Hybrid Seed Adoption and Farmers' Perceptions of Traditional Seed Varieties in Northwestern Bangladesh

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ABSTRACT

Hybrid seeds are widely promoted to enhance agricultural productivity, yet their rapid diffusion has raised concerns about the erosion of traditional seed diversity and long-term agro-biodiversity in smallholder farming systems. This study examined hybrid seed adoption, farmer motivations, institutional support, and perceived implications for traditional seed use in northwestern Bangladesh. Primary data were collected through a structured survey of 100 farmers across five districts through a structured survey and analyzed using descriptive statistics, correlation, and regression analysis.Results indicate that 63–64% of farmers adopted hybrid seeds mainly for higher yield and increase income, rice was the most preferred hybrid crop (28.74%), followed by maize (9.58%), okra (7.78%), and potato (7.18%). Hybrid cultivation was associated with higher input intensity, as 42% of farmers applied increased levels of irrigation and fertilizers, while 59% reported severe pest and disease problems. Institutional support was limited, with 78% of respondents receiving no formal training on hybrid seed cultivation and only 8% accessing advice from agricultural extension services. In contrast, 48% of farmers considered traditional varieties more climate-resilient, compared to 27% for hybrids, reflecting their adaptability, lower input requirements, and cultural food preferences. The findings reveal a clear productivity–resilience trade-off, where hybrid seeds offer short-term yield advantages while traditional varieties contribute to agro-biodiversity conservation and climate adaptability. The results suggest the coexistence of dual seed systems shaped by economic incentives and institutional constraints. Future research should employ broader studies and evaluate biodiversity and policy interventions to better understand long term sustainability outcomes.

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1. Introduction

Seed production is fundamental to agricultural development and plays a critical role in ensuring food security, generating rural income, and promoting national economic growth. The availability and use of quality seeds are essential for achieving sustainable productivity and enhancing the resilience of farming systems (Louwaars&Manicad, 2022). Beyond their productive function, seeds serve as an important mechanism for technology transfer and constitute a vital component of agrobiodiversity conservation (Louwaars& De Boef, 2012).

Agrobiodiversity refers to the variety and variability of plants, animals, microorganisms, and genetic resources that are directly or indirectly used in agriculture and food production systems (Food and Agriculture Organization [FAO], 2019). It encompasses the diversity of crop species, varieties, farming practices, and associated ecosystems that support agricultural productivity, environmental sustainability, and resilience to biotic and abiotic stresses. The conservation of agrobiodiversity is increasingly recognized as essential for ensuring long-term food security under changing climatic and socio-economic conditions.

Traditional crop varieties represent valuable genetic resources, possessing traits such as resistance to pests and diseases, tolerance to drought and flooding, and adaptation to diverse agroecological conditions (Lazaridi et al., 2024). In Bangladesh, these varieties have been cultivated for centuries and form an integral part of the country's agricultural heritage (Hosan et al., 1970). A notable example is Rayada, a deep-water rice ecotype characterized by exceptional submergence tolerance (Bin Rahman & Zhang, 2013). These farmer-managed seed systems are typically based on seed saving, exchange, and local adaptation, enabling farming communities to maintain a diverse portfolio of crop varieties suited to varying environmental conditions and cultural preferences.

In contrast, hybrid seeds are developed by crossing genetically distinct parental lines to produce offspring with enhanced yield potential, uniformity, and other desirable agronomic traits (Chakrabarty et al., 2025). In Bangladesh, hybrid seeds have demonstrated yield advantages of approximately 15–20% over traditional varieties (Mottaleb et al., 2025). Consequently, farmers have increasingly adopted hybrid seeds, primarily driven by the pursuit of higher yields, improved market opportunities, and policy support.

The expansion of hybrid seeds has significantly transformed traditional seed systems. Historically, farmers relied on locally adapted varieties and

informal seed networks based on seed saving, exchange, and community-level management. However, hybrid seeds generally require farmers to purchase new seeds each growing season because the desirable characteristics of first-generation hybrids are not reliably maintained in subsequent generations. This shift has gradually increased farmers' dependence on formal seed systems, commercial seed suppliers, and external agricultural inputs. In Bangladesh, the adoption of hybrid rice accelerated during the 1990s, facilitated by government initiatives, technologies released by the Bangladesh Rice Research Institute (BRRI), and collaborations with the International Rice Research Institute (IRRI) (Mottaleb et al., 2015a). Between 1998 and 2010, a total of 75 hybrid rice varieties were approved for cultivation, including 60 originating from China, five from India, one from the Philippines , four developed by BRRI, and five introduced by private companies (Spielman et al., 2012a). Although initial adoption remained limited, with approximately 1% of farmers using hybrid seeds during the early stages (Azinu, 2014), hybrid rice expanded to cover around 6.8% of the total rice cultivation area in Bangladesh by 2010 (Spielman et al., 2012b).

