

Post-Intervention Outcomes in Farmer Behaviour and Crop Diversification in Dinajpur, Bangladesh

Research Note 34

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ABOUT THIS NOTE

Crop production is highly rice-centric in Bangladesh and, although economically rational, is risky and arguably unsustainable (1). Crop diversification emerged as an important strategy for achieving sustainable agriculture in Bangladesh (2). On-farm trials were conducted to evaluate new cropping patterns in the Dinajpur district and promote crop diversification among smallholder farmers. This brief summarizes the results from post-intervention outcomes in farmer behavior covering a) preferred cropping patterns among farmers; b) perceived benefits, challenges, and transaction costs of crop diversification, and c) market awareness among trial farmers. Data were collected through face-to-face surveys involving on-farm trial farmers in the Dinajpur district.

KEY STUDY FINDINGS

1. Rice remains the dominant crop in Dinajpur, with 97.94% of farmers preferring Aman rice during the Aman/Kharif 2 season and 76.29% preferring Boro rice in the Robi/Boro season, indicating a strong preference for staple crops.
2. While rice is the preferred crop, some farmers diversified, particularly with potatoes (56.70%) and maize (54.64%) during the Robi/Boro season, and jute (28.35%) during the Aus/Kharif 1 season.
3. The major perceived benefit of crop diversification is diversified income streams, recognized by 84% of farmers, followed by increased income on small landholdings (77%) and improved food availability (73%).
4. Key barriers include a lack of agronomic skills (46%), difficulty managing multiple crops (46%), financial risks (42%), and limited knowledge of alternative crops (42%).
5. Crop diversification increases transaction costs, with 90% of farmers acknowledging the need for more knowledge and skills, and 76% noting increased time and supervision requirements.

6. Farmers mainly rely on middlemen to sell their crops, especially maize (100%) and potatoes (98%), which reduces their profit margins, highlighting the need for improved market systems and direct sales options.
7. Most farmers (87%) are not part of any farmer collectives but are interested in joining such groups, with 94% believing it would help them reduce costs and access better market information.

BACKGROUND

On-farm research trials are part of TAFSSA's Work Package 2 (WP2) activities, which focus on farm and landscape-level interdisciplinary research. On-farm trials were carried out to explore crop diversification options at both field and landscape scales, supporting multiple benefits, including potential nutritional yield, across the environmental and socio-economic gradients of rice-based farming systems. The Rangpur and Rajshahi divisions in northern Bangladesh have been selected as learning sites based on critical

information regarding food and nutrition security gaps, environmental stresses, climate challenges, and the presence of commodities and farming systems with the greatest potential to achieve TAFSSA's outcomes.

While exploring the options to diversify prevailing rice-based cropping systems to more diversified cropping systems through on-farm trials, it is imperative to understand farmer behavior in this transition. This shift can be complex and challenging for farmers, involving changes in practices, knowledge, and potentially economic considerations.



Above: Farmer is working in the maize field in Bangladesh; photo: CIMMYT

BACKGROUND

To assess the cropping preferences of smallholder farmers in Rangpur, focusing on their transition from rice-dominant systems to diversified crops, while investigating the benefits, perceived challenges, economic, agronomic, and environmental factors, as well as market influences, transaction costs, and the impact of on-farm trials on their decision-making processes.

METHODOLOGY

Refer Cheesman et al. (2022) (3,4) for detailed methodology followed to conduct the on-farm trial experiments. The link can be found <https://hdl.handle.net/10568/127991>.

Surveys of on-farm trial farmers are conducted to understand the post-intervention outcomes in farmer behavior in Dinajpur, and the farmer behavior-related questions are analysed and the brief results are presented in this research note.

RESULTS

Increased trend of adoption of diverse crops among farmers in Rangpur district

On-farm trials were conducted to explore crop diversification options. The proposed cropping patterns for different seasons are outlined by Cheesman et al. 2023 (3,4). However, post-season farmer surveys revealed discrepancies between the cropping patterns preferred by the farmers and those tested in the trials. This discrepancy underscores the complexities involved in cropping pattern selection in specific seasons. Market demand and economic viability influence farmers' preferences for specific cropping patterns. Besides, environmental factors such as climate, soil type, water availability, and technological advancements are critical in determining suitable cropping patterns (5).



Above: Farmers are working in the crop field in Bangladesh; photo: CIMMYT

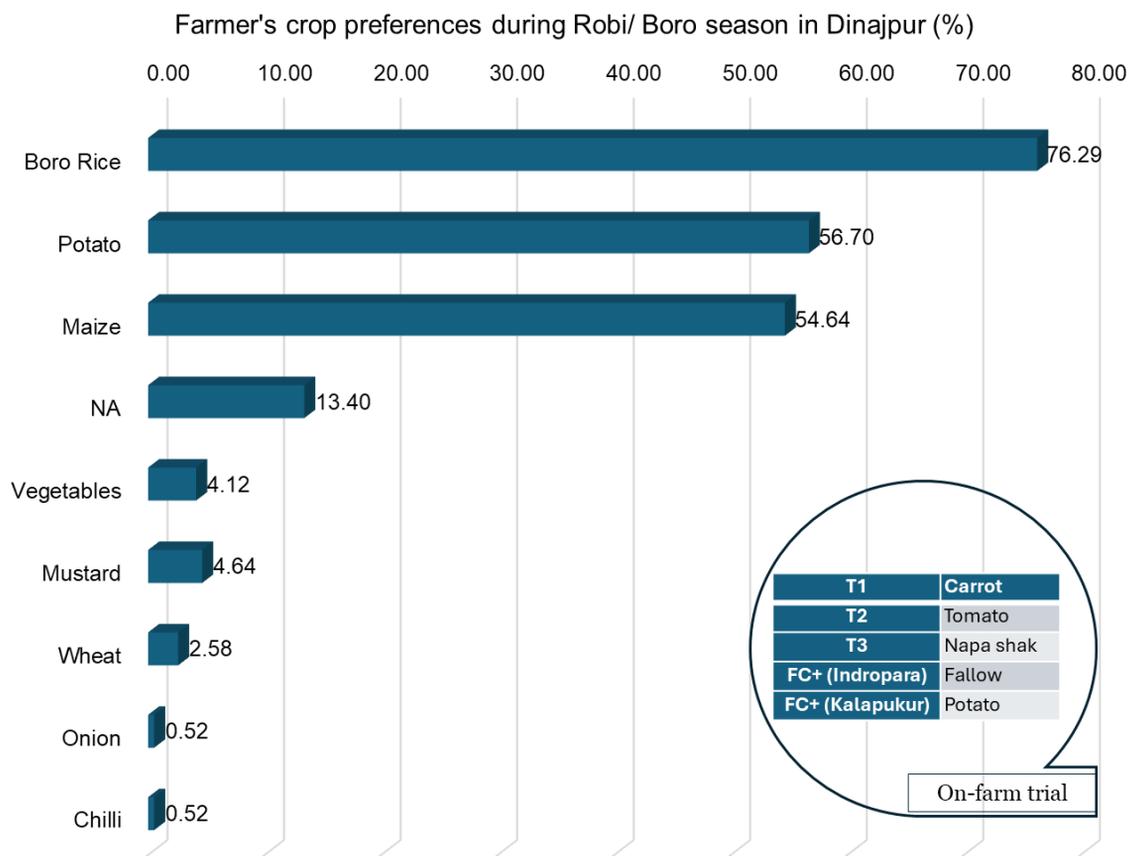


Figure 1: Farmer's crop preferences in Robi/ Boro season in Dinajpur (%) (Mention maximum 2 desired crops): n=198

