus zone viz, Gorkha municipality and Sahid Lakhan rural municipality of Gorkha purposively being the areas withhighest production potentials in district. Simple random sampling technique was followed for data collection. A list of mandarin growers was prepared as provided by citrus zone, Gorkha which was used as sampling frame. The sample size of 80 from Gorkha municipality and 40 from Sahid Lakhan rural municipality was taken by making a total of 120 respondents to analyze the adoption and constraints faced by growers in the study area. For the collection of data, interview schedule was developed. The respondents were asked to give information about the use of improved orchard management practices. Arbitrary values were assigned for measurement; 0 for no adoption of practice and 1 for adoption of the practice. Level of adoption was calculated on the basis of the adoption index. Similarly, the constraints faced by the mandarin growers were also recorded on the point continuum namely. Very serious, Serious, Somewhat Serious and the scores were assigned 2, 1 and 0 respectively. The results on the basis of feedback were calculated accordingly. Quantitative and qualitative data obtained from the survey was analyzed and interpreted by using SPSS and MS-excel.

III. RESULTS AND DISCUSSIONS

A. Socio-demographic characteristics

The perusal of the data given in table 1 revealed that the majority of the respondents (70.0%) were in between37-63 years of age followed by 16.7% of respondents under 37 years of age and 13.3% of the respondents above 63 years of age. The majority of the respondents (75.8%) were male and 24.2% were female. Only 29.2% percent of the respondents were having education level as less than SLC. Annual income of mandarin was categorized into low, medium and high and it was found that 71.7 % farmers had medium level of annual income. Land holding of mandarin was categorized into small,medium and large and it was found that eighty (80.0 %) farmers had medium sized land holding while 12.5% had largeand 7.5 had small sized land holding.The majority of the respondents (72.5%) were having membership of social organization/farmer's group while 27.5 percent were not involved in membership with any organizations. The percent of respondents who had training related to mandarin cultivation was 42.5% while 57.5% of respondents had not received any sorts of training. Majority of respondents (39.2%) never had contact with extension agents while 30.8% had frequent contact and 30% had occasional contact.

Table 1: Socio-demographic characteristics of respondents (N=120) in study area, 2020

Variables	Characteristics	No.	%
Age	Less than 37	20	16.7
	37-63	84	70
	Above 63	16	13.3
Gender	Male	91	75.8
	Female	29	24.2
Education	Illiterate	21	17.5
	Literate	30	25
	Less than SLC	35	29.2
	SLC or above	34	28.3
Family income	Low (<240)	12	10
	Medium (240-595)	86	71.7
	High (>595)	22	18.3

Area of orchard	Small (<0.28)	9	7.5
	Medium (0.28-0.82)	96	80
	Large (>0.82)	15	12.5
Membership	Membership	87	72.5
	Non-membership	33	27.5
Training	Training received	51	42.5
	Training not received	69	57.5
Extension contact	Frequent	37	30.8
	Occasional	36	30
	No contact	47	39.2

B.   Adoption of improved orchard management practices of mandarin

The improved mandarin orchard management practices recommended in the study area was taken into consideration in determining the farmers' adoption level. They were soil amendment practice, training and pruning, manures and fertilizers application, irrigation, bordeaux paste and mixture application, micronutrient application, weeding, insect control, disease control and mulching

Table 2: Adoption of improved orchard management practices by farmers in study area, 2020

S. N	Practices	Adoption level			
		Adopters		Non-adopters	
		No.	%	No.	%
1.	Soil amendment practice	27	22.5	93	77.5
2.	Training and pruning	105	87.5	15	12.5
3.	Manures and fertilizers application	37	30.8	83	16.2
4.	Irrigation	8	6.7	112	93.3
5.	Bordeaux paste and mixture application	52	43.3	68	56.7
6.	Micronutrient application	27	22.5	93	77.5
7.	Weeding	120	100	0	0
8.	Insect control	66	55	54	45
9.	Disease control	52	43.3	68	56.7
10.	Mulching	70	58.3	50	41.7

The above table showed that there was a variation in the extent of adoption of different improved mandarin orchard management practices. Table 2 showed that majority of the respondents (100%) adopted weed management practice followed by training and pruning (87.5%), mulching (58.3%), insect control (55%), disease control (43.3%), bordeaux paste and mixture application (43.3%), manures and fertilizer application (30.8%), micronutrient application (22.5%), soil amendment practice (22.5%) and irrigation practice (6.7%). The result indicated that weed management had highest adoptions as compared to other improved practices while the least adopted one was irrigation practice.

Distribution of respondents based on level of adoption

Table 3: Distribution of respondents based on level of adoption in study area, 2020

	No.	%
Low adopter (>0.25)	37	31
Medium adopter (0.25-0.50)	59	49
High adopter (>0.50)	24	20

The respondents were categorized into low adopter, medium adopter and high adopter based on adoption index. Low adopter had adoption index less than 0.25, medium adopter had 0.25 to 0.50 and high adopter had more than 0.50. Study revealed that majority of respondents (49%) were medium adopter followed by low adopter (31%) and high adopter (20%).

