Available online at www.elixirpublishers.com (Elixir International Journal)

Agriculture

Elixir Agriculture 96 (2016) 41901-41903

ISSN: 2229-712X

Effect of different methods of Transplanting/Seeding on yield and Economics of medium Land Rainfed rice (*Oryza Sativa* l.) in Jharkhand

D.Oraon, R.K.Singh V.P. Rai,, V.K.Pandey, U.K. Singh, Z. Alam and R.P. Singh 'Ratan'
Krishi Vigyan Kendra, Chatra Birsa Agricultural University, Ranchi.

ARTICLE INFO

Article history:
Received: 20 May 2016;
Received in revised form:
24 July 2016;
Accepted: 30 July 2016;

Keywords
Farmers Practice,
Conventional Transplanting,
SRI,
Drum Seeder,
Yield attributes,
Growth parameters,
Yield,
Economics.

ABSTRACT

The present study was carried out at farmers fields in Simdega district of Jharkhand during Kharif 2013 and 2014 to evaluate the effects of different methods of transplanting/seeding on yield and economics of medium land rainfed rice. The experiment was conducted with four methods of transplanting/seeding {T_1: Farmers practice (Transplanting of 25-30 day old seedlings, more than 5 seedlings/hill at uneven distance and two manual weedings.), T_2 : Cultivation under modified SRI (10-12 days old seedling, 25x25 cm^2 spacing, single seedling/hill, two weeding by cono weeder and regular ponding of rain water in field.), T_3 : Sowing of sprouted seeds by drum seeder and weeding two by cono weeder., T_4 :Conventional practice (Transplanting of 20-25 days old seeding, 2-3 seedling/hill at 20x20 cm^2 and two mannual weedings.) in 10 replications at farmers filed under RBD. All growth, yield attributing characters, yield and net return was found significantly highest in modified SRI (T_2) followed by conventional method. Conventional method and sowing by cono weeder were found at par. The lowest performance was found under farmers practice.

Introduction

Rice is the staple food for about 50 per cent of the world's population that resides in Asia, where 90 per cent of the world's rice is grown and consumed in Asia. For India it is estimated that the demand of rice will be 140 million tons in 2025 for 70 per cent over the next 30 years.

In order to meet increasing demands of food due to rising population and income, food production in India and other south Asian countries need to be increased. India has the largest area under rice (43.0 million ha) accounting for 29.4 per cent of the global rice area and it stood next only to China in the world with respect to rice production. Rain-fed agriculture in India, practiced on 94 million hactares (M ha), is future. Under rain-fed agriculture, rice accounts the major area. Rain-fed rice in India occupies up to 55 per cent of the total rice area and contributes nearly 30 per cent to the total rice production of the country . In Jharkhand, only 30-35 per cent of total geographical area is under cultivation with limited irrigation potential so far explored. Almost 92 per cent area is rain-fed. Mono cropping of rice is the main agricultural practice of Jharkhand. The average productivity of rice in Jharkhand is lower than the national average. Between transplanted situations, the medium land yields are lower than the low land rice. The major causes of low productivity under medium land situation is rain-fed agriculture, low soil productivity, low investment capacity of farmers, lack of knowledge about improved package of practices of rain-fed rice. Among package of practices, method of transplanting/seeding is the fore most important factor contributing to the yield. In general practice, farmers transplant 25-30 day old seedlings, more than 5 seedlings per hill at uneven distance in puddled field. This results into less number of tillers, difficulty in weeding, smaller panicle length and ultimately low yield. Hence, the present investigation was carried out to assess the performance of different methods of transplanting/seeding under mid land rain-fed rice.

