



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(11): 495-498
Received: 10-09-2025
Accepted: 13-10-2025

Mandira Chakraborti
SMS, Department of Agronomy,
KVK West Tripura, ICAR
Research Complex for NEH
Region, Tripura, India

Ganesh Das
Senior Scientist & Head, KVK
West Tripura, ICAR Research
Complex for NEH Region, Tripura
Centre, Tripura, India

BU Choudhury
Head, ICAR Research Complex for
NEH Region, Tripura Centre,
Tripura, India

Corresponding Author:
Mandira Chakraborti
SMS, Department of Agronomy,
KVK West Tripura, ICAR
Research Complex for NEH
Region, Tripura, India

Performance of rice variety Khowai in rainfed lowland of West Tripura district

Mandira Chakraborti, Ganesh Das and BU Choudhury

DOI: <https://www.doi.org/10.33545/2618060X.2025.v8.i11g.4220>

Abstract

Rice is the staple food for entire population of Tripura. Though rice is cultivated in 58% of net cultivated area in Tripura but the production obtained is not sufficient to feed 42.85 lakhs people of the state. Less coverage of high yielding varieties, lack of knowledge on scientific package and practices of rice cultivation are the main hindrance in getting higher production of rice in the state. In view of this, KVK West Tripura carried out 50 nos. of Front Line Demonstration on high yielding Kharif rice var. khowai in 10 ha area in six selected village. The demonstration was conducted consecutively for two years. The average yield obtained from farmers field of the demonstrated variety Tripura Khowai was ranged from 5752 to 5770 kg ha⁻¹, where as yield obtained from the local variety was 4361 kg ha⁻¹ and 4283 kg ha⁻¹ during *kharif* 2023 and 2024 respectively. The farmers of West Tripura district achieved higher net return and B C ratio by cultivating Khowai variety of rice in comparison to their local variety. The percent increase in yield of rice variety khowai ranges from 32.31% to 33.88% over the farmers own practices during both the year. The results clearly showed the beneficial impact of front line demonstrations over the farmers practices. Feedback of all the demonstrated farmers were recorded and the farmers showed their satisfaction and also expressed their desire to cultivate the khowai variety in near future. Many farmers from nearby villages who were present during the field day and crop cutting experiment program of khowai rice were highly convinced by seeing the potentiality of the variety. This khowai variety also showed its uniqueness by withstanding submergence during the flood that took place in August 2024 in Tripura. This unique characters of rice variety was also witnessed by the demonstrated farmers of the FLD program.

Keywords: FLD rice, Khowai variety, extension gap, yield, technology index, benefit cost ratio

Introduction

Tripura is a small, landlocked state located in the North Eastern Region of India, which does not have good communication facilities with other parts of India. The geographical area of the state is 10,49,169 hectares of which 60% is high land. The economy of the state is mainly depends on agriculture and allied sectors. More than 70% of the population are dependent on agriculture for maintenance of their livelihood. Total 96% of the farmers are small and marginal with an average land holding of 0.49 ha (Source. Department of Agriculture and Farmers' Welfare, Govt. of Tripura). The population of the state has been increased from 36.74 lakhs in 2011 to 42.85 lakhs in 2025. This ever increasing population will pose a serious threat to agricultural scenario of the state in the coming years. There is hardly any scope to bring additional land under cultivation.

Rice serves as the primary food source for over two-thirds of the Indian population. (Sahu *et.al* 2015)^[8]. But in case of Tripura, it is staple food for 100% population of the state. The cropping system of Tripura is characterized by predominance of Rice as a lead crop. In Tripura, rice alone occupies 58% (1.48 lakh ha) area of total net cropped (2.55 lakh ha). The average productivity of rice in the state is 3.3 MT ha⁻¹ which is slightly higher than the national average of 2.7 MT ha⁻¹ (Source: Department of Agriculture & Farmers Welfare). The total rice production of the state is 7.9 MT. But the requirement is 9.62 MT during 2024-25 (Source: Department of Agriculture & Farmers Welfare). There always exist gap between the production and requirement of food grain mainly rice in the state. Besides maintaining livelihood of the state, rice cultivation also provide direct employment opportunities to rural labourers of the rice growing areas of the state.

