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TECHNOLOGY GAP AND KNOWLEDGE CONSTRAINTS IN BANANA CULTIVATION : A CASE FROM RURAL NAGALAND

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ABSTRACT

This study investigates the technology gap and knowledge constraints in banana cultivation among farmers in Tuli Block, Mokokchung District of Nagaland during year 2020. The research covered 120 banana growers selected through a multistage random sampling technique across four villages. Data were collected using structured interviews and a Knowledge Index was developed to assess the respondents' understanding of recommended cultivation practices. The findings revealed that 87.5% of farmers possessed low to medium knowledge levels, with the most significant gaps observed in pest and disease management, irrigation scheduling, and nutrient management. Intercultural operations showed the least knowledge and technology gap, indicating stronger experiential familiarity. Training needs were highest in areas with greater knowledge deficits, and a strong negative correlation was found between knowledge levels and training requirements. Socio-economic variables had no significant impact on training needs. The study highlights the importance of targeted capacity-building programs focusing on technical areas to enhance productivity and sustainable banana farming in rural Nagaland.

(Key words: Banana cultivation, technology gap, knowledge constraints, training needs, rural Nagaland)

INTRODUCTION

Banana (*Musa spp.*) is one of the most important fruit crops in the world, both in terms of production and economic value. Globally, it serves as a staple fruit in many tropical and subtropical countries. India is the largest producer of bananas, contributing nearly 23% of the total global output (Anonymous, 2019). The crop plays a vital role in ensuring nutritional security and providing livelihood opportunities, especially in rural areas. Rich in potassium, fiber, and essential vitamins, bananas form a significant component of both diet and local economy in many regions of the country (Kumar *et al*., 2014).

The northeastern region of India, including the state of Nagaland, is well-suited for banana cultivation due to its favorable climatic and soil conditions. According to the Horticulture Statistics Division of the Government of India (2019), Nagaland cultivates bananas on approximately 6,901 hectares, producing around 87,437 metric tons annually. Despite this potential, productivity remains suboptimal, largely due to limited adoption of improved cultivation practices. Factors such as inadequate extension services, lack of awareness about scientific methods, and poor access to quality planting materials contribute to this gap. Studies have also indicated that nutrient management and input optimization play a significant role in yield enhancement (Zohry and Mohamadin, 2020; Mate *et al*., 2020).

Several studies (Kirar and Mehta, 2009; Prodhan *et al*., 2017) have identified technology gaps and low levels of knowledge among fruit growers, especially in pest and disease management, irrigation practices, and nutrient application. These gaps ultimately lead to lower yields and economic returns. In regions like Tuli Block in Mokokchung District, where banana farming is an important livelihood activity, thus, understanding the knowledge level of farmers and their specific training needs becomes crucial.

This study aimed to assess the extent of technology gaps and identify the key knowledge constraints faced by banana cultivators in four selected villages of Tuli Block. By focusing on farmer perceptions and training requirements, the research intends to inform targeted extension interventions and contribute to sustainable banana production in the region.

MATERIALS AND METHODS

The study, conducted in 2020 in Tuli Block, Mokokchung District, Nagaland, involved 120 banana farmers selected through multistage random sampling across

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four villages. Primary data was gathered via structured interviews, focusing on socio-economic characteristics, knowledge levels, and training needs in banana cultivation. A knowledge index was created from 17 questions related to best practices. Descriptive statistics, mean scores, and Pearson correlation analysis were used for data interpretation.

The multistage sampling process first involved randomly selecting four villages based on accessibility and representation of banana farming. In the second stage, banana farmers were randomly chosen within each village, ensuring a diverse sample in terms of farming practices and socio-economic backgrounds, with 30 participants from each village. Table 1 observes the overall knowledge level of the respondents on banana cultivation and Table 2 focuses on the knowledge level of the respondents in specific areas on banana cultivation. Table 3 focuses on depicting the technology gap of the respondents on specific area of banana cultivation. Table 4 represents the overall training needed of the farmers and table 5 observes the training need in specific area under banana cultivation.

