Journal of Plant Biota

Original Research Article
ISSN: 3048-4863
Journal homepage: https://plant.researchfloor.org/

# Farmers' Characteristics and Constraints in T-aman Rice Cultivation in Bangladesh

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## Abstract

*Transplanted Aman (T-aman) rice remains integral to household food access and livelihood resilience in northern Bangladesh, yet its production remains constrained by multiple agronomic and socio-economic challenges. This study examined the intensity of constraints encountered by producers involved in T-aman rice production and analysed their relationships with selected farmer attributes. Information was gathered from randomly selected farmers using a pretested structured interview schedule during October 2012. Farmers' problem confrontation was assessed using a four-point scale across 15 identified constraints, and a PCI was done to classify problem severity. Pearson's Coefficient was applied to observe linkages between problem confrontation and farmers' socio-economic and communication characteristics. Results showed that 72.8% of farmers experienced a medium level of problems, while 27.2% faced a high level of problems in T-aman cultivation. High production cost ranked as the most severe constraint. The rest have negative or no significant association. The findings highlight the importance of strengthening farmer knowledge, extension services, and input quality regulation to reduce production constraints and enhance the sustainability of T-aman rice cultivation in vulnerable regions of Bangladesh.*

***Keywords:*** *T-aman cultivation; Problem confrontation; Farmers' characteristics; Extension media contact; Bangladesh*

## 2. Introduction

Bangladesh's economy and rural society are strongly shaped by agriculture, which continues to play a pivotal role in employment generation, food supply, and livelihood security. Approximately four-fifths of the population are engaged in agricultural activities either directly or through related sectors, which contributes about 18.4% to the national gross domestic product [1]. Rice (Oryza sativa L.) is the staple food and the dominant crop, occupying approximately 80% of the cultivated land and serving as the primary source of calories for the population [2,3]. However, rapid population growth, declining cultivable land, and increasing climate variability pose serious challenges to sustaining rice production.

Rice cultivation in Bangladesh follows three seasonal cycles—Aus, Aman, and Boro—among which transplanted Aman (T-aman) occupies the largest share, accounting for nearly half of the country's total rice-growing area [4]. Despite its importance, T-aman productivity remains highly vulnerable to climatic stresses, including floods, drought spells, erratic rainfall, cold waves, and riverbank erosion. Such stresses are especially acute in northern Bangladesh, particularly in areas influenced by the Teesta and Jamuna river systems, where fragile agro-ecological conditions and limited opportunities for livelihood diversification restrict agricultural productivity.

One of the most critical manifestations of agricultural vulnerability in northern Bangladesh is Monga, a recurring seasonal phenomenon of food insecurity and unemployment. Monga is most pronounced during the pre-harvest scarcity period preceding the Aman rice harvest (mid-September to mid-November) and, to a lesser extent, before the Boro harvest [5]. Poor or unstable Aman rice yields are widely recognized as a major driver of Monga, as rural livelihoods in the region are heavily dependent on agricultural wage labor and a limited number of cropping cycles. In districts such as Gaibandha, Kurigram, Rangpur, Nilphamari, and Lalmonirhat, crop failure or reduced T-aman productivity often leads to sharp income declines, food shortages, and heightened vulnerability among smallholder and landless households.

Farmers' ability to achieve stable T-aman production is constrained by multiple agronomic, environmental, and socio-economic factors. These include drought or untimely rainfall, flooding and waterlogging, lack of early-maturing or stress-tolerant varieties, inadequate access to quality seed, limited extension support, and poor access to inputs [6].