While the expansion of hybrid seeds has contributed to increased agricultural productivity, it has also generated concerns regarding the decline of traditional seed systems and the erosion of agrobiodiversity. The widespread replacement of traditional varieties with a limited number of commercially available hybrids can reduce on-farm genetic diversity and increase the vulnerability of agricultural systems to pests, diseases, climate variability, and market disruptions (Foysal et al., 2021). Furthermore, reliance on hybrid seeds is often associated with increased dependence on external inputs, including fertilizers and pesticides, higher seed costs, and reduced farmer autonomy over seed management (Macharia et al., 2010). Similar concerns have been reported in neighboring countries, where dependence on imported hybrid seeds has raised issues related to production costs, local seed sovereignty, and genetic erosion (Bist et al., 2025).

Farmers perception is important in the choice of seed selection and conservation of traditional crop varieties(Edilegnaw Wale, 2017). Although Hybrid seeds are popular for their higher yield potential and market demand.Many farmers still prefer traditional varieties for their better taste, adaptation to local conditions, lower input needs and the possibility to save seeds for the next season. However, the replacement of traditional varieties is often driven by factors such as increasing market competition, government support and availability of commercial hybrid seed(Bist et al., 2025).These perceptions are important for explaining the seed choice behaviour of farmers and assessing for the impact of hybrid seed adoption on the conservation of agrobiodiversity.

Previous studies indicate that hybrid seed adoption is influenced by factors such as farm size, access to credit, market integration, and rural infrastructure (Mottaleb et al., 2015b). Although it is widely recognized that hybrid adoption may contribute to declining varietal diversity, much of the existing literature relies on theoretical assumptions or indirect evidence rather than localized empirical investigations. Studies such as Pautasso et al. (2013) have highlighted the biodiversity risks associated with varietal replacement; however, the direct relationship between hybrid seed adoption and measurable agrobiodiversity loss remains insufficiently explored, particularly at regional scales.

To address this research gap, the present study integrates farmer survey data, seed inventory assessments, and spatial analysis to examine the decline of traditional seed varieties and its relationship with hybrid seed adoption in northwestern Bangladesh, specifically in the districts of Joypurhat, Naogaon, Natore, Pabna, and Rajshahi. By providing empirical evidence from a major agricultural region, this study contributes to a better understanding of how seed system transformation influences agrobiodiversity and farmers' seed management practices and to analyze the correlation between farmers' socio-economic perceptions (e.g., yield preferences, market pressure) and the calculated agrobiodiversity scores (H') and know the varietal richness and diversity.

The findings of this research are expected to support the achievement of the United Nations Sustainable Development Goals (SDGs), particularly SDG 2.4 and SDG 2.5. By identifying pathways to balance productivity gains from hybrid seeds with the conservation of traditional varieties, the study contributes to SDG 2.4, which aims to ensure sustainable food production systems and promote resilient agricultural practices that maintain ecosystems and strengthen adaptation to climate change. Furthermore, by documenting the status and decline of traditional seed varieties and highlighting the importance of conserving locally adapted genetic resources, the study directly supports SDG 2.5, which focuses on maintaining the genetic diversity of seeds, cultivated plants, and farmed animals. Ultimately, the research seeks to inform evidence-based policies and interventions that foster both agricultural productivity and the long-term conservation of Bangladesh's agricultural biodiversity.

2. Methodology

2.1. Study Area

This study was conducted in the districts of Joypurhat, Naogaon, Natore, Pabna and Rajshahi in northwestern Bangladesh. The five districts were selected because they represent major agricultural production zones of northwestern

Bangladesh where both hybrid and traditional varieties coexist, allowing assessment of varietal replacement and agrobiodiversity change.

