Post-Intervention Outcomes in Farmer's Behaviour and Crop Diversification in Chapainawabganj, Bangladesh

Research note 47
October 2024

ABOUT THIS NOTE

Crop production is predominantly rice-centric in Bangladesh and, although economically rational, is risky and arguably unsustainable (1). In response, crop diversification emerged as an important strategy for achieving sustainable agriculture in Bangladesh (2). On-farm trials evaluated new cropping patterns in the Chapainawabganj district and promoted 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 trail farmers in the Chapainawabganj district.

KEY STUDY FINDINGS

1. In Chapainawabganj district, Aman rice dominates the Kharif season, as all farmers report a strong preference for cultivating rice, leaving limited opportunity for crop diversification.
2. Wheat and mustard are popular choices during the Rabi/Boro season, while limited preferences for crops other than rice and vegetables are observed in the Aus/Kharif 1 season, reflecting constraints in diversifying away from rice-based systems.
3. Farmers view diversification positively, citing financial resilience (74.2%), enhanced food availability (73.3%), and increased income (68.3%) as primary benefits, helping mitigate risks associated with mono-cropping.
4. Knowledge gaps are significant barriers, with 49.8% lacking agronomic skills for new crops and many facing challenges in managing crop rotation and pest management, alongside limited market demand and financial risks

CIMMYT International Maize and Wheat Improvement Center
IFPRI International Food Policy Research Institute
IRRI International Rice Research Institute
IWMI International Water Management Institute
CIP International Potato Center
WorldFish
ILRI International Livestock Research Institute

5. Farmers experience substantial transaction costs associated with crop diversification, including needing specific knowledge, higher labor, and increased marketing and transportation costs due to diversified crops.
6. Farmers report moderate awareness of agricultural markets for new crops but need to gain knowledge in packaging and storage and rely heavily on intermediaries for selling produce, which reduces profitability.
7. Greater opportunity for promoting collectives that address the challenges associated with crop diversification.

BACKGROUND

On-farm research trials are part of TAFSSA's Work Package 2 (WP2) activities, focusing 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 Chapainawabganj 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 most significant 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.

OBJECTIVES

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

METHODOLOGY

Refer to Cheesman et al. (2022, 2023) (3,4) for the detailed methodology used to conduct the on-farm trial experiments. The link can be found at https://hdl.handle.net/10568/127991.

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

RESULTS

PREFERRED CROPPING PATTERNS AMONG SMALLHOLDER FARMERS TOWARD CROP DIVERSIFICATION

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 of cropping pattern selection in specific seasons—market demand and economic viability influence farmers' preferences for cropping patterns. Besides, environmental factors such as climate, soil type, water availability, and technological advancements are critical in determining suitable cropping patterns (5).

Figure 1 shows the crop preferences of farmers in Chapainawabganj during the Robi/Boro season based on responses from 208 farmers.

Wheat is the most preferred crop during the Rabi/Boro season, with 84.13% of farmers selecting it as their first choice, underscoring its importance in the district. Following wheat, 75.48% of farmers chose mustard as their second option, while 32.21% selected boro rice, highlighting these two crops as significant during this season. Other crops, such as lentils (5.29%), maize (3.85%), potato (3.85%), soybean (1.92%), onion, and chickpea, are grown at lower levels, each accounting for less than 1% of farmer preferences in Chapainawabganj. Additionally, 11.54% of farmers indicated 'NA,' suggesting either they have no second preference after wheat or that their land is unsuitable for crops other than wheat during the Rabi season.

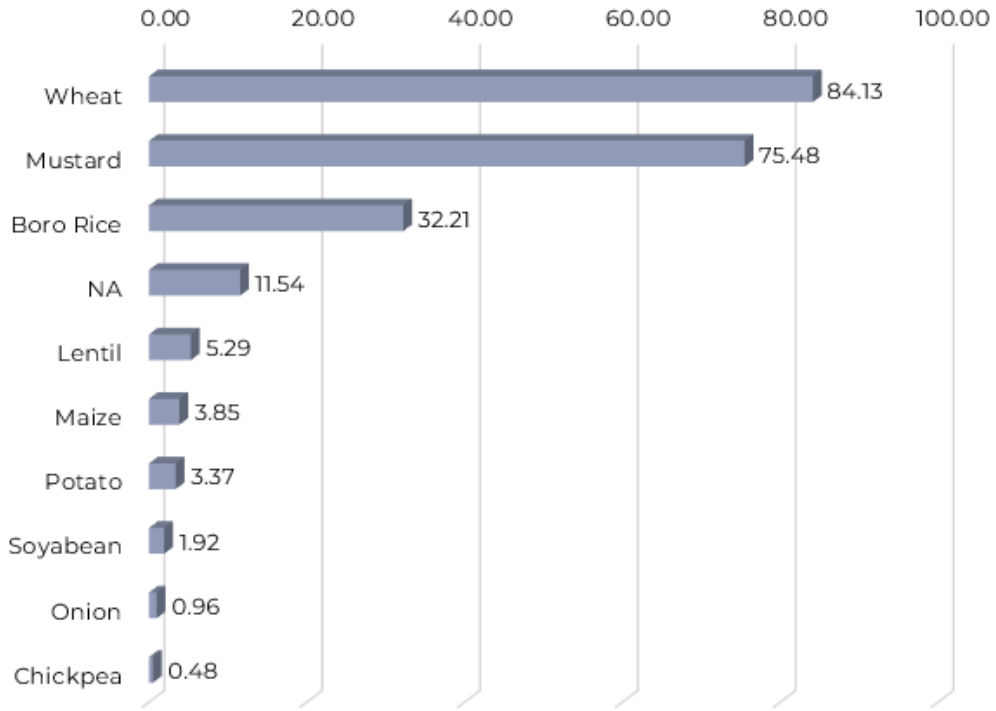

Figure 1: Farmer's crop preferences in Robi/ Boro season in Chapainawabganj (%) (Mention maximum 2 desired crops): n=208