C. The influence of independent factors on the adoption of improved orchard management practices of mandarin

i. Association between farmers' age and improved orchard management practices of mandarin

Table 4: Distribution of respondents according to their age and adoption of improved orchard management practices (N=120)study area, 2020

	Age of respondents			Total
	less than 37	37-63	above 63	
Low Adopter	3(6.2)	31(25.9)	3(4.9)	37(37.0)
Medium Adopter	11(9.8)	35(41.3)	13(7.9)	59(59.0)
High adopter	6(4.0)	18(16.8)	0(3.2)	24(24.0)
Total	20(20.0)	84(84.0)	16(16.0)	120(120.0)

Figures in parentheses indicates expected frequency

Chi-Square (χ^2 Cal) = 15.127* (χ^2 tab) = 9.49 P value 0.004; df=4   Significant at 0.05 level of significance

The study revealed the distribution of farmer's age to the adoption of improved orchard management practices which were categorized as low adopter, medium adopter and high-adopter. Among the respondent, farmers of age group less than 37 years were more likely to be high adopter compared to other ages.

This result signifies that the association between age of farmer and improved orchard management practices used by them are statistically significant. Farmers belonging to low age groups were high adopters compared to other ages. This might be due to the fact that old age farmers have almost fixed mindset behavior patterns, so middle aged, and especially young farmers must be targeted for imparting skill trainings in mandarin production technologies [5].

ii. Association between gender and adoption of improved orchard management practices of mandarin

Table 5: Distribution of respondents according to their gender and adoption of improved orchard management practices (N=120) in study area, 2020

	Distribution of respondents		Total
	Male	Female	
Low adopter	24(28.1)	13(8.9)	37(37.0)
Medium adopter	46(44.7)	13(14.3)	59(59.0)
High adopter	21(18.2)	3(5.8)	24(24.0)
Total	91(91.0)	29(29.0)	120(120.0)

Chi-Square (χ^2 Cal) = 4.358 (χ^2 tab) =5.99 P value 0.113   df = 2 Non-Significant at 0.05 level of significance.

This shows that there was no association between gender of farmers and adoption of improved orchard management practices.

iii.   Association between farmers' education level and adoption of improved orchard management practices of mandarin

This study revealed the distribution of education level of farmer to the adoption of improved orchard management practices of mandarinwhich were categorized as low adopter, medium adopter and high adopter. The table shows higher educated people were high adopter while those having lower education had relatively lower level of adoption.

Table 6: Distribution of respondents according to their level of education and adoption of improved orchard management practices (N=120) in study area, 2020

Level of adoption	Education status				Total
	Illiterate	Literate	Below SLC	SLC and above	
Low Adopter	11(6.5)	8(9.2)	9(10.8)	9(10.5)	37(37.0)
Medium Adopter	10(10.3)	17(14.8)	19(17.2)	13(16.7)	59(59.0)
High-adopter	0(4.2)	5(6.0)	7(7.0)	12(6.8)	24(24.0)
Total	21(21.0)	30(30.0)	35(35.0)	34(34.0)	120(120.0)

Figures in parentheses indicates expected frequency

Chi-Square (χ^2 Cal) = 16.543** (χ^2 tab) = 12.592 P value 0.011; df = 6   Significant at 0.05 level of significance

This result signifies that there was significant association between education level of farmer and level of adoption. These findings are in conformity with the finding of (Choudhary, Bangarva, & Singh, 2011) and (Yadav, Choudhary, & Saran, 2013). This might be due to the fact that educated people have access and ability to connect to new articles, internet and resources that aid them to have knowledge about mandarin orchard management practices and encourage them inadoption. It is expected that educated respondents can make better decision to adopt recommended production practices than non-educated ones.

iv.   Association between annual income and adoption of improved orchard management practices of mandarin

The table shows the distribution of respondents having different annual income to the adoption of improved orchard management practices of mandarin

Table 7: Distribution of respondents according to their total annual income and adoption of improved orchard management practices(N=120) in the study area, 2020

Level of adoption	Distribution of respondents			Total
	Low Income	Medium Income	High Income	
Low adopter	5(3.7)	28(26.5)	4(6.8)	37(37.0)
Medium adopter	7(5.9)	41(42.3)	11(10.8)	59(59.0)
High adopter	0(2.4)	17(17.2)	7(4.4)	24(24.0)
Total	12(12.0)	86(86.0)	22(22.0)	120(120.0)

Chi-Square (χ^2 Cal) = 8.172 (χ^2 tab) = 9.49 P value 0.085   df = 4 Not significant at 0.05 level of significance

This shows that there was no association between annual income of farmers and level of adoption. In the case of high income family, as the farming cannot be used as a primary source of income so the farmers earning money from other eternal sources also don't want to invest on the mandarin orchard. This might be the reason why income does not have any effect on the level of adoption.

v.   Association between area of mandarin orchard and adoptionimproved orchard management practices of mandarin

The study revealed the distribution of area of mandarin orchard to the adoption improved orchard management practices which were categorized as low adopter, medium adopter and high adopter.

