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Adoption of Technology in Cardamom Cultivation in Taplejung District, Nepal

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Abstract— *A study assessed the farmers' knowledge of technology adoption status in large cardamoms in the Taplejung district of Nepal. For the study, primary data were collected from 60 randomly selected farmers using a semi-structured interview schedule, focal group discussion (FGD), and key informant interview (KII). Secondary information was collected by reviewing different relevant publications. The data were processed and analyzed using descriptive statistics through SPSS and Excel programs. The study shows that farmers are aware of modern technology available for large cardamom cultivation. Most farmers adopt modern irrigation techniques (86%) to irrigate cardamom orchards. Only 2% farmers used chemical fertilizer in cardamom orchards, and 50% of farmers use organic manure. Mainly, cultural practices are used to control diseases, insects and pests. During field preparation, 72% of farmers used traditional tools, i.e., spades. For pruning operations, only a few farmers, 28%, used chainsaws but mainly used secateurs, and for weeding, hand tools were used primarily than brush cutters (only 33% adopted). The study shows that most farmers adopt improved air dryers (68%) rather than traditional dryers for post-harvest technology. The tail trimming method is carried out by 86% of cardamom farmers, and grading operation was not carried out before selling. Farmers mostly received subsidies from PMAMP and a few from the Agriculture Knowledge Center and other organizations. Furthermore, a lack of financial resources, technical issues, a lack of training or capacity-building programs, and difficulties with maintenance and repair were the significant constraints to adopting technology.*

Keywords— ***Cardamom, Adoption, Production, Subsidy, Technology***

I. INTRODUCTION

Large cardamom (*Amomum subulatom Roxb*) is one of the most popular spices crops of the Zingibersceae family under the order Scitaminae. It is also known as Alaichi in Nepal, Badhi Alaichi in Hindi, and renounced as black gold, black cardamom, and queen of spices (Banjade et al., 2023). It is the world's oldest and third most expensive spice, followed by saffron and vanilla (Bohara et al., 2023). It is a high-value spice crop grown commonly in the himalayan region's mid-hill districts. The major producers of this species are Nepal (52%), India (37%) and Bhutan (11%) of total world production per annum (Gautam et al., 2016). It is typically pollinated by bumblebees (Basnet et al., 2021).

The Ramsai, Golsai, Dambersai, Jirmale, and Bharlyange are five registered varieties under Nepal government (Basnet et al., 2021). It is a tall, evergreen, perennial, herbaceous monocot plant. The height of this plant ranges from 1.5 to 3.0 meters (Bisht et al., 2011). It has several tillers consisting of pseudo stems with leaves on the upper part. The inflorescence (spike) appears on the rhizome from where the pseudo stems shoot up (Sharma et al., 2000). The ripened fruit is trilocular, reddish brown, and

contains dark pink seeded capsules (Hussain et al., 2009). Capsules of large cardamom are held together inside the spike with viscous sugary pulp and are 20–25 millimeters (mm) long and oval to globular in shape (Thomas et al., 2009). It is a climate-dependent crop; the best production is between a temperature of 4-20ºC, two annual rainfall of 2000-2500 mm, and more than 90 % humidity (Rijal, 2013; Banjade et al., 2023). This research can guide us in providing the support and tools to improve cardamom farming methods, making it easier and more profitable for farmers. The findings could help to know different technologies adopted at different stages of cardamom production, from field preparation to harvesting, about subsidies provided by government bodies at various scales and constraints to adopt technology in cardamom production.

II. METHODS

2.1 Selection of research site

The study was conducted in the Taplejung district of Koshi province from January to June 2024. The district is located in the Himalayas in eastern Nepal. The district covers an area of 3,646 square kilometers and has a total population of 120,590 (2022 Nepal census). Tibet surrounds the district in the north, Sankhuwasabha district in the west, Tehrathum district and Panchthar district in the south, and Sikkim (India) in the east. Geographically, the district is located at a latitude of 27º 06' to 27º 55'N and a longitude of 87º57' to 87º40' E. The research was conducted in the Prime Minister Agriculture Modernization Project (PMAMP) command area.