Materials and Methods

A field experiment was conducted at farmers' field in Simdega district of Jharkhand, during Kharif 2013 and 2014. The district has a subtropical climate with hot and dry summer comparatively moderate cool rainy season followed by moderate winter with mean annual rainfall of 944.8 mm and 1372.9 mm in 2013 and 2014 respectively. The soils of the experimental sites were sandy loam (medium texture). The soils were acidic in reaction (pH 6.0 to 6.8) with low organic carbon (0.34 to 0.38%). The fertility status revealed that the soils were low in available nitrogen (281.2 Kg N/ha to 306.4 Kg N/ha), medium in available phosphorus (14.1 to 16.8 Kg P_2O_5/ha) and potassium (146.3 to 166.2 Kg K_2O/ha).The experiment was conducted with 4 treatments which were;T_1: Farmers practice (Transplanting of 25-30 days old seedlings, more than 5 seedlings/hill at uneven distance and twice manual weeding),T_2: Cultivation under modified SRI (10-12 days old seedlings at 25x25 cm^2 spacing, single seedling//hill transplanting, weeding twice by cono weeder and regular ponding of rain water in the field.),T_3: Sowing of sprouted seeds by drum seeder and weeding twice by cono weeder and T_4: Conventional practice(Transplanting of 20-25 days old seedling, 2-3 seedlings/hill at 20x20 cm^2 and twice manual weeding).

Due to rain -fed situation, the SRI was modified with regular pounding of the filed in place of drying and wetting. The experiment was conducted at 10 locations (farmer's field). The experiment had 40 plots of gross size 10mx50m each.Two types of nurseries were raised separately. For the conventional (T_1 and T_4) 40 kg/ha seed was required where as 5 kg/ha seed

Tele:
E-mail address: chatrakvk@gmail.com

for modified SRI (T_2). Both types of nurseries were sown at same time and transplanted as per treatment where as seeds were kept for soaking of water for sowing in T_3 one day before nursery (T_1, T_2 & T_4) raising and sowing of sprouted seeds was done on the day of nursery sowing. The recommended dose of nutrients 120 kg N, 60 kg P_2O_5 and 40 Kg K_2O/ha were applied through urea, diamonium phosphate and muriate of potash, respectively. Half of nitrogen and full amount of phosphorus and potassium were applied in experimental fields as basal application before transplanting and rest amount of nitrogen was top dressed in two equal splits at active tillering and panicle initiation stages. Hand weeding and weeding by cono weeder was done as per treatment. No irrigation was applied as the experiment was conducted under rain-fed situation. Two weeding were done in every treatment either by cono weeder or manual.

Data on growth parameter, yield attributing characters, grain and straw yields were recorded at crop maturity. The economics parameters (gross return, net return and B: C ratio) were quantified on the basis of prevailing market prices of inputs and outputs. The data were analyzed by using the analysis of variance technique for randomized block design (RBD) as per the procedure described by Gomez and Gomez (1984). The treatment means were compared at 5 % level of significance.

Result and Discussion

Effect on growth and yield attributes

Different methods of transplanting, seeding and weeding showed significant effect on plant height, effective tillers, panicle length and panicle weight (Table 1). Cultivation under modified SRI (T_2- 10-12 days old seedling, 25x25 cm^2 spacing, single seedling per hill transplanting, weeding twice by cono weeder and regular pounding of rainwater) produced significantly more height, number of effective tillers/m^2, panicle length and panicle weight than the farmers practice (T_1) and more number of effective tillers/m^2 and panicle weight than other two treatments (T_3 – sowing of sprouted seeds by drum seeder and twice weeding by cono weeder and T_4- conventional practice: Transplanting of 20-25 day old seedling, 2-3 seedlings/hill at 20x20 cm^2 spacing and twice manual weedings), Sowing by drum seeder (T_3) and conventional practice (T_4) were at par but significantly superior to farmers practice in respect of growth and yield attributing characters. The treatments failed to exert any significant effect on 1000- grain weight. The greater spacing in SRI leading to lower competition between the plant thus favorable better growth and development of plant height and total tillers (Patwardhan and Patel, 2008). The transplanting of young seedling to produce more *phyllochron* before entering the reproductive phase compared to older seedling and it provide sufficient nutrient for vegetative growth and also for reproduction phase which ultimately led to increase plant growth. Planting young seedling at their second or third phyllochron stage did not disturb the rapid tillering and rooting which begin at the fourth phyllochron stage (Uphoff, 2004). The peak tiller production time was enhanced in system of rice intensification than conventional method of cultivation resulting in higher number of tillers/m^2 (Thava prakash etal 2008). For the formation of more number of productive tillers such as increase in CO_2 assimilation rate, delay in the senescence of flag leaf and effective translocation of photsynthates from source to sink resulted in production of higher number of panicle with longer panicle (Watanabe and Yoshida, 1970). Under SRI cultivation biomass producing efficiency increases distinctly. Higher translocation of assimilates viz., dry matter, carbohydrates, nitrogen and their conversion rates enhanced the grain filling spike weight in SRI rice (Wang et al., 2010). The conventional transplanting and direct sowing by cono weeder were at par in respect of growth and yield attributed. Mabbayad *et al* (1968) and Seth et al (1971) also found same trend of result in conventional and direct sown rice.

