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RESEARCH ARTICLE

A BRIEF STATUS OF TECHNOLOGY ADOPTION IN LARGE CARDAMOM PRODUCTION AT LAMJUNG, NEPAL

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ABSTRACT

The study was carried to determine the status of adoption technology among cardamom growing farmers at Lamjung, Nepal. Besishahar Municipality and Dordi, Dudhpokhari, Marsyandi and Kolahasothar Rural Municipality were purposively selected for this study. Primary data were collected by the use of pre-tested semi-structured questionnaire from 100 respondents selected by simple random sampling. The data were processed and analyzed by using MS-excel and SPSS. Majority of respondent were male belonging to Janajati ethnicity. The average cardamom cultivated land holding was 0.50 ha. 51% of the farmer were affiliated to farmers group and 54% had received training related to cardamom cultivation. The major means of irrigation were pipe irrigation and canal irrigation. Similarly, improved production technologies like shade management and mulching were adopted by 96% of the farmers. Weeding and pruning were adopted by 97% and 85% of the farmers respectively. Improved air dryer was adopted by 84% of the farmers whereas adoption of other post-harvest technologies such as grading and tail-cutting were low. Moreover, there was found to be significant association of, education level and land holding of farmers with the adoption of improved production technology. Therefore, the study has suggested need of extension services on Commercial large cultivation practices in Lamjung district of Nepal.

KEYWORDS

Large cardamom, adoption, logistic regression, shade management, improved air dryer.

1. INTRODUCTION

Nepal is an agricultural country and more than 65.6% of the population depends upon agriculture for livelihood (MoAD, 2013/2014). Agriculture production accounts for around 24.26% of total GDP and about more than a quarter population work in agriculture sector of Nepal (MoAD, 2019). Large cardamom (*Amomum Subulatum*) is an important high value cash crop grown commonly in mid-hills of Nepal (Bhattarai et al., 2013). Nepal is among the main producer and exporter of Large Cardamom within the world (MoAD, 2015). Majority of large cardamom produced in Nepal, about 90 percent is marketed to India (ITC, 2017). Nepal holds 18,273 ha land under large cardamom cultivation with total production of 7954 MT (MoALD, 2020). Cardamom production being a profitable occupation is the potential source of export earning, rural employment, economic growth and sources of income for small farmers (NPC, 1995).

At present, large cardamom is grown in 56 districts of Nepal, among which Taplejung district is the largest producer of large cardamom followed by Sankhuwasabha and Panchthar (MoALD, 2019). Lamjung holds 1032 ha of land under large cardamom cultivation with productive area of 530 ha and total production of 85 MT (MoALD, 2019). Large cardamom is high value spices crop dominant over the eastern Himalayan region including Sikkim and Darjeeling in India and eastern hills of Nepal (Sharma, 2000). It is the world third most expensive spices after saffron and vanilla and is popular as black gold due to its color of capsule and high market value. It is evergreen, shade loving species belonging to zingiberaceae family. It can grow properly in Cool, humid and shaded area of altitudinal range from 700 to 2100m from the mean sea level (NSCDP, 2006-09).

Among many cultivars of large cardamom golsai, ramsai, jirmale, dambersai. are widely cultivated in Nepal (MoAD, 2015). Traditional practice is employed in each activity from nursery raising to cultivation, intercultural operation, harvesting and postharvest processing (Chaudhary and Vista, 2015). Involvement of traditional practices and lack of technology dissemination has been major curse to commercial large cardamom farming. At the mean time mechanization aspect of the farmers is very weak which has resulted in enduring manual practices. Lack of priority in Soil health, plant nutrients, irrigation management, lack of seeds of recommended varieties as per elevation and lack of scientific postharvest technology among farmers are the major technology constraint of large cardamom (Bhandari and Bhandari, 2018).

Similarly, lack of postharvest technology is creating a large variance among the economic outcome of farmer. Therefore, this research was designed with the broader objective to determine the status of technology adoption in large cardamom production. Other specific objective were to study about various technology used during overall cultivation and postharvest processing of crop, analyze the level of farm mechanization and to determine the factors affecting adoption of improved production technology.

