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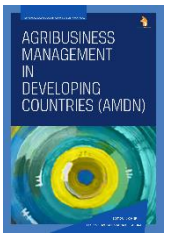

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RESEARCH ARTICLE

FACTORS AFFECTING THE ADOPTION ON IMPROVED DRYING PRACTICES BY LARGE CARDAMOM FARMERS OF LAMJUNG DISTRICT

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ABSTRACT

Large cardamom is one of the major cash crops of Nepal. The research was carried out during February-July 2023 AD to determine the factors affecting the adoption of improved drying practices by cardamom farmers at Lamjung, Nepal. Marsyandhi, Dordi and Dudhpokhari rural municipality. From the multi-stage sampling technique, 95 large cardamom cultivars were selected and personally interviewed for the collection of primary data. The binary logistic regression model was used to assess the various factors affecting the adoption of improved drying practices. The findings also revealed that the majority of the farmers 58.95% uses improved bhatties whereas 41.06% farmers still use traditional bhatties. Age, membership and training show a positive relationship with improved drying practice being statistically significant with 5%, 1% and 1% level of significance respectively. The adoption of improved drying practices of large cardamom was mostly driven by training. These results suggested that training and membership in any social organization should be strengthened to enhance the adoption of improved technology in post-harvest practices of large cardamom.

KEYWORDS

Large cardamom, Binary logistic regression model, Alaichi.

1. INTRODUCTION

The Nepalese economy is primarily based on agriculture. It employs approximately 65% of the total population (MoALD, 2023) and adds approximately 23.95% to GDP (NRB 2021/22) Nepal has exported Alaichi of about 5916.59 tons last fiscal year (MoALD, 2023). For the past two decades, Nepal has been among the top five cardamom producers in the world (FAO, 2023). Cardamom contributes to GDP by 0.31%. At present, 55 districts of Nepal have been cultivating large cardamom. Lamjung district holds a productive area of a total 465 ha with a production of 182 tons (MoALD, 2023).

The large cardamom (*Amomum subulatum* Roxb.) as 'Alainchi' in Nepali and often called the 'black gold' or 'queen of spices' is a perennial herbaceous plant belonging to the Zingiberaceae family. Large cardamom is one of the most expensive spices globally, following saffron and vanilla (Khatiwada et al., 2019). It is grown mostly in the eastern hilly and mountainous regions, eventually spreading to the western regions (Shrestha et al., 2018). This spice thrives in shaded, moist soil conditions (Singh et al., 1989). Optimal production occurs in temperatures ranging from 4 to 20°C, with 2000 to 2500 mm of annual rainfall, and humidity level exceeding 90% (NSCDP, 2009). The underground portion of rhizomes is a dull red color, and flower buds protrude from the root. With a short peduncle and bud enclosed in a compact red bract, flowering happens in the spring. In the humid, moist, and shaded areas of the sloping hills, plants are normally cultivated at an altitude of 765 to 1675 meters above sea level (Gautam et al., 2016). The third year after plantation is when large cardamom begins to produce economically, and 8 to 10 years after that is when it produces at its best. Large cardamom plants have a life expectancy of 20-25 years. There are sixteen different kinds of large cardamom in the globe, and they're well-known for being of the highest quality because of their distinctive flavors and tastes (Adhikari & Sigdel, 2015). The eight major cardamom species (cultivars) that are most appropriate and widely planted in Nepal are as follows: Ramsai (1500-2000 masl), Golsai (1200-1600 masl), Saune (700-1200 masl), Chibesai (700-1000 masl), Dambersai (700-1200 masl), Salakpur (1500-2000 masl), Varlangae (1500-2000 masl), and Jirmale (600-1200 masl) (Shrestha et al., 2018).

Large cardamom is harvested and processed using conventional methods with little help from science (Sharma et al., 2008). Cardamom is widely used in foods, drinks, fragrances and pharmaceuticals. Since production is presently declining, an improved post-harvest procedure would be one method to ensure the long-term viability of this kind of crop. When compared to improved drying with high-quality products, the traditional drying method has decreased the quality of cardamom capsules (Ranjan et al., 2018). Due to several variables, including diseases and fluctuating global prices, the production of large cardamom has decreased globally in recent years. Adopting effective postharvest processing methods can increase value and help make up for decreased output by lowering postharvest losses. The quality of the product produced by improved kilns (bhattis) is higher than that of conventional kilns (bhattis), but farmers do not generally favor these technologies. Numerous other time-consuming postharvest processing procedures, such as cleaning, tail cutting, and grading, have not been well implemented at the farm level in the study regions (Singh and Pothula, 2013). Farmers classify their cardamom into three categories: Jumbo Jet (JJ), Standard/Super Deluxe (SD), and common type (Chalan chalti/Ilami), resulting in price variations for the producers as well as for marketing high-quality products (FLCEN, 2016).