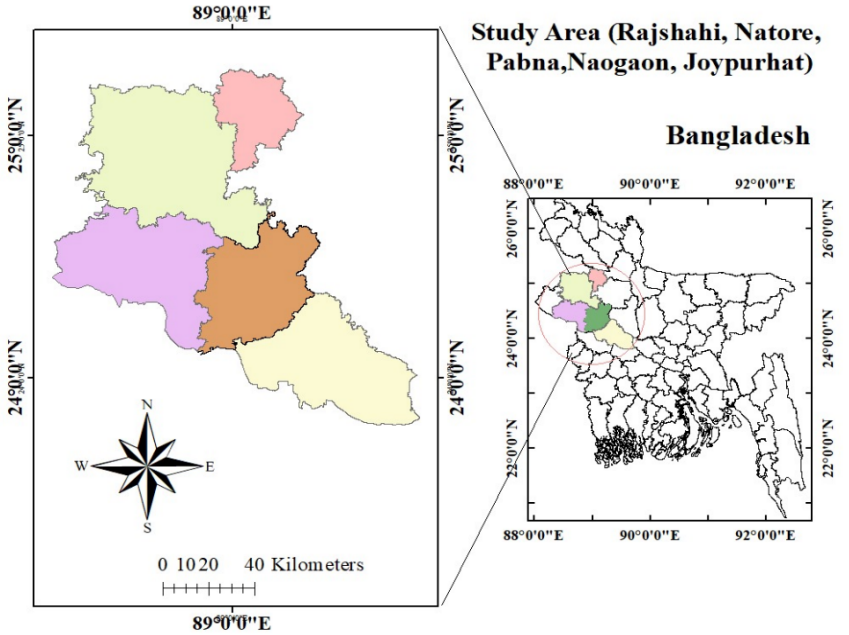

Figure 1. Map of Study Area

2.2. Research framework

This study applied a mixed-methods approach to assess the impact of hybrid seed adoption on agrobiodiversity.

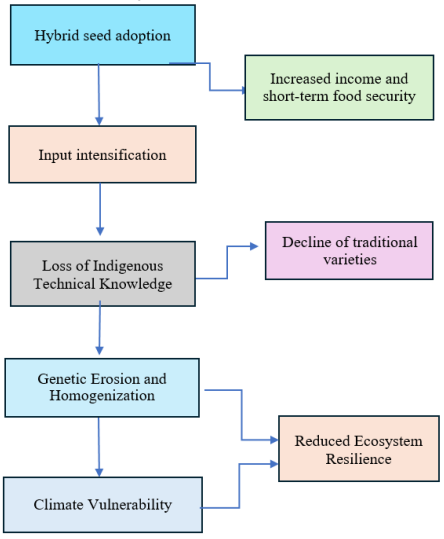

Figure 2. Social-Ecological Framework of Hybridization Risk

2.3. Sampling Procedure

A multistage sampling procedure was used in this study. Initially, five districts of northwestern Bangladesh—Rajshahi, Naogaon, Natore, Pabna, and Joypurhat—were purposively selected due to the widespread cultivation of hybrid crops and the continued existence of traditional crop varieties in these areas.

In the second stage, a total of 40 villages were selected from the study districts with the assistance of local agricultural extension personnel. The selected villages represented different levels of hybrid seed adoption and farming practices.

The respondents were chosen to capture a broad range of farming experiences and perceptions regarding hybrid seed adoption and its implications for agro-biodiversity.

2.4. Sample size

100 farmers were randomly selected from village clusters for face-to-face interviews. The sample size was considered suitable given the exploratory nature of the study and logistical limitations of time.

2.5. Data Collection and Quality Control

• Collection period:

Primary data were collected between 10 July and 10 August 2025 during the monsoon crop season.

• Questionnaire survey:

The questionnaire was reviewed by three agricultural research experts and pre-tested with 15 farmers outside the study sample. Necessary modifications were made based on respondent feedback.

• Focus Group Discussions (FGDs):

Five FGDs were conducted, one in each district, involving 10–15 participants including farmers, extension officers, and local agricultural experts. Discussions were audio-recorded, field notes were taken, and thematic summaries were prepared for analysis.

2.6. Data analysis

Data were analyzed using SPSS for statistical analysis and ArcGIS (version 10.8) for spatial mapping. Pearson correlation analysis was used to examine relationships among key variables, while the chi-square test was applied to assess associations between categorical socio-economic and institutional factors.

2.7. Potential Sources of Bias

The study considered potential sources of bias that could influence the findings. Recall bias may have occurred because respondents relied on memory when reporting past farming practices and seed-use histories. Perception bias may also have affected responses regarding the benefits and risks of hybrid seed adoption. To minimize these biases, cross-checking questions were incorporated into the survey, and survey findings were triangulated with FGD results and information obtained from local agricultural extension personnel

2.8. Ethical Consideration

Participants were clearly informed about the objectives of the study. Assurance was provided that the collected information would be used solely for research purposes and that all personal information would be kept confidential. Throughout the data collection process, participants were appreciated for their time and valuable opinions, and they were encouraged to express their views freely. Standard ethical principles for conducting research with farmers were strictly maintained to ensure trust, transparency, and fairness in the study.