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2. Materials and Methods

2.1 Study area, sample size and data collection technique

The study was carried out in Lamjung district of Gandaki province. The research was conducted in the command area of the Prime Minister Agriculture Modernization Project (PM-AMP), Project Implementation Unit (PIU), Cardamom Zone i.e. Besishahar Municipality and; Dordi, Marsyandi, Kolahasothar and Dudhpokhari rural Municipality. The farmers having at least 4 ropani of land under cardamom production were selected as sampling unit. There were approximately 1000 registered farmers under the study area. Rao soft calculator was used to determine the sample size at 95% confidence interval and 10% margin of error. Hence, simple random sampling of altogether 100 farmers was done. 20 respondents from each municipality/ rural municipality under zone command area were selected. Pre-tested semi structured questionnaire were used to collect the primary data from the selected farmers applying face to face interview method. The commercial farmer and key informants of study area were the major sources of primary data. Focus group discussion was carried out through involvement of farmers, local leaders, villagers inclusive both male and female and representative of different ethnic groups. Secondary data were obtained Department of Agriculture, Ministry of Agriculture Development (MOAD), related reports on the large cardamom from different journals and articles.

2.2 Data analysis

The collected data were then coded and entered. The descriptive statistic were used to describe the respondent socio-economic characteristics such as gender, age, farm size, education, etc. SPSS version 25 and MS-Excel program were used for detailed analysis. Farmers were categorized based on average Cardamom cultivated land. The average cardamom cultivated land was 16.97 ropani. Farmers having land holding less than or equals 16.97 ropani were categorized as small-scale farmer and greater than 16.97 ropani were categorized as large-scale farmer. Logistic regression was used to determine the factors affecting various agricultural practices in the study area. This regression or function is used when the outcome variable is dummy. Logistic equation is given by;

$$p/(1-p) = eb0 + b1x1 + b2x2+...bnxn$$

Where, p /(1-p) is odds of an event

p is the probability
e is base of natural logarithm
b0…bn are coefficients
x1 …….xn are independent variables.

Logit form of equation can be obtained by taking natural log both sides,

$$\ln(p/1-p) = b0 + b1X1 + b2X2 +\ldots.. bnXn$$

Dependent variables were coded 1 for adopter of that production practice and 0 for non-adopter. Similarly, those respondents having membership of agriculture group, received training, visit of extension workers were coded as 1 otherwise 0. Cardamom cultivated land data was taken in hectare.

3. Results and Discussions

3.1 Socio-demographic information of household

The average age of household head was 42.20. It was 43.11 in commercial farmers and 41.71 in case of non-commercial farmers which was slightly lower as compared to commercial farmer. Similarly, 99(99%) respondents were married and 1(1%) respondent was unmarried. The overall dependency percentage of household was found to be 43.76% and active population percentage was 56.23%. Dependency percentage of large-scale farmer was 39.76 whereas small scale farmer was 62.32. Similarly, economic active ratio was 3.22 on average. Result shows that 87(87% percent) of the household head were male on an average while only 13(13 percent) were female. Regarding the education status, 82% of the respondent were literate. 49 (49%) holds primary level of education, 16(16%), 8(8%) and 9(9%) respondents hold secondary, intermediate and bachelor's level education respectively whereas 18(18%) respondents were illiterate. The ethnicity of farmers were categorized into Bhramin, Chhettri, Janajati, Dalit and Others. We can conclude from the table that Janajati people are mostly engaged in large cardamom cultivation as 87 respondents belong too Janajati category followed by Bhramin (7), Dalit (5) and Chhettri (1).

Table 1: Socioeconomic and demographic information of respondents by scale of farmers

Variable	Overall (N=100)	Large scale farmers(n=35)	Small scale farmers(n=65)	t-value or chi-square value	P-value
Age (in Year)	47.24	43.11	41.71	37.160	0.142
Dependency percentage of HH members	53.55	39.76	62.32	6.830	0.555
Economically active population (age group 15-59 years)	3.88	3.83	3.91	8.438	0.208
Gender				2.711	0.110
Male	83	32	51		
Female	17	3	14		
Education				0.027	0.870
Literate	82	29	53		
Illiterate	18	6	12		
Ethnicity				3.686	0.297
Bhramin	7	2	5		
Chhettri	1	0	1		
Janajati	87	33	54		
Dalit	5	0	5		

Note: ** indicate statistically significant difference at 5% level.

3.2 Land holding information of household

In the study site, land was categorized into *khet/bari*, forest land, leased land and irrigated land. The study showed that there was no significant different between total *khet* owned by large and small-scale farmers. Cardamom cultivated land of farmer was 0.5082 ha on an average. Cardamom cultivated land owned by large scale farmers was 1.8009 ha which was significantly different at less than 1% level of significance compared to 0.5082-hectare forest owned by small scale farmers. Moreover, leased land holding of large scale farmers (0.7791 hectares) and small scale farmers (0.0078 hectares) was significantly different at less than 1% level of significance.