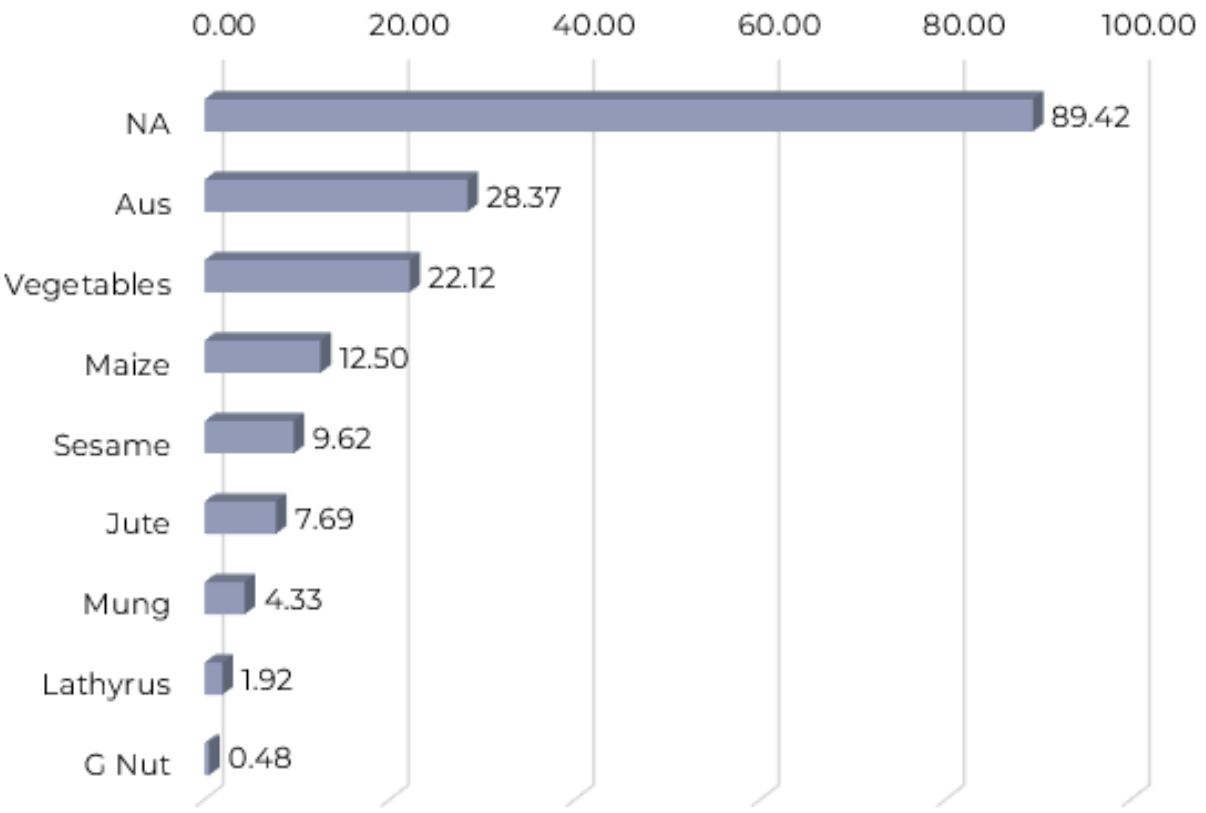

Figure 2: Farmer's crop preferences in Aus/Kharaif 1 season in Chapainawabganj (%) (Mention maximum 2 desired crops crops).n=208

Figure 2 illustrates farmers' crop preferences during the Aus/Kharif 1 season in Chapainawabganj. A large majority (89.42%) of farmers indicated 'NA' (Not Applicable), suggesting that many either leave their land fallow during the Aus season or that the land may not be suitable for the specific crops listed. Among those who did select a crop, Aus rice was the most popular choice, preferred by 28.37% of farmers. Vegetables were chosen by 22.12% of farmers, demonstrating their continued relevance across different seasons in Chapainawabganj. Smaller portions of farmers opted for other crops: 12.50% for maize, 9.62% for sesame, 7.69% for jute, 4.33% for mung beans, and 1.92% for lathyrus, indicating that some farmers diversify with a variety of crops.

Similarly, Figure 3 shows the farmer's crop preference during the Aman/Kharif 2 season. All the farmers (100%) indicated Aman rice as the most critical crop as the first option during the Aman/Kharif 2 season in Chapainawabganj. A large percentage (97.60%) did not specify a crop and chose "NA," which means they don't prefer any crops during this season other than Aman rice. Besides, 10.58% of farmers opted for vegetables, indicating very limited diversification in crop selection during this season in Chapainawabganj.

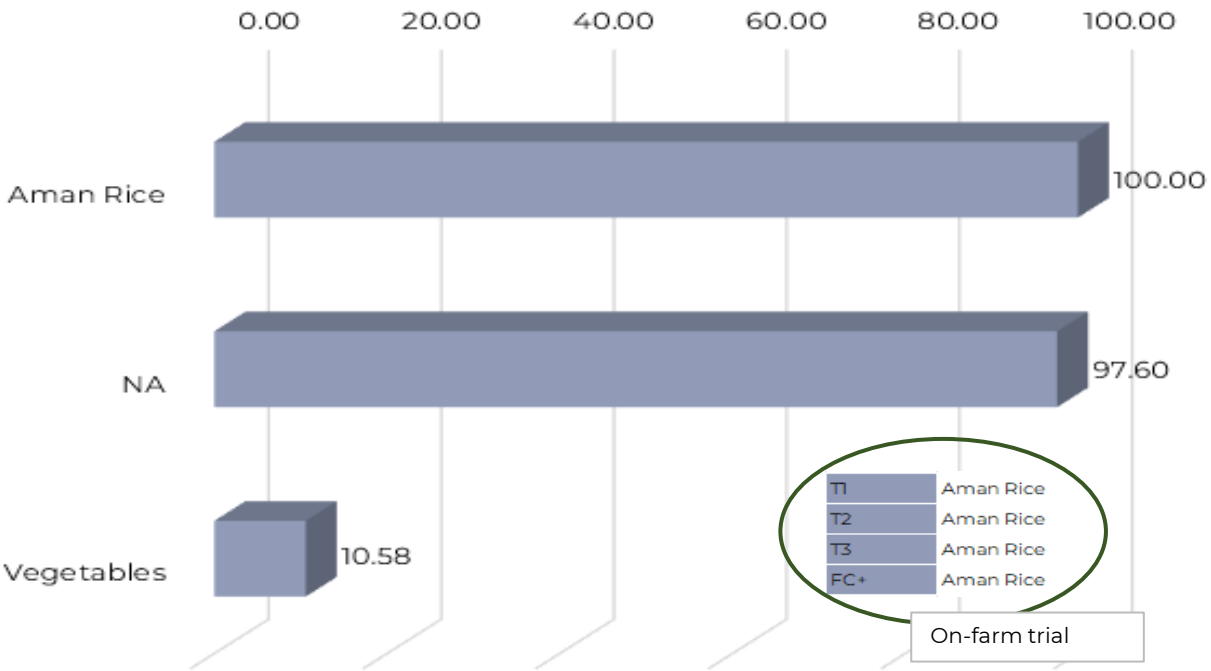

Figure 3: Farmer's crop preferences in Aman/ kharaif 2 season/Rainy season in Chapainawabganj (%) (Mention maximum 2 desired crops). N=208.

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 Chapainawabganj, based on responses from 208 farmers as shown in Figure 4. Aman rice has the highest preference across all treatments, indicating that it is the most widely preferred crop. While the second option, indicated as NA (Not applicable), is seen across all treatments, it slightly varies. NA refers to farmers not interested in a second crop besides Aman rice in Aman season or their land is unsuitable for other crops listed due to high rainfall. The preference for Vegetables remains low across all treatments. This suggests that Aman rice remains the dominant crop choice, while many farmers either do not specify a preference or choose no crop preference.

