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Double Transplanting- A Indigenous Technology Practiced By Tribal Farmers to Combat Aberrant Climatic Condition

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ABSTRACT

The state Meghalaya has diversified topography, altitude and climatic conditions and it is dominated by tribal indigenous communities. Rice is the main crop in the state during monsoon season. In the Garo Hills region, a large proportion of rice land is under medium and low-lying areas, which are subjected to the risk of flood due to heavy rains within a short span of time. To recover of yield losses, the tribal farmers started practicing of a indigenous technology *i.e.* double transplanting. During kharif 2015, sixty farmers practicing double transplanting system were selected from Garo Hills to assess the benefit of the technology in real farming situation. The data, collected through survey and focus group discussion with key informants, revealed that average yield obtained under double transplanting (41.5 q/ha) was 83% higher than the average yield achieved with single transplanting. This was primarily due to more vigorous seedlings leading to higher tillering ability (10-12/plant against 6-7 under single transplanting) with more number of panicles (240-280/sq. m.). Despite the higher cost of cultivation, double transplanting recorded the maximum net return (Rs. 30950.00/ha) as well as benefit-cost ratio (1.99).

1. Introduction

Indian farming was largely based on indigenous technical knowledge of the farmers. Indigenous knowledge is the knowledge of indigenous people inhabiting different geographical region of the world with their own language, culture, tradition, belief, folklore, rites and rituals (Chhetry GKN and Belbahri L, 2009). Indigenous Technical Knowledges (ITKs) are the knowledge of local people developed during close interactions with nature and natural resources for their livelihood to mitigate immediate crop environmental situation with the objective of maintaining productivity and sustainability (Talukdar RK, Barman S and Hussain A, 2012). Traditional farming consists of technologies developed by farmers over decades of adjusting farming systems to local agro climatic and social conditions (Venkata Ramaiah P and Rama Raju KV, 2004).

In course of close interaction with nature and natural resources for their livelihood, farmers have developed some knowledge to mitigate immediate environment with maintaining sustainability. In the Garo Hills region, a large proportion of land is medium and low-lying paddy, the monsoon crop, which is subjected to the risk of flood due to heavy rains within a short span of time. Double transplanting is a indigenous crop cultivation system in Sali rice where farmers transplant the seedlings twice during the season and it is locally called *Changgini ge.ani.* This system is practiced in medium to low land flood affected area, due to heavy rains. This method of rice cultivation is called *Bolon* system in Bangladesh (Md Abdus Samad Azad & Mahabub Hossain, 2006). In double transplanting system, first the seedlings are prepared in medium land for about a month and the seedlings are transplanted in a plot with 30% of total area to be cultivated or transplanted.

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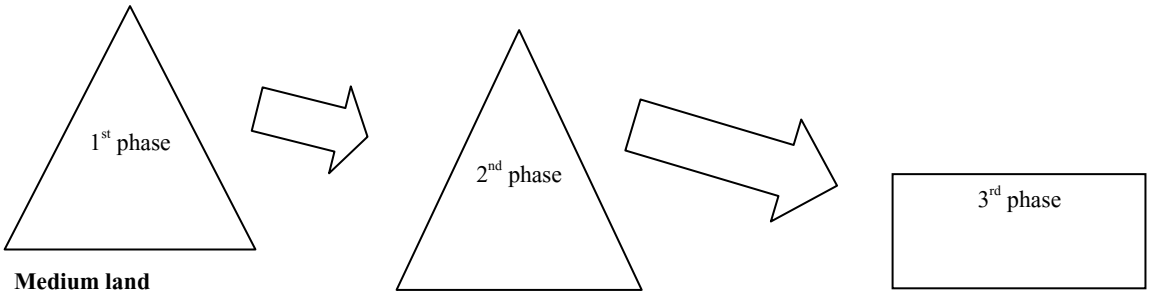

Figure 1. Sali rice cultivation under the double transplanting system

The double transplanting system permits a flexible late transplanting during the rainy season, which is its prime advantage. During the months of August to mid-September, generally the medium to low lying areas of rice is submerged in water if there is consecutive heavy rainfall. Therefore, at that period it is not suitable for transplanting young seedlings directly from the seedbed to main plot, because the seedling height is not tall enough and has risk of submergence. Thus, this method of crop establishment helps to avoid submergence of rice plant from flood due to the uneven distribution of rainfall during the peak of the monsoon season. The study was conducted to assess economic viability of indigenous technology called double transplanting system practiced by the tribal farmer's in Garo Hills districts of Meghalaya during kharif season.