Figure 1 shows the crop preferences of farmers in Dinajpur during the Robi/Boro season, based on responses from 198 participants. Boro rice is the most popular crop, with 76.29% of farmers selecting it as first option, highlighting its significance as a staple crop in the district. Following rice, 56.70% of farmers chose potato as second option, while 54.64% preferred maize, making these two crops also important during this season. A smaller proportion of farmers (13.40%) either did not specify or did not have a strong preference for any particular crop. Other crops like mustard (4.64%), vegetables (4.12%), wheat (2.58%), onion (0.52%), and chili (0.52%) are less commonly grown, indicating a focus on key staple crops in Dinajpur.



Above: Mst Laily Begum, working in her tomato field in Birganj, Dinajpur, Bangladesh; Photo: CIMMYT

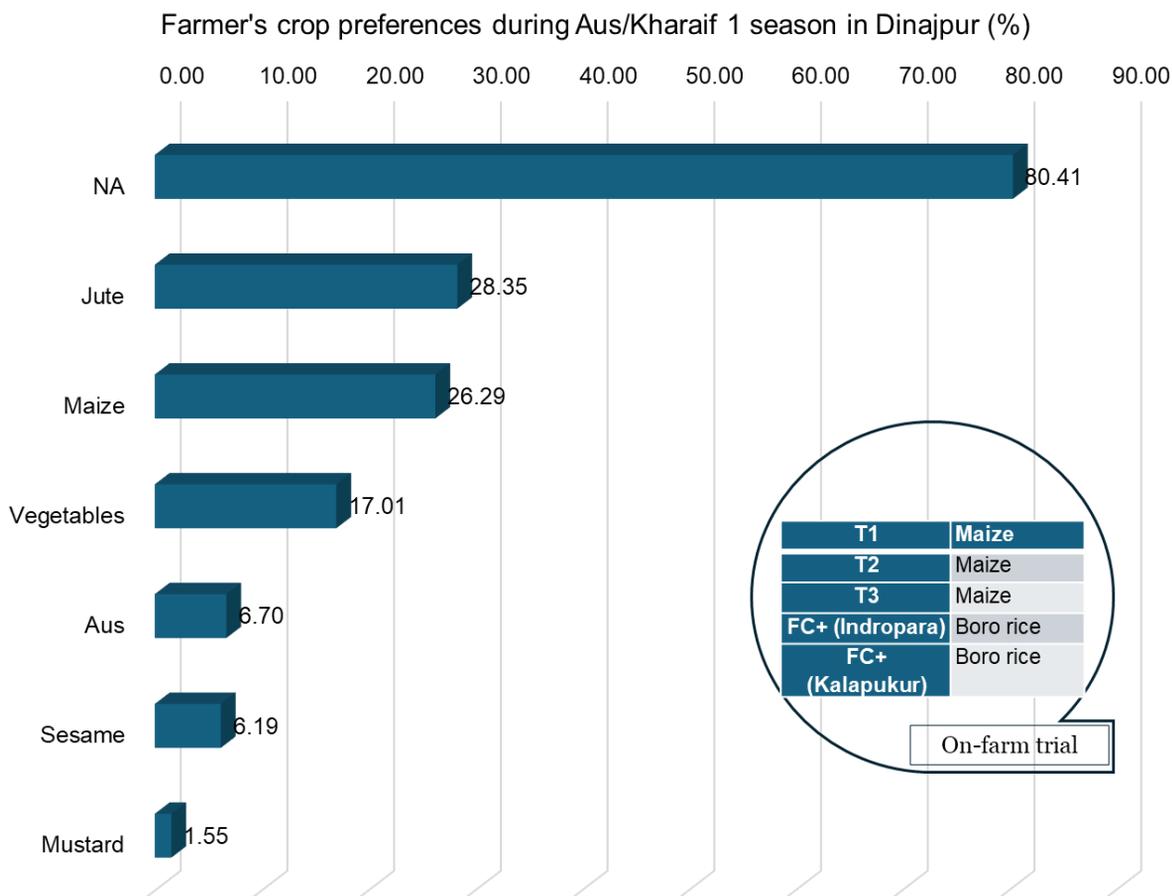


Figure 2: Farmer's crop preferences in Aus/Kharaif 1 season in Dinajpur (%) (Mention maximum 2 desire crops)

Figure 2 shows farmers' crop preferences during the Aus/Kharif 1 season in Dinajpur. A significant portion of farmers (80.41%) indicated "NA" (Not Applicable), suggesting either they don't grow crops during Aus or the land may not be suitable for the crops listed. Among those who did specify a crop, Jute was the most commonly preferred, chosen by 28.35% of farmers, highlighting its importance as a cash crop during the season. Maize was selected by 26.29%, demonstrating its continued relevance in various seasons across Dinajpur. A smaller portion, 17.01%, opted for Vegetables, indicating some farmers diversify with vegetable cultivation.