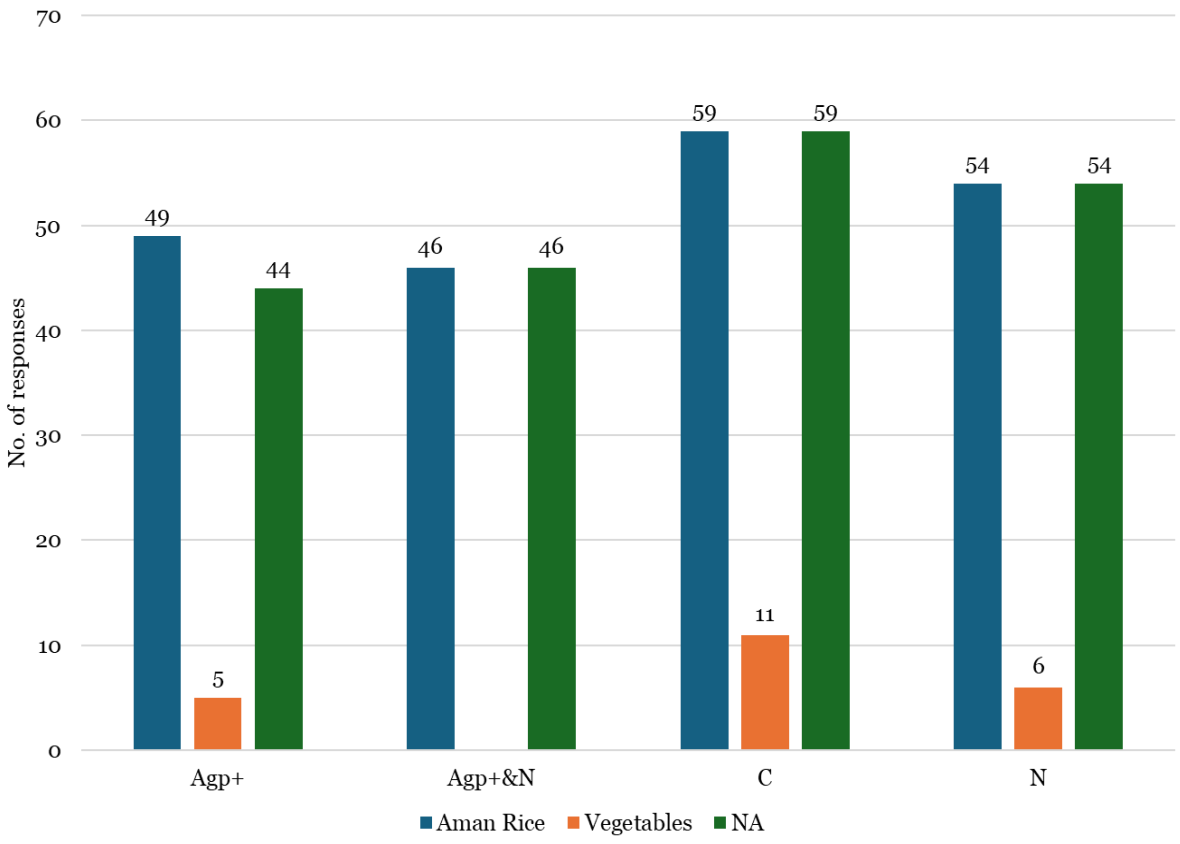

Figure 4: Farmer's crop preferences across treatments during Aman seasons in Chapainawabganj (n=208)

During Kharif 1, there was 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 and indicates no specific crop preference due to the land left fallow or not suitable for growing particular crops listed, with the highest responses in C (58), followed by N (51), AgP+ (41), and AgP+N (36). Aus is the most preferred crop, particularly in the N and C treatments. Conversely, AgP+N (5) treatments have the least preference, while AgP+ (6) preference. Less preference in treatments AgP+ and AgP+N could be due to their preference for other crops. Interestingly, in C, the response rate is relatively high (39).

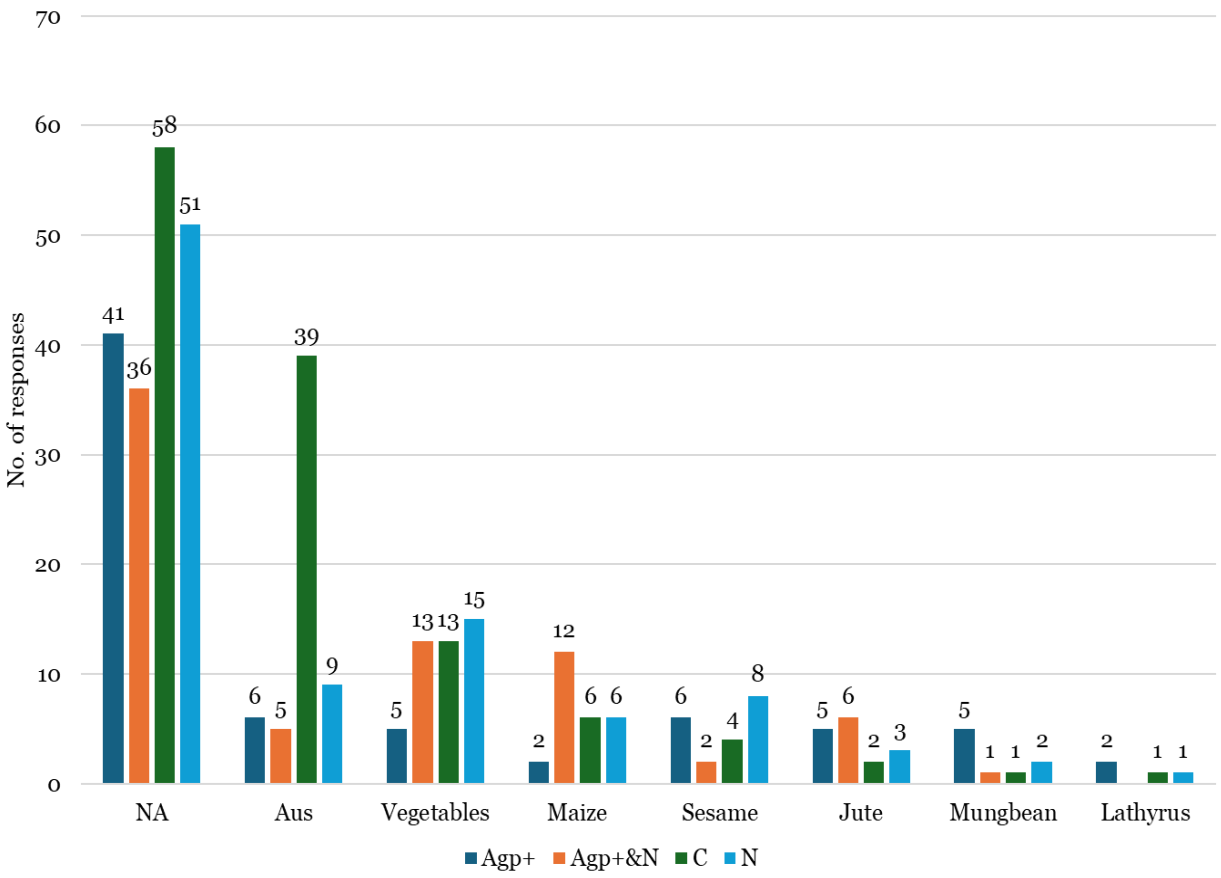

Figure 5: Farmer's crop preferences across treatments during Aus/Kharaif 1 season in Chapainawabganj (n=208)