2. Methodology

The study was conducted during kharif, 2015 in three villages*viz.*Dengasi, Shyamnagar and Dopatchigre of West Garo Hills district and three villages *viz*. Nagarpara, Bhoirakupi, Betasingh of South West Garo Hills district. The selected six villages were mostly affected by the flood due to heavy rain during the peak of the monsoon season crop establishment to avoid submergence of young seedlings. Altogether. 60 farmers who practiced double transplanting method for rice cultivation were selected randomly from six villages with ten farmers from each village. According to land situation, 60 farmers were categorised into two groups as follows:

Table 1. No. and percentage of farmers in different land situation practicing double transplanting under the study

Land Type	**No. of Farmers**	**Percentage of farmers**
Medium land (land submergence upto 25-30 cm)	26	43.33
Low land(land submergence upto 50 cm or more)	34	56.66

In double transplanting method, 30-35 days aged seedlings from in primary nursery bed were transplanted in secondary nursery bed with 4-6 seedling/hill and a spacing of 15cm X 10cm, keeping 65-70 hills/ sq.m. Again 30-35 days aged seedlings from the secondary nursery bed were transplanted to the main field with 2-3 seedlings /hill at spacing of 20 cm X 15 cm. Package of practices for double transplanting and single transplanting were as follows:

Table 2. Package of practices adopted for single and double transplanting

Package of practices	**Single transplanting**	**Double transplanting**
Land situation	Medium-low	Medium-low
Variety grown	*Champali, Tolsimala, Morong, Loha, Motong, Aizong, Kagra, Malsira, Rangakishor, Jahaminil, PaichongMiganggetetc*	*Kehol, Resu, Barut, tipi, jabilin and Kochugisimetc*
Seed rate	65.2kg	36.4kg
Spacing	15cm x 15cm	20 cm X 15 cm
Age of seedlings under nursery bed(days)	30-35	60-70(including age of seedlings at secondary beds)
Time of transplanting	July- Aug	August-September
Manure and Fertilizer application	Only 8-10 Kg Farm Yard Manure(FYM) during nursery bed preparation	Only 8-10 Kg FYM during nursery bed preparation and no application of chemical fertilizers

The primary data was collected through survey and focus group discussion with key informants.

3. Results and Discussion

Perusal of data in Table-3 revealed that average yield obtained under double transplanting (41.5 q/ha) was 83% higher than the average yield achieved with single transplanting. This was primarily due to more vigorous seedlings leading to higher tillering ability (10-12/plant against 6-7 under single transplanting) with more number of panicles (240-280/sq. m.). Satpathy *et al.* (2015) also recorded a significant yield increase in rice under double transplanting in north eastern parts of India. It was also noted that the percentage of unfilled grains were reduced to 15-20% against 30-35% under single transplanting due to susceptibility of seedlings under single transplanting to lodging. However, due to the higher man-days requirement for transplanting the seedlings twice in beds, double transplanting fetched higher cost of cultivation (Table 4). But the average gross return (Rs. 62250.00/ha) as well as average net return (Rs. 30950.00/ha) were much higher in double transplanting. Max. Benefit cost ratio of 1.99 was also achieved in case of double transplanting. Higher profitability in double transplanted rice – potato system was reported from Northern part of West Bengal which is adjacent to North Eastern states (Arya *et al.,* 2015).

The following advantages and disadvantages were pointed out by the farmers:

Advantages

- Farmers can transplant sali rice in the field without delaying the optimum time due to inundation
- The aged seedlings were very hardy and robust
- Healthy seedlings produced longer and uniform panicles resulting in less unfilled grains
- Higher yielding ability
- Saving in seed
- Ease labour scarcity and avoid high wage rate during transplanting.

Disadvantages

- Additional cost involved in land preparation and transplanting of seedlings
- Rice straw produced from double transplanting cultivation system was stiff and not preferred by the cattle as feed

Conclusion

The study revealed the suitability of double transplanting system as an appropriate technology to avoid submergence problem in the flood-prone rice in low lying areas of Garo Hills.

Table 3. Difference between single and double transplanting based on response of practicing farmers

Characteristics	**Single transplanting system**	**Double transplanting system**
Man days required for transplanting	Less (Around 106/ha)	More (Around 125/ha)
No. of tillers(per plant)	Less (6-7)	More(10-12)
Growth of the plant	Average	Healthy
Susceptibility to lodging	More	Less
Requirement of water	Less	Slightly More
Length of panicle	Medium-long	Long
No. of panicles (per sq. m.)	Less(130-170)	High(240-280)
No. of unfilled grains	More (30-35%)	Less (15-20%)
Duration of the crop	±120days	±115 days
Average yield(Q//Ha)	22.67	41.5
Straw as cattle feed	Soft & preferred by cattle	Hard & less preferred by cattle

Table 4. Production economics of double transplanting *vs* single transplanting systems

Characteristics	**Single transplanting**	**Double transplanting**
Average cost of cultivation (Rs.) /ha	26650.00	31300.00
Average Gross return	34005.00	62250.00
Average Net return	7355.00	30950.00
Average B:C ratio	1.27	1.99

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