3. Result and Discussion

3.1. Farmers' perceptions of yield performance in hybrid and traditional varieties

The pie chart (Figure 1) shows that most farmers preferred hybrid seeds mainly for their higher yield performance, while a smaller group favored traditional varieties for their superior taste. A few respondents expressed no specific preference. The yield advantage was the most influential factor, and taste preference ranked lowest in relative importance (R), indicating that productivity remains the key driver in farmers' seed selection decisions. Sensory attributes such as taste and grain quality tend to play a secondary role in varietal adoption when yield performance and productivity gains are prioritized by farmers (Ghimire et al., 2015). Although many farmers believe hybrids have superior appearance and aroma compared to traditional varieties, only a small proportion feel that their taste is better than that of traditional types (Spielman et al., 2021). Yield is prioritized over taste and quality by farmers, limiting the understanding of comprehensive adoption factors. The effects of hybrids on taste, quality, and farmer preferences alongside productivity should be explored in future studies.

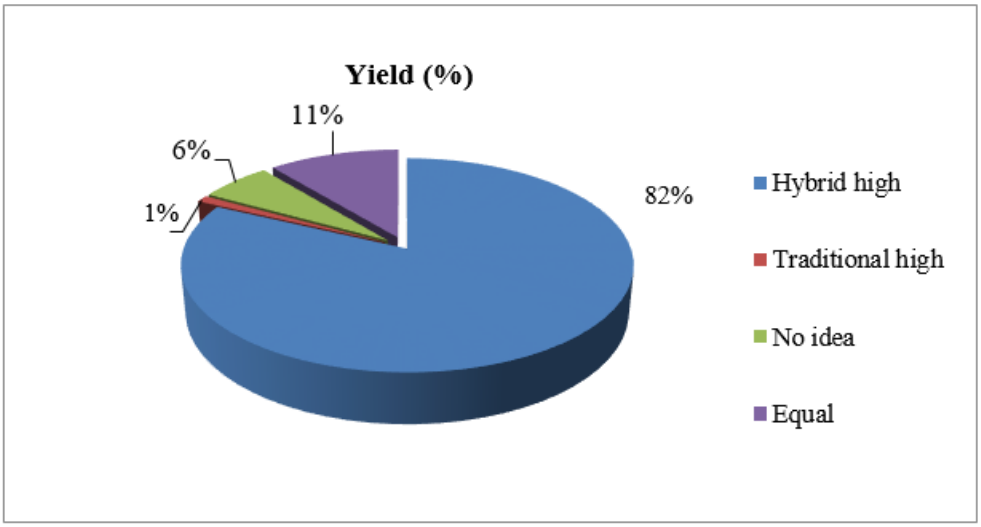

Figure 3. Yield comparison of hybrid and traditional varieties

3.2. Suitable seeds for adverse climatic condition

When selecting seeds for challenging climates, a majority of farmers (45%) favored hybrids due to their higher yield and resilience (Figure 2). Conversely, a significant 34% chose traditional seeds, valuing their minimal input requirements. This observation contrasts with other research that indicated a much larger adoption rate (exceeding 65%) of specific climate-resilient modern varieties in coastal regions (Nayak et al., 2022). This implies that local conditions play a crucial role in these decisions. Moreover, while the data reveals only 11% of farmers employing a mixed approach, numerous studies suggest that in regions with high agrobiodiversity, over 40% of farmers frequently utilize different seed varieties (Pautasso et al., 2013).A declining tendency toward varietal diversification may reduce the resilience of local seed systems and increase vulnerability to climatic and environmental shocks (Hampton et al., 2016).This indicates that the area we investigated may be drifting away from diverse agricultural practices. This study is limited because it focuses on just one area and relies on survey data, which may not include all factors affecting seed choice. The low adoption of mixed and climate-resilient varieties points to a gap in understanding how farmers make decisions. Future research should include studies from multiple locations over time. It should also consider environmental, socio-economic, and market factors to better explain seed selection patterns.