Food grain requirement and production of rice of last three years i.e from 2022-23 to 2024-25 is given below:

Table 1: Food grain requirement, production and projection of last three years

Component	2022-23	2023-24	2024-25
Population (lakhs)	41.84	42.22	42.60
Requirement (lakh Tonnes)	9.45	9.54	9.62
Production (lakh Tonnes)	8.42	8.50	7.9
Gap (lakh Tonnes)	(-) 1.03	(-) 1.04	-(1.72)

(Source: Department of Agriculture & Farmers Welfare, 2024)

Less coverage of high yielding varieties throughout the state is the main reason for this gap. With this background, Krishi Vigyan Kendra West Tripura carried out Front Line Demonstration (FLD) on high yielding rice var. Khowai during kharif season with the following objectives:

1. To show the performance of rice var. Khowai in rainfed lowland of West Tripura district.
2. To increase the productivity of rice crop by practicing good agronomic management
3. To compare the yield level with local varieties practiced by the farmers.

Location and climate of the study area: West Tripura district lies approximately between latitude 23 degrees 16' to 24 degrees 14' north and longitude 91 degrees 09' east to 91 degrees 47' east. The total area of the district is 983.63 sq km. Around 75% of the total work force is depended on Agriculture for their subsistence. Total gross cropped area is 65,926 ha and net cropped area is 35,579 ha with a cropping intensity of 185%. The district is classified within Agro climatic zone III, which features humid dissected mounds and valleys alongside sub-humid denuded hills of varying elevations. The physiographic characteristics of the district can be categorized into nine distinct units: high relief, medium relief, low relief, flat-topped, residual, undulating plain, flood plain, alluvial plain, and inter-hill valley. The climate in the district is marked by humid summers and dry, cool winters. The area received a mean annual rainfall of 1700 mm, the 80% of which was received during southwest monsoon. The maximum and minimum temperature recorded during the plant growth was 21 °C to 34 °C. The crop evapotranspiration of the district varied from 8.67 mm in April to 5.2 mm in December. The soil of the experimental site is strongly acidic with pH from 4.5 to 5.0.

The programme on Front Line Demonstration of rice was carried out during the kharif season of 2023 and 2024 in different villages of West Tripura district.

Materials and Methods

The Front line Demonstration on rice var. khowai was conducted through a number of extension practices like awareness programme, group meeting, training, demonstration, field day etc. Based on the experiment conducted by ICAR, Tripura Centre, Khowai variety was chosen for demonstration in the farmers field. Total 50 nos. of demonstration covering 10 ha area were conducted in six selected villages namely Biswamanipara, Shantinagar, Janmejaynagar, Brajabashipara, Lankamura and West Bhubanban. Awareness programme followed by group discussion with the farmers was organised in each villages. Training programme on improved cultivation practices and integrated crop management was conducted before starting the FLD programme. The critical inputs like seed, fertilizer, insecticide/pesticides were supplied to the demonstration farmers by KVK, West Tripura. Regular visits by the KVK scientist were ensured to guide the farmers on all aspects of cultivation. These visits were also utilized to collect feedback for further improvement in research and extension programme. Field Day was organized at the demonstration site to provide opportunities for other farmers to witness the benefit of demonstrated technologies. Regular data on various parameters were collected both from the demonstrated variety and local check.

The demonstrations were conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practices and technology index. The yield data was collected from both the demonstration plot and farmers practice by random crop cutting method. The percent increase yield, technology gap, extension gap and technology index were calculated by using following formula as per Samui *et al.* (2000) [11], as given below:

Percent increase in yield = (Demonstration yield - Farmers practice yield)/ Farmers practice yield X 100

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers practice plot yield

Technology index (%) =Technology gap/Potential yield X 100

Result and discussion

Front Line Demonstration on rice variety Khowai was conducted during kharif season of 2023 and 2024 in the villages of West Tripura district. Major gap was observed between demonstrated technology and farmers’ practice of rice cultivation in West Tripura district is given in Table 2.