Table 2: Land holding characteristics of farmers by scale of farming

Total area (ha)	Overall (N=100)	Large scale farmers (n=35)	Small scale farmers (n=65)	t-value	P-value
Bari/khet	0.8684	0.5073	0.5087	0.009	0.484
Forest/cardamom cultivated land	0.5082	1.8009	0.3663	-14.736***	0.000
Leased	0.2778	0.7791	0.0078	-4.793***	0.000
Irrigated	0.9287	1.7471	0.4740	-6.222***	0.000

Note: ***, **, *indicate statistically significant difference at 1%, 5% and 10% levels respectively.

3.3 Farmer's access to extension services

With 22% of them involved in agricultural group the large-scale farmers had significantly lower involvement in the group than small scale farmers who had 29% involvement in it as shown in Table 3. Among the household surveyed, 60% of the farmers had access to training related with Large Cardamom cultivation. Among the large-scale farmers 26% of the farmers had regular contact with the extension workers, in case of small-scale farmers 58.2% participants had regular contact with extension workers.

Table 3: Farmer's access to extension services

Extension services	Overall (N=100)	Large scale farmers (n=35)	Small scale farmers (n=65)	Chi square-value	P-value
Agricultural group	51	22	29	3.029*	0.082
Access to Training	60	26	34	4.579**	0.032
Contact with extension workers	55	26	29	8.092***	0.004

Note: ***, **, *indicate statistically significant difference at 1%, 5% and 10% levels respectively.

3.4 Adoption of intercultural operation

Selection is practiced based on yield, spike per tiller, capsule size, disease and pest resistance and adaptability to desired agro-climatic conditions (Chaudhary and Vista, 2015). Farmers mainly adopted three ways of irrigation—pipe irrigation, water harvesting by plastic ponds and sprinkle irrigation. Overall, 48%, 9% and 11% of the farmers adopted irrigation by pipe, sprinkle and plastic pond respectively. Compost manure was applied by 100% of Cardamom growers whereas farmyard manure was applied by 29% of farmers only. Similarly, mulching was adopted by 96% of the farmers. Mulching was particularly practiced to suppress the weed growth, control evaporation loss and maintain optimum soil temperature in cardamom field (Vijayan et al., 2018). Moreover, weeding practices was adopted by 97% of the respondents. Farmers carried out weeding in their cardamom field ranging from 1 to 9 times a year. Orchard management practices like shade management and pruning was practiced by 96% and 85% of the farmers respectively. Out of 100 respondents surveyed 18% of the respondents used insect pest management practices in their cardamom field. 4% of farmers applied *trichhoderma* in their field which is a method of biological disease control.

Table 4: Adoption of intercultural operation by farmers

Intercultural operation	Overall (N=100)	Large scale farmers (n=35)	Small scale farmers (n=65)	Chi-square value	P value
Irrigation					
pipe irrigation	48	24	24	9.129***	0.003
Sprinkle irrigation	9	7	2	7.955***	0.005
Plastic pond	11	4	7	0.010*	0.920
Farmyard Manure application	29	12	17	10.017***	0.002
Mulching	96	34	62	1.099	0.285
Weeding	97	64	33	1.363	0.243
Disease control	18	2	16	5.506**	0.019
Insect/Pest control	18	2	16	5.506**	0.019
Bio-pesticide application	4	2	2	0.412	0.521
Shade Management	96	33	66	0.412	0.521
Pruning/Thrashing	85	30	55	0.022	0.883

Note: ***, **, *indicate statistically significant difference at 1%, 5% and 10% levels respectively.

3.5 Adoption of Post-harvest technology

All the farmers carry out various post-harvest activities after harvesting including compacting of inflorescence, fruit separation, drying, tail trimming, grading, packaging and storage. Curing is the most important step in Large Cardamom processing, as quality of capsule largely depends upon the method and process of curing (Kafle, 2015). Among 100 respondent, 16% farmer adopted traditional sun drying method whereas 74% adopted improved air-drying method for drying of cardamom. Sun drying method adopted by large scale farmer (3%) was significantly different at 1% level of significance to compared small scale farmer (13%). Improved air drying was adopted by 32% in case of large-scale farmer and 52% in case of small scale farmer. Similarly, tail cutting was adopted by overall 64% of farmers. There was significant difference between the adoption of tail trimming by large scale farmers (28%) and small-scale farmers (52%) at less than 5% level of significance. Among the 100 respondents only 35% of respondents carried out grading operation before selling.

Table 5: Post-harvest processing of cardamom by scale of farming

Post-harvest techniques	Overall (N=100)	Large scale farmers (n=35)	Small scale farmers (n=65)	Chi-square value	P-value
Drying					
Sun-drying	16	3	13	1.489***	0.002
Improved air drying	84	32	52	2.006	0.157
Tail cutting	64	28	36	5.918**	0.014
grading	35	18	17	7.005**	0.030

Note: ***, **, *indicate statistically significant difference at 1%, 5% and 10% levels, respectively.