Above: Maize crop field, Dinajpur, Bangladesh; Photo: CIMMYT

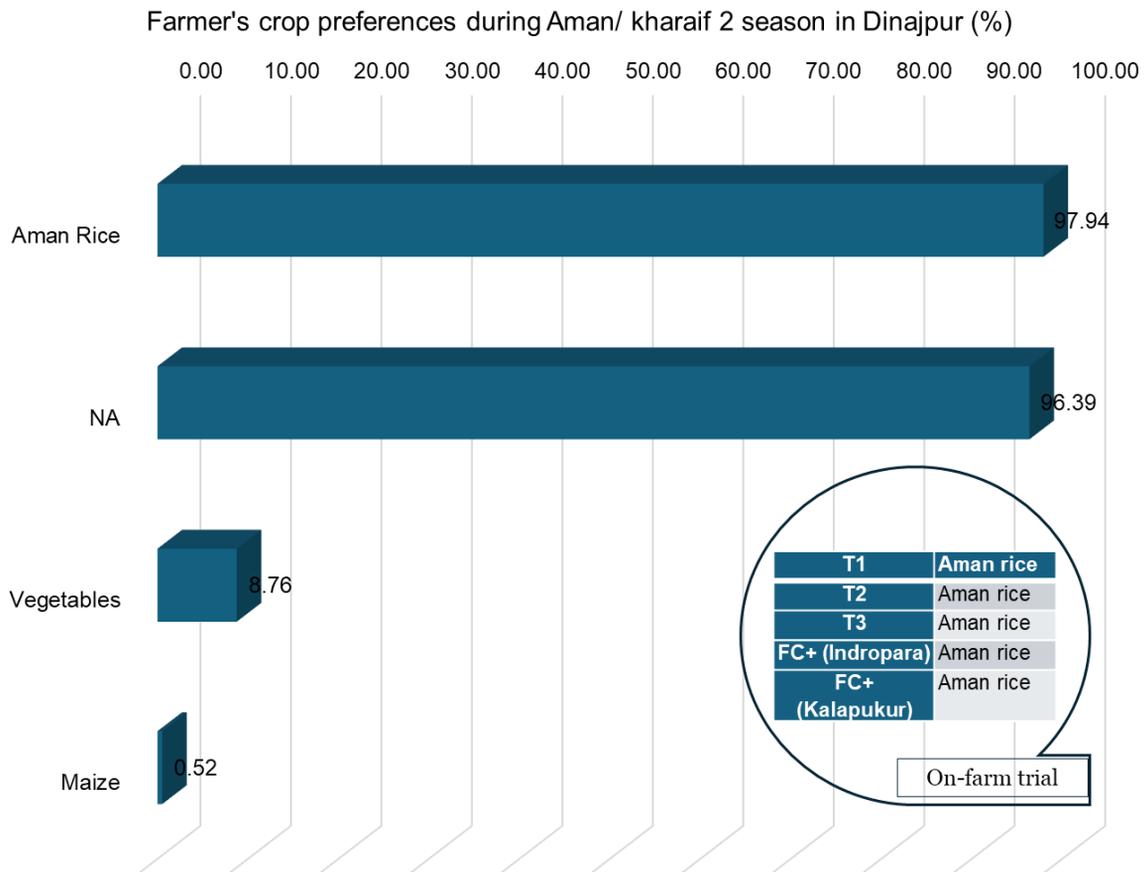


Figure 3: Farmer's crop preferences in Aman/ kharai 2 season/Rainy season in Dinajpur (%) (Mention maximum 2 desired crops)

Similarly, Figure 3 shows the farmer's crop preference during the Aman/Kharif 2 season. Aman rice is indicated by almost all the farmers highlighting the most important crop as the first option during the Aman/Kharif 2 season in Dinajpur, with 97.94% of farmers choosing it. A large percentage (96.39%) either did not specify a crop or chose "NA." which means they don't prefer any other crops during this season other than Aman rice. Besides, 8.76% of farmers opted for vegetables, and 0.52% for maize, indicating very limited diversification in crop selection during this season in Dinajpur.



Above: Women working together to dry and process harvested grains, showcasing their vital role in sustainable agriculture and rural livelihoods in Dinajpur, Bangladesh; Photo: CIMMYT

FARMER'S PREFERENCES FOR SPECIFIC CROPS ACROSS THE TREATMENTS AND SEASONS

Crop preferences across four treatments (AgP+, AgP+&N, C, and N) during the Aman season in Dinajpur, based on responses from 194 farmers. As shown in Figure 4, Aman rice has the highest preference across all treatments, indicating that it is the most widely preferred crop. The response rates are very similar across the treatments. While the second option indicated as NA (Not applicable) is seen across all treatments, slightly varies across the

treatments. NA refers to either farmers not interested in a second crop besides Aman rice in Aman season or their land is not suitable for other crops listed. The preference for Vegetables remains low across all treatments. This suggests that Aman rice remains the dominant crop choice, while a significant portion of farmers either do not specify a preference or choose no crop preference.



Above: Happy to establish diversified crops (Maize, tomato and carrot) in the same fields.
photo: CIMMYT

Farmer's crop preferences across treatments during Aman seasons in Dinajpur (n=194)

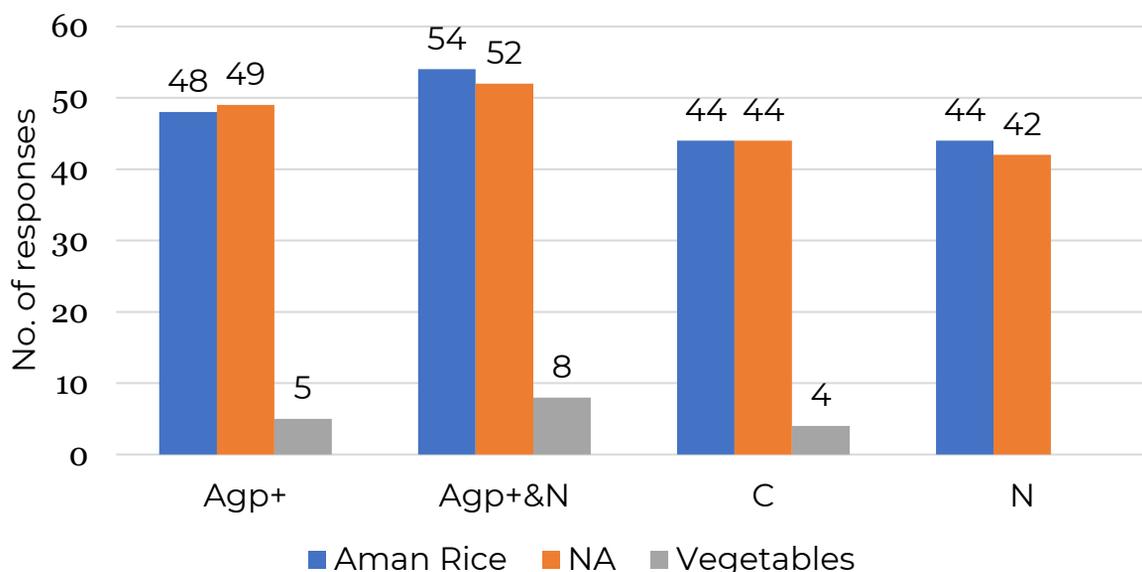


Figure 4: Farmer's crop preferences across treatments during Aman seasons in Dinajpur (n=194)

During Kharif 1, there is a noticeable difference in farmers' preferences for specific crops across the treatments (Figure 5), compared to the Aman season. NA (no preference or not applicable) dominates across all treatments, with the highest responses in N (46), followed by AgP+ (39), AgP+&N (36), and C (35), which indicates no specific crop preference, due to the land left fallow or not suitable for growing specific crops listed. Jute and Maize are the next most preferred crops, particularly in the AgP+ and C treatments. For Jute, the highest preference is seen in AgP+ (12), while for Maize, it's AgP+ (23) and C (22). Preferences for other crops like Vegetables, Aus, Sesame, and Mustard are much lower. Vegetables show minor preference in AgP+ (6) and AgP+&N (10). Sesame is most favored in the AgP+&N treatment (9), while Mustard appears only in AgP+&N with 3 responses. It is difficult to attribute slight changes to different treatments.

Similarly, during the Robi/boro season, as shown in Figure 6, Boro rice and potato are the most preferred crops, especially in the AgP+ and AgP+&N treatments. Maize is also popular, particularly in the C treatment.



