*Policy paper*

**Rice Fallow in North East India: Challenges, Opportunities and Policy Intervention**

**Abstract**

This study investigates rice fallow management in North East India, focusing on challenges, opportunities, and policy implications. Rice-based cropping System is found in all North Eastern States except Sikkim. But in almost all the states the land has been kept fallow after harvesting of *kharif* rice. This may be attributed to factors like planting of long-duration rice varieties during the kharif season, lack of irrigation water, moisture stress at the time of sowing of rabi crops, stray cattle etc. Despite many challenges of rice fallow, it can be well utilized for the cultivation of short-duration pulses and oilseed. Different interventions like resource conservation technologies could be effective in addressing the challenges in rice fallow. Retaining mulch on the soil surface, and making of farm pond, along with suitable establishment techniques, may mitigate severe stress by preserving soil moisture. Practising zero tillage with minimal soil disturbance and maintaining crop residues can positively influence soil properties, thereby enhancing overall productivity in rice-fallow systems. Besides technological interventions, subsidies on farm input, credit and crop insurance schemes should be taken into consideration for the poor risk-prone farmers of the northeast region for better utilization of rice fallow.

**Keywords: Rice fallow, Zero tillage, Pulse crops, Farm Pond, Crop residue**

**INTRODUCTION**

Rice fallow refers to the uncultivated land that remains without crops after the harvest of the *kharif* rice. The primary factors contributing to the fallowing of land during the winter season include insufficient irrigation, delayed harvesting of long-duration rice varieties, moisture stress at the time of sowing of rabi crops due to the early cessation of the monsoon, and disturbances caused by stray cattle (Ali and Kumar 2009). In India, rice fallow encompasses approximately 11.7 million hectares, predominantly (82%) located in the eastern and northeastern states (Pande *et al.* 2012, Kumar *et al*. 2018). The practice of leaving land fallow after the harvest of Aman rice is a common trend in the northeastern region as well as in Tripura state. Around 35% of the land after the harvesting of kharif rice in Tripura is kept fallow (Source: Department of Agriculture & Farmers’ Welfare). The rainfed rice agroecosystem of the state plays a crucial role in food production, and there exists significant potential for utilizing residual moisture of these rice fallows to grow short-duration, low-input crops. However, rainfed areas are characterized by its peculiarities such as complex nature, diverse and fragile ecosystems, and under-invested, risky, ethno-economically unique and distress-prone production systems (Singh et al., 2016; GEETHIKA et al., 2024). This approach represents a promising opportunity for the efficient use of resources, fostering sustainable crop intensification, and enhancing land productivity and ultimately cropping intensity. Rice follows are well-suited for the introduction of short-duration (≤3 months), low-water-consuming grain legumes such as pea, chickpea, lentil, black gram, green gram, and oilseeds like linseed, safflower, and toria, which can improve the incomes of small farmers and enhance soil health. A comparison of soil under natural vegetation and adjoining cultivated soils has revealed that prolonged agricultural land use alters some soil properties, mostly those related to fertility (Alidoust et al., 2018; Chakravarty et al., 2023). However, the success of rice fallow cultivation is largely contingent upon the method employed and the rice cultivar used. The objective of this study is to investigate rice fallow management in North East India, focusing on challenges, opportunities, and policy implications.

**CHALLENGES IN THE RICE FALLOW**

The per capita availability of cultivated land in the northeastern regions is the lowest in the country, measuring 0.15 hectares (Kumar *et al.* 2016). The majority of agricultural holdings in this area are either marginal or small, and they are highly fragmented, which poses challenges for the adoption of mechanized farming practices. The region receives an annual rainfall of around 2200 mm, which is generally sufficient to satisfy the water requirements of various crops. However, spatial and temporal variations in rainfall patterns and distribution; lead to inconsistencies in agricultural productivity. Rice is the predominant crop, primarily cultivated as transplanted during the rainy season, necessitating puddling operations to create suitable conditions for crop growth. However, puddling results in soil compaction that damages macro-pores and aggregates (Cassman *et al.* 1995). These soils often dry out, developing cracks by the end of the post-kharif season, which leads to insufficient soil moisture to support winter crops. Additionally, ploughing these soils after the rice harvest produces large clods with increased breaking strength, which can diminish the yields of subsequent crops, likely due to restricted root development (Kar and Kumar, 2009). Resource-poor farmers in these regions struggle to afford irrigation and fertilizers necessary for raising rabi crop production. Consequently, the cultivation of a second crop following the harvest of kharif-transplanted rice relies heavily on the effective utilization of residual soil moisture.