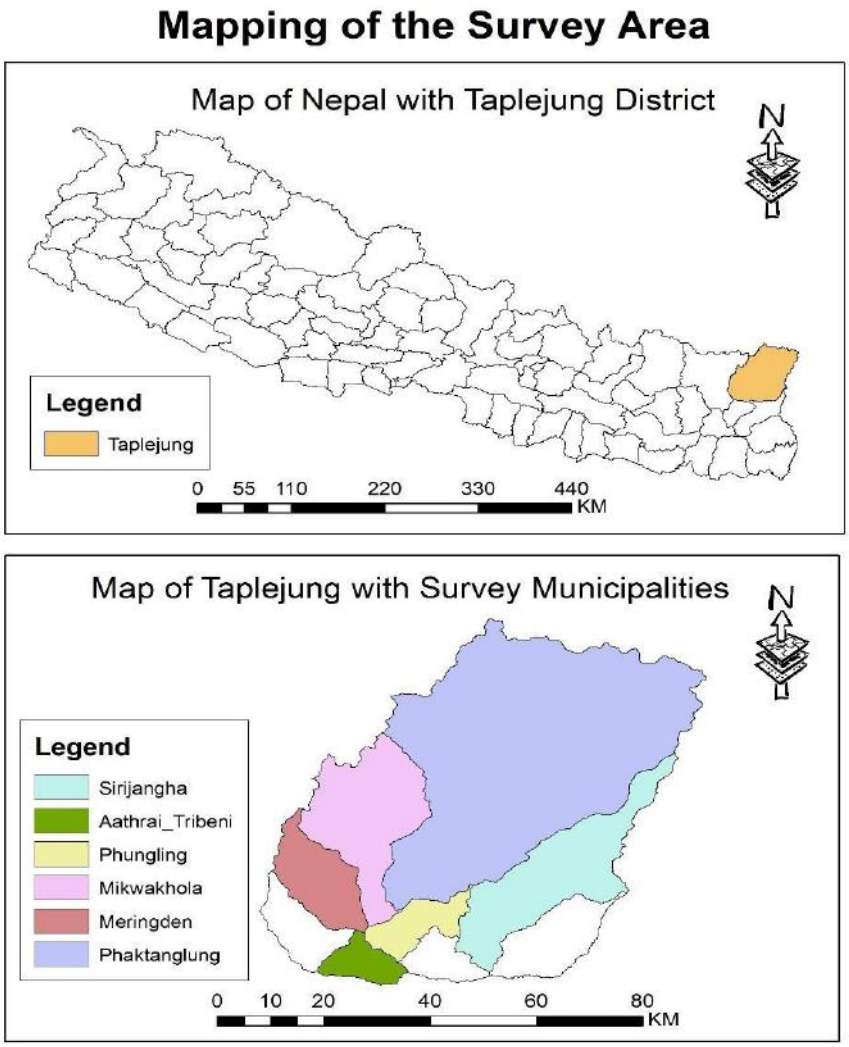

Fig.1. Map of Nepal showing study area (ArcGIS, Esri, 2024)

2.2 Sampling size and procedures

The farmers of the local areas, i.e., Taplejung municipality, Sirijangha rural municipality, Phaktanglung rural municipality, Meringden rural municipality, Mikwakhola

rural municipality, and Aathrai Tribeni rural municipality, were selected. Sixty cardamom farming households were selected based on a purposive random sampling method.

2.3 Survey design and field survey

The pre-survey field visit was conducted to gather preliminary information regarding the site's socioeconomic, demographic, and topographical settings. An interview schedule design was prepared to collect the farmers' primary information. Pre-testing of the interview schedule was done before the field survey. The interview schedule was designed for the nearby respondents in the study area with the help of the site supervisor of PMAMP, Taplejung. Focus Group Discussion was done to obtain detailed information about individual farmers' feelings, perceptions, and opinions. It was conducted before and after the final survey to build up ideas for interview schedule preparation. The participants of the focus group discussion were cardamom farmers for this survey. The primary key informants were farmers, the government agriculture officer, and the Agriculture Knowledge Center. The socio-demographic and farm characteristics were used for descriptive analysis of the study site and population. Different variables like land size, education status, family size, ethnicity, etc., were analyzed using simple descriptive.