17 October 2025: Received | 14 November 2025: Revised | 18 December 2025: Accepted | 21 January 2026: Available Online

**Citation:** Md. Jahangir Kabir, Md. Shamsuzzoha, Md. Raju Ahmad, Nur- E -Shahrin Nurani, and Madhuri Rani Roy (2026). Farmers' Characteristics and Constraints in T-aman Rice Cultivation in Bangladesh. *Journal of Plant Biota.* **26 to 30.**
**DOI: https://doi.org/10.51470/JPB.2026.5.1.26**

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The extent to which farmers confront these problems is not uniform and may vary depending on individual characteristics. Understanding how these characteristics influence farmers' problem confrontation is essential for designing effective extension strategies and policy interventions aimed at improving T-aman productivity and reducing Monga-related food insecurity [7].

Despite the recognized importance of T-aman rice for food security in northern Bangladesh, systematic empirical evidence on the nature and severity of problems faced by farmers—and how these problems relate to their socio-economic characteristics—remains limited [8]. Most existing studies focus on poverty, food security, or climatic vulnerability, with comparatively little attention given to farmer-level problem confrontation in T-aman cultivation. Addressing this knowledge gap is crucial for developing targeted, context-specific solutions [9].

We did the study to assess the severity of constraints encountered by farmers in cultivation. We selected Monga-affected areas of northern Bangladesh and to examine the relationship between these problems and farmers' selected personal, economic, and communication characteristics [10]. The findings are expected to provide valuable insights for agricultural extension services, development practitioners, and policymakers seeking to enhance rice productivity and mitigate seasonal food insecurity in vulnerable regions [11].

## 3. Materials and Methods

### Study Area

The study was conducted in two villages—Rajabirat and Katabari—located in Gobindaganj Upazila of Gaibandha district, northern Bangladesh. These villages are situated approximately 20 km and 10 km northeast of the district headquarters, respectively. The study sites were selected purposively due to their high dependence on T-aman cultivation and the absence of prior empirical studies addressing farmers' problem confrontation in T-aman production in this area.

### Population and Sampling

An updated sampling frame comprising 1,029 T-aman farmers was compiled with support from local Sub-Assistant Agricultural Officers. From this population, 10% of farmers (n = 103) were selected.

### Survey Instrument and Pre-testing

Information was gathered out using an interview schedule specifically designed to address the study objectives. The instrument comprised both open- and closed-ended questions and applied appropriate scaling techniques for measuring the selected variables. Before the main survey, the schedule was pilot-tested with ten T-aman farmers from outside the study area, and revisions were subsequently made to enhance clarity, relevance, and overall consistency.

### Measurement of Variables

### Farmers' Characteristics

The study examined nine independent variables: age, level of education, family size, experience, area, annual income, knowledge, extension media contact, and innovativeness.

### Problems Faced by Farmers in T-Aman Rice Production

Problem confrontation was measured using 15 statements related to constraints in T-aman cultivation.

The severity of each problem was rated by respondents using a four-point scale ranging from high (3) to not at all (0).An overall problem confrontation score was calculated for each farmer by compiling the responses, yielding a possible range of 0–45, with higher values indicating greater severity of problems.To prioritise individual constraints, a (PCI) was calculated.

### Hypothesis Testing

The null hypothesis posited that farmers' problem confrontation in T-aman cultivation was not significantly associated with their selected socio-economic and communication characteristics.

### Data Collection Procedure

The researcher collected data via direct, face-to-face interviews during October 2012. Interviews were carried out at respondents' homes or fields during their leisure time. Rapport was established prior to interviews to ensure accurate and reliable responses.

### Statistical Treatment and Data Analysis

The collected data were coded and analyzed using SPSS software (version 11.5). The data were summarized using descriptive statistical measures, including frequencies, percentages, means, and standard deviations. Relationships between farmers' characteristics and problem confrontation scores were analyzed using Pearson's Correlation Coefficient (r) at the 5% probability level ($p \leq 0.05$).