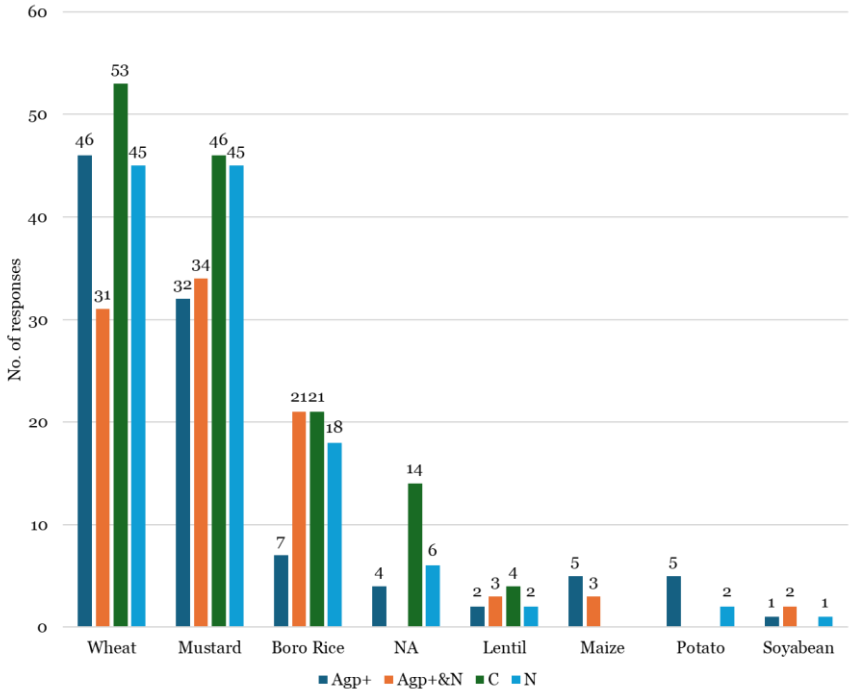

Figure 6: Farmer's crop preferences across treatments during Robi/ Boro season in Chapainawabganj (n=208)

Similarly, during the Robi/boro season, as shown in Figure 6, wheat is the most preferred crop, particularly in the AgP+ and C treatments. Mustard is also preferred, particularly in the C and N treatment, followed by Agp+ and Agp+N.

FARMER'S PERCEIVED BENEFITS OF PRACTICING CROP DIVERSIFICATION IN CHAPAINAWABGANJ

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 critical approach to sustainable agriculture, offering numerous benefits, including enhanced agricultural resilience, improved farmer incomes, and improved food security (7,8).

In the current research on farm trials, farmers were asked about the benefits they experienced after adopting crop diversification on their farms. Figure 7 provides a descriptive analysis of farmers' perceptions of the benefits of crop diversification as identified by farmers in the Chapainawabganj district of Bangladesh. The highest rate of responses from farmers (74.2%) indicated that crop diversification allows diversified income streams, reducing their dependency on a single crop and thereby enhancing financial resilience; 73.3% of farmers reported crop diversification enhances diverse food availability for home consumption.

This suggests that the primary perceived benefit is having multiple income streams that build resilience against the risks, particularly market risk. This supports the literature that farm production diversity has a positive association with dietary diversity and diverse income throughout the year (9). Additionally, 68.3% of respondents believed crop diversification leads to increased revenue, particularly on small landholdings, indicating that farmers see economic potential in diversifying their crops.

Around 35.0% agreed that crop diversification helps in reducing risks such as mitigating crop failure, pest outbreaks, or price falls, 26.3% of farmers mentioned that crop diversification improves soil health and fertility. Further, 19.2% of farmers also noted that it helps reduce the cost of production, suggesting a potential for more efficient farming practices. However, only 3.8% of respondents recognized its role in conserving natural resources, such as soil, water, and fauna, indicating that environmental benefits are less commonly associated with crop diversification among the surveyed farmers. Economic gains are prioritized over environmental benefits. Studies have shown that crop diversification enhances income streams (7), food security (10), nutritional benefits (11), and soil health improvements (12).

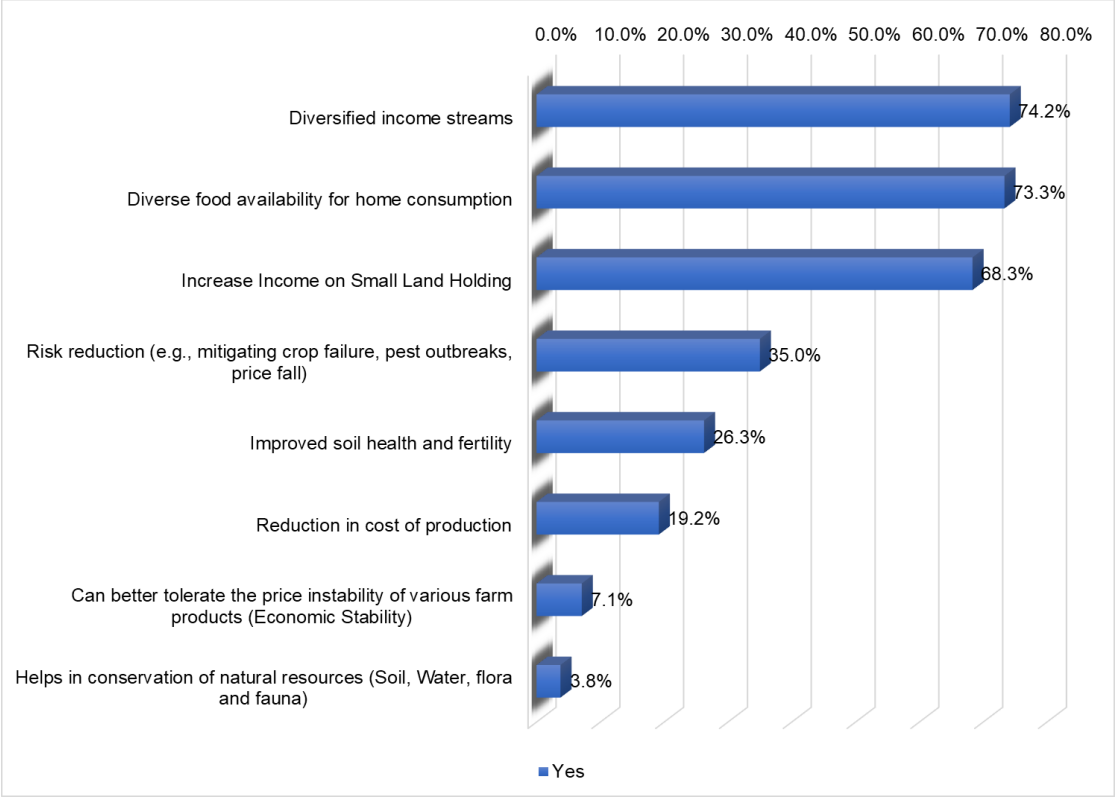

Figure 7: Farmer's perceived benefits of practicing crop diversification in Chapainawabganj (n=240)