Table 2: Comparison between technological interventions and farmers practices of field pea cultivation

Component	Technological Interventions	Farmer Practices	Gap
Variety	Khowai	Local Non descriptive	Full gap
Seed rate	6 kg ha ⁻¹	50 kg ha ⁻¹	Full gap
Seed treatment	Seed treatment with bavistin @ 2 g per kg seed	No seed treatment	Full gap
Sowing method	Line sowing	Line sowing	No gap
Sowing time in nursery	2 nd week of June 2024	1 st week of July 2024	Full gap
Transplanting in the main field	1 st week of July	1 st week of August	Full gap
Spacing	25 cm x 25 cm	15 x 10 cm	Full gap
Fertiliser dose	80:40:40 kg N, P ₂ O ₅ , K ₂ O	60:40:40 kg N, P ₂ O ₅ , K ₂ O	Partial gap
Irrigation	Rainfed	Rainfed	No gap
Plant protection	Plant protection measures taken as and when required	Not taken	Full gap

Among different technological components, full gap was observed in the component viz. variety, seed rate, seed treatment, sowing time in nursery, transplanting in the main field, spacing and plant protection measures. Partial gap was observed in case of fertilizer dose. These gaps observed at the farmers field were ascribed to slow pace of extension activities; coupled with unreached extension system, poor accessibility of improved agro technologies especially among small land holding farmers (Shivran *et al.*, 2020) ^[10]. Under farmers practice, seed of local/nondescriptive type with low yield potential was sown instead of newly recommended varieties for the district with improper application of improved recommended technologies. On the basis of observed gap under the demonstration, seeds of improved variety of Kharif rice var, Khowai, fungicide, insecticide, etc. were provided to beneficiary farmers by KVK well in before taking the demonstration and other crop management practices were timely performed by the

beneficiary farmer himself under the close supervision of KVK Scientist.

Rice Yield

Results obtained from two years of study are presented in Table 3. Results reflected that an average yield of 5752 kg ha⁻¹ was obtained with demonstration of rice var. khowai as compared to 4322 kg ha⁻¹ with farmers' practice. The highest rice yield of 5770 kg ha⁻¹ in demonstrated plot was obtained during the year 2023. The percent increase in yield of rice variety khowai ranges from 32.31% to 33.88% over the farmers own practices during both the year. (Table 3). These results clearly indicated that the higher average seed yield in demonstration plots over farmers practice might be due to use of high yielding variety along with integrated crop management practices. Adoption of scientific package of practices along with need based plant protection measures resulted in higher yields. Similar result was obtained by Hashim *et al.* 2024 and Mauriya *et al.* 2023 ^[3, 7].

Table 3: Yield, technology gap, extension gap and technology index in Khowai rice cultivation during kharif season 2023 and 2024

Year	Potential yield kg ha ⁻¹	Average seed yield (kg ha ⁻¹)		Percent Increase (%)	Technology gap (kg ha ⁻¹)	Extension gap (kg ha ⁻¹)	Technology index (%)
		Demo	Farmers' practise				
Kharif 2023 ^[13]	5800	5770	4361	32.31	30	1409	0.52
Kharif 2024 ^[12]	5800	5734	4283	33.88	60	1451	1.03
Mean	5800	5752	4322	33.09	45	1430	0.78

Technology gap

The technology gap which is the difference between potential yield and demonstration yield is presented in Table 3. The technology gap observed during different years was 30 kg ha⁻¹ and 60 kg ha⁻¹ respectively. On an average technology gap of 45 kg ha⁻¹ was observed during both the years. The technology gap reflects the lesser adoption of package and practices by the farmers. Hence, extension activities and location specific technological recommendation appear to be necessary to reduce the technology gap. The above findings are similar in lines with Meena *et al.* (2021) ^[6] and Keshavreddy *et al.* (2018) ^[4].

Extension gap

Extension gap is considered as a parameter to know the yield difference between the demonstrated improved technology and farmers practices. The extension gap ranges from 1409 kg ha⁻¹ to 1451 kg ha⁻¹ during both the year (Table 3). On an average 1430 kg ha⁻¹ extension gap was observed. To enhance the farmers income, there is need to reduce extension gap. Therefore, it is necessary to educate the farmer's through various extension technique, trainings, awareness camp for more adoption of recommended improved technologies. The extension gap need to bring at minimum level. Consequently the farmers will be convinced to adapt the new technologies leaving the old ones. This

result is at par with the findings of Singh *et al.* (2020) ^[9], Girish *et al.* (2020) ^[2].