## 4. Result

### 4.1 Socio-economic and Farm Characteristics of the Farmers

*Table 4.1 Distribution of the farmers according to their age*

| Categories (Scores) | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Young (upto 35 years) | 56 | 54.4 | 36.13 | 8.97 |
| Middle (35-50 years) | 41 | 39.8 | | |
| Old (above 50 years) | 6 | 5.8 | | |
| Total | 103 | 100 | | |

The socio-economic and farm characteristics of the T-aman farmers are presented in Tables 4.1–4.9. Farmers' ages ranged from 22 to 63 years, with a mean of 36.13 ± 8.97 years. The majority belonged to the young (54.4%) and middle-aged (39.8%) categories (Table 4.1).

*Table 4.2 Distribution of the farmers according to their educational level*

| Categories (Scores) | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Illiterate (0) | 11 | 10.7 | 4.04 | 3.54 |
| Can sign only (0.5) | 20 | 19.4 | | |
| Primary education (1-5) | 45 | 43.7 | | |
| Secondary education (6-10) | 21 | 20.4 | | |
| Above secondary education (above 10) | 6 | 5.8 | | |
| Total | 103 | 100 | | |

Educational attainment varied from illiterate to above secondary level. Most respondents had primary education (43.7%), followed by secondary education (20.4%), while only 5.8% had education beyond the secondary level (Table 4.2).

*Table 4.3 Distribution of the farmers according to their family size*

| Categories (Scores) | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Small (≤ 4 nos.) | 79 | 76.7 | 3.62 | 1.58 |
| Medium (5 to 7 nos.) | 20 | 19.4 | | |
| Large (> 7 nos.) | 4 | 3.9 | | |
| Total | 103 | 100 | | |

Family size ranged from 2 to 9 members, with most households classified as small (76.7%) or medium (19.4%) (Table 4.3).

*Table 4.4 Distribution of the farmers according to their experience in T-aman cultivation*

| Categories | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Low (< 12) | 12 | 11.7 | 21.13 | 8.97 |
| Medium (12-30) | 81 | 78.6 | | |
| High (> 30 ) | 10 | 9.7 | | |
| Total | 103 | 100 | | |

Experience in T-aman cultivation ranged from 7 to 48 years, and the majority of farmers (78.6%) fell into the medium-experience category (Table 4.4).

*Table 4.5 Distribution of the farmers according to their T-aman cultivation*

| Categories | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Small (≤ 1.0 ha) | 76 | 73.8 | 0.84 | 0.45 |
| Medium (1.01-2.0 ha) | 23 | 22.3 | | |
| Large (> 2.0 ha) | 4 | 3.9 | | |
| Total | 103 | 100 | | |

T-aman cultivation area varied between 0.21 and 2.03 ha, with 73.8% of farmers cultivating small areas (≤1.0 ha) (Table 4.5).

*Table 4.6 Distribution of the farmers according to their annual family income*

| Categories | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Low (≤ 100 thousand Tk.) | 49 | 47.6 | 104.60 | 26.52 |
| Medium (>100 thousand Tk.) | 54 | 52.4 | | |
| Total | 103 | 100 | | |

Annual family income ranged from Tk. 61,000 to 186,000, with all respondents categorized as low to medium income earners (Table 4.6).

*Table 4.7 Distribution of the farmers according to their knowledge on T-aman cultivation*

| Categories (Scores) | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Low (≤ 20) | 17 | 16.5 | 25.65 | 4.75 |
| Medium (21-30) | 69 | 67 | | |
| High (> 30) | 17 | 16.5 | | |
| Total | 103 | 100 | | |

Farmers' knowledge on T-aman cultivation scores ranged from 14 to 38, with most respondents (67%) having medium knowledge levels (Table 4.7).

*Table 4.8 Distribution of the farmers according to their extension media contact*

| Categories (Scores) | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Low (< 7) | 14 | 13.6 | 9.02 | 2.11 |
| Medium (7-11) | 78 | 75.7 | | |
| High (> 11) | 11 | 10.7 | | |
| Total | 103 | 100 | | |

Extension media contact was predominantly medium (75.7%), while only 10.7% of farmers had high contact (Table 4.8).