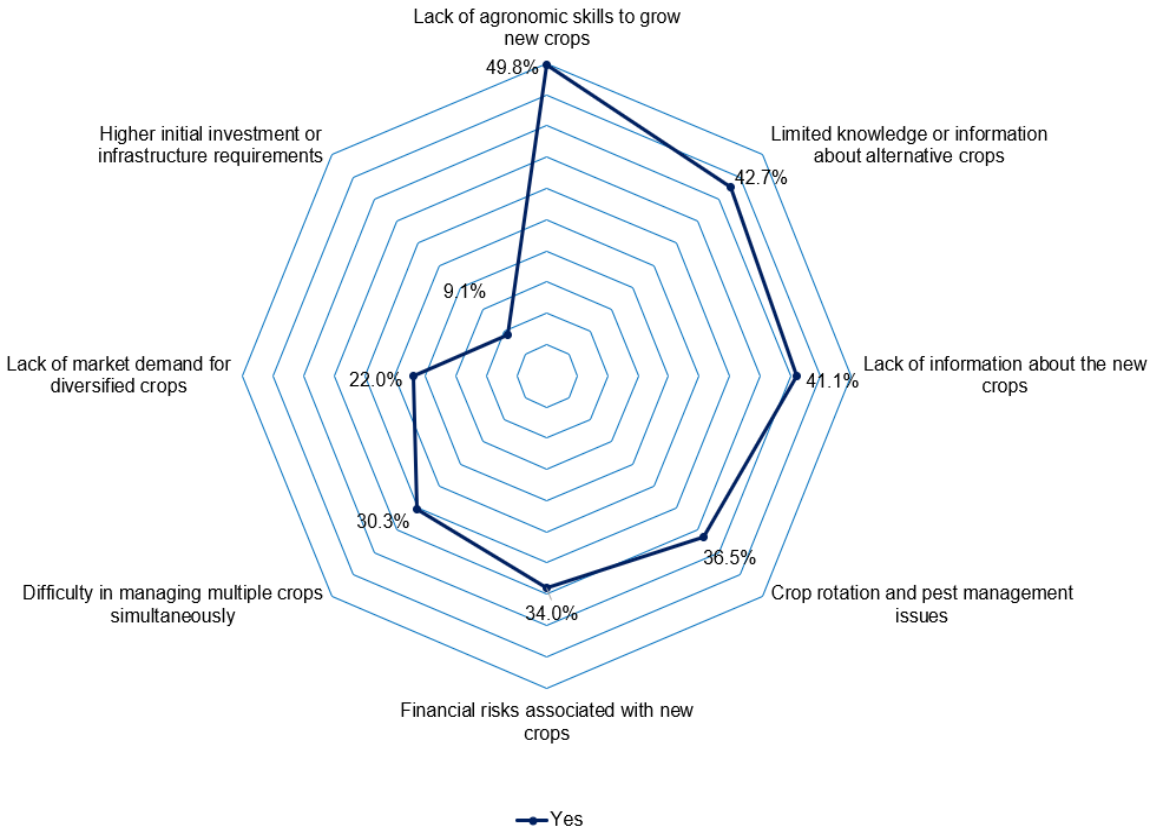

Figure 8: Farmer's perceived challenges of practicing and continuing crop diversification (n=241)

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.

The most significant challenge, reported by 49.8% of farmers, is the need for agronomic skills to grow new crops. This is closely followed by limited knowledge or information about alternative crops (42.7%) and a lack of specific details about new crops (41.1%), indicating a substantial knowledge gap in adopting diversified cropping Practices. Issues related to crop rotation and pest management (36.5%) and financial risks associated with new crops (34%) also pose considerable challenges. Additionally, farmers report difficulty managing multiple crops simultaneously (30.3%) and a lack of market demand for diversified crops (22.0%) as further barriers. The least concerning factor appears to be the higher initial investment or infrastructure requirements, noted by only 9.1% of farmers.

The primary challenges revolve around knowledge, skills, and risk management, with fewer concerns about market demand and investment costs.

Farmers are traditionally familiar with growing rice, and the challenges of growing new crops are the reality. Studies have shown that farmers need access to information about crop diversification techniques in Bangladesh. This knowledge gap can hinder their decision-making about transitioning to diversified systems (10,12). 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 (10). Therefore, there is a need for coordinated efforts to address the challenges of promoting and scaling up crop diversification in the Chapainawabganj district.

Above: A vendor selling vegetables; photo: CIMMYT

PERCEIVED TRANSACTION COSTS ASSOCIATED WITH CROP DIVERSIFICATION AMONG SMALLHOLDER FARMERS

Transaction costs play a significant role in determining the feasibility and success of crop diversification among smallholder farmers. These include expenses related to access to assets (e.g., land, machinery) and market participation. Farmers may face higher transaction costs if they need more information about market prices or limited access to financial resources (13,14). Approximately 88.5% of farms in Bangladesh are less than 1 hectare (ha), collectively occupying 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 (15).

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 small farmland (16). Cultivating several crops in a small piece of land may lead to higher transaction costs due to various crops needing different agronomic practices at different crop cycles, different inputs, different marketplaces, and preparation of fields 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 (17). The current study tried to understand perceived transaction costs associated with crop diversification among smallholder farmers in Chapainawabganj.