2.4 Data analysis

The collected data were edited, and local units of measurement were standardized into scientific units. Data were entered and analyzed using computer software like Microsoft Excel and SPSS (Statistical Package for Social Science). The information was analyzed using descriptive statistical tools like mean, standard deviation, frequency, etc.

III. RESULTS AND DISCUSSIONS

3.1 Socio demographic characteristic

The total number of cardamom-growing households sampled was 60. Among those 60 respondents, 26 were female, and the remaining 34 were male. The age of the respondent in the study area ranged from 27 to 71 years. 58% of the surveyed households were Jana Jati, mainly Limbu and Gurung, 30% were Kshettri, 10% were Brahmin, and 2% of the respondents were found to be Dalit. The majority of the respondents were found to be Hindu. And, 42% of the survey households were Hindu, 30% were Kirat, 26% were Buddhist, and the remaining 2% were Christian. Household size determines the supply of labor force to the farm operations. The maximum family size was found to be 10, and the minimum to 3. The study revealed that 38% of respondents' main occupation was cardamom farming, 42% were engaged in other agricultural work, mainly cultivating oranges, kiwi, and livestock, 2% were involved in agri-tech professional, 2% were students, and the remaining 16% respondents engaged in other types of occupation.

3.2 Status of Cardamon farming

Only medium- and large-scale cardamom production farmers were identified during the study. The respondents of the study area cultivated an average of 40.88 ropani of land, ranging from a minimum of 12 ropani to a maximum of 200 ropani of land. The respondents of the study area had an average of 33.34 of self-owned land and remaining on an average of 7.54 ropani of contracted/rented land. Cardamom farming in the study area has been done for many years. Most of the respondents have done cardamom farming for more than ten years. It revealed that cardamom farming in the study area was a primary farming practice, and cultivation practices are transferred from generation to generation. The main cardamom cultivated in the study area is the Ramsai variety. Other varieties grown in the study area include Golsai, Chibasai, and Jirmale varieties. The maximum area is covered by the Ramsai variety, followed by Golsai and Chibasai. Topography and climatic conditions determine the varieties of cardamom to be cultivated, and climatic conditions and topography of this study area favored the cultivation of the Ramsai variety.

Table 1: Varieties of cultivated cardamom

Variety	Percentage
Ramsai	54%
Ramsai,Bharlang	2%
Ramsai,Chibasai	8%
Ramsai,Chibasai,Sawne	2%
Ramsai,Dambarsai	4%
Ramsai, Golsai	16%
Ramsai,Golsai,Dambarsai,Jirmale	2%
Ramsai,Golsai,Jirmala,Chibasai, Dambarsai	2%
Ramsai,Golsai,Jirmale	2%
Ramsai,Jirmala	2%
Sawne	6%
Total	100%

On average, the respondent's farmers have 18.24 years of experience in cardamom cultivation, with a minimum of 5 years and a maximum of 40 years of experience in cardamom farming.

3.3 Technology awareness and access

The study revealed that all the respondents were aware of modern technology available for large cardamom cultivation. Out of 60 respondents, 100% respondent were aware. Out of 60 respondents, 86% respondent had access to modern technology, and only 14% hadn't access due to certain reasons. The results showed that most of the farmers become aware through extension services from agriculture authorities (36%) on technology, followed by training programs/workshops (28%), peer recommendations (18%), internet/online research (10%), and 10% through agriculture fairs/exhibitions. The result also showed that the respondents with bachelor and above education status were more aware through the internet and online research.

3.4 Adoption of Intercultural Operation

Cardamom farmers of Taplejung district mostly used modern irrigation methods (88%) and 12% of farmers used traditional irrigation methods. There were no fully rain-fed depended orchards. Most of the respondents adopted modern irrigation techniques. Out of 88% of modern irrigation, 86% adopted sprinkler irrigation, 2% adopted pipe irrigation, and no cardamom farmers have adopted drip irrigation. In cardamom orchards, only half of the respondents use manure and fertilizer, and half don't use any kind of fertilizer in the orchards. FYM, compost, and vermicompost are applied around the plant, and urine is applied by spraying in the cardamom plant. The results showed that most farmers (98%) in the study area don't use chemical fertilizers. Only 2% of the farmers use chemical fertilizers, such as urea and DAP.