Technology Index

The technology index is a parameter to show the feasibility of the improved technology at the farmers fields. The technology index of the present study was varied from 0.52 to 1.03. On an average technology index was 0.78 over the years. This lower technology index reflected the efficiency and effectiveness of extension services in transferring improved technologies among the farmers successfully. The results are in conformity with Girish *et al.* 2011 ^[1].

Economics

Economic analysis was done on the basis of market prices of input and output. Economic analysis was done for both demonstrated and farmers' practices (Table 4). The cultivation of high yielding varieties of rice with scientific packages of practices fetches higher net return (Rs.67,110/- ha⁻¹ & Rs.66,282/- ha⁻¹) than the local check (Rs.36,803/- ha⁻¹ and Rs.35009/- ha⁻¹) during both the year viz. kharif 2023 and kharif 2024. This result is in conformity with the findings of Kumar *et al.* 2020 ^[2]. Highest benefit cost ratio of 2.02:1 and 2.01:1 was obtained with demonstrated variety (Khowai) in comparison with local check (1.57:1 and 1.55:1) during both the years.

Table 4: Economic impact of rice var khowai cultivated under FLD and Farmers practice during Kharif 2023 and 2024

Year	No. of Demo	Area (ha)	Cost of Cultivation (Rs. ha ⁻¹)		Gross Income (Rs. ha ⁻¹)		Net Income (Rs. ha ⁻¹)		B C Ratio	
			Demo	Farmers' Practice	Demo	Farmers' Practice	Demo	Farmers' Practice	Demo	Farmers' Practice
Kharif 2023 ^[13]	25	5	65600	63500	132710	100303	67110	36803	2.02:1	1.57:1
Kharif 2024 ^[12]	25	5	65600	63500	131882	98,509	66282	35009	2.01:1	1.55:1
Mean	25	5	65600	63500	132296	99406	66,696	35906	-	-

Feed back of the farmers

The Khowai variety of rice was evaluated over a period of two-year in various villages within the West Tripura district. They have shown interest in adopting the new Khowai variety, particularly in lowland areas where water remains for extended periods. The Khowai rice variety not only surpasses the local varieties cultivated by farmers but also outperforms many high-yielding varieties grown in the state of Tripura. Farmers observed the variety's ability to withstand submergence up to 10

days during the flooding that occurred in August 2024 in the West Tripura district. Although there was a 15 to 20% decrease in yield under submerged conditions, this was still considered acceptable, especially since other varieties yielded zero or were completely devastated under similar submerged conditions during the flood. Additionally, this variety exhibits lodging resistance, a quality noted by the farmers in the district. The level of satisfaction with the support provided was also satisfactory (Table 5).

Table: 5 Feedback of the farmers

Particulars	Feedback
Benefit of the demonstrated rice variety in comparison to local ones	Highly beneficial
Response of the neighbouring farmers to the demonstrated varieties	Positive
Yield satisfaction level	Very high
Whether the farmers will adopt the demonstrated technologies if input support from the institution is withdrawn	Yes
Level of satisfaction with the support provided	Very high

Conclusion

The Front Line Demonstration on rice var. khowai in different villages of West Tripura district made a positive impact among participating and nonparticipating farmers. The demonstration of new technology helps in increasing rice productivity up to 33.88% over the farmers' practice. Adoption of new technology helps in changing skill, attitude and knowledge of participating farmers. The Front Line Demonstration significantly motivated not only the beneficiary farmers but include the farmers of the nearby villages who witnessed the potentiality of the variety khowai during the field day programme, organised at harvesting stage. Demonstration on rice variety khowai also improved the relationship between the KVK scientist and the farmers of the district and also built confidence among them. The selected beneficiary of the demonstration also acted as a source of information and pure seeds of the variety for further dissemination of the technologies to the farmers of the district.

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