Effect on yield

As reflected In Table 2, the grain yield was significantly highest In modified SRI (57.5 q/ha in 2013 and 65.7 q/ha in 2014) followed by conventional transplanting (37.2 q/ha in 2013 and 40.2 q/ha in 2014). The conventional transplanting followed by drum seeding method (35.8 q/ha in 2013 and 37.9 q q/ha in 2014) and both methods were at par. The lowest yield was obtained under farmers practice (27.4 q/ha in 2013 and 28.5 q/ha in 2014). The same trend was obtained in straw yield also. The modified SRI method provided the plants better growth conditions (such as wider spacing, better aeration and better utilization of resources) which enabled them to grow vigorously. This has been exhibited in terms of higher leaf area and ultimately higher dry matter production. These enhanced growth parameters might have helped in better filling of spikelet. These results are in agreement with those of Nayak *et al* (1998)and Barison (2002) and Ali *et al*. (2014). Maximum grain yield achieved in SRI was due to higher leaf area index (LAI) and light interception at wider spacing between plants gained from open plant structure. This result in SRI was due to higher LAI and greater leaf size, leading to vigorous root system and more adequate room to grow. In the conventional method at closer spacing between rice plants the number of panicles per unit area increases but with the shorter panicles containing fewer grains, resulting in to lower yield. This result is in confirmation with result obtained by Pandian, B.J 2010. Conventional method of transplanting produced slightly higher yield than the direct sown by drum seeder but failed to give significant difference. It might be due to the fact that the conventional method got more ideal soil condition for growth of rice plant like unaerobic condition, low weed infestation, regular ponding of water than the direct sown by drum seeder, whereas the drum seeding method had another benefit of no disturbance of roots as in transplanting and hence better tillering and growth environment. These factors might balanced their effects and both the methods became at par. Conventional method and direct sowing by drum seeder were significantly superior to farmers practice. This might be due to transplanting of more number of over - aged seedlings which got less growth period and less number of tillers and ultimately lower yield.

Straw yield is primarily a function of vegetative growth of the crop in terms of plant height, tiller production per unit area and number of leaves per plant. Plant height, number of tillers/m^2 panicle length and weight were higher in modified SRI followed by conventional and drum seeding methods with lowest in farmers practice. Similarly the straw yield was found highest in modified SRI followed by conventional transplanting and drum seeding methods. The lowest yield was obtained in farmers practice. The results supported the findings of Kumar *et al* (2006).

Effect on economics

The highest gross and net returns were obtained in modified SRI followed significantly by conventional transplanting which was at par with drum seeding method. The lowest were obtained in farmers practice (Table 2).

The benefit : cost ratio also followed the same trend. Due to higher production of grain and straw, the gross return was highest in modified SRI followed by conventional and drum seeding methods. Though the cost of cultivation was highest in SRI and lowest in farmers practice. But due to higher degree increase in yield, the net return as well as B :C ratios were highest in case of modified SRI and lowest in farmers practice. The economics of SRI cultivation also indicated higher profit by Sarath and Thilak (2004). The net return and B:C ratios of conventional and drum seeding methods were at par which might be due to the result of grain and straw yields.