3.6 Adoption of farm Equipment

Traditional equipment owned by farmers include *kuto, Kodalo, churi* and *hasiya*. *Kuto* and *kodalo* were used for performing tillage operation and weeding whereas *hasiya* was used for trimming and weeding operation. These were multi-purpose equipment, so farmers had 100% access to them. Chainsaw was used for bucking and pruning of trees adopted under agroforestry system. Chain saw access to large scale farmers (17%) was significantly different at less than 1% level of significance compared to small scale farmer (11%). Bush cutter was used during intercultural operation. Bush cutter ownership to large scale farmer (17%) was significantly different at less than 1% level of significance compared to small scale farmer (9%). Sieve was used for grading of large cardamom. Tails of Large cardamom were removed with the help of scissor. Capsules with the tail removed are graded as kainchi-cut and without tail cut as non-kainchi-cut (Singh, 2013).

Table 6: Equipment used by scale of farming

Equipment	Overall (N=100)	Large scale farmers (n=35)	Small scale farmers (n=65)	Chi-square value	P-value
Chainsaw	28	17	11	11.303***	0.001
Bush cutter	26	17	9	14.218***	0.000
Sieve (*chalno*)	35	18	17	7.005**	0.030
Improved air dryer (*Bhatti*)	84	32	52	2.006	0.157
scissor	64	28	36	5.918**	0.014

Note: ***, **, * indicate statistically significant difference at 1%, 5% and 10% levels respectively.

3.7 Regression analysis of dependent and independent/predictor variables

The result shows the binary logistic regression analysis of factors affecting the adoption of improved production technology. The result showed that the odds of irrigation adoption by farmers having contact with extension worker was 2.870 times the odds of irrigation adoption by farmers not having contact with extension worker ($p<0.05$). Similarly, the odds of adoption of irrigation increases by 2.04 times with increase in 1 ropani of cardamom cultivated land ($p<0.05$). In the same way, odds adoption of farmyard manure was 1.928 times more by respondents who received training compared to those who haven't received training. Kattel (2020) indicated that training dummy variable has a positive impact on farmers' decision on technology adoption.

The odds of adoption of farmyard manure increases by 1.733 times with increase in 1 ropani of cardamom cultivated land. The odds of adoption of disease control method by respondent who were educated was 2.691 times the odds of adoption of disease control by respondent who were not educated. Positive and significant association was observed in adoption of drying with agriculture group and contact with extension workers. Kattel (2020) reported that there was positive influence of extension services on adoption of improved technology. Similarly, positive and significant association of grading was observed with agriculture group, contact with extension worker and cardamom cultivated land. Ghimire and Huang (2015) reported that farmer with greater land holding are more likely to adopt post-harvest technology than those with smaller holding. Similarly, Khatik (1997) suggested that the adoption of improved agricultural practices varies from farmer to farmer according to their knowledge understanding about the technology and availability of sources.

Table 7: Regression analysis of dependent and independent/predictor variables

Variable	Irrigation adoption	FYM application	Disease/ pest control	Pruning/ Thrashing	Drying	Grading
Agriculture Group	1.323	-	1.143	1.77	**2.691****	**2.819****
Education	1.823	-	**2.691***	2.663	-	1.193
Training	1.854	**1.928****	-	**2.868****	-	1.134
Extension workers	**2.870****	1.785	1.118	**14.07*****	**16.902*****	**2.890*****
Cardamom cultivated land	**2.040****	**1.733****	1.001	1.077	1.030	**1.031***
Number of observation	100	100	100	100	100	100
Log likelihood	-53	-54	-57	-34	-32	-56
LR Chi^2	32.628***	18.404**	13.39*	15.956***	33.56***	20.169***
Prob>Chi^2	0.00	0.03	0.09	0.007	0.00	0.001
Pseudo R^2	0.371	0.167	0.059	0.258	0.458	0.249

*, **, *** represent level of significance at 10%, 5%and 1% respectively.

4. Conclusion

Adoption of improved production technologies like mulching, shade management, pruning and thrashing by farmers of Lamjung district were high whereas disease/pest management, irrigation and nutrient management were low. Majority of farmer had access to improved air dryer but access to other post-harvest equipment was very low. Moreover, post-harvest processing had direct effect over pricing of commodity and farmers are not able to fetch optimum profit. The major determining factors for adoption of improved technology were found to be trainings received, organization involvement, Access to extension worker's and Education status of HH head. Similarly, farmer's access to modern farming equipment was low which makes farming tedious and tiresome job. It is recommended to adopt value addition practices and proper packaging for higher prices. Skills development of farmers regarding effective input management like micro nutrients, fertilizers must be prioritize through extension services.

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