*Table 4.9 Distribution of the farmers according to their innovativeness*

| Categories (Scores) | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Low (≤ 12) | 31 | 30.1 | 13.95 | 3.45 |
| Medium (> 12) | 72 | 69.9 | | |
| Total | 103 | 100 | | |

Innovativeness scores indicated that most farmers (69.9%) belonged to the medium innovativeness category (Table 4.9).

## 4.2 Problems Confrontation in T-aman Cultivation

*Table 4.10 Distribution of the farmers according to their problems confrontation in T-aman cultivation*

| Categories (Scores) | Respondents | | Mean | Sd |
|---|---|---|---|---|
| | Number | Percent | | |
| Medium (≤ 30) | 75 | 72.8 | 23.03 | 4.93 |
| High (> 30) | 28 | 27.2 | | |
| Total | 103 | 100 | | |

The problems confrontation score of the respondents ranged from 18 to 38, with a mean value of 27.0 ± 5.80. The majority of farmers (72.8%) experienced a medium level of problems, while 27.2% faced high levels of problems in T-aman cultivation (Table 4.10).

## 4.3 Relationship Between Farmers' Characteristics and Problems Confrontation

*Table 4.11 Pearson's product moment co-efficient of correlation showing relationship between problems confrontation of the farmers in T-aman cultivation and their selected characteristics*

| Dependent variable | Independent variables | Value of co-efficient of correlation (r) | Tabulated value at 101 df | |
|---|---|---|---|---|
| | | | 0.05 level | 0.01 level |
| Problems confrontation of the farmers in T-aman cultivation | Age | -0.137$^{NS}$ | 0.194 | 0.253 |
| | Educational level | -0.280** | | |
| | Family size | -0.181$^{NS}$ | | |
| | Experience in T-aman cultivation | -0.137 $^{NS}$ | | |
| | T-aman cultivation area | 0.076 $^{NS}$ | | |
| | Annual family income | -0.129 $^{NS}$ | | |
| | Knowledge on T-aman cultivation | -0.498** | | |
| | Extension media contact | -0.398** | | |
| | Innovativeness | -0.376** | | |

The linkage between selected farmer attributes and problems facing were analyzed using Pearson's product-moment correlation coefficients, as presented in Table 4.11. The variables show negative or non-significant relationship.

### 4.4 Severity Ranking of Problems in T-aman Cultivation

*Table 4.12 Rank order of 15 selected items of problems confrontation in T-aman cultivation according to descending order of PCI*

| Sl. No. | Problems | Percentage (%) of the respondents | | | | Problem Confronta- tion Index (PCI) | Rank Order (RO) |
|---|---|---|---|---|---|---|---|
| | | Confrontation high problem ($P_h$) | Confrontation medium problem ($P_m$) | Confrontation low problem ($P_l$) | Confrontation no problem ($P_n$) | | |
| 01. | High cost of production | 82.8 | 13.9 | 3.3 | 0 | 279.5 | **1** |
| 02. | Adulterated fertilizers and pesticides | 75.3 | 12.9 | 6.2 | 5.6 | 257.9 | **2** |
| 03. | Lack of quality seed | 38.7 | 41.9 | 13.1 | 6.3 | 213 | **3** |
| 04. | Disease infestation and insect attack in T-aman cultivation | 24 | 33.2 | 40.8 | 2 | 179.2 | **4** |
| 05. | High cost of seed | 8.3 | 62.8 | 23.2 | 5.7 | 173.7 | **5** |
| 06. | Lack of suitable land for seedbed | 5.2 | 54.7 | 34.9 | 5.2 | 159.9 | **6** |
| 07. | Insufficient rainfall during transplantation results over-aged of seedlings | 2.4 | 60.8 | 30.1 | 6.7 | 158.9 | **7** |
| 08. | Drought problem | 7.3 | 28.9 | 56.5 | 7.3 | 136.2 | **8** |
| 09. | Lack of irrigation facility | 5.2 | 19 | 68.2 | 7.6 | 121.8 | **9** |
| 10. | Lack of skilled labor. | 3.4 | 20 | 50.8 | 25.8 | 101 | **10** |
| 11. | Seedling unavailability | 4.3 | 11.5 | 63.4 | 20.8 | 99.3 | **11** |
| 12. | Lack of necessary technical advice from extension worker | 3.3 | 15.2 | 56.5 | 25 | 96.8 | **12** |
| 13. | Weed infestation | 1.4 | 16.8 | 50.7 | 31.1 | 88.5 | **13** |
| 14. | Flood problem | 0 | 13.6 | 49.3 | 37.1 | 76.5 | **14** |
| 15. | Lack of knowledge on rice seed production | 0 | 3.4 | 62.8 | 33.8 | 69.6 | **15** |