**MAIN REASONS FOR RICE FALLOW IN NORTH EASTERN INDIA**

***Soil moisture stress and lack of irrigation***

Rice-fallow regions typically experience normal to high levels of rainfall during the Kharif season; however, a significant portion of this rainfall is lost due to high runoff and low moisture retention capacity of soil. The compaction of soil following puddle rice cultivation hinders water infiltration, while the formation of deep and wide cracks in the soil after the rice harvest accelerates the evaporation of stored soil moisture. Consequently, soil moisture stress at the time of sowing fallow crops leads to inadequate plant establishment (Kumar *et al*. 2018). Even when crops are successfully established with residual soil moisture, insufficient winter rainfall during the reproductive phase frequently results in crop failure (Ghosh *et al.* 2016). At this stage, the available soil moisture is depleted, and as the crop progresses to flowering, it faces terminal drought and heat stress (Kumar *et al*. 2018).

***Long-duration rice varieties***

In NEH regions, farmers traditionally cultivated long-duration rice varieties that of more than 150 days. This practice leads to delays in the sowing of pulse and oilseed crops, ultimately resulting in reduced yields attributed to terminal drought conditions. The lack of appropriate crop varieties is the main constraint for 90% farmers of in this region.

***Soil acidity***

The high acidity of the soil in the northeastern region is one of the important factors contributing to the reduced productivity of pulses. Over 80% of the total land area in this region is characterized by acidic soil (Kumar *et al*. 2016). Pulses are particularly sensitive to acidic conditions, which adversely affect biological nitrogen fixation (BNF), microbial diversity, and the availability of nutrients to plants, and can be toxic to root systems (Sultana *et al*. 2014). Strongly acidic soils have been observed in the rice-fallow systems of the northeastern region including Tripura state.

***Terminal drought***

The post-rainy season crops rely on residual soil moisture under rainfed conditions, making them particularly vulnerable to terminal drought, which significantly affects crop yields (Kumar *et al.* 2016). Drought accelerates leaf senescence, reduces net photosynthesis, and hinders the translocation of nutrients from leaves to developing grains. The combination of terminal drought and temperature stress leads to premature ripening and can reduce yields by as much as 50% (Reddy 2009).

***Poor Crop Management***

Rabi crops cultivated in rice fallows are regarded as supplementary crops. Given the risks associated with the successful cultivation of a second crop, including limited soil moisture along with various socio-economic challenges, farmers often neglect essential crop management practices. These practices include selecting suitable varieties, timely sowing, determining optimal seed rates, managing pests, applying rhizobial inoculation, implementing foliar nutrition, and utilizing mechanization.

***Lack of improved varieties and quality seeds***

Crop varieties suitable for rice fallows in various regions have yet to be developed. Consequently, it is essential to recommend those available varieties that possess a comparative advantage. Non-availability of quality seeds of the recommended varieties forces farmers to cultivate low-yielding local varieties.

***Socio-economic constraints***

The adverse economic conditions and limited purchasing power of the farmers of this region compel them to leave their fields fallow after harvesting rice. Issues such as fragmented land, labour shortages, -non-availability of agricultural inputs in time, restricted access to institutional credit, insufficient market opportunities, a lack of knowledge regarding water conservation techniques, and inadequate extension services discourage farmers from taking second crops.(Joshi *et al.* 2002).

**POTENTIAL CROPS FOR RICE FOLLOW**

To optimize land use, there are a variety of crops that can be grown in rice fallow systems, depending on factors such as climate, soil, water availability, and market demand. The residual moisture left in the soil at the time of rice harvest is often sufficient to raise short-duration pulse and oilseed crops. Further using short-duration rice varieties and timely cultivation of it during Kharif season allowed to vacate the land by the end of October. Cultivation of cool and warm season pulses like pea, moong, lentil, lathyrus etc. as soon as after harvesting of rice crops can increase the system productivity and sustainability of rice crops. Utera or relay cropping can be practised to make such land more productive. Moreover, growing pulses after rice will enrich the soil fertility. Introduction of toria/rapeseed and mustard may be a profitable intervention in rice fallow of North Eastern region as well as in Tripura state.