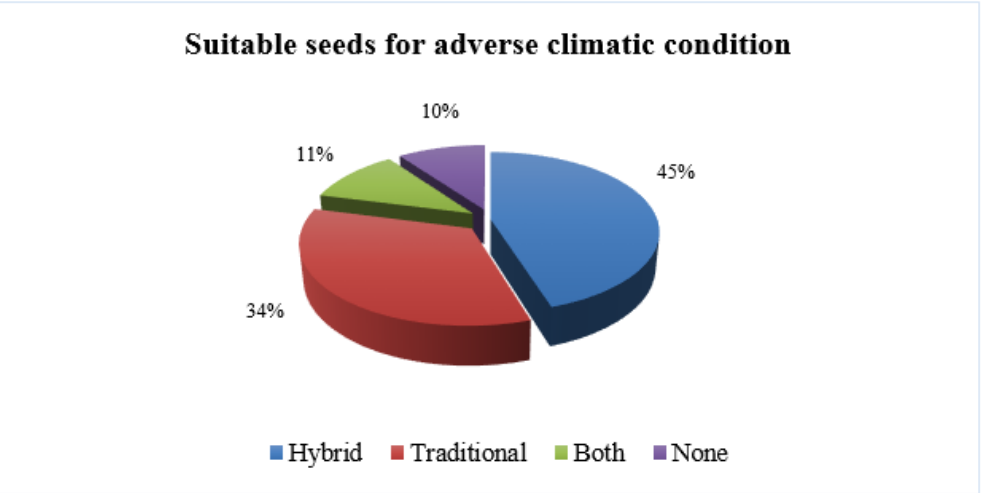

Figure 4. Suitable seeds for adverse climatic condition

3.3. Age, Educational Qualification, Experience in agriculture field

The analysis of correlation (Table 1) indicated a negative correlation between Age and Educational Qualification ($r = -0.337$). Notably, we did not find a significant correlation between Education and Agricultural Experience ($r = -0.185$, $p=0.065$). This finding differs from another study that reported a significant positive correlation ($r = 0.28$, $p < 0.01$) between education levels and the effectiveness of adopting agricultural technology in China (Wang et al., 2020).The findings reveal no such relationship in this context, implying that the local socio-economic factors may obstruct the usual positive association between education and efficient farm management, potentially due to a lack of relevant agricultural training within formal education. In many smallholder systems, agricultural experience is primarily accumulated through hands-on practice and intergenerational knowledge transfer rather than through formal education pathways (Lazaridi et al., 2024). The study relies on correlations, which don't capture the socio-economic or institutional factors that influence education and farming experience. The lack of a significant connection points to a gap in understanding why education does not enhance farm management in the area. Future research should use a mix of methods, including multivariate and qualitative approaches, to investigate barriers like limited agricultural training and socio-economic challenges.

Table 1. Age, Educational Qualification, Experience in agriculture field

Correlations				
		Age	Educational Qualification	Experience in agriculture field
Age	Pearson Correlation	1	-.337**	.568**
	Sig. (2-tailed)		.001	.000
	N	100	100	100
Educational Qualification	Pearson Correlation	-.337**	1	-.185
	Sig. (2-tailed)	.001		.065
	N	100	100	100
Experience in agriculture field	Pearson Correlation	.568**	-.185	1
	Sig. (2-tailed)	.000	.065	
	N	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

a. Predictors: (Constant), Experience in agriculture field, Age

b. Dependent Variable: Land size

3.4. Association of age, farming experience, and land size

A regression analysis indicated no significant correlation between the size of land and the age of farmers (B=0.011, p=0.222) or their agricultural experience (B=0.002, p=0.857), with the model accounting for merely 2.7% of the variance (R^2=0.027). This is in contrast to other research, which demonstrated that hybrid adopters had larger farms (1.22 ha compared to 0.39 ha, p<0.01) (Mottaleb et al., 2015). Additional studies have also revealed a positive association between age and farm size (β=0.15, p<0.05) (Yan et al., 2022). The findings suggest that land access in Northwestern Bangladesh is influenced more by structural factors than by the demographics of the farmers. Structural and institutional arrangements, including land tenure and inheritance systems, often play a more decisive role in determining landholding size than farmers' age or experience (Louwaars&Manicad, 2022). It misses structural and institutional factors that might better explain landholding patterns. The absence of significant relationships, which contradicts studies that show links between farm size, age, and technology adoption, highlights a gap in understanding why demographics do not affect land access in this context. Future research should include variables such as land tenure systems, inheritance practices, and socio-economic constraints. It should also use broader, multi-regional models to identify the structural drivers that shape land distribution.

Table 2. Regression analysis age, experience and land size

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.163[a]	.027	.007	.64226332

a. Predictors: (Constant), Experience in agriculture field, Age

b. Dependent Variable: Land size

Model		Sum of Squares	do	Mean Square	F	Sig.
1	Regression	1.094	2	.547	1.327	.270[b]
	Residual	40.013	97	.413		
	Total	41.107	99			

a. Dependent Variable: Land size

b. Predictors: (Constant), Experience in agriculture field, Age

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.163	.335		.486	.628
	Age	.011	.009	.150	1.230	.222
	Experience in agriculture field	.002	.010	.022	.180	.857

a. Dependent Variable: Land size

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.4398650	.8772346	.6905020	.10514039	100
Residual	-.69278079	2.50166082	.00000000	.63574271	100
Std. Predicted Value	-2.384	1.776	.000	1.000	100
Std. Residual	-1.079	3.895	.000	.990	100