Above: Farmers collaborating in the preparation of rice seedlings, demonstrating teamwork and sustainable farming practices in Bangladesh; photo: CIMMYT

Farmer's crop preferences across treatments during Aus/Kharaif 1 season in Dinajpur (n=194)

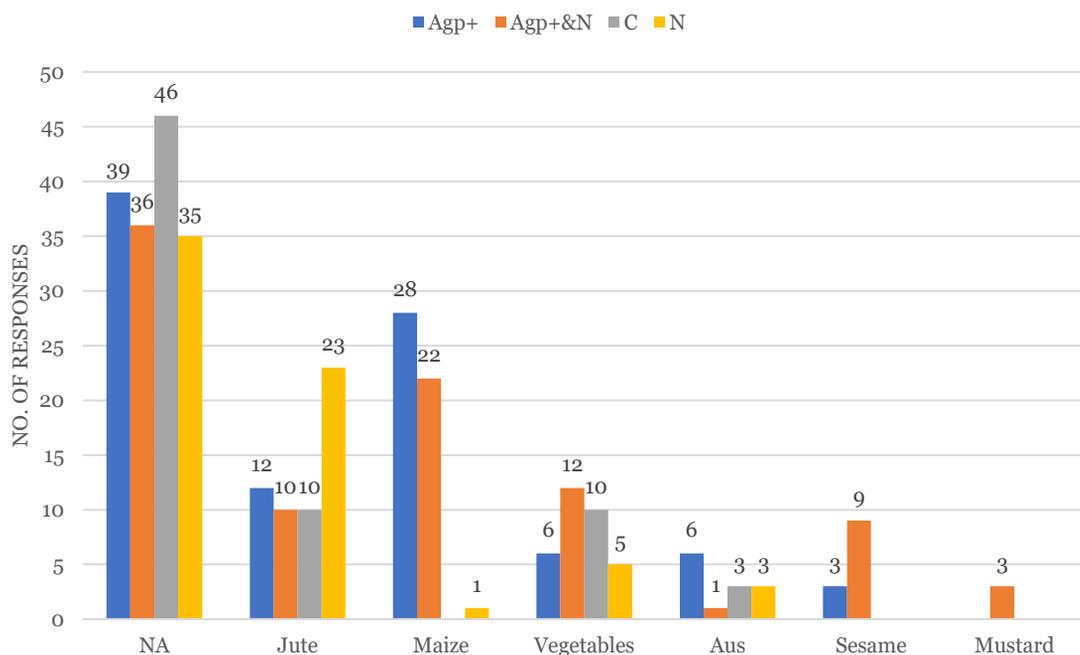


Figure 5: Farmer's crop preferences across treatments during Aus/Kharaif 1 season in Dinajpur (n=194)

Farmer's crop preferences across treatments during Robi/ Boro season in Dinajpur (n=194)

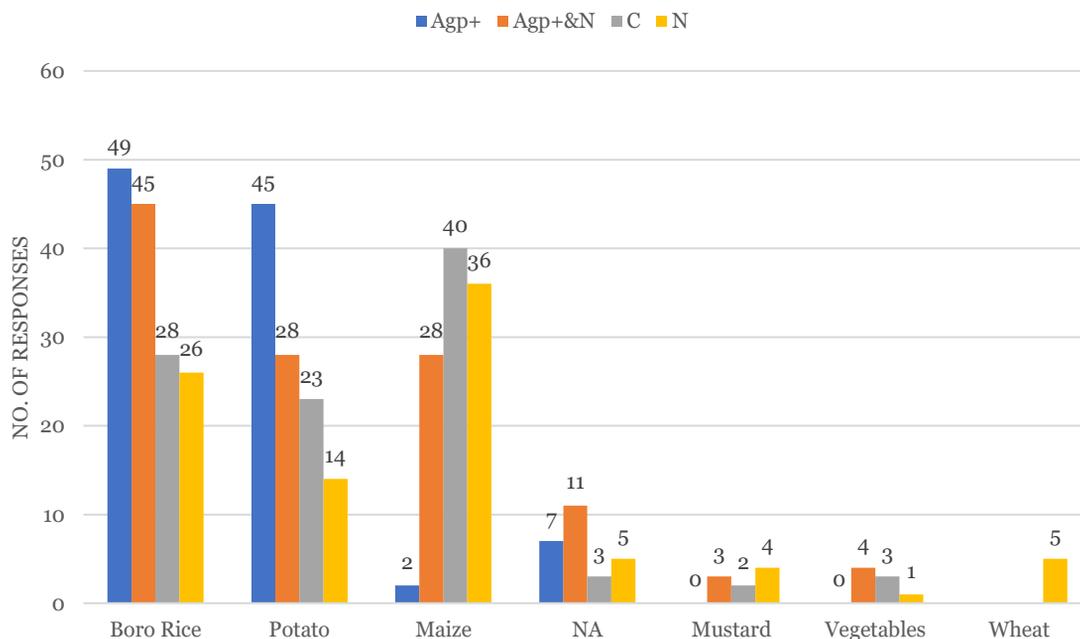


Figure 6: Farmer's crop preferences across treatments during Robi/ Boro season in Dinajpur (n=194)

Farmer's perceived benefits of practicing crop diversification in Dinajpur.

Farmers in Bangladesh are gradually transitioning from their historical dependence on rice to cultivating a more diverse range of crops (6). The area under high-value crops, such as fruits and vegetables, has steadily increased over the last decade.

Understanding the benefits that farmers gain from shifting away from intensive mono-cropping patterns to more diverse cropping systems is crucial. Crop diversification is a key approach to sustainable agriculture, offering numerous benefits, including enhanced agricultural resilience, improved farmer incomes, and improved food security (7,8).



Above: Intercultural activity in tomato field, Bangladesh; photo: CIMMYT

In the current research on-farm trial farmers were asked about the benefits they experienced after adopting crop diversification in their farms. Figure 7 provides a descriptive analysis of farmers' perceptions of the benefits of crop diversification as identified by farmers in the Dinajpur district of Bangladesh. The most recognized benefit is diversified income streams, with 84% of farmers agreeing. Previously, farmers relied solely on rice, which provided income only twice a year after each harvest. However, by diversifying crops that are grown and harvested at different times throughout the year, farmers now enjoy a more consistent and continuous income stream. This is followed by increased income on small landholdings (77%) and improved food availability for home consumption

(73%). Risk reduction, such as protection from crop failure or price fluctuations, is noted by 35%. Fewer farmers see benefits in improved soil health (24%), economic stability (23%), cost reduction (18%), and natural resource conservation (7%). Economic gains are prioritized over environmental benefits. Studies have shown that crop diversification enhances income streams (7), food security (9), nutritional benefits (10), and soil health improvements (11).

Similarly, on-farm trial farmers were asked about the challenges they are experiencing in practicing crop diversification in their farms. Figure 8 shows, a descriptive analysis of farmers' perceived challenges associated with crop diversification.



