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Direct seeded rice: purely a site specific technology

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Abstract

A field study was conducted to evaluate the comparison between direct seeded rice vs transplanted rice with an objective to improve productivity and efficiency during kharif 2014-2016. Maximum number of productive tillersm^{-2} was recorded in direct seeded rice (3.25.89); (365.67); (380.97) followed by transplanted rice (319.27); (345.67) and (355.78) during these three respective years. Maximum 1000 grain wt. (g) was recorded in direct seeded rice (24.73); (25.82); (26.01) followed by transplanted rice (23.98); (24.80) and (25.67). Maximum yield was recorded in direct seeded rice (4.30; 4.47 and 4.85tha^{-1}) followed by transplanting method (3.89; 4.29 and 4.63tha^{-1}). However highest cost benefit ratio (CBR) was recorded (1:1.49) in direct seeded rice with net benefit (Rs.59875 ha^{-1}) followed by transplanting with CBR (1:1.35) with net benefit of Rs. 44225ha^{-1}. At the end it was concluded that direct seeded rice is a site specific technology for sowing of rice which save labor and energy. However the farmers are advised to grow their rice crop with the consultation of plant doctors of Agriculture Department.

Keywords: Rice (*Oryza sativa* L.), planting methods, direct seeded rice, transplanting

Introduction

Rice is one of the most widely consumed food crop in the world. It is grown on an area of 1.98 m ha with annual production of 3.64 mtones and average production in yield was 1842 kg ha^{-1} (Anonymous, 2010). In Pakistan, Punjab and Sindh are rice-producing provinces and however these provinces account for more than 88 percent (%) of total rice production (Abedullah et al., 2007). Rice (Oryza sativa L.) is the second largest staple food crop after wheat in Pakistan and is also a major source of export earnings (Nadeem et al., 2013). It adds for 4.4% of value added in agriculture and 0.9% in GDP. Pakistan grows high quality aromatic rice to meet both local market demand and exports. Transplanting of rice required maximum labor resulting in maximum cost of production however planting was delayed due to labor scarcity. Low plant population is the major cause for low rice (*Oryza sativa* L.) yields in Pakistan which can be optimized using a proper sowing method. It would be advantageous, if transplanting could be substituted by direct seeding of rice which could result in proper plant population. Direct seeded rice is an alternate option to cope with the problems of water and labor scarcity associated with conventional method (Weerakoon et al., 2011). Direct seeding of rice is accomplished by methods such as water seeding, wet seeding and dry seeding (Ehsanullah et al., 2007; Bouman et al., 2007; Farooq et al., 2011). The important reasons for low rice yield include water shortage, weed infestation, prevalence of insect pests and diseases and inappropriate sowing method leading to low plant population. Low plant population can be optimized using a proper sowing method. Transplanting is widely practiced in most of the Asian

countries (Mabbayad and Obordo, 1971). Transplanting method is more laborious, time consuming and expensive than direct seeding (Hashimoto et al. 1976). A lot of expenditure is required on raising nursery, its uprooting and transporting. Whereas for direct seeding, only two man hours are required to sow the same area. It requires less labor, less time and is more efficient. Other advantages are good and quick stand establishment, higher tillering and thus higher paddy yield. At present, rice cultivation is as direct seeded in America, Western Europe such as Italy and French, Russia, Japan, Cuba, India, Korea, and the Philippines and in some parts of Iran, due to high technology, high labor cost and shortage of skilled labor (Akhgari, 2004). Limited irrigation water is available to the farmers in many rice-growing areas and, in the future, predictions are that, 17 million-ha. of irrigated rice areas in Asia may experience ‘‘physical water scarcity’’ and 22 million ha may have ‘‘economic water scarcity’’ by next 15-20 years to come (Bouman and Tuong, 2001). Thus, water scarcity threatens the productivity and sustainability of irrigated rice ecosystems as it may no longer be feasible for the farmers to have wet cultivation and flood fields for ensuring good crop establishment and suppressing weeds (Johnson and Mortimer, 2005). Climate extremes and poor water availability will necessitate growing more food with less and less water in coming years. An average 1°C rise in temperature will increase the demand for irrigation water by 2-3% to sustain production at the current level (Reeves, 2009). Rice, in many parts of IGP, is normally irrigated almost continuously with water pumped from the groundwater (Sarkar et al., 2009). Further reduced labor availability is increasing the cost of transplanting and squeezing the farmer’s profit as the cost of transplanting is increasing continuously. Paddy transplanting by labour results in low and non-uniform plant population due to which crop yields are reduced (Mahajan et al., 2009). Direct seeding of rice and wheat after no tillage performed as well as the conventional practice but with significant savings in water and labour use (Bhusan et al., 2007). Among the herbicides bispyribac sodium 100SC and Ethoxy sulfuron 60WG proved as the best herbicide with 90.50% and 87.19% weed control respectively Direct-seeding is cost-effective, can save water through earlier rice crop establishment, and allows early sowing of wheat (Singh et al., 2003). Therefore, heavy weed infestation is a major problem in direct seeded rice and its success lies in effective weed control measures (Singh et al., 2003; Rao et al., 2007). Keeping in view, present study has been planned to evaluate DSR compared to transplanting method with a goal for finding most suitable one technique in District Sialkot as site specific technology.

Materials and Methods

Experimental site: The experiment was conducted at farmers’ field of District Sialkot during 2014-2016. In transplanting method; one month old nursery of paddy was transplanted but on other treatment seed used @ 30kgha^{-1}. The experiment was conducted in randomized complete block design with three replications having net plot size one acre. Single Super Phosphorus @ 250 kgha^{-1} and Murate of Potash @ 125kgha^{-1} were manually broadcasted in the field. In line sowing plant to plant and row to row spacing was maintained at 9 inches in transplanting techniques. Recommended post emergence herbicide (Pyranix Gold @ 250gha^{-1}) was sprayed on 30 days after sowing in direct seeded plots at wattar condition. In transplanting method pre-emergence herbicide (acetochlor @ 250mlha^{-1}) was applied in the field 5 days after transplanting of rice crop with shaker bottle. Zinc Sulphate 21% in crystalline form was broadcasted in each treatment @ 25 kgha^{-1} on 25 days after transplanting the nursery. The dose of Urea @187.50kgha^{-1} was broadcasted in both sowing methods. Two split doses of cartap hydrochloride 4%G were broadcasted in the field @ 22.5 kgha^{-1}. Other agronomic and plant protection measures were kept standard, constant and uniform for all treatments to avoid biasness. Data regarding productive tillers m^{-2}, 1000 grain weight (g), paddy yield (kg ha^{-1}) and economic analysis were recorded by counting three samples taken randomly from each repeat during Kharif 2014-16.

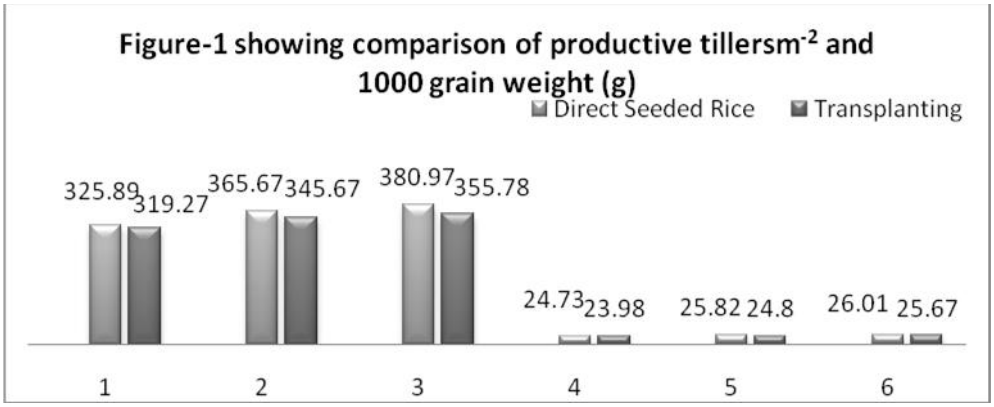
Results and Discussion

Productive tillers m^{-2}

From figure-1 showed that maximum number of productive tillers m^{-2} was recorded in direct seeded rice (3.25.89); (365.67); (380.97) followed by transplanted rice (319.27); (345.67) and (355.78) during these three respective years.

Thousand Grain Weight (g)

From figure-1 showed that maximum 1000 grain wt. (g) was recorded in direct seeded rice (24.73); (25.82); (26.01) followed by transplanted rice (23.98); (24.80) and (25.67) during these three respective years.



At present, 23% of rice is direct-seeded globally (Rao et al., 2007). Labour saving of DSR method induced by preparation of nursery and transplanting, causes the reduction of 11.2% in total production cost. DSR methods have several advantages over transpalnting (Singh et al.,2005a; Naresh et al., 2010). In addition to higher economic returns, DSR crops are faster and easier to plant and less labor intensive (Jehangir et al., 2005). Thus, it is necessary to change the cultivation system from transplanting to direct seeded rice (Sanjitha Rani and Jayakiran, 2010).

Table-1 Effect of different sowing techniques on the yield (tha-1) and cost benefit ratio of Super Basmati during 2014-2016.

Method of Sowing	Yield (tha^{-1})			Mean yield (tha^{-1})	Total Cost of production ($Rsha^{-1}$)	Total Income ($Rsha^{-1}$)	Net Benefit ($Rs.ha^{-1}$)	CBR
	2014	2015	2016					
Direct Seeded Rice	4.30	4.47	4.85	4.540	121725	181600	59875	1:1.49
Transplanting	3.89	4.29	4.63	4.270	126575	170800	44225	1:1.35

In calculation the rate of paddy was presumed Rs. $40kg^{-1}$

These results were in accordance to Kumar (2011) who reported that labor saving of 86% and cost saving of 87% in DSR compared to manual transplanting. In paddy, a labor saving of 95-99% in DSR was recorded compared to transplanting during three years. Sehrawat et al. (2010) also observed 13-16% labor saving in DSR as compared to manual puddled transplanted rice. Kumar (2011) also recorded similar findings and found higher B:C ratio in DSR as compared to transplanted rice. These results were contradictory to Iqbal et. al., (2015) who reported that conventional/transplanting method was best compared to DSR method.

Grain yield (tha^{-1})

Table-1 showed that maximum yield was recorded in direct seeded rice (4.30; 4.47 and $4.85tha^{-1}$) followed by transplanting method (3.89; 4.29 and $4.63tha^{-1}$) during three years.

Economic analysis

However highest cost benefit ratio (CBR) was recorded (1:1.49) in direct seeded rice with net benefit (Rs.59875 ha^{-1}) followed by transplanting with CBR (1:1.35) with net benefit of Rs. $44225ha^{-1}$. The method of cost benefit ratio was followed by Kahloon et al. (2012).

Conclusion

At the end it was concluded that direct seeded rice is purely a site specific technology for sowing of rice crop that save labor and energy. However the farmers are advised to grow their rice crop by this technique with the consultation of plant doctors of Agriculture Department, Punjab-Pakistan.

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