a. Dependent Variable: Land size

3.5. Received training and the location

The table shows that 78% of farmers had received no formal training in hybrid seed cultivation, indicating a major gap in capacity building. Among those trained, Agricultural Extension Officers or unspecified organizations were the most common sources (8%), while BRRI (2%), BADC (2%), AIS (1%), and internet platforms (1%) were less frequent. These results highlight the limited reach of formal training and the need to strengthen extension services and knowledge dissemination, practical, hands-on knowledge transfer can often be more influential than formal training in improving farmers' adoption of hybrid seeds (Chakrabarty et al., 2025). Nonetheless, previous studies reveled that knowledge rather than formal training may be the key driver of adoption, suggesting that improving farmers' practical understanding of hybrid seed cultivation is as important as expanding formal training programs (Sarma et al., 2022). Farmers reported that the majority of them had not received any formal training on hybrid seed cultivation, revealing a substantial weakness in current capacity development efforts. The limited involvement of key institutions such as BRRI, BADC, and AIS further highlights the need for more structured and accessible training opportunities.

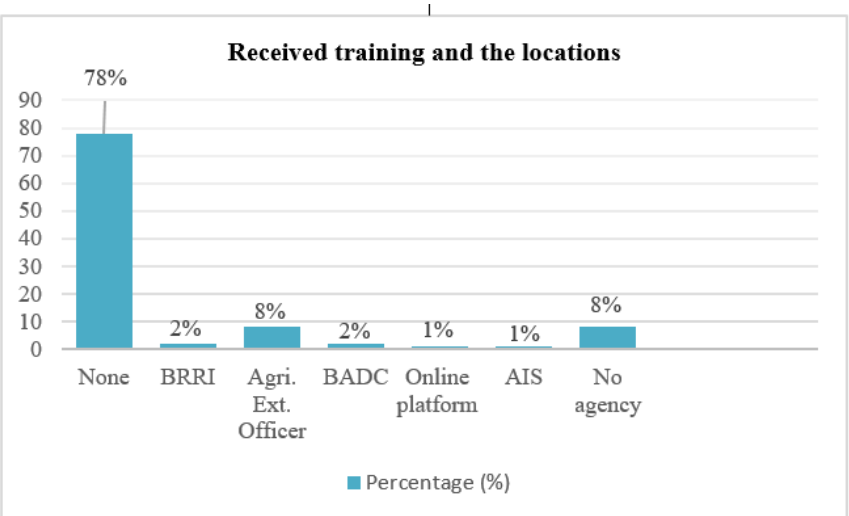

Figure 5. The location of training

3.6. Factors of hybrid seed for the conservation of agrobiodiversity

The study shows that 64% of farmers choose hybrid seeds mainly for higher yield. Food security accounts for 13.6%, while disease resistance plays a role for 11.2%. Other reasons include increased food production at 6.4%, harvesting benefits at 2.4%, food demand conservation at 1.6%, and suitable conditions at 0.8%. These findings emphasize that productivity drives adoption more than ecological or

conservation concerns. Yield is the primary motivator for hybrid seed adoption, often outweighing other factors such as ecological benefits or disease resistance (Bist et al., 2025). In contrast, various studies highlight more diverse reasons for adoption. Several studies found that only 42% of farmers in Nepal adopted hybrids primarily for yield (Ghimire et al., 2015). Disease resistance influenced 21%, nearly double the 11.2% we observed. Similarly, several studies reported that food security concerns motivated 35-40% of adopters in India and the Philippines, which is much higher than our 13.6%. This suggests that farmers in areas with greater food insecurity depend on hybrids for stability(Pandey, 2010). Environmental factors also vary significantly. These differences indicate that farmers in the study area focus on short-term yield benefits, while farmers in other regions consider broader risks, ecology, and food security. Improving extension support may help connect hybrid adoption with agro-biodiversity conservation goals. Farmers reported that they adopt hybrid seeds mainly for higher yield, placing productivity above other considerations. Their limited mention of factors such as food security, disease resistance, and environmental suitability suggests a narrow understanding of the broader agronomic and sustainability benefits of hybrid seed use.