Above: A cabbage vegetable market; photo: CIMMYT

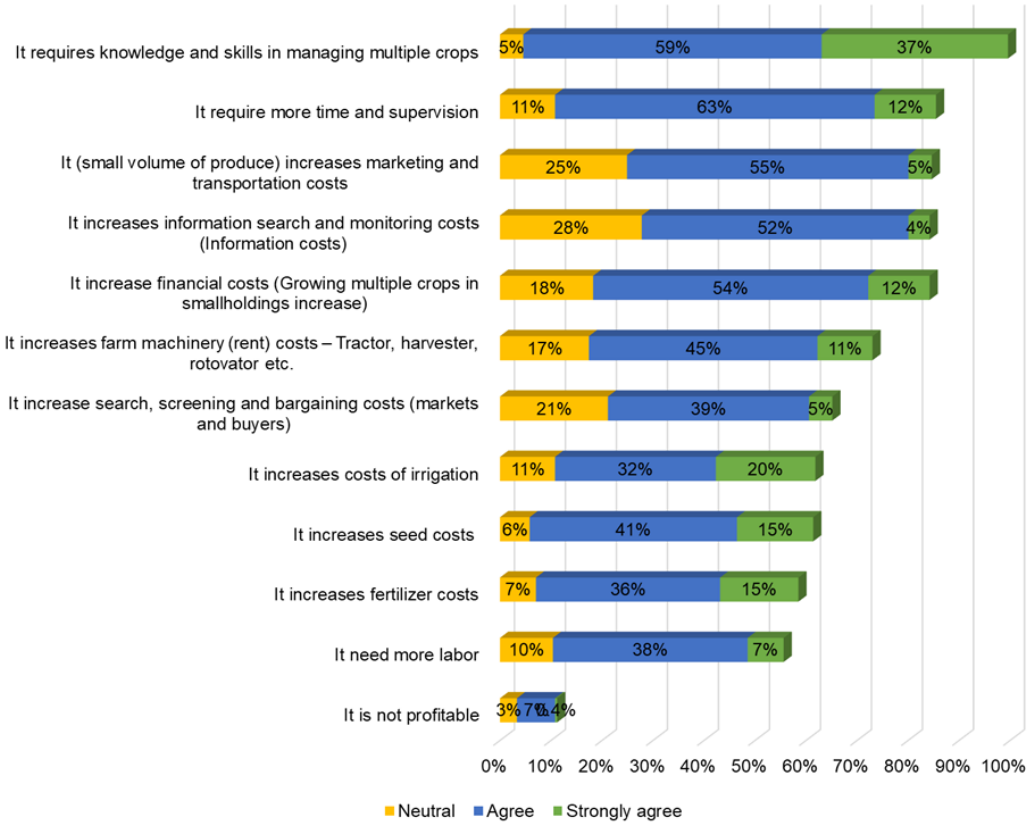

Figure 9: farmers perceived transaction costs associated with crop diversification (n=241). Note: Responses 1 to 5 scale (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5 strongly agree).

Figure 9 shows the responses of on-farm trial farmers to transaction cost-related statements associated with crop diversification. The most notable statement, as acknowledged by 59% who agree and 37% who strongly agree, is the requirement for knowledge and skills to manage multiple crops effectively. Additionally, 63% agree and 12% strongly agree that diversification demands more time and supervision, indicating the substantial labor and management commitment required. Marketing and transportation costs are perceived as high due to the small volume of diversified produce, with 55% agreeing and 5% strongly agreeing. Information costs, including the need for additional search and monitoring, are also seen as a burden, with 52% agreeing and 4% strongly agreeing. Financial costs for growing multiple crops on smallholdings, such as expenses for farm machinery, irrigation, seeds, and fertilizers, are moderately acknowledged, with agreement levels between 36% and 54%. Although labor requirements and profitability concerns exist, they are less prominent, with only 7% strongly agreeing that diversification requires more labor and 3% strongly agreeing that it is unprofitable. This suggests that while knowledge, time, and marketing costs are significant concerns for farmers, they do not overwhelmingly view crop diversification as unprofitable or overly labor-intensive.

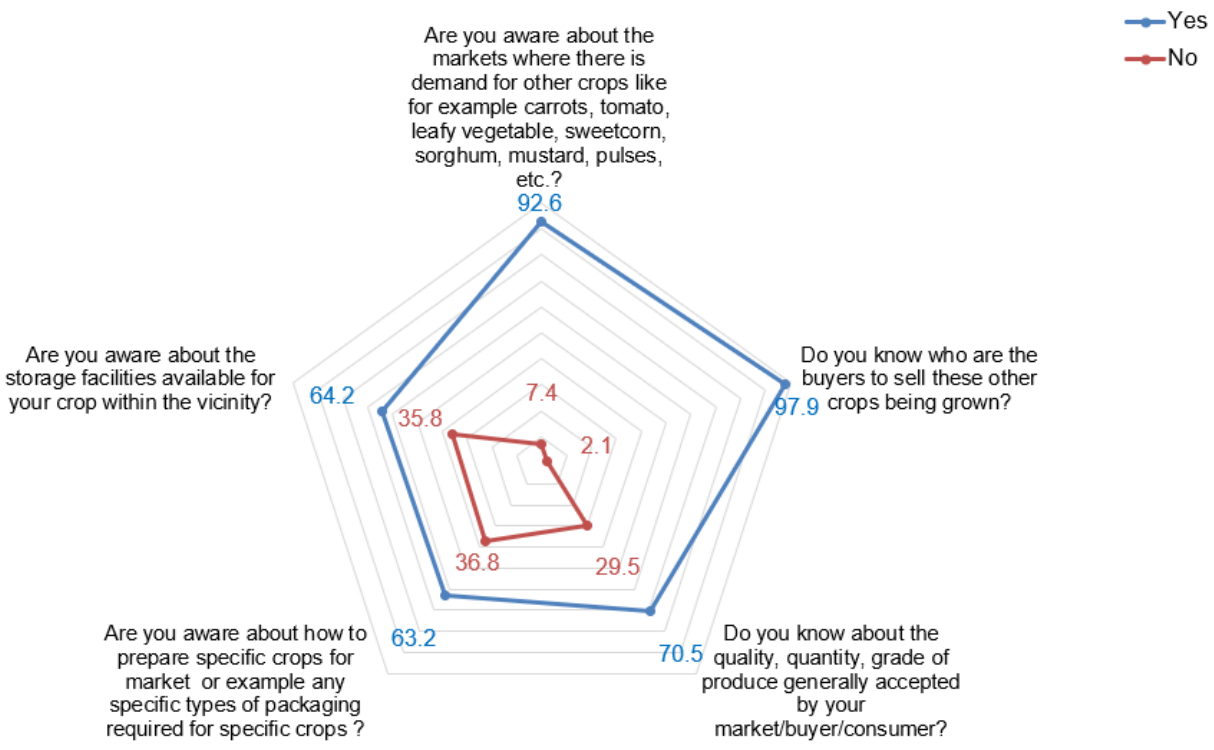

Figure 10: Farmers' awareness (%) about the marketing of new crops (n=95: Agp+ and Agp+N).

UNDERSTANDING FARMERS' AWARENESS OF AGRICULTURAL MARKET FACILITIES IN CHAPAINAWABGANJ

Bangladesh's farmers need help marketing farm produce, mainly fruits and vegetables, despite being relatively well-informed about rice marketing. The primary issues are inadequate market infrastructure and a lack of support systems for the recently cultivated newer crops (18). The survey responses from on-farm trials growing vegetables highlight their marketing challenges with these new crops. Their responses are shown in Figure 10.