Conclusion

The modified SRI produced the highest number of effective tillers/m2 (318 and 325 during 2013 and 2014, respectively),grain yield (57.5 and q/ha during 2013 and 2014, respectively), net return (Rs.47000/ha during 2013 and Rs. 62410/ha during 2014) and B:C ratio (3.14 and 3.71 during 2013 and 2014, respectively) and found significantly superior over other methods of transplanting/seeding of direct sown rain-fed rice under medium land situation. The conventional transplanting method and sowing by drum seeder were significantly at par but superior over farmers practice. Therefore, modified SRI is the recommendation for direct sown rain-fed under medium land situation.

References

Ali, M.N., Alam, M.P., Tirkey, R.N. , Sah, Akhilesh and Barnwal , M.K. 2014. Effect of SRI components on yield and econimcs of rice (*Oryza sativa* L.) in Jharkhand. *Progessive Research (An international Journal). I (Conf. Spl.) Part* – I:119-122

Barison, J.2002. Evaluation of nutrient uptake and nutrient use efficiency of SRI and conventional rice cultivation methods in Madagascar. In: *An assessment of the system of Rice Intensification (SRI): Proceedings of an International Conference, Sanya , China, 1-4 April 2002, CIIFAD, Ithaca, New York, USA pp. 143-147.*

Mabbayad, B.B., Emerson, B.N. and Aragon, E.L. 1968. Further tests on "minimal Tillage" and rates of nitrogen application on transplanted rice. Philipp. Agric. 52:200-210.

Nayak, B.C., Mohanty, K and Sahoo, B.C. 1988. Maximization of yield of rice-rice sequence through optimum combination of nutrient and plant density. In: Extended summaries at *21st International Congress in Agronomy held at New Delhi during 23 November, 1998*, pp. 454-455.

Pandian, B.I. 2010. The system of Rice Intensification: a unique system to produce more with less input. Presented at the *28th International Rice Research Conference, 8-12 November 2010, Raising the Yield Potential.*

Patwardhan, S.M. and Patel, S.M. 2008. Promotion of System of Rice Intensification (SRI) in rain- fed rice cultivation amongst the farmers of Damgs district of Gujarat. *3rd Symposium on system of Rice.*

Sarath, P.N. and Thilak, B. 2004. Comparison of productivity of system of rice intensification and conventional rice farming system in the dry zone region of Sri Lanka. 4th International Crop Science Congress.

Seth, A.K., Khaw, C.H. and Fua, J.M. 1971. Minimal and zero tillage techniques and post-planting weed control in rice. Pages 180-200 in *Proceedings of sysmposium on 3rd Asian-Pacific weed science conference Kuala Lumpur, Malaysia.*

Thavaprakash, N., Sangetha, S.P., Devasenapathy, P. and Nataranjan, S. 2008. Performace evaluation of SRI in comparison with method of planting under Organic farming in rice. *3rd Symposium on "System of Rice Intesification in India-Extended summaries"* held at TNAU- Coimbatore from 1-3rd December 2008 46:200-202.

Uphoff, N. 2004. Changes and evaluation in SRI methods In : Proceedings of the International Conference on the Dissemination of SRI, 1-4 April 2002, Sanya, China. Ithaca, New York : Cornell Uni. http:// ciifad. cornell. edu/sri, ciifad @ cornell. edu.

Vijaya Kumar, M.S., Chandrasekaran, R.B., Thiyagarajan, T.M. 2006. Effect of system of rice intensification (SRI) practices on yield attributes, yield and water productivity of rice (*Oryza satira* L.). *Research Journal of Agriculture and Biological Sciences*. 2 (6): 236-242

Wang R.,G. Zhou, Y, Li. He and C. Zhang. 2010. Effect of different seedling ages on yield on Xinliang you 4. Chinese seed. 34-36

Watnabe, H. and Yoshida, S. 1970. Effect of nitrogen, phosphorus and potassium on photophosphorylation in rice in relation to photosynthetic rate of single leaves. *Soil science and plant Nutrition.* 16:163-166.