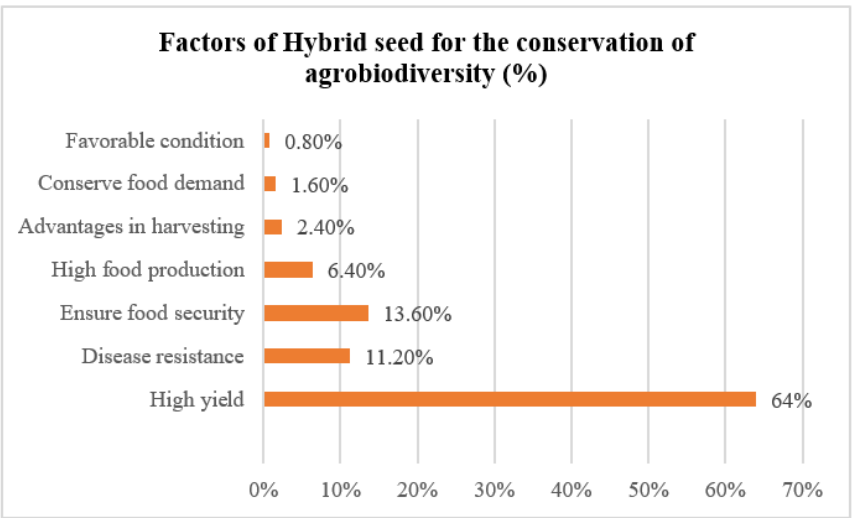

Figure 6. Factors of Hybrid seed for the conservation of agrobiodiversity

3.7. Climate-friendly varieties

The findings indicate that farmers perceive traditional varieties as significantly more climate-friendly, with 48% supporting this view, compared to only 27% for hybrids. This stands in stark contrast to studies conducted in areas with robust breeding initiatives. Few studies demonstrated that certain enhanced alfalfa hybrids retained up to 90% of their biomass yield even under extreme

water restrictions, surpassing traditional varieties(Molero et al., 2019). Hybrid varieties developed through breeding often show better drought tolerance and stable yields (Louwaars&Manicad, 2022). Furthermore, previous studies also highlighted that advancements in breeding for climate resilience have resulted in varieties that can achieve yields 20-30% higher under drought conditions compared to local cultivars in select temperate regions (Hampton et al., 2016). The predominant preference for traditional seeds observed in our study area underscores a notable limitation of hybrid varieties available in Bangladesh, which have yet to convincingly demonstrate improved climate adaptability to farmers. The statement that natural disasters rapidly harm hybrid seeds. In a similar vein, the finding that hybrids need more pesticides may differ depending on the area and farming methods, resulting in an inadequate evaluation of their environmental impact. Furthermore, a thorough understanding of the environmental effects of hybrid seed farming is limited because the study does not completely assess long term ecological effect such as soil health and fertility.

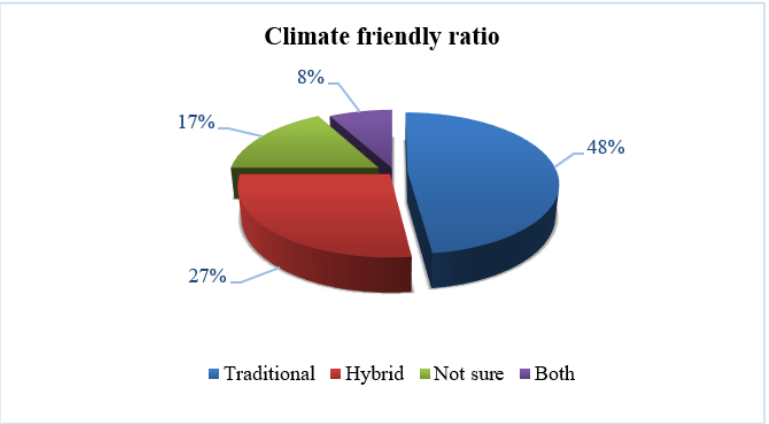

Figure 7. Climate friendly ratio between traditional and hybrid

3.8. Effect in food culture and crop diversity for hybrid seed on age

This study shows that the prevalent belief of "high yield but inferior taste" was common across all age demographics. This perspective contradicts findings suggesting a significant generational shift in preferences. For instance, A study noted that in African contexts, younger farmers frequently drove the adoption of new hybrid seeds, resulting in a 40% quicker turnover rate of varieties in communities with strong youth participation(Sperling & Mcguire, 2010). Generational differences in adoption may be influenced by access to information and exposure to new varieties (Louwaars&Manicad, 2022). Our data does not reveal a distinct generational gap. Instead, the shared acknowledgment of the taste compromise indicates that cultural and culinary values persist as a strong,

unifying concern that transcends age groups, serving as a more effective barrier to the full acceptance of hybrids than previously observed in other regions. The primary downside is that it is based on participant views rather than actual taste testing, so assertions that hybrids taste worse could be the result of cultural preference or subjective bias. For more trustworthy findings, empirical taste assessments should be used in future studies.