Farmers exhibit relatively high awareness in several areas. For example, 97.9% of farmers know whom to sell these crops to, and awareness of market dem and for various crops like carrots, tomatoes, leafy vegetables, and others, with 92.6% indicating familiarity with these markets. Farmers are also fairly knowledgeable about the quality, quantity, and grade standards their markets require, with 70.5% awareness.

However, there needs to be more awareness. While 64.2% of farmers know about storage facilities in the vicinity, only 63.2% know the specific preparations or packaging requirements for certain crops.

This suggests moderate familiarity with post-harvest processes. The lowest level of awareness is found in the understanding of storage and preparation for market requirements, showing that although farmers are well-connected to markets and buyers, they may need more nuanced information on packaging and handling needed to optimize crop marketing.

MARKETING CHANNELS USED BY FARMERS TO SELL THEIR PRODUCE

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 (19,20). However, every year, a Significant amount of harvested produce is wasted due to seasonal gluts and a need for proper marketing networks (20). 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 (21). The post-harvest losses and the price realization for farmers vary across marketing channels (22). Therefore, understanding the specific market channel farmers are using is very important.

Figure 11 shows the marketing channels farmers use for different crops. For Aman, most farmers (100%) sell to wholesalers or intermediaries, while 67% use local farmers' markets.

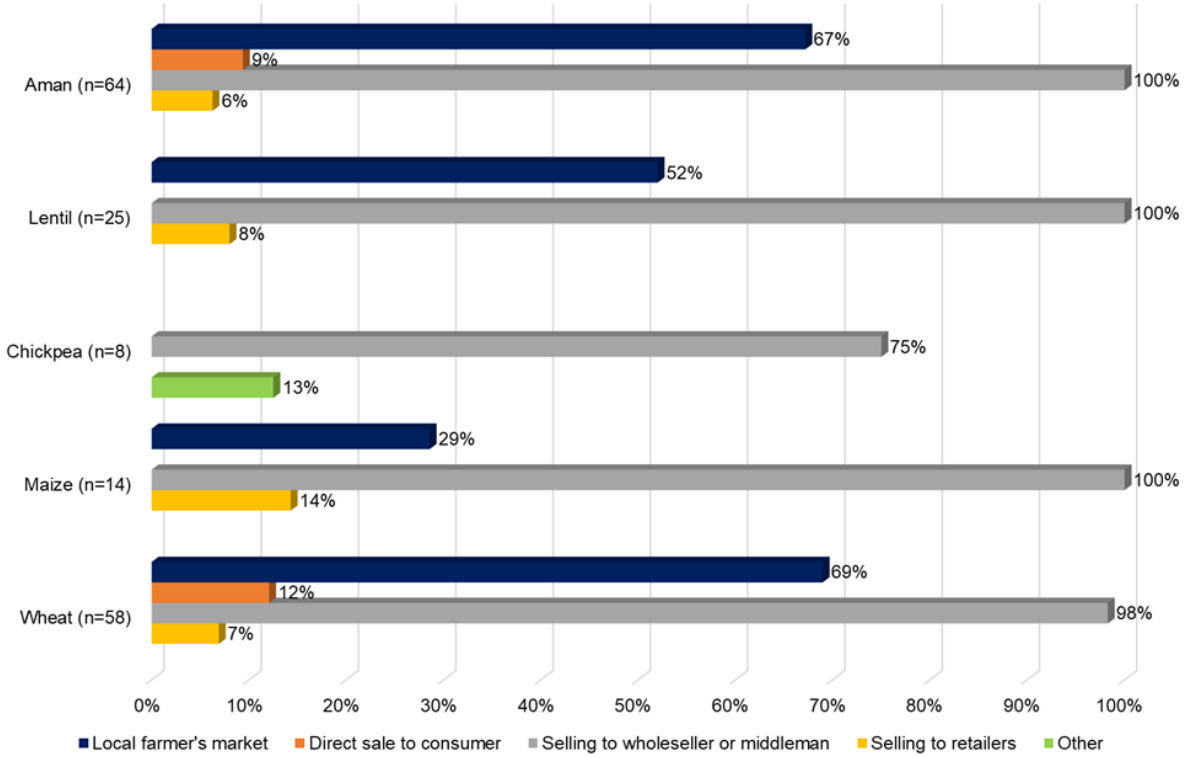

Figure 11: Various marketing channels used by on-farm trial farmers (Agp+) to sell their crops

Lentil farmers also primarily sell to wholesalers (100%), with 52% using farmers' markets. For chickpeas, 75% is sold to wholesalers, with 13% directed to retailers, indicating some diversification in marketing channels. Maize also shows reliance on wholesalers (100%) but has a minor portion (14%) sold to retailers. Wheat has a similar trend, with 98% sold through wholesalers, 69% through local markets, and smaller proportions to direct consumers (12%) and retailers (7%).

The data suggests that most farmers primarily depend on wholesalers or intermediaries to sell their crops, with some variation in local markets and direct sales, particularly for crops like wheat and chickpea. Direct access to retailers and consumers remains limited, reflecting a dependency on intermediaries for market access. Online platforms and other channels are less commonly used across all 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 (varies with the type of crop). Middlemen, including merchants and retailers, capture a substantial portion of the profits, often leaving farmers with minimal returns after covering their production costs (23).

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 (23).

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 to promote farmers' collectives. Such initiatives potentially empower farmers to negotiate better prices and reduce reliance on middlemen and the cost of production. 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 (24,25). The results of this study reveal that 94 percent of the farmers mentioned they are not members of any farmer collectives, such as cooperatives, self-help groups, or producer organizations.

However, 97 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.

Additionally, all the farmers reported that they plan to continue with crop diversification. Of the 128 farmers surveyed (Agp+ and Agp+N groups), 75 percent consult primarily on neighbors and friends, while 70 percent depend on their own experience to assess market demand for specific agricultural products. Interestingly, only 15 percent of these farmers seek advice from agricultural extension officers for market information. The least dependence on extension personnel may be their availability and technical competency.

Moreover, 90 percent of the 128 farmers (Agp+ and Agp+N) expressed a desire to attend workshops or training sessions focused on the marketing of diversified farm produce. Specifically, 80 percent are looking for help with price information, whereas 69 percent are seeking additional support in connecting with potential buyers and 35 percent need guidance on understanding the quality requirements of potential buyers.

CONCLUSIONS AND RECOMMENDATIONS

The research note highlights that while farmers in Chapainawabganj recognize the potential of crop diversification for economic and food security benefits, numerous challenges hinder widespread adoption. Challenges include limited technical knowledge, high transaction costs, and market infrastructure constraints, which collectively make diversification a less attractive option compared to rice cultivation. Addressing these challenges could aid in scaling up crop diversification efforts and contributing to sustainable agricultural practices. The following operational recommendations may be considered.

