EFFECT OF DIFFERENT CROP ESTABLISHMENT METHODS ON RICE (ORYZA SATIVA L.) GROWTH AND YIELD - A REVIEW

Y.S. Parameswari*, A. Srinivas, T. Ram Prakash and G. Narendra
Department of Agronomy, College of Agriculture, Acharya N.G. Ranga, Agricultural University, Hyderabad- 500 030, India
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ABSTRACT

Rice is grown mostly through transplanting in India, in spite of the fact that transplanting is cumbersome practice and requires more labour. The inadequacy of irrigation water and scarce labour coupled with higher wages during the peak period of farm operations, invariably lead to delay in transplanting. To overcome this problem, farmers are gradually switching over to direct seeding under puddle condition. Wet seeding (Sowing pre-germinated seed on to puddle soil) reduces substantially the amount of labour needed for growing of rice crop. The wet seeding also helps to harvest the crop by 8-10 days earlier than transplanting. It eliminates the use of seedlings and operations such as nursery preparation care of seedlings, pulling, bundling, transporting and transplanting. The demand for more irrigation water and seed rate with transplanting and direct sowing methods signifies the importance of the other methods of rice crop establishment such as System of Rice intensification (SRI) to save water. With proper water and weed management under SRI and wet sowing we can get similar yields as that of transplanted rice. An attempt has been made in this paper to review the effect of establishment methods on rice crop yield.

Key words: Direct seeded rice, Grain yield, Rice, Transplanting.

Rice (Oryza sativa L.) is the most important staple food crop for more than half of the world’s population, including regions of high population density and rapid growth. It provides about 21 per cent of the total calorie intake of the world population. Transplanting is the most dominant and traditional method of establishment in irrigated low land rice. The area under transplanted rice in world is decreasing due to scarcity of water and labour. So, there is need to search for alternate crop establishment methods to increase the productivity of rice (Farooq et al., 2011). Pandey and Valesco (2005) stated that transplanted rice practiced in areas where low wages for labour and adequate water is available whereas, direct seeded rice can be practiced in areas with high wages and low water availability. Direct seeding reduces labour requirement, shortens the crop duration by 7-10 days and can produce as much grain yield as that of transplanted crop. It needs only 34% of the total labour requirement and saves 29% of the total cost of the transplanted crop (Ho and Romali, 2000). Direct seeding of rice allows early establishment of the succeeding crop and higher profit in areas with assured water supply by utilizing short duration modern varieties and cost efficient herbicides (Balasubramanian and Hill, 2002). However, this has been accompanied by increase in weed problems and a shift in dominant grassy weeds. The innovative systems of rice cultivation such as System of Rice Cultivation (SRI) is being evolved to increase the productivity of irrigated rice.

Effect of rice establishment methods on rice growth

Plant height: Hogar et al. (2009) noticed significantly taller plants were recorded with normal transplanting which was followed by SRI. On silty clay loam soil, Shekar et al. (2009) observed taller plants with SRI and Integrated crop management method of crop establishment than transplanting method of establishment. In contrast, more plant height was recorded with direct sown rice than transplanted rice.

*Corresponding author’s e-mail: samata.param@gmail.com
by Prabhakar, (1996). This may be due to the transplanting shock which may take about one week for establishment in transplanted rice. Singh et al. (1997) observed that higher plant with transplanted rice.

**Dry matter production:** Chander and Pandey (2001) and Gill et al. (2006) recorded the maximum dry matter accumulation in transplanted rice, which was significantly more than direct seeded rice. In contrast to above findings, Halder et al. (2009) and Chandrapala et al. (2010) recorded significantly higher plant dry weight under SRI method of establishment compared to direct sowing and conventional transplanting methods.

Kumar et al. (2008) revealed that the direct seeding of sprouted seeds under puddle condition recorded higher growth attributes than other systems of cultivation. In contrast to the above views, Halder et al. (2009) and Chandrapala et al. (2010) recorded significantly higher plant dry weight under SRI method of establishment compared to direct sowing and conventional transplanting methods.

**Tillers m\(^{-2}\) and productive tillers m\(^{-2}\):** Peng et al. (2006) stated that transplanting of rice seedling registered higher number of tillers on sandy loam soils during wet season. Gill (2008) reported that the transplanted rice on the day of direct sowing produced significantly more effective tillers m\(^{-2}\) (320) than the crop transplanted after 25 days of sowing (276.9 m\(^{-2}\)).

In contrast, Awan et al. (2007) reported maximum productive tillers m\(^{-2}\) (336) in direct seeded rice than manual transplanted crop (229 tillers m\(^{-2}\)). Hugar et al. (2009) reported that SRI method of cultivation recorded significantly higher number of and effective tillers (376.5 m\(^{-2}\)), followed by conventional transplanting and aerobic rice respectively.

**Effect of rice establishment methods on yield attributes and yield:** At Banglore, Hugar et al., (2009) reported that SRI method resulted in significantly higher yield attributes viz., panicle length (23.5 cm), number of seed per panicle (94.5), 1000 grain weight (27.5g), grain yield (6140 kg ha\(^{-1}\)) and straw yield (9306 kg ha\(^{-1}\)) compared to aerobic and conventional method. The results are in conformity with the findings of J ayadeva and Prabhakar Shetty (2008), Raju and Sreenivas (2008). In contrarily, Singh et al. (2005a) observed significantly higher number of panicles per unit area in wet seeded rice (429 m\(^{-2}\)) than in transplanted rice (248 m\(^{-2}\)).

Maximum panicle length was observed in direct sown rice crop over transplanted crop (Shekhar and Singh, 1991). However, Gill et al. (2006) found that the panicle length and test weight did not differ significantly on account of method of crop establishment.

Mankotia et al. (2009) found that among four methods of rice establishment transplanted method of paddy resulted in significantly higher grain yield (3.98 t ha\(^{-1}\)) followed by drum seeding(3.37 t ha\(^{-1}\)), broadcast seeding(3.27 t ha\(^{-1}\)) of sprouted seeds and row seeding(2.95 t ha\(^{-1}\)) in prepared bed. Hugar et al. (2009) and Chandrapala et al. (2010) higher yield attributes and biological yield were observed with SRI establishment method when compared with direct sowing and transplanting method at during wet season). Similar results were observed by Dubey and Singh et al. (2012). Non significant results were observed with respect to grain yield, straw yield and harvest index in conventional and SRI methods of establishment (Jai Kumar et al., 2012).

**Effect of rice establishment methods on nutrient uptake:** Chander and Pandey (1997) observed that N (112.8 kg ha\(^{-1}\)), P (17.0 kg ha\(^{-1}\)) and K (172.3 kg ha\(^{-1}\)) up take by rice were significantly higher under transplanting than direct seeded rice under puddle condition. Similarly, Anbumani et al. (2004) and Shashi kumar, (1990) found that line transplanted rice registered significantly higher nutrient up take than direct seeded rice. In contrast, higher nitrogen uptake (Mukherjee and Chaterjee, 1970) and phosphorus uptake (Purushotahman and Morchan, 1974).

**Effect of rice establishment on weeds:** On sandy loam soils, Chander and Pandey, (2001) registered significantly lower weed dry weight in transplanted rice than in direct seeded rice at tillering, flowering and maturity stages. The results are in agreement with the findings of Singh et al. (2006). Significantly the highest weed density and weed dry matter production was observed in wet seeded rice compared to transplanting (Singh et al., 2005b) Yadhav and Singh, (2006) observed the lowest population of weeds in transplanted rice compared to direct sowing.
Weeds removed nutrients (N, P and K) eight times higher under direct seeded rice compared to that of puddle transplanting (Singh et al., 2002). Sudhalakshmi et al. (2005) reported that nutrient uptake by weeds was 30 kg N, 10 kg P and 17 kg K per hectare in transplanted rice in clay loam soil of Coimbatore. Nutrient removal by weeds in broadcast sowing method (12.1, 2.4, and 19.5 N, P and K kg ha\(^{-1}\)) was significantly higher compared to line transplanting method (9.2, 1.8 and 15.1 kg ha\(^{-1}\) N, P and K respectively) reported by Sanjay et al. (2006 b).

**Economics of different crop establishment methods:** Sanjay et al. (2006a) stated that line transplanting recorded significantly higher gross income (Rs.31,158 ha\(^{-1}\) compared to drum seeding (Rs. 30,829 ha\(^{-1}\) and broadcast seeding (Rs. 22,032 ha\(^{-1}\) ). Significantly higher net returns (Rs. 37,086 ha\(^{-1}\) ) and higher B: C (2.03) ratio was observed under SRI method, when compared to aerobic and conventional method of rice establishment (Hugar et al., 2009). Similar results were also reported by Jayadeva and Prabhakar Shetty, (2008).

**CONCLUSION**

Though transplanting is the popular method of establishment it is cost effective due to nursery raising, transporting of seedlings to the main field and transplanting. Direct wet seeding and SRI better options of crop raising as it saves considerable labour, time and water requirement and there is a possibility of increasing the cropping intensity in case of direct wet sowing. Transplanting can be replaced by direct seeding under puddle condition and SRI where water and labour scarcity exists.

**REFERENCES**