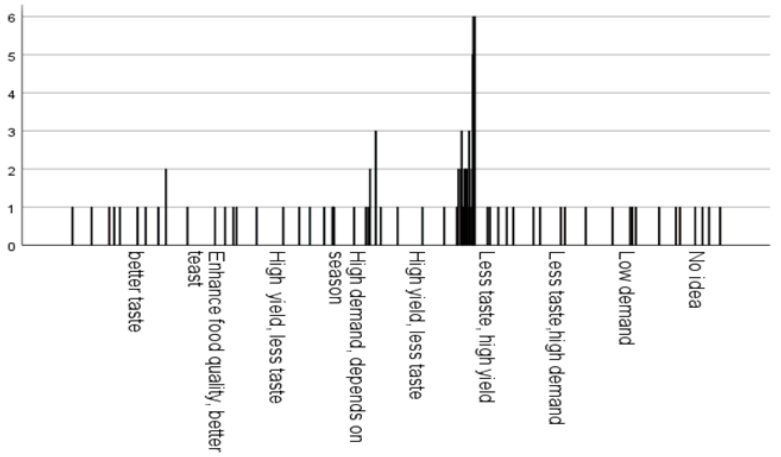

Figure 8. Effect in food culture and crop diversity for hybrid seed on age

Table 3:Case Processing Summary

Valid		Missing %		Total		
	N		Percent	N	%	
Effect in food culture and crop diversity for hybrid seed * Age	100	49.0%	104	51.0%	204	100.0%

3.9. Disease and Pest problem for hybrid seed in study area

A majority of farmers, 59%, reported encountering significant issues with pests and diseases related to hybrid seeds. The major pest of crop varieties like rice yellow stem borer, brown planthopper, rice hispa, cutworm, aphids etc are responsible for crop loss. Besides these, major diseases like rice blast, BLB, wheat blast, jute stem rot, late blight of potato, powdery mildew etc. are majorly harmful for crops which are also responsible for maximum crop loss. This elevated level of biotic stress presents a far more negative outlook than indicated in other studies. Previous study revealed that while pest pressures existed, farmers cultivating high-yielding varieties in certain regions of Bangladesh

reported that effective pesticide application reduced perceived crop losses to below 20%(Ali et al., 2020). Limited training in integrated pest management can exacerbate pest problems in hybrid cultivation (Louwaars& De Boef, 2012). The serious challenges highlighted by our farmers, with 59% experiencing high problems compared to the managed losses of under 20% reported elsewhere, emphasizes that the difficulty lies not only with hybrid technology itself but also with a combination of highly susceptible varieties available in our study area and a critical deficiency in training for integrated pest management, resulting in uncontrolled infestations. The reliance on farmer self-reports in a specific region, possible perception bias, and variations from other studies that restrict direct comparisons limit research findings on pest and disease issues in hybrid seeds. Firm judgments about causality cannot be drawn from observational data highlights the importance of conducting empirical research.

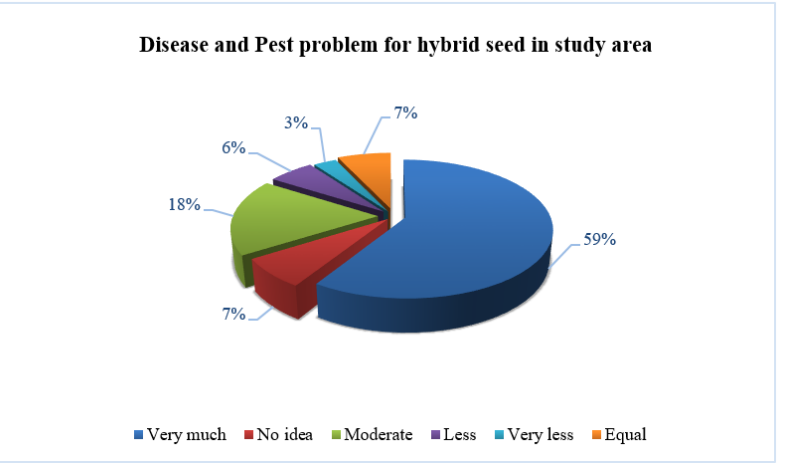

Figure 9. Disease and Pest problem for hybrid seed in study area

4. Conclusion

This study focused on the perceptions of farmers towards hybrid seeds and traditional varieties in the areas of inputs, crop preferences, training, institutional support, adoption and constraints in productivity, climate adaptability and pest or disease incidence. The majority of the farmers (63-64%) adopted hybrid seeds mainly for higher yields and income, with rice as the most preferred hybrid crop. However adoption was not uniform as 78% of the farmers did not receive training and 59% identified pest and disease susceptibility as a major hindrance and mostly are pest and disease resistant along with drought and saline tolerant varieties. Traditional seeds were more climate adaptable (48%) than hybrids (27%), which is consistent with the continued reliance on conventional varieties for resilience, lower input requirements and cultural food traditions.

Overall, the findings indicated that while hybrid seeds play an important role in improving agricultural productivity and farm income, traditional seed varieties are still crucial for climate resilience, local adaptation and the conservation of agricultural biodiversity. The sustainable and resilient agricultural future in Bangladesh requires balanced adoption of improved hybrid seeds and conservation of traditional seed varieties through increased awareness of farmers, active community participation, supportive policies and effective seed management practices.

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