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2. METHODOLOGY

The study was conducted in Lamjung, a temperate, western hill of Province 4, Nepal. The district encompasses within coordinates of latitude 28° 13' 60.00" N to 82° 24' 59.99" E longitude (Latitude 2024). Purposefully chosen for the research were the Marsayandhi and Dordi and Dudhpokhari rural municipalities, which are part of the Cardamom Zone command areas.

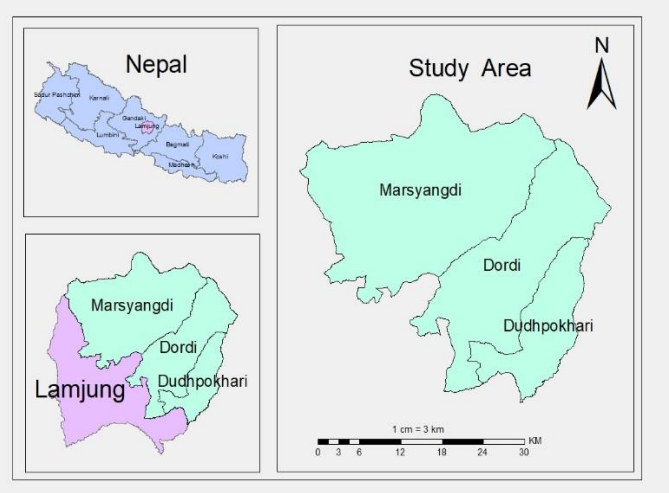

Figure 1: Map of Nepal showing Lamjung district as research site (2023)

The primary factors in choosing these locations were their great potential for commercial production, their ease of accessibility, and their potential as cardamom production areas. Initially, a sample frame is created by combining information from several sources, including key informants from the research areas and Cardamom Zone. The study will sample 95 cardamom producers from the chosen location using multi-stage sampling technique. Data were collected and analyzed using Statistical Package for Social Sciences (SPSS 25.0). Both descriptive statistics (mean, median, standard deviation) and inferential statistics (chi-square test, One-way ANOVA, binary logistic regression) were performed. Binary Logistic Regression model was used to find the various factors affecting the adoption of improved drying practice in large cardamom in Lamjung district. This model helped to analyze the degree and direction of the relationship between dependent and independent variables.

The Logistic Regression equation is as follow:

$$\log \{P_X/(1-P_X)\} = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6$$

Where P_X (dependent variable) is the probability that the farmer adopts improved drying practice and $(1-P_X)$ is the probability of non-adoption

Here,

X_1 = Gender of the household head

X_2 = Age of the household head

X_3 = Membership in any organization

X_4 = Training on large cardamom farming

X_5 = Out-migration of any family members

X_6 = Subsidy provided by government

B_1 to β_6 = Coefficient of independent variables (X_1 to X_6)

β_0 = Intercept made on the regression line

Table 1: The statistical description of the variables used in the binary logistic regression model

Variables	Description	Values	Expected sign
Gender	Gender of the household head	Male=0, otherwise=1	+/-
Age	Age of the household head	Years (in numbers)	+/-
Membership	Membership of any organization	If had membership=0, otherwise=1	+
Training	Training related to large cardamom	If had training=0, otherwise=1	+
Out-Migration	Family members living abroad	If yes=0, otherwise=1	+/-
Subsidy	Subsidy provided by the government	If yes=0, otherwise=1	+

3. RESULTS AND DISCUSSION

3.1 Socio-demographic characteristics of large cardamom growing farmers of Lamjung district

The socio-demographic characteristics of large cardamom growing farmers of lamjung district can be seen in Table no. 1 and Table no.2. Out of the total sample of 95 farmers in three different rural municipalities, the overall average age of the household was found to be 47.82 years. The overall average family size was found to be 5.74. According to the (NPHC, 2021) average household size of Lamjung district was found to be 3.53. The economically active household members were 3.19 (54.08% of total population). The average cardamom cultivated area was 0.54 ha. The overall experience of cardamom farming was 9.02 years. The overall average income of the farmers was NRS. 108278.95. Age of household and years of experience was found to be significant with a 5% level and 1% level of significance respectively.