Table 2: Status of adoption of organic manure

Organic manure	Percentage
FYM	52%
Compost	20%
Vermicompost	4%
Urine	24%
Total	100%

They determine the quantity of manure/fertilizer to apply in large cardamom orchards mainly by experience-based estimation followed by advice from agriculture extension services and visual inspection of the plant. No one farmer has done soil testing to measure soil nutrients. The result showed that half of the respondents who apply fertilizer mainly apply it once a year, followed on an as-needed basis.

The result showed that 46% of the respondents adopted the pruning technique due to the motivation of disease prevention and management, 22% due to enhanced light penetration to lower parts of the plant, 14% due to improved air circulation around the plant, 12% due to improved flowering and fruiting and 6% due to enhance plant health. Out of 98% of farmers who adopted weeding operations, 78% conducted them on an as-needed basis, 18% conducted them once a month, and 6% conducted them twice a month. The study revealed that 90 percent of respondents used cultural practices to control diseases, and 10 percent used chemicals to prevent diseases. In the cultural method, farmers mostly used sanitation processes and diseased-free plants; in the chemical method, most farmers used Allcop.

Table 3. Frequency of manure application

Application	Percentage
Once a year	48%
Twice a year	12%
Thrice a year	12%
As needed basis	28%
Total	100%

Respondents whose orchards are more than 20 years old have plowed their orchards. Farmers on terraced land have used mini tillers or tractors for field preparation. The result showed that most of the farmers, about 72%, used spades for field preparation, mainly to dig pits.

3.5 Post-harvest technology

The result showed that cardamom farmers adopt modern technology in the drying process. Among them, 62% of the respondents used improved air dryers, and only 38% used traditional dryers. Most respondents (86%) carried out the tail-trimming process, and only 14% didn't. It showed that no equipment is used for the tail trimming process, which is done by the rubbing process. The result showed that no respondent carried out grading operations before selling. The farmer sold the cardamom to a wholesaler without grading operation. All respondents have used jute bags as a storage method for dried cardamom. It also showed that no respondent used air-tight containers and vacuum-sealed containers.

3.6 Subsidy regarding technology adoption

The result showed that 84% of the respondents applied for and received a subsidy, and 16% of the respondents didn't apply for a subsidy. Similarly, the result showed that most respondents received an air dryer (Bhatti) and irrigation, chainsaw brush cutter, sprayer, and tractor mini tiller as a subsidy. Air dryers are obtained mainly from PMAMP and a few from the Agriculture Knowledge Center. Most respondents want air dryers with a 100% subsidy from the government and then irrigation, chainsaws, brush cutters, and grading machines, respectively.

3.7 Constrains to adopting technology

The result showed that almost half of the respondents (50%) moderately used modern technology. 30% of respondents did not easily access modern technology, 16% of respondents had high accessibility, and 4% of respondents did not have access at all. The main factor that prevented the adoption of modern technology was that more than half of the respondents did not know how to use modern technology. Financial assistance, training programs, and access to information support are equally required to encourage cardamom farmers to adopt modern technology. All respondents had encountered challenges related to the maintenance or repair of technology used in cardamom cultivation. The result showed that 92% of the respondents participated in training sessions.

IV. CONCLUSION

The study revealed that farmers in the area were engaged in various agricultural activities, with cardamom cultivation being a primary focus. Most farmers grew the Ramsai variety of cardamom, adopting modern irrigation techniques like sprinkler systems and primarily using organic fertilizers. While traditional tools were commonly used for field preparation, some farmers had started adopting improved technologies like air dryers, which were often subsidized. However, challenges such as insufficient knowledge of modern technology and difficulty in accessing qualified technicians hindered broader adoption. Financial support and training are identified as key to encouraging the use of modern technology in cardamom farming.

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