Above: Farmers preparing a crop field in Bangladesh, reflecting their hard work and commitment to ensuring productive agricultural seasons.; Photo: CIMMYT

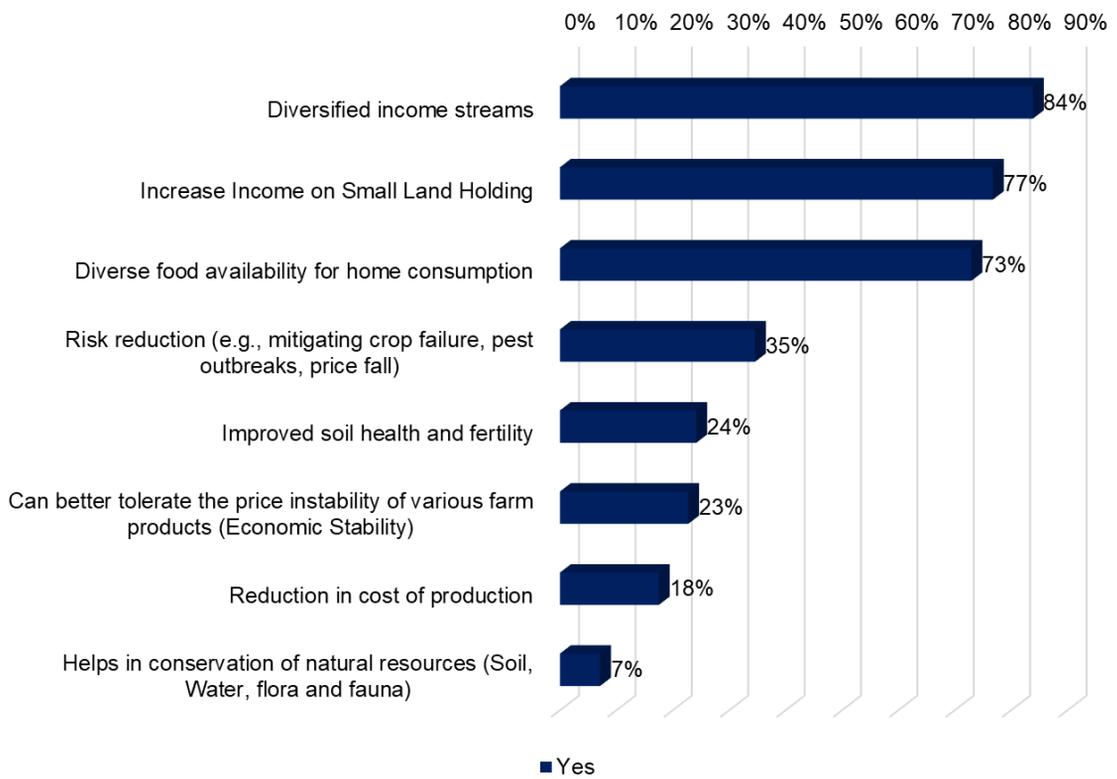


Figure 7: Farmer's perceived benefits of practicing crop diversification in Dinajpur (n=211)

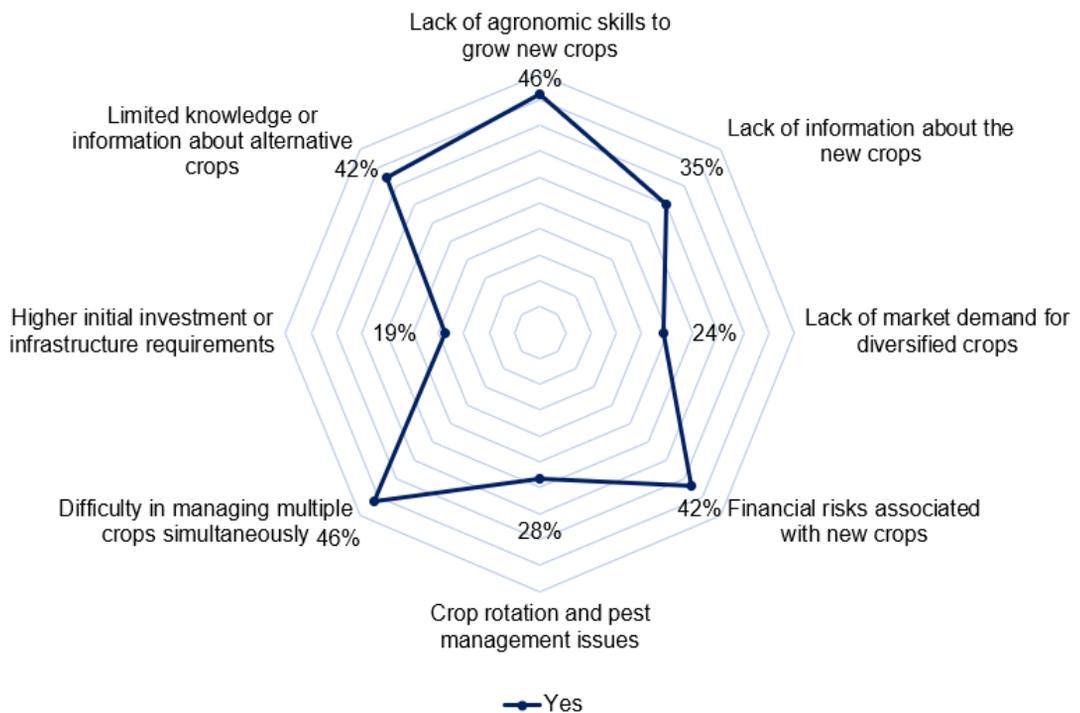


Figure 8: Farmer's perceived challenges of practicing and continuing crop diversification (n=211)

The results reveal that the highest perceived challenges, each identified by 46% of farmers, are the lack of agronomic skills to grow new crops and difficulty in managing multiple crops simultaneously. This suggests that the complexity of managing diverse crops and the need for specialized knowledge are major barriers. Other significant challenges include financial risks associated with new crops (42%) and limited knowledge or information about alternative crops (42%), indicating that economic uncertainty and lack of information also deter farmers from diversifying. Lack of market demand for diversified crops is seen as an issue by 24% of farmers, while 35% highlight the lack of information about new crops. These challenges suggest that both knowledge gaps and market factors play a role in limiting diversification efforts. Lower on the list are higher initial investment or infrastructure requirements (19%) and crop rotation and pest management issues (28%), indicating that while these are concerns, they are less

pressing compared to other challenges. This suggests a strong need for tailored training for farmers and linking farmers to markets, that provide detailed information and knowledge about new crops, management techniques, and market information to support farmers in overcoming these barriers and successfully adopting crop diversification. Farmers are traditionally familiar with growing rice, and mentioned challenges with growing new crops are the reality. Studies have shown that farmers lack access to information about the techniques of crop diversification in Bangladesh. This knowledge gap can hinder their ability to make informed decisions about transitioning to diversified systems (9,11). Besides, Bangladesh is highly susceptible to climate change impacts, including flooding and droughts, which can affect crop yields. This environmental uncertainty can make farmers reluctant to experiment with new crops that may not withstand these conditions (9).



Above: Farmers preparing to transplant rice; Photo: CIMMYT

PERCEIVED TRANSACTION COSTS ASSOCIATED WITH CROP DIVERSIFICATION AMONG SMALLHOLDER FARMERS

Approximately 88.5% of farms in Bangladesh are less than 1 hectare (ha), which collectively occupies about 60% of the total farmland area. The average size of a farm is reported to be around 0.60 ha, with many farmers owning even smaller parcels (12). Rice is the primary crop for almost all farmers, and its cultivation on a large scale reduces production costs compared to growing multiple crops on the same land (13). Cultivating several crops in a small piece of land

may lead to higher transaction costs, due to multiple crops needing different agronomic practices at different crop cycles, different inputs, different marketplaces, and preparation of field and harvesting comes at different times resulting in higher labor costs. Studies have shown that promoting crop diversification among smallholder farmers is risky due to their exposure to several risks such as market and weather risks including higher transaction costs (14).