- Align crop diversification efforts with farmers' seasonal preferences. Aman/Kharif 2 season has the least scope to promote diversification due to enabling climate conditions.
- Develop extensive training programs on agronomic skills and market information to bridge the knowledge gaps. Focus on technical skills, such as crop rotation, pest management, and market-readiness, to empower farmers in diversifying crops successfully.
- Encourage the formation of farmer groups or cooperatives to increase bargaining power, reduce dependency on intermediaries, and improve access to markets, thereby lowering transaction costs and facilitating better price realization.
- Invest in improving local market infrastructure and promoting direct sales channels, such as e-commerce and institutional buyers, to enhance farmers' access to markets, especially for perishable crops, and reduce reliance on middlemen.
- Provide accessible credit options and incentives for diversifying into high-value crops like fruits and vegetables. Government or NGO support for machinery, seeds, and inputs can also help farmers manage the initial costs of diversification.

ANNEXURE I

CROP-SPECIFIC VALUE CHAINS IN CHAPAINAWABGANJ

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

RICE

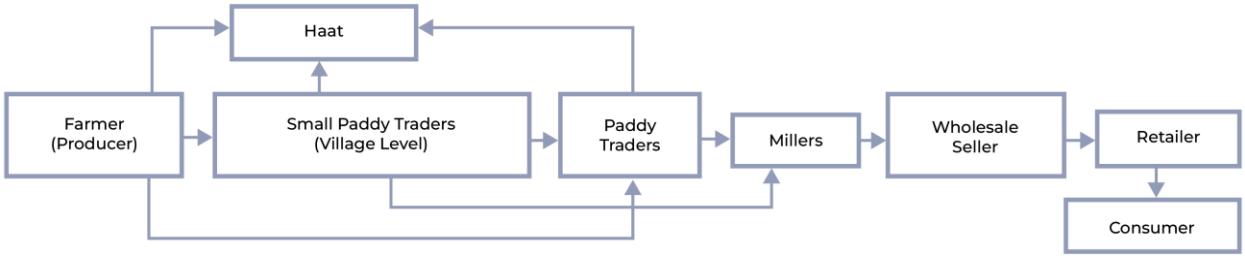

Figure 12: Rice value chain in Chapainawabganj. Note: The auto rice mills collect paddy directly from farmers through collection points, eliminating middlemen.

LENTIL/ CHICKPEA

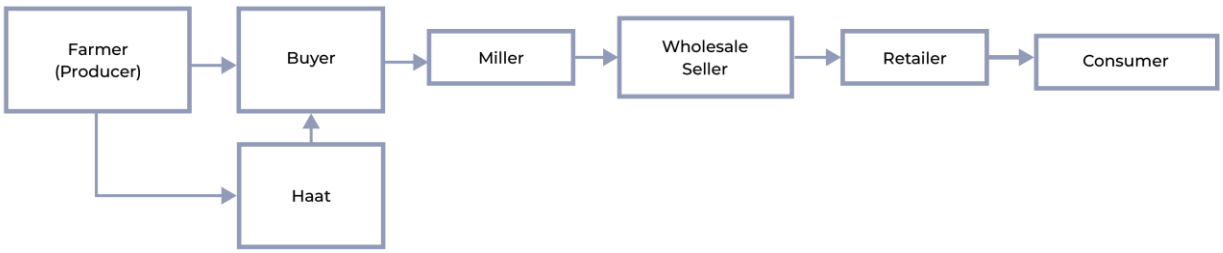

Figure 13: Lentil/Chickpea value chain in Chapainawabganj. Note: Local buyers collect the lentil/Chickpea from the farm gate. Some farmers sell in the local haat if they get better price.

WHEAT/MUSTARD

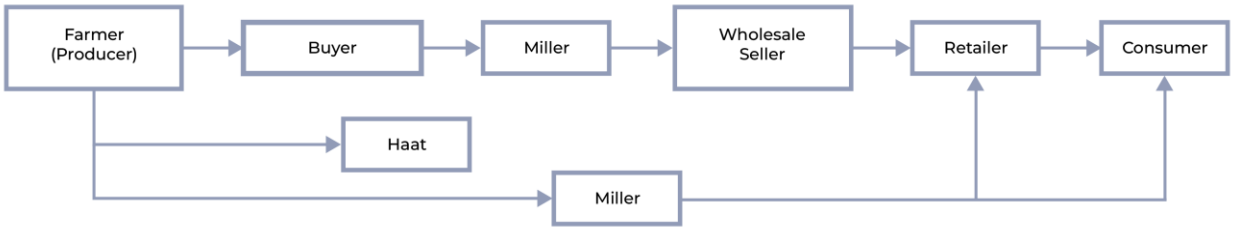

Figure 14: Wheat value chain in Chapainawabganj. Note: The local buyers collect the mustard and wheat from the farm gates after drying. Some farmers sell in the local market (haat) if they get a better price. Besides, some local millers collect the mustard and wheat from the farm gates and sell them to local consumers and retailers after milling.

MAIZE

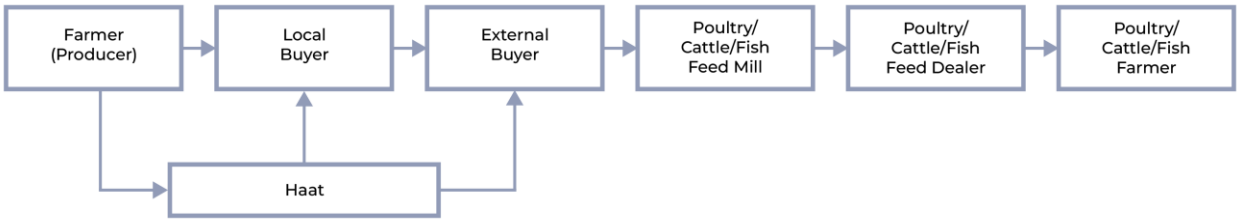

Figure 15: Maize value chain in Chapainawabganj.

COWPEA/SORGHUM

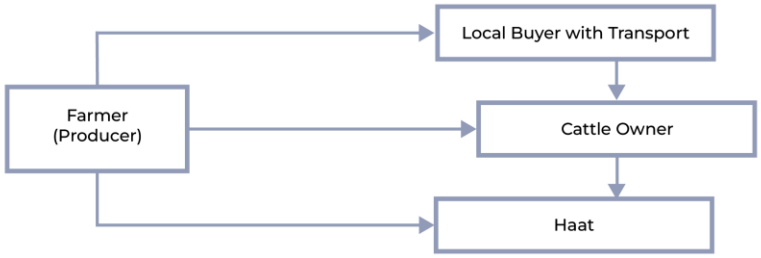

Figure 16: Cowpea/Sorghum value chain in Chapainawabganj.

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Above: A farmer tending to a young crop field; photo: CIMMYT

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ABOUT TAFSSA

TAFSSA (*Transforming Agrifood Systems in South Asia)* is a CGIAR Regional Integrated Initiative to support actions that improve equitable access to sustainable healthy diets, improve farmers' livelihoods and resilience, and conserve land, air, and water resources in South Asia.

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