Currently, due to a significant disparity between the supply and demand for pulses, India is importing a substantial quantity of pulses at elevated prices. To address the increasing demand for pulses, it is essential to incorporate them as a fundamental component in rice-fallow systems, which offer the dual benefits of expanding cultivated area, promoting sustainable production and increase of cropping intensity. A similar situation exists with oilseeds. Therefore, the promotion of pulse and oilseed crops in these fallow lands would enhance the sustainability of rice-based cropping system besides increasing the system productivity and incomes of the farming communities of this region (Reddy and Reddy 2010). For the effective utilization of rice fields through the integration of pulses and oilseeds, it is necessary to identify location-specific and economically viable techniques by thoroughly understanding the system's ecology and constraints. The appropriate pulses and oilseed crops, along with suitable varieties for the rice fallows of Northeastern India viz a viz Tripura are as follows:

**Table 1 Suitable Pulses and Oilseed Crop for Rice Fallows of North East India**

|  |  |
| --- | --- |
| **Crop** | **Varieties** |
| Lentil | HUL-57, WBL-58, WBL-77 |
| Lathyrus | Ratna, Pratek |
| Pea | Arkel Azad, Aman, TRC-P-8 |
| Mungbean | Pusa Bishal, Samrat, TRC-mung |
| Urdbean | PU-31, Tripura Mashkoloi-1 |
| Toria/Mustard & Rapeseed | B-9, NRCHB-101, M-27, TRC toria 1-5-1, TS-38, TS-36 |

(Modified from Ghosh *et.al* 2016 and ICAR, Tripura Centre)

**INTERVENTIONS REQUIRED TO MANAGE RICE FALLOW**

***Technological interventions***

Resource conservation technologies (RCTs) could be effective in addressing challenges in fallow areas. Following the harvest of rice, the reduction in soil moisture content and the subsequent decline in the water table during winter lead to mid and terminal drought conditions during the reproductive phases, adversely affecting yield. Consequently, retaining crop residue on the soil surface, along with suitable establishment techniques, may mitigate severe stress by preserving soil moisture. Implementing zero tillage with minimal soil disturbance and maintaining crop residues can positively influence soil properties, thereby enhancing overall productivity in rice-fallow systems. This approach contributes to lowering cultivation costs and improving input-use efficiency. Simple practices such as seed priming, and the application of 2% urea, diammonium phosphate (DAP), and micronutrients during the vegetative stages can increase productivity to profitable levels for resource-poor farmers (Kumar et al. 2018). Over and above cultivation of short-duration rice varieties is also important to raise pulses and oilseed in residual moisture of rice fallow of North Eastern Region.

  

**Fig 1: Biomulch in pea** **Fig 2: Zero tillage pea in rice fallow**

**POLICY INTERVENTIONS**

To ensure effective use of rice fallow, the following policy measures are necessary:

**Creation of community water reservoir**: Soil moisture becomes a limiting factor during winter months despite sufficient rainfall during the kharif season. This is just because of runoff of water. It is essential to establish farm ponds, jalkund and community water reservoirs in the region, with strong support from policymakers. This small structure will help in life-saving and supplemental irrigation.

**Quality seeds**: The timely access to high-quality seeds frequently poses a significant challenge, leading to delayed planting and suboptimal yields. Therefore, it is essential to initiate community-based seed production programs that incorporate suitable processing and storage facilities.

**Ensuring timely availability of other critical inputs:** Traditionally, the winter crops on residual soil moisture are grown using local varieties without application of plant nutrients, biofertilizers, fungicides and other agrochemicals due to their non-availability. Since crop productivity is the driver for area expansion, which in turn is influenced by better crop management, emphasis needs to be placed on the timely availability of all critical inputs.

**Rural credit**: Poor socio-economic conditions and purchasing power compel farmers either to skip the second crop after rice or resort to no input use. Therefore, subsidies on farm inputs, credit and crop insurance schemes should be implemented.

**Marketing setup**: Marketing plays a key role in encouraging farmers to crop production. Organized market and processing of farm produce is the need of the hour.

**CONCLUSION**:

The rice fallows of the North Eastern Region present a promising opportunity for expanding the cultivation of short-duration pulses and oilseed crops and enhancing the cropping intensity. Effective utilization of these areas can address various social and economic challenges in the region, such as unemployment, labour migration, and low-income levels. The cultivation of short-duration rice varieties along with the advancement and promotion of superior varieties of pulses and oilseeds that are well-suited to the rice fallows across diverse agro-ecological zones of North East India can boost the income and livelihood security of the farming community of this region.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**: Author(s) hereby declare that NO generative AI technologies such as Large Language Models (Chat GPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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