The severity of 15 selected problems was assessed using the Problems Confrontation Index (PCI). PCI values ranged from 69.6 to 279.5 (Table 4.12). High cost of production ranked as the most severe problem.

## 5. Discussion

The predominance of young and middle-aged farmers in T-aman cultivation indicates active engagement of the working-age population in rice farming [12]. However, the relatively low level of formal education among farmers may limit their capacity to effectively manage production constraints and adopt improved technologies [13].

The dominance of small farm holdings and low to medium income levels reflects the smallholder-based nature of T-aman rice production [14]. These structural constraints likely increase farmers' vulnerability to input price volatility and production risks. Although farmers possessed considerable experience in T-aman cultivation, experience alone did not significantly reduce problems, suggesting that traditional knowledge may be insufficient to address emerging challenges [15].

The significant negative relationships between problem confrontation and education, knowledge, extension media contact, and innovativeness highlight the critical role of information access and adaptive capacity in mitigating production constraints. Farmers with better knowledge and stronger extension linkages were more capable of managing production problems, underscoring the importance of effective extension services and farmer training programs [16].

The severity ranking of problems indicates that input-related constraints, particularly high production costs and poor-quality inputs, are the most pressing challenges in T-aman cultivation. These findings point to systemic issues in input supply chains and regulatory oversight. Moderate constraints related to climate variability and pest pressure further emphasise the need for climate-resilient practices and integrated pest management strategies [17].

Overall, the findings suggest that strengthening farmer education, improving access to reliable extension services, and ensuring the availability of quality agricultural inputs are essential for reducing production problems and enhancing the sustainability of T-aman rice cultivation.

## 6. Conclusion

This study demonstrates that the challenges faced by T-aman rice farmers in Bangladesh are driven less by farm size or farming experience and more by disparities in access to knowledge, extension services, and quality production inputs. The persistence of medium to high levels of problem confrontation among farmers, despite long-term cultivation experience, indicates that traditional practices alone are insufficient to cope with evolving production and market constraints.

The strong influence of education, technical knowledge, extension media contact, and innovativeness on reducing production problems highlights the central role of human capital and institutional support in enhancing the resilience of T-aman rice cultivation systems. These findings suggest that productivity gains in T-aman rice are unlikely to be achieved solely through increased input use unless accompanied by effective knowledge dissemination and advisory support.

Furthermore, the predominance of input-related constraints—particularly high production costs and poor-quality inputs—points to structural weaknesses in agricultural input supply and regulatory mechanisms. Addressing these systemic issues is therefore critical for ensuring sustainable rice production and safeguarding smallholder livelihoods.

In conclusion, improving T-aman rice cultivation in Bangladesh requires a shift from input-intensive approaches toward knowledge-driven, institutionally supported, and farmer-centred strategies. Strengthening extension systems and ensuring the availability of reliable and affordable inputs will be essential for reducing production constraints and sustaining T-aman rice productivity in the long term.

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