Double transplanting technology of boro rice in the rice-potato-rice system for enhanced productivity and reduced poverty in Bangladesh.

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Abstract

The T. Aman (wet season rice)- Fallow- Boro (summer) rice is dominant cropping system in Bangladesh. The introduction of both double transplanting of boro rice and high yielding potato varieties into the rice based cropping system proved beneficial as higher productivity and returns were obtained from the T. Aman rice- Potato-double transplanted Boro rice compared to the other systems. In spite of higher cost of double transplanted technology of boro rice over traditional system, the T. Aman-Potato-DT Boro system gave about 35-47% higher gross margin (net profit) than the conventional T.Aman-Potato-Boro Rice pattern. Including double transplanting of boro rice in the T.Aman-Potato-Boro rice pattern, the margin of gross profit was increased between US$ 700 to 1000/hectare. The double transplanting of boro rice can be practiced successfully in the upper and middle highlands as an option for optimizing the productivity of T.Aman-Potato-Boro rice cropping pattern

Media Summary

Implementing double transplanting technology will enhance productivity and profitability of rice-potato-rice system and improve food security.

Key Words

Double transplanting, boro rice, aman rice, cropping system

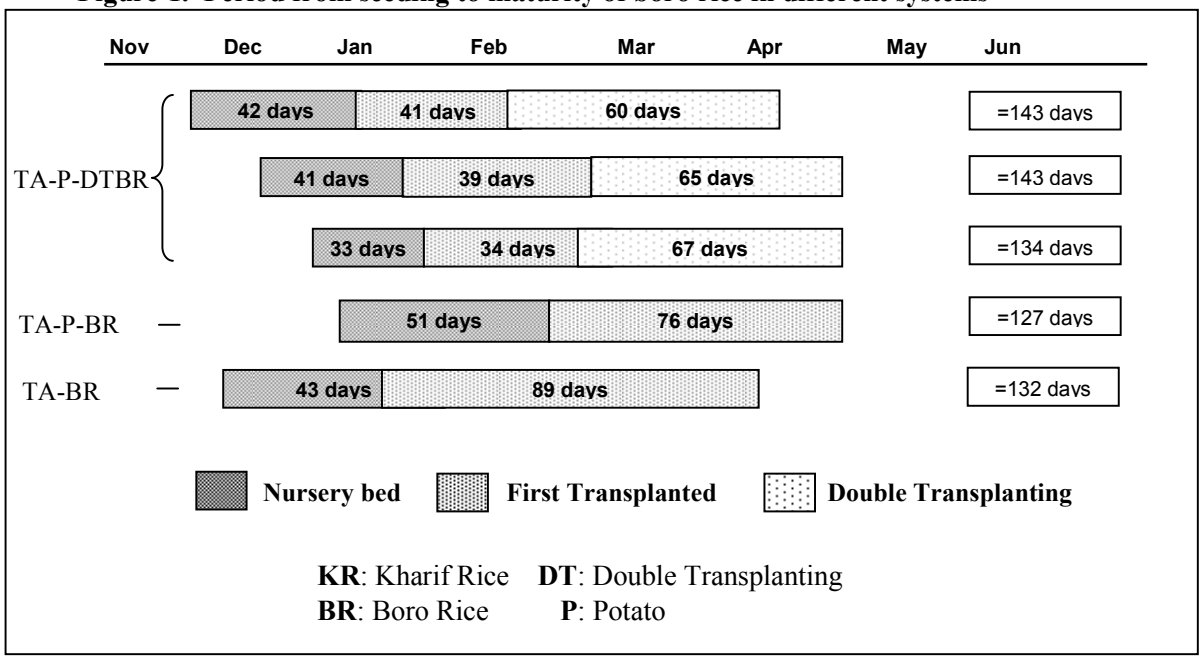
Introduction

The dominant cropping pattern of Bangladesh is T. Aman (Kharif rice/wet season rice)– Fallow-Boro (Summer rice) covers about 1.8 million hectare of land, which is about 22% of the total land occupied by 34 major cropping sequences. This pattern covers the upper area of the middle highland (Elahi *et al.,* 2001). The Bangladesh Rice Research Institute (BRRI) has recommended the T. Aman-Potato-Boro cropping pattern for the irrigated ecosystem (BARC, 2001; Khan, *et al,* 2004) where 80-90 days transition period is required for potato cultivation. The pattern has the advantages of increasing cropping intensity and productivity of the agro-ecosystem, which in turn help improve farmers' livelihood. There has been strong concern about maximizing the productivity of the T. Aman rice-Potato-Boro rice system by improving the yields of both potato and Boro rice. Potato yield could be improved by introducing a high yielding variety (HYV) with good quality seed and keeping the crop in the field up to full maturity. An agronomic way of preventing the reduction of Boro rice yield that results from delayed planting may the adoption of Double Transplanting (DT) in Boro rice. Higher grain yield of boro rice are obtained when transplanting is carried out no later than 25 January, after which date the grain yield declines significantly (BRRI,1998; Choudhury and Guha,2000).