Table 8: Distribution of respondents according to area covered by mandarin and adoption of improved orchard management practices (N=120) in study area, 2020

Level of adoption	Distribution of respondents			Total
	Small	Medium	Large	
Low adopter	4(2.8)	30(29.6)	3(4.6)	37(37.0)
Medium adopter	4(4.4)	48(47.2)	7(7.4)	59(59.0)
High adopter	1(1.8)	18(19.2)	5(3.0)	24(24.0)
Total	9(9.0)	96(96.0)	15(15.0)	120(120.0)

Chi-Square (χ^2 Cal) = 2.818(χ^2 tab) =9.49 P value 0.589   df = 4 Non-significant at 0.05 level of significance.

The result implies that there is no significant association or relationship between the area of mandarin orchard and level of adoption. Findings of this result is similar to the findings of (Ashraf, Khan, Ali, & Iftikhar, 2015) which state and contradicts to the findings of (Anarvat, 2015) showing positive and significant association between mandarin acreage and level of adoption.

vi.   Association between farmers' group membership and adoption of improved orchard management practices of mandarin

Table 9: Distribution of respondents according to their farmer group membership and improved orchard management practices (N=120) in study area, 2020

Level of adoption	Distribution of respondents		Total
	Membership	Non-Membership	
Low adopter	21(26.8)	16(10.2)	37(37)
Medium adopter	45(42.8)	14(16.2)	59(59)
High adopter	21(17.4)	3(6.6)	24(24)
Total	87(87.0)	33(33.0)	120(120.0)

Figures in parentheses indicates expected frequency

Chi-Square (χ^2 Cal) = 7.729[**] (χ^2 tab) =5.99   P value 0.021 df = 2 Significant at 0.05 level of Significance

This result signifies that the association between respondent involved in farmer's group and mandarin orchard management practices used by them are statistically significant. This means that mandarin growers having membership in farmer's group possessed higher level of adoption. This might be because of the involvement of members in different events and communication media where they get idea and help from other technical personnels. The findings of study are in contradicts with the finding of [6] and [7] which showed a non significant association with these two variables.

vii.   Association between farmers participation in training and adoption of improved orchard management practices of mandarin

The study revealed the distribution of farmer's participation in training to the adoption of improved orchard management practices which were categorized as low adopter, medium adopter and high adopter. Among the respondents non-trained farmers were low adopter while trained one were high adopters.

Table 10: Distribution of respondents according to their participation in trainings and adoption of improved orchard management practices (N=120) in study area, 2020

Level of adoption	Distribution of respondents		Total
	Training received	Training not received	
Low adopter	10(15.7)	27(21.3)	37(37.0)
Medium adopter	23(25.1)	36(33.9)	59(59.00)
High adopter	18(10.2)	6(13.8)	24(24.0)
Total	51(51.0)	69(69.0)	120(120.0)

Figures in parentheses indicates expected frequency

Chi-Square (χ^2 Cal) = 14.297[**] (χ^2 tab) =5.99 P value 0.001 df = 2 Significant at 0.05 level of significance

This result signifies that the association between farmer's participation in training and improved orchard management practices used by them is statistically significant. This means that mandarin growers having training opportunities possessed higher level of adoption. This finding was supported by [8]. It was reported that training is an important part of the extension strategy followed in the entire agricultural development projects. Be it the training of the farmers of that of extension professionals that training is imperative for better performance.

D. Major problems of mandarin production

There are many problems pertaining to mandarin production. This study attempted to find some of them as perceived by the farmers. The following were the major problems associated with the mandarin production.

Table 11: Constraints pertaining to mandarin production in study area, 2020

S. N	Constraints	Index	Rank
1	High price of inputs	0.618	VI
2	Lack of good quality saplings	0.525	VII
3	Lack of irrigation	0.946	I
4	Insect infestation	0.809	II
5	Disease problems	0.787	III
6	Climatic factors	0.743	IV
7	Labor shortage	0.468	VIII
8	Lack of knowledge of management practices	0.641	V

Constraints perceived by the farmers are due to lack of regular water supply, lack of technical knowledge, Disease infestation, labor intensive affairs, high cost of insecticide and pesticides and costly plant material [9] which lines up with the data obtained in this research. In other study, [10] also found the same result in her study pointed above.

IV. CONCLUSION

Mandarin growers had not adopted orchard management practices as per recommendation which is degrading health status of orchard and declining productivity in the study area. So, farmers should be encouraged for proper orchard management by implementing effective programs, information dissemination through target groupsand prioritization of agriculture extension program.

V. ACKNOWLEDGEMENT

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