In the case of categorical variables, gender of the respondents was mostly male (82.1%). Major ethnics was found to be Janajati in all of three municipalities. It overall covers 89.47% Similarly, Education levels were found to be higher at primary level in all three local levels. Farmers seem to be engaged more in agriculture (72.63%) than business and service. Most of the families were found to be living in a Joint family (66.31%) rather than a nuclear family (33.69%). The decision about the cardamom selling is usually made by the Male member (80%). Among all the respondents only 35.78% turns out to have taken training about cardamom farming. 74.73% of the respondents was found to be membership in different social groups. Very less farmers had technical access for cardamom farming.

Table 2: Socio-demographic characteristics (continuous variables) of large cardamom growing farmers of Lamjung district

Variables	Marsyangdhi (N=35)	Dordi (N=30)	Dudhpokhari (N=30)	Overall	F-value	P-value
Age of HH	46.71 ± 12.359	52.07 ± 12.665	44.87± 10.136	47.82± 12.059	3.033**	0.05
No. of family members	5.66 ± 2.461	5.63 ± 2.125	5.93 ± 2.638	5.74 ± 2.398	0.145	0.865
Economically active Members	3.29 ± 1.296	3.07 ± 1.258	3.20 ± 1.324	3.19 ± 1.282	0.233	0.792
Cardamom cultivated land (Ha)	0.57 ± 0.27	0.58 ± 0.33	0.49 ± 0.29	0.54 ± 0.29	0.841	0.435
Years of experience	8.50 ± 2.263	8.09 ± 2.877	10.82 ± 0.951	8.89 ± 1.875	19.065***	0.000
Annual household income (NRS.)	121700 ± 61519.031	93800 ± 41792.303	107100 ± 48502.648	108278.95 ± 52611.114	2.348	0.101

Note: figures after ± resembles standard deviation. *** and ** indicates significant difference at 1 and 5% levels, respectively

Table 3: Socio-demographic and institutional characteristics (categorial variables) of large cardamom growing farmers of Lamjung district						
Variables		**Marsyangdhi**	**Dordi**	**Dudhpokhari**	**Pearson χ^2 value**	**P-value**
Gender	Male	27(34.6)	24(30.8)	27(34.6)	4.894	0.180
	Female	8(47.1)	6(35.3)	3(17.6)		
Ethnicity	Bhramin	1(33.3)	0	2(66.7)	24.470***	0.004
	Chhetri	2(40)	1(20)	2(40)		
	Janajati	31(36.5)	28(32.9)	26(30.6)		
	Dalit	1(50)	1(50)	0		
Education level	Illiterate	3(33.3)	4(44.4)	2(22.2)	12.321	0.19
	Primary	24(34.8)	25(36.2)	20(29)		
	Secondary	8(47.1)	1(5.9)	8(47.1)		
Occupation	Agriculture	23(33.3)	21(30.4)	25(36.2)	12.610**	0.050
	Service	6(50)	2(16.7)	4(33.3)		
	Business	6(42.9)	7(50)	1(7.1)		
Family Type	Nuclear	15(46.9)	8(25)	9(28.1)	5.829	0.120
	Joint	20(31.7)	22(34.9)	21(33.3)		
Out-Migration	Yes	17(37)	16(34.8)	13(28.3)	0.601	0.740
	No	18(36.7)	14(28.6)	17(34.7)		
Decision about cardamom selling	Male	27(35.5)	23(30.3)	26(34.2)	1.220	0.543
	Female	8(42.1)	7(36.8)	4(21.1)		
Membership in social group	Yes	30(42.3)	22(37.7)	19(26.8)	4.331	0.115
	No	5(20.8)	8(33.3)	11(45.8)		
Training	Yes	14(41.2)	7(20.6)	13(38.2)	5.942**	0.05
	No	21(34.4)	23(37.7)	17(27.9)		
Technical Access	Yes	17(37)	10(21.7)	19(41.3)	0.649	0.723
	No	18(36.7)	20(40.8)	11(22.4)		

Note: figures in parenthesis include percent. *** and ** indicates significant difference at 1 and 5% level

3.2 Post-harvest practices of large Cardamom

The major processing activities in the large cardamom includes curing followed by cleaning, tail cutting and grading. It was found that tail cutting and grading shows statistically significance with the three local levels whereas cleaning and curing shows no significance with the local levels. There were two types of bhatties for curing of the cardamom. Majority of the farmers 58.95% uses improved bhatties whereas 41.06% farmers still use traditional bhatties.

