*Environment & Ecology* 27 (4B) : 2035—2039, 2009
 *ISSN 0970-0420*

# Yield and Yield Attributes of Rice Cultivars as Affected by Transplanting Dates under Terai Region of West Bengal

PARTHA SARATHI PATRA[1] AND SUPRIYA BISWAS[2]

[1]*Department of Agronomy*, [2]*Department of Agricultural Entomology*, *Uttar Banga Krishi Viswavidyalaya Pundibari 736165*, *India*
*E-mail : parthaagro@gmail.com*

**Abstract**

A study was conducted to find out the effect of transplanting date on tillering and yield of some rice cultivars during *kharif* season of two consecutive years, 2006 and 2007. The experiment was laid out in a split plot design with three replications. Altogether eight cultivars of rice belonging to different groups were selected. Result shows that total number of tillers/hill was increased consistently upto 60 days after transplanting and then decrease gradually due to non-effective side tiller mortality. Plant height shows no significant co-relation with the yield of rice. Earlier transplanting dates produced more grain/panicle, 1000 grain weight was found higher in earlier transplanting dates than last one, this is due to higher conservation of light energy into chemical energy and its subsequent translocation from source to sink. Above and beyond earlier transplanting shows highest grain yield. This may due to the availability of more sunshine hours during the critical periods, which ultimately had its pronounced effect on more number of productive tillers per hill.

**Key words : Cultivars, Rice, Tillering, Transplanting date, Yield attributes, Yield.**

Rice (*Oryza sativa* L.) production constitutes the major economic activity and a key source of employment for the rural population of India. India has the largest acreage under rice about 44.6 million hectares of land with a production of about 90 million tones. The total cultivated area under rice in West Bengal was 5,856.8 thousand hectare during 2003-2004. In Cooch Behar district total area used for rice cultivation was 276.2 thousand hectare and the production was 515.4 thousand tones having the productivity of 1,865 kg per hectare during 2003-2004 (Directorate of Agriculture, Evaluation Wing, Government of West Bengal). Among the crop production tools, proper time and method of sowing are the prerequisites that allow the crop to complete its life phase timely and successfully under specific agro-ecology. For successful rice production, timely planting, appropriate control of vegetative growth throughout the duration of the crop, suitable transplanting densities for optimum tillering and control of leaf growth by controlling water, fertilizer and chemical inputs are essential for improving the growth variables responsible for high yield (1). In terai region of West Bengal, a vast rice growing area, particularly confined to *kharif* cultivation and mostly depending on monsoon shower, where rice based cropping system is practiced by the farmers. Cultivation of local cultivar of rice took place a considerable area in this region. The present studies were conducted for determin-ing the effect of transplanting dates on the productivity of transplanted rice under terai agro-ecology of West Bengal.

## Methods

The experiments were conducted at the research farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal during *kharif* season of two consecutive years 2006 and 2007. The farm is situated at 26° 19′ 86′′ N latitude 89° 23′ 53′′ E longitude at an elevation of 43 meters above MSL. The soil of the farm is generally sandy loam in texture, acidic in nature (pH 4.8—5.7), high in raw humus content and low in water retention capacity. The climate of the area is sub-tropical in nature with distinctive characteristics of high rainfall, high humidity and prolonged winter. The *kharif* season is characterized by the prevalence of moderate to high mean air temperature, high rainfall with cloudy and sunny days. The experiment was laid out in a split

**Table 1.** Effect of transplanting date on plant height and tillering at different growth stages of rice.

| | Plant height (cm) | | | Number of effective tiller/hill on DAT 20 | | | 40 | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14 July | 3 Aug | 23 Aug | 14 July | 3 Aug | 23 Aug | 14 July | 3 Aug | 23 Aug |
| **Cultivars** | | | | | | | | | |
| Doodh kalam | 136.00 | 112.33 | 104.00 | 10.47 | 13.90 | 11.70 | 12.20 | 12.73 | 13.63 |
| Swarna | 89.00 | 83.67 | 63.33 | 13.27 | 11.40 | 12.40 | 14.57 | 11.23 | 16.40 |
| Changa | 136.00 | 116.67 | 107.00 | 10.27 | 11.00 | 11.33 | 13.87 | 12.20 | 12.30 |
| Malseera | 117.67 | 110.00 | 79.33 | 11.07 | 10.93 | 13.47 | 13.07 | 13.23 | 15.63 |
| Tulaipanji | 109.00 | 107.33 | 91.33 | 10.80 | 11.23 | 10.67 | 13.03 | 14.03 | 14.57 |
| Hasansarai | 117.33 | 115.67 | 97.33 | 9.10 | 10.50 | 9.80 | 10.10 | 10.83 | 11.93 |
| Kalonunia | 127.67 | 110.67 | 104.67 | 9.87 | 11.27 | 9.67 | 13.40 | 11.47 | 14.90 |
| Masuri | 131.67 | 113.00 | 104.67 | 12.52 | 11.10 | 9.83 | 11.93 | 11.93 | 12.60 |
| **Date of Transplanting** | | | | | | | | | |
| SE (±) | | 0.56 | | | 0.33 | | | 0.34 | |
| CD ($P = 0.05$) | | 2.18 | | | 1.28 | | | 1.33 | |
| **Cultivars** | | | | | | | | | |
| SE (±) | | 1.80 | | | 0.37 | | | 0.37 | |
| CD ($P = 0.05$) | | 5.15 | | | 1.06 | | | 1.06 | |
| **Date of Transplanting × Cultivars** | | | | | | | | | |
| SE (±) | | 3.12 | | | 0.64 | | | 0.65 | |
| CD ($P = 0.05$) | | 8.92 | | | 1.84 | | | 1.84 | |

**Table 1.** Continued.

| | Number of Effective tiller/hill on DAT 60 | | | 80 | | | At harvest | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14 July | 3 Aug | 23 Aug | 14 July | 3 Aug | 23 Aug | 14 July | 3 Aug | 23 Aug |
| **Cultivars** | | | | | | | | | |
| Doodh kalam | 12.53 | 14.03 | 12.10 | 12.83 | 12.40 | 11.60 | 11.23 | 10.83 | 10.03 |
| Swarna | 14.17 | 14.47 | 17.63 | 12.67 | 11.07 | 14.90 | 12.67 | 11.93 | 10.33 |
| Changa | 11.03 | 11.73 | 12.77 | 11.10 | 11.93 | 10.87 | 11.57 | 10.20 | 9.97 |
| Malseera | 12.00 | 12.23 | 15.20 | 10.40 | 13.10 | 14.37 | 12.13 | 10.80 | 9.23 |
| Tulaipanji | 13.73 | 12.87 | 14.63 | 12.27 | 12.97 | 12.27 | 10.70 | 10.17 | 10.13 |
| Hasansarai | 14.90 | 17.13 | 13.87 | 12.60 | 9.77 | 12.10 | 11.17 | 9.57 | 8.57 |
| Kalonunia