**Performance of rice cultivars under different resource conservation techniques**

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**Abstract**

In large parts of India and in many South Asian countries, rice is traditionally being grown by transplanting in puddled fields. Puddling reduces water losses through percolation besides being very effective in controlling weeds. But it has resulted in reduced soil fertility and increased soil compaction. Therefore, the present experiment was conducted to study the feasibility of other planting techniques. It was carried out in a farmer's field in Haryana in India during kharif 2002 and 2003. The study examined 3 factors – Variety (HKR 126 and IR 64), Tillage (Puddled and Zero tilled) and seeding method (Transplanted and Broadcast of sprouted seed). The grain yield of HKR 126 (6.24 t/ha) was significantly higher than IR 64 (5.75 t/ha). The higher yield in HKR 126 was attributed to more effective tillers and, depending on year, more filled grain and larger grain weight. Overall, Transplanting produced significantly higher yields (6.54 t/ha) than Broadcasting sprouted seed (5.44 t/ha). However, Tillage had no significant effect (Puddled 6.00 t/ha and Zero tilled 5.99 t/ha). Although the Transplanted treatments had fewer tillers/$m^2$ (300) than Broadcast (332), it produced a higher yield because it had more grains in the panicle (148 compared with 122) and larger grains (27 g compared with 25g).

**Media summary**

The grain yield of rice cultivar HKR-126 was significantly better than IR-64. However, zero tillage and puddling produced similar grain yield but the transplanted treatments were superior to the direct broadcast of sprouted seed treatments.

**Key words**

Cultivars, puddling, transplanting, broadcasting, zero-tillage.

**Introduction**

In India, rice is grown over an area of 43 m ha with total production of 87 m tons amounting 41.8 percent of total food grain (Singh, 2001). Presently, in Haryana the area, production and productivity of rice are around 1083 thousand ha, 2583 thousand tones and 2385 kg/ha, respectively. However, rice yield has reached a plateau in the irrigated ecosystem.

In most of the south asia, common practice of establishing rice in the rice-wheat system is puddling. puddling helps in reducing water losses through percolation and controlling weeds in rice fields (adachi 1992, singh *et al*., 1995). but besides being costly, cumbersome and time consuming, it results in degradation of soil and other natural resources and subsequently poses difficulties in seedbed preparation for succeeding wheat crop in rotation. it also promotes the formation of a plough pan, which affects rooting depth in the next crop. in recent years, the migration of rural labour to the industrial sector, especially in india, has led to the non-availability of labour for transplanting at the appropriate time, resulting in a yield reduction. this method also results in drudgery among women workers (budhar and tamilselvan, 2001). Rice can also be established by direct seeding or by wet seeding. direct seeding of rice is an attractive alternative to puddle transplanted rice (gupta *et al*., 2003). one of the transformations

that is taking place in the cultivation of wheat in rice-wheat cropping system is the evolution of zero-tillage technology. there is a significant paradigm shift from conventional tillage to zero-tillage, which has been made possible through farmers participatory research. more research is needed on resource conservation technologies including surface seeding and zero-tillage in both rice and wheat (malik *et al*., 2000). zero-tillage establishment is used widely for many crops around the world and this technology has potential to allow savings in time, energy, water and labour during rice establishment (piggin *et al*., 2002). hence, to get rid of puddling or transplanting or both, efforts are required to explore the possibilities of other crop establishment techniques in rice like direct seeding under puddled or zero till situation or transplanting under zero till or unpuddled conditions.

**Methods**

To evaluate the performance of two rice cultivars under four crop establishment techniques/resource conservation techniques (RCT's), an experiment was conducted during kharif seasons of year 2002 and 2003 represented the traditionally rice wheat cropping area of the state. The soil of the experimental field was clay loam in texture, medium in fertility and slightly alkaline in reaction (pH-8.2). The experiment comprising two rice cultivars (IR-64 and HKR-126) and four crop establishment techniques making eight treatment combinations viz., puddled-transplant-IR-64, puddled-transplant-HKR-126, puddled-broadcast (sprouted seed)-IR-64, puddle-broadcast (sprouted seed)- HKR-126, zero till-transplant-IR-64, zero till-transplant-HKR-126, zero till-broadcast (sprouted seed)-IR-64 and zero till-broadcast (sprouted seed)-HKR-126. The treatments were laid out in randomized block design, replicated thrice. The plot size under each treatment was kept relatively large (20mX33.33m). Under puddled condition the plots after wheat harvest were subjected to dry harrowing thrice and flooded with water (15cm) before subjecting to puddling. Puddling was accomplished with two harrowings followed by one cultivator and planking with tractor in the standing water. Under zero-tillage, the respective plots after wheat harvest were not subjected to any ploughing, however, pre-germinated weeds were knocked down by spraying glyphosate (Round up@ 1.5% solution) 10 days before transplanting or broadcasting of sprouted seeds. For raising nursery of both varieties, sprouted seeds were sown in small part of the field on 14$^{th}$ June 2002 & 14$^{th}$ June 2003. The sprouted seeds were broadcast at 40 kg/ha on 14$^{th}$ June 2002 and 14$^{th}$ June 2003 in the plots under puddled and zero tillage treatments. For transplanting, one month old seedlings from a nursery were used. Otherwise, the crop was raised using recommended practices.