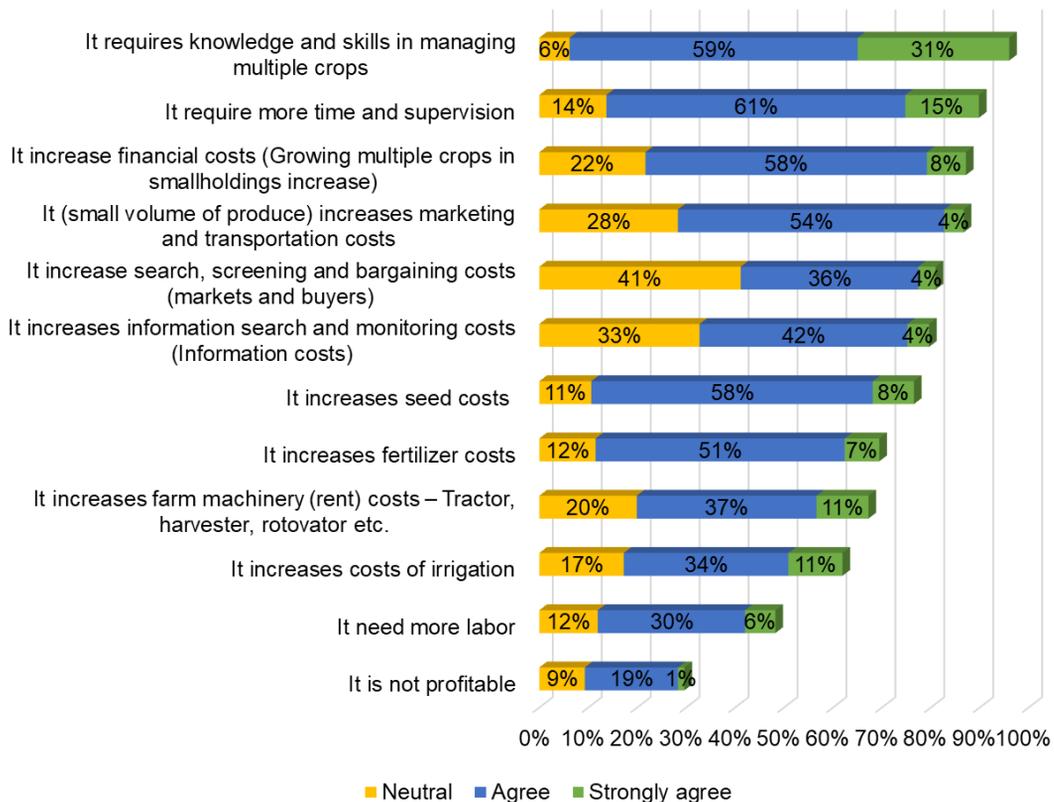


Figure 9: farmers perceived transaction costs associated with crop diversification (n=211). Note: Responses 1 to 5 scale (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5 strongly agree).

Figure 9 shows the responses of on-farm trial farmers to transaction cost-related statements that are associated with crop diversification. The most significant perceived cost is the requirement for knowledge and skills to manage multiple crops, with 90% of farmers either agreeing (59%) or strongly agreeing (31%). Similarly, 76% of farmers believe crop diversification demands more time and supervision. Financial costs are a major concern, as 66% of farmers feel that growing multiple crops increases financial costs. Additionally, 58% of farmers agree that crop diversification leads to higher marketing and transportation costs due to the small volume of

produce. Search, screening, and bargaining costs are highlighted by 40% of farmers as an issue, while 46% feel that information search and monitoring costs also rise with crop diversification. In terms of input costs, 66% of farmers perceive an increase in seed costs, and 58% feel fertilizer costs rise. Machinery costs are seen as a concern by 48%, while irrigation costs are flagged by 45%. Regarding labor, 36% of farmers think that more labor is required for diversified farming. These responses collectively highlight the challenges and doubts farmers hold regarding the profitability and management of crop diversification.



Above: Local market, Bangladesh; Photo: CIMMYT

Farmers in Bangladesh face challenges in the marketing of farm produce, particularly fruits and vegetables, despite relatively being well-informed about rice marketing. The primary issues are inadequate market infrastructure and a lack of support systems for these newer crops recently farmers cultivating (15). The survey responses from on-farm trials growing vegetables highlight the marketing challenges they face with these new crops. Their responses are shown in Figure 10. Farmers exhibit

relatively high awareness in several areas. For example, 67.7% of respondents are aware of the storage facilities available for their crops in the vicinity, and 64.6% know the markets where there is demand for other crops like carrots. Farmers show a reasonable level of understanding about the buyers of these crops (with 70.8% being aware) and how to prepare crops for the market (58.3%). In terms of general crop quality, quantity, and grade, about 58.3% are aware of the standards.

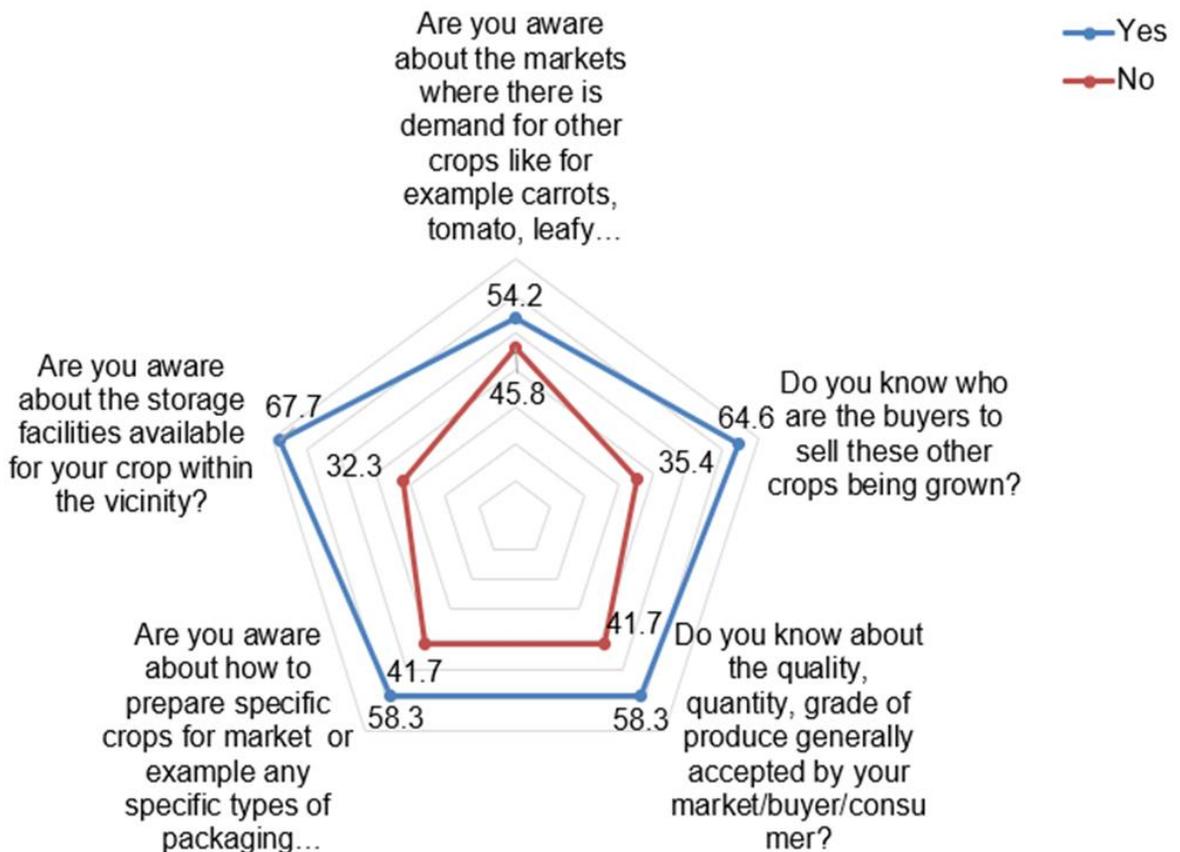


Figure 10: Farmers' awareness about the marketing of new crops (n=96 - Agp+ and Agp+N)

Farmers in Bangladesh use various marketing channels to sell their agricultural produce, facing challenges. The marketing system is characterized by a mix of direct sales and intermediaries, which can impact the prices that farmers receive for their produce (16,17). However, every year, a significant amount of harvested produce is wasted due to seasonal gluts and a lack of proper marketing networks (17). For instance, post-harvest losses of fruits and vegetables in Bangladesh are a significant concern, with estimates between 23.6% to 43.5% (5.13 million tonnes) of produce wasted after harvest worth approximately \$2.4 billion (18). The post-harvest losses and the price realization for farmers vary across marketing channels (19). Therefore, understanding the specific market channel farmers are using is very important.

Figure 11 shows, the predominant channel across all crops is selling to wholesalers or middlemen, which is particularly high for maize (100%),

potato (98%), and Boro (92%). Local farmer's markets are also a common sales channel, with significant usage for carrots (85%), tomatoes (82%), and maize (67%). Direct sales to consumers and selling to retailers are relatively less common. For tomatoes, direct sales to consumers account for 9%, and 5% of tomato farmers sell directly to retailers. A small percentage (2%) of Boro farmers also sell to retailers. However, direct consumer sales and retailer sales are almost negligible for other crops. This indicates a preference for traditional sales channels over modern retail or digital platforms. Selling through the middlemen/wholesalers is an inefficient channel as farmers receive very less for their produce. Studies have shown that farmers typically receive less than 40% of the final consumer price for their produce. Middlemen, including merchants and retailers, capture a substantial portion of the profits, often leaving farmers with minimal returns after covering their production costs (20).



Above: Farmer is selling vegetables in local market, Bangladesh; Photo: CIMMYT

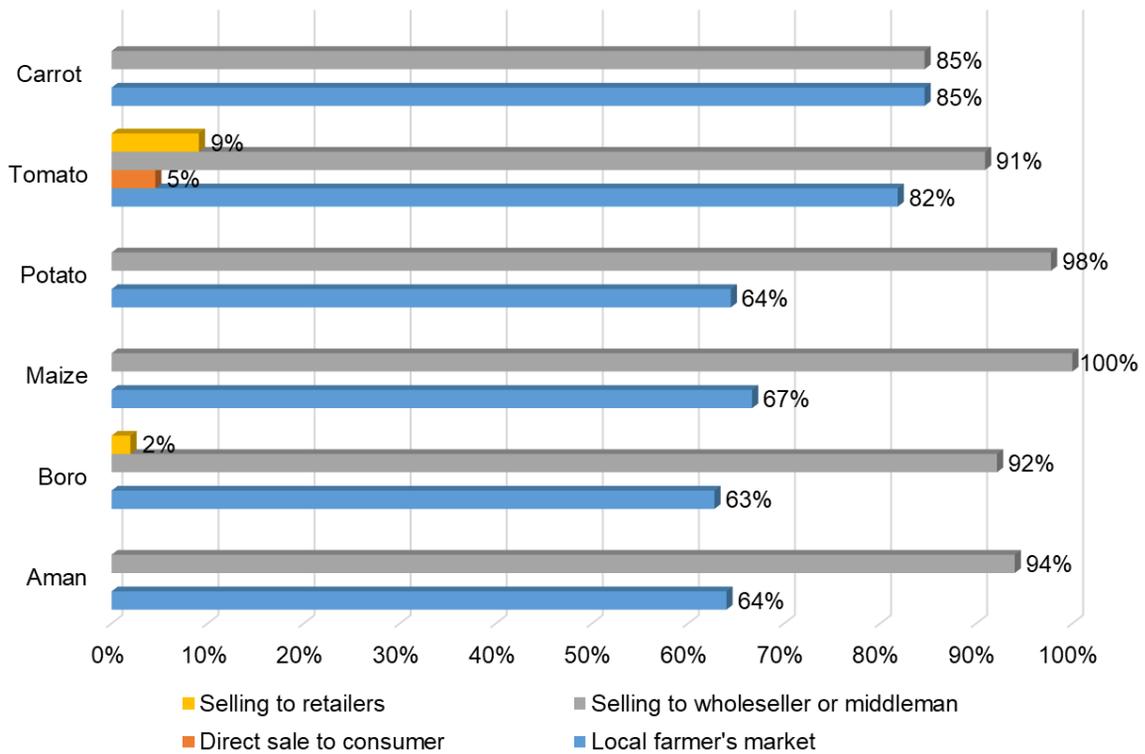


Figure 11: Various marketing channels used by on-farm trial farmers (Agp+) to sell their crops

A few powerful middlemen dominate the market, dictating prices that smallholder farmers must accept. This situation is exacerbated by inadequate market infrastructure and poor transportation systems, which further limit farmers' ability to negotiate better prices. Despite the disadvantages, many farmers continue to sell through traditional middlemen (referred to as "farias") due to perceived benefits such as immediate cash payments and reduced bargaining efforts. However, studies indicate that if farmers sought alternative selling methods, they could potentially increase their profits (20). Prevailing crop-specific value chains are mapped in Rangpur district and presented in Annexure I.

Due to a large number of smallholdings and resource-poor farmers with information asymmetry about the markets, there is a need for promoting farmers' collectives, such

initiatives potentially empower farmers to negotiate better prices and reduce reliance on middlemen and cost of production.



Above: A farmer is taking sugarcane to market, Bangladesh; Photo: CIMMYT

Additionally, establishing direct sales to e-commerce companies, and institutional buyers is a way to stabilize prices and ensure that producers receive fair prices for their crops. Studies have shown that farmers' collectives are an effective approach that increases farmers' bargaining power and can lead to better prices than individual negotiations. Besides, collectives can also help in reducing the number of intermediaries, thereby increasing the share of profits that reach the farmers (21,22).

The results of this study reveal that 87 percent of the farmers mentioned they are not members of any farmer collectives, such as cooperatives, self-help groups, or producer organizations. However, 94 percent of the farmers expressed interest in joining such collectives, which they believe could reduce production costs and provide better access to market information, knowledge, experience, and bargaining power.



Above: A Women selling vegetables (Shak) in a local market; Photo: CIMMYT

Additionally, all the farmers reported that they plan to continue with crop diversification. Of the 116 farmers surveyed (Agp+ and Agp+N groups), 85 percent rely primarily on their own experience to assess market demand for specific agricultural products, while 74 percent consult with neighbors and friends. Interestingly, only 15 percent of these farmers seek advice from agricultural extension officers for market information. Least dependence on extension personnel may be their availability and technical

competency.

Moreover, 82 percent of the 116 farmers expressed a desire to attend workshops or training sessions focused on the marketing of diversified farm produce. Specifically, 83 percent of the farmers seek additional support in connecting with potential buyers, 52 percent are looking for help with price information, and 43 percent need guidance on understanding the quality requirements of potential buyers.



Above: Farmers collecting, carrying, and selling fodder to local markets in Dinajpur. Photo: CIMMYT

CONCLUSION AND RECOMMENDATIONS

Crop diversification is gaining slowly momentum in Dinajpur, but rice remains the dominant crop. Despite potential benefits such as income diversification and improved food security, farmers face significant challenges like lack of knowledge, financial risks, and market access issues. Transaction costs and labor intensiveness also act as deterrents, particularly for smallholder farmers. Market systems and infrastructure need to be strengthened, as most farmers rely heavily on middlemen, limiting their profits. There is a clear gap in the availability of technical support and market information for diversified crops. To support the farmers in Dinajpur and scale the crop diversification efforts, the following operational recommendations may be considered.

- **Training and Support:** More tailored training programs should be provided to equip farmers with the necessary agronomic skills and knowledge about managing diverse crops.
- **Market Linkages:** Improve market access and infrastructure, encouraging direct sales through cooperatives or e-commerce platforms to reduce reliance on middlemen and increase farmer profits.
- **Farmer Collectives:** Promoting farmer collectives would help farmers negotiate better prices and reduce transaction costs. This approach can increase their bargaining power and provide them with better access to information and markets.
- **Addressing Financial and Risk Barriers:** Introducing financial products such as crop insurance and credit facilities may mitigate the perceived financial risks of diversification. Additionally, efforts should be made to enhance the market demand for diversified crops to incentivize farmers further.



Above: Shaymol Kumar Sarkar, an idol farmer after working in his maize field, Bangladesh; Photo: CIMMYT

CROP-SPECIFIC VALUE CHAINS IN RANGPUR

The crop-specific value chains prevailing in the Rangpur district are as follows:

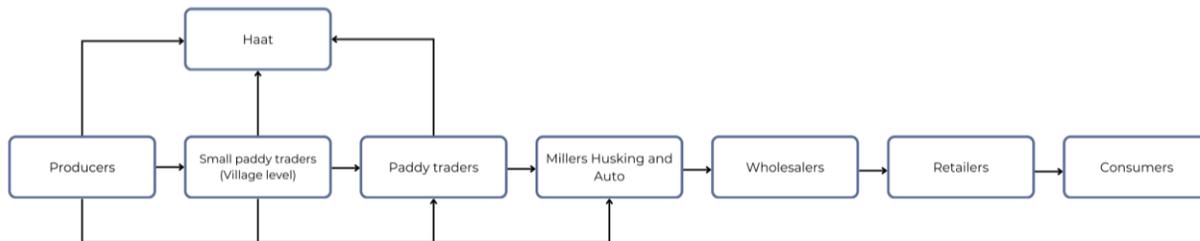


Figure 12: Rice value chain in Dinajpur

POTATO

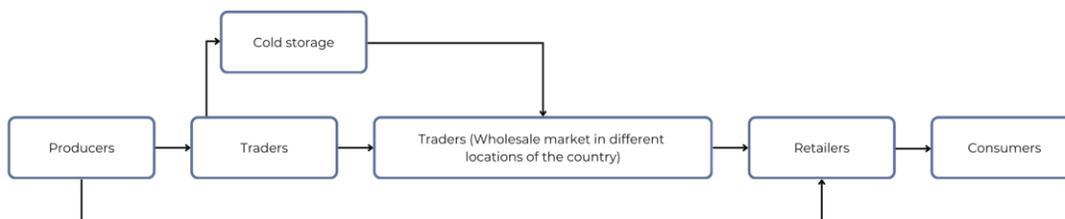


Figure 13: Potato value chain in Dinajpur

TOMATO



Figure 14: Tomato value chain in Chirirbandar and Dinajpur Sadar upazila of Dinajpur district

MAIZE

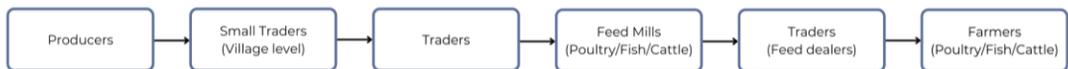


Figure 15: Maize value chain in Dinajpur

NAPA SHAK



Figure 16: Napa Shak value chain in Dinajpur

GROUND NUT

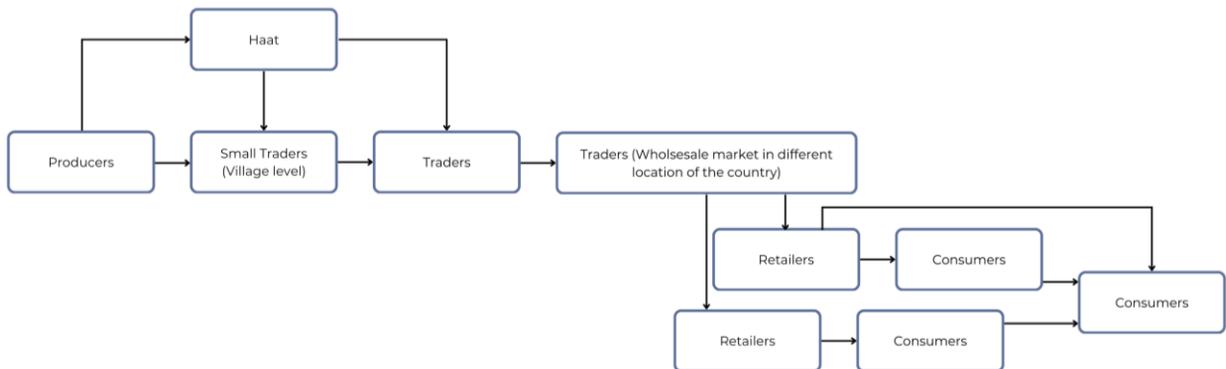


Figure 17: Groundnut value chain in Rangpur. Source: Author’s compilation based on discussion with farmers

CARROT



Figure 18: Carrot value chain in Rangpur. Source: Author’s compilation based on discussion with farmers

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Above: Field preparation for rice plantation, Bangladesh; photo: CIMMYT



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ABOUT TAFSSA

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