Methods

The work was conducted in farmer's fields in North Bangladesh. Participant institutions included the Department of Agricultural Extension, the Tuber Crop Research Center (TCRC), the Rice Farming Systems Division of the Bangladesh Rice Research Institute (BRRI) and Bangladesh Agricultural Research Institute (BARI). The International Potato Center (CIP) provided technical collaboration and financial support. Twenty dispersed farmers' plots, 10 from each village, were selected for the trial. In each farmer's plot the alternative technology (T. Aman-Potato-DT Boro pattern) was compared with farmers' existing practice of T. Aman-Potato-Boro cropping pattern. For DT technology, the rice stand is transplanted two times. Initially, 40-45 day old seedlings are transplanted from nursery beds to a small piece of land, at a close interplant spacing of 10 cm × 10 cm, with more than 10 seedlings per hill. Some 35-405 days after the first transplant, rice tillers are split and transplanted into the main field after potato harvesting at full maturity (80-90 days of growing period). Period from seedling to maturity of boro rice in different systems is presented in Figure-1. In all cases, Boro rice was grown with farmers' management and on an average, only 20 kg N ha^{-1} was applied as basal dressing following the potato crop. Total productivity of different cropping systems was compared in terms of rice equivalent yield (REY). The REY was computed by converting the yield of potato into US$ (value) and then this value is converted into the yield of rice $\{$ REY = potato yield (kg) x potato price (US$ kg^{-1})/Unit price of paddy (US$ kg^{-1}) $\}$.

Figure-1. Period from seeding to maturity of boro rice in different systems



Source: SK Bardhan Roy et.al.2007

Results

The average potato tuber yields of high yielding varieties in T.Aman-Potato-DT Boro rice were 30.35t/ha and 30.82t/ha respectively, at two locations (Shibganj,Kahaloo). The tuber yields of local varieties grown in traditional system were very poor (Table-1). Agro-economic analysis

presented in Tables 1 & 2 indicates that the T. Aman-Potato-DT Boro pattern produced 62% higher REY (Rice Equivalent Yield) than the traditional farmers' practice (T. Aman-Potato-Boro pattern). Double transplanted Boro rice increased production cost between 81-133 US$ per hectare over farmers' traditional practice. In spite of the higher cost due to double transplanting, the T. Aman-Potato-DT Boro system net return increased at two sites between 35-47% than the traditional T. Aman-Potato-Boro pattern. The low yield of boro rice at Kahaloo was attributed to the prolonged moisture stress that resulted from the non-functioning of a deep-tube well.

Table.1.Agronomic productivity of the cropping systems, 2005-06

Cropping Pattern	Yield (t/ha^{-1})			REY (t/ha^{-1})**
	T.Aman	Potato	Boro	
Location: Shibganj				
T.Aman-Fallow-Boro	5.14	-	7.43	12.57
T.Aman-Potato-Boro	3.11	14.27	4.70	17.62
T.Aman-Potato-Boro (DT)*	2.78	30.35	6.84	28.59
Location: Kahaloo				
T.Aman-Fallow-Boro	2.99	-	4.01	7.00
T.Aman-Potato-Boro	3.54	16.00	1.70	16.24
T.Aman-Potato-Boro (DT)*	3.43	30.82	3.46	26.15

*DT = Double Transplanting, ** REY=Rice equivalent yield, Straw value included

Table 2. Economic productivity of the cropping systems, 2005-06

Cropping Pattern	Total variable cost (US$/ha^{-1})				Gross return (US$ ha^{-1})				Gross margin (US$ ha^{-1} **)
	T. Aman	Potato	Boro	Total	T.Aman	Potato	Boro	Total	
Location: Shibganj									
T.Aman-Fallow-Boro	285	-	338	623	685	-	991	1676	1053
T.Aman-Potato-Boro	263	774	269	1306	415	2378	627	3420	2114
T.Aman-Potato-Boro (DT)*	251	1416	350	2017	371	4047	912	5330	3113
Location: Kahaloo									
T.Aman-Fallow-Boro	264	-	342	606	399	-	535	933	327
T.Aman-Potato-Boro	229	833	233	1295	472	2667	227	3365	2071
T.Aman-Potato-Boro (DT)*	258	1612	366	2236	457	4109	461	5027	2791

Discussion

In the upper and middle highlands, double transplanting of Boro rice can be practiced as an option for optimizing the productivity of T. Aman-Potato-Boro cropping pattern. Regardless of locations, the highest REY and gross margin were obtained from T. Aman-Potato-DT Boro rice pattern followed by T. Aman- Potato-Boro rice. The lowest REY and gross margin were obtained from T. Aman- Fallow- Boro rice. Experimental evidence reveals that there is an ample scope of substantial improvement of the productivity of the ecosystem with the inclusion of high yielding potato varieties along with DT in Boro rice and an area of about 0.1 million hectares could be farmed with the T. Aman-Potato-DT Boro cropping pattern. Wider scale validation is highly imperative for the promotion of large scale adoption of the technology.

Conclusion

The participating farmers obtained higher productivity and return from T. Aman rice- Potato- Double transplanted Boro rice compared to the T.Aman rice- Potato- Boro rice and T.Aman rice- Fallow- Boro rice, widespread traditional cropping systems practiced in Bangladesh. The introduction of double transplanted technology for boro rice and planting high yielding potato varieties in the cropping system increased the rice equivalent yield (REY) significantly compared to the traditional systems. The gross margin (net return) was enhanced by practicing double transplanting system of boro rice. The introduction of potato between two rice crops and the adoption of double transplanting technique improved the income many folds compared to T.Aman rice- Fallow- Boro rice- system. The participating farmers were encouraged by the increased profit brought about by the novel technology.

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