Knowledge Index

KI (Knowledge Index) = $\{\Sigma K_i / (n \times K_{max})\} \times 100$

Where,

Kb_i = Score obtained by the respondent on the i^{th} knowledge item

K_{max} = Maximum possible score per item

n = Total number of knowledge items/questions

ΣK_i = Sum of scores obtained across all items

KI = Knowledge Index expressed in percentage

Technology Gap

TG (Technology Gap) = $((T_{max} - T_a) / T_{max}) \times 100$

Where,

T_a = Actual level of technology adopted by the farmer

T_{max} = Maximum recommended technology level

TG = Technology Gap expressed in percentage

RESULTS AND DISCUSSION

Table 1 revealed that a significant proportion (87.5%) of respondents had either low or medium knowledge of improved banana cultivation practices, highlighting a substantial gap in scientific understanding. Similar findings were observed by Goel and Sodhi (2013), who reported medium knowledge levels among soy processing technology users. The findings indicates that 87.5% of farmers had low or medium knowledge of improved banana cultivation practices. This knowledge gap is significant given the favorable climatic and edaphic conditions for banana farming in Nagaland. Despite these advantages, a lack of technical knowledge on best practices hinders farmers from fully optimizing the potential of their banana crops. This observation was consistent with the findings from Goel and Sodhi (2013) and Raghuprasad *et al*. (2013), who reported similar gaps in knowledge among farmers in other regions. The low and medium knowledge levels observed among banana farmers in Tuli Block suggest a pressing need for more effective knowledge dissemination programs. In line with Kumar *et al*. (2014), whose research pointed to low adoption rates of improved agricultural practices in India due to limited knowledge, the findings highlighted that even though Nagaland has favorable conditions for banana cultivation, the lack of knowledge about pest management, irrigation techniques, and nutrient application is preventing farmers from reaching optimal yields.

Table 2 revealed that the highest knowledge was observed in intercultural operations, likely due to the repetitive nature of tasks such as weeding and mulching, which farmers learn through experience. Table 3 clearly revealed that pest and disease management had the highest technology gap, followed closely by irrigation scheduling and land preparation. These are the areas where farmers possessed the least amount of technical knowledge in relation to what is recommended. In contrast, intercultural operations exhibited the smallest gap, suggesting that farmers had already gained practical knowledge in this area through experience. These findings indicate that training programs should be prioritized based on the severity of the technology gap, particularly in areas that involve scientific and technical inputs, such as pest control and irrigation planning. This is in line with earlier findings by Alarima *et al*. (2011) and Prodhan *et al*. (2017), who also identified that pest and disease management and irrigation scheduling had the highest need for training among horticultural and fruit crop farmers.

Table 4 revealed that majority of respondents indicated medium-level training needs. This reflected a partially informed but still inadequately equipped farming population. The results are consistent with the findings of Singh *et al*. (2014), who found out that there was medium-level of training needs among farmers practicing paddy cultivation. Table 5 revealed that the high ranking of pest and disease management aligned with the low knowledge scores in this area. It affirms the argument of Alarima *et al*. (2011) that pest and disease control often emerge as a primary training need among horticulture farmers. Intercultural operations, where farmers already possess significant experiential knowledge, received the lowest priority.

The study inferred that banana cultivators in the Tuli Block of Nagaland demonstrated moderate experience but significant gaps in technical knowledge. Areas like pest and disease management, irrigation, and nutrient application present the most pronounced training needs. Since knowledge level showed a strong negative correlation with training requirements, enhancing knowledge through targeted capacity-building can bridge the technology gap. Thus, the study recommended that Krishi Vigyan Kendras (KVKs), NGOs, and the Department of Horticulture needs to prioritize their focus on conducting practical, village-level training sessions, particularly in areas with the highest training demand, demonstration-based approaches and field schools.

Table 1. Overall knowledge level of respondents on improved banana cultivation N=120

Sl. No.	Knowledge Level	Frequency	Percentage (%)
1	Low	51	42.50
2	Medium	54	45.00
3	High	15	12.50

Table 2. Knowledge level of respondents on specific areas of banana cultivation N=120

Sl. No.	Cultivation Practice	Knowledge (%)	Rank
1	Intercultural Operations	77.83	I
2	Seed and Sowing	48.33	II
3	Harvesting	17.50	III
4	Post-harvest Management	11.67	IV
5	Spacing	10.83	V
6	Land Preparation	10.00	VI
7	Nutrient Management	10.00	VI
8	Irrigation Schedule	8.33	VII
9	Pest and Disease Management	7.08	VIII

Table 3. Technology gap by cultivation area N=120

Sl. No.	Area of cultivation	Recommended Score	Actual knowledge score	Technology gap (%)	Rank
1	Pest and Disease Management	3.00	1.54	48.67	I
2	Irrigation Schedule	3.00	1.56	48.00	II
3	Land Preparation	3.00	1.58	47.33	III
4	Nutrient Management	3.00	1.61	46.33	IV
5	Spacing	3.00	1.63	45.67	V
6	Post-harvest Management	3.00	1.65	45.00	VI
7	Harvesting	3.00	1.70	43.33	VII
8	Seed and Sowing	3.00	1.80	40.00	VIII
9	Intercultural Operations	3.00	2.65	11.67	IX

Table 4. Overall training needs of respondents on improved banana cultivation N=120

Sl. No.	Degree of training need	Frequency	Percentage (%)
1	Low (Not Needed)	23	19.17
2	Medium (Needed)	82	68.33
3	High (Most Needed)	15	12.50

Table 5. Specific training needs by cultivation area **N=120**

Sl. No.	Area of Training	Mean Score	Overall Rank
1	Pest and Disease Management	1.93	I
2	Irrigation Schedule	1.91	II
3	Land Preparation	1.90	III
4	Nutrient Management	1.89	IV
5	Spacing	1.88	V
6	Post-harvest Management	1.87	VI
7	Harvesting	1.80	VII
8	Seed and Sowing	1.50	VIII
9	Intercultural Operations	0.68	IX

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