Table 4: Post-harvest of large cardamom in Lamjung district				
Processing of large cardamom (1=Yes)	**Marsyangdhi**	**Dordi**	**Dudhpokhari**	**Chi-square value**
Cleaning	28(37.3)	25(33.3)	22(29.3)	0.939
Curing (drying)	30(36.8)	28(31.6)	28(31.6)	0.507
Tail cutting	15(25.9)	20(34.5)	23(39.7)	8.347**
Grading	17(25.4)	27(40.3)	23(34.3)	14.133***

Note: figures in parenthesis includes percent. *** and ** indicates significant difference at 1 and 5% levels

3.3 Factors affecting improved drying practices in cardamom farming

Table 5: Factors affecting adoption on improved drying practices in cardamom farming (2023)			
Variables	**Improved Drying Practices**		
	Co-efficient B	S.E.	Odd ratios
Gender	-0.105	0.657	0.900
Age	0.053**	0.025	1.054
Membership	2.189***	0.664	8.929
Training	1.947***	0.571	7.006
Out-migration	-0.716	0.523	0.489
Subsidy	0.068	0.548	1.070

Note: figures in parenthesis includes percent. *** and ** indicates significant difference at 1 and 5% levels

The analysis has shown that there is a significant positive relationship between age with improved drying methods. Odd ratio 1.054 of age means for every 1 unit change in age there is probability of 1.054 unit increase in adoption of improved drying method. Older farmers are better equipped to assess technological information than younger farmers since they have more knowledge and experience (Kariyasa & Dewi, 2013). Melesse (2018) also mentions age as an essential variable in determining a farmer's technology adoption behavior, as age appears to be crucial in both accessing information and responding on that information. Similar consistent were found with positive relationship with age and technology adoption. (Ullah et al., 2018) and (Chuang et al., 2020). However, young farmer comparatively would be in support of new technology (Emmanuel et al., 2016). The analysis also shows the positive relation between Membership in any organization with increases the likelihood of adoption of improved drying practices by 8.9 percent. Cooperatives can significantly speed up the implementation of agricultural technology (Abebaw and Haile, 2013). Another study also shows a positive and significant influence in membership of farmers in conservation and development groups (Tiwari et al., 2008). Training related to large cardamom farming was found to be significant positively at 1% level of significance which was

similar to the results of (Shrestha et al., 2021). Moreover, study on the factors influencing post-harvest practices of large cardamom in Nepal had shown that the training dummy variable has a positive impact on farmers' decision on technology adoption (Kattel et al., 2020).

A study highlighted that, while gender is a key factor in determining technology adoption, it is highly dependent on the socio-cultural characteristics of the particular population (Melesse, 2018). Gender has shown negative and insignificant with improved drying method which was found similar with the result of (Tiwari et al., 2008; Subedi et al., 2019). While in contrast, , according to a Nigerian study on the introduction of cassava growing techniques, gender has a favorable impact on the uptake of technology (Olayide et al., 2021). Out-migration has not significantly impacted on the improved drying practices which is coincided with the findings of (Kattel et al., 2020). Fassil et al., contradicts the findings of the out migration. His findings are clear that participation in international migration by households increases the likelihood of technology adoption by 38.9 percent (Fassil et al., 2023). In case of subsidy provided by the government it was positively related but insignificant with improved drying practices. A study on the adoption of enhanced wheat varieties found that the adoption of recently released agricultural innovations is aided by subsidies and low-interest farm loans (Subedi et al., 2019).

4. Conclusion

This study was made to overview the factors affecting the adoption on improved drying practice on large cardamom. The overall average age of the household was found to be 47.82 years. The overall average family size was found to be 5.74. The average cardamom cultivated area was 0.54 ha. The overall experience of cardamom farming was 9.02 years. Age of household and years of experience was found to be significant with a 5% level and 1% level of significance respectively.

Binary logistics regression was used to determine the factors affecting adoption on improved drying practices. Age, membership in any organization and training has shown the positive relationship with statistically significant with 5% ,1% and 1% level respectively. Whereas the gender, out-migration and subsidy was not found to be statistically significant. The export share of the commodity implies that it is highly export oriented cash crop commodity. This study concluded that improved drying procedures at the farm level would be required to raise farmers' income and capture the competitiveness of large cardamom in the global market. The findings of this study provide knowledge that is useful in national policy decisions. Finally, government initiatives to promote training, access to capital, and technical services, are needed to boost long-term technology adoption of large cardamom post-harvest drying practice.

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Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this manuscript.

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