**Results**

The yield attributes and grain yield in kharif 2002 and 2003 for the two rice cultivars and four crop establishment techniques are shown in Table 1. The grain yield of rice cultivar HKR126 (6.07 and 6.41 t/ha in 2002 and 2003 respectively) was significantly higher than IR64 (5.59 and 5.90 t/ha). This might be due to significantly higher number of effective tillers (316 and 328), filled grains per panicle [127 (non-significant), 172], 1000 grain weight (25.2 and 28.5 (NS) g) compared to IR64. However, the panicle length was statistically longer in IR64 than HKR126 in 2002 but was similar in both varieties during the second year.

**Table 1:mean performance of rice cultivars under different resource conservation techniques**

| Treatment | Effective tillers/m$^2$ | | Panicle length (cms) | | Filled grain/panicle (NOS) | | Unfilled grain/panicle (NOS) | | 1000 grain weight (g) | | Grain yield t/ha | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2002** | **2003** | **2002** | **2003** | **2002** | **2003** | **2002** | **2003** | **2002** | **2003** | **2002** | **2003** |
| Variety | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IR-64 | 304 | 316 | 26.2 | 27.7 | 117 | 123 | 13 | 15 | 23.9 | 27.0 | 5.59 | 5.90 |
| HKR-126 | 316 | 328 | 25.3 | 27.7 | 127 | 172 | 13 | 21 | 25.2 | 28.3 | 6.07 | 6.41 |
| C.D. (p=0.05) | 11 | 11 | 0.7 | NS | NS | 11 | NS | 3.5 | 1.2 | NS | 0.22 | 0.27 |
| Crop establishment techniques | | | | | | | | | | | | |
| Puddled-Transplant | 291 | 306 | 26.3 | 29.5 | 133 | 159 | 16 | 24 | 25.0 | 28.6 | 6.33 | 6.72 |
| Puddled-Broadcast (sprouted seed) | 329 | 341 | 25.2 | 26.4 | 109 | 140 | 11 | 17 | 24.3 | 26.7 | 5.33 | 5.60 |
| Zero till-Transplant | 295 | 307 | 25.9 | 28.4 | 138 | 161 | 10 | 13 | 26.0 | 28.8 | 6.36 | 6.74 |
| Zero-till-Broadcast (sprouted seed) | 325 | 334 | 25.9 | 26.6 | 108 | 130 | 15 | 18 | 23.3 | 26.5 | 5.29 | 5.56 |
| C.D. (p=0.05) | 16 | 16 | NS | 1.0 | 14 | 15 | 3.4 | 5.0 | 1.7 | 1.8 | 0.31 | 0.38 |

Among different crop establishment techniques, the number of effective tillers under puddled-transplant (291, 306) and zero till transplant (295, 307) were similar but each was statistically lower than both puddled-broadcast (329, 341) and zero till-broadcast (325, 334). However, panicle length of IR 64 (26.2 cm) was higher than HKR126 (25.3cm) in 2002 but it was similar in both varieties during the second year. Filled grains/panicle were highest under zero till- transplant (138, 161) in both years and less under zero till-broadcast (108, 130). There were more unfilled grains under puddle-transplant than in zero till-transplant during both years. The grain yield under zero till-transplant (6.36 and 6.74 t/ha) was similar to puddled-transplant (6.33 and 6.72 t/ha) but was significantly more than both puddled-broadcast (5.33 and 5.60 t/ha) and zero till broadcast (5.29 and 5.56 t/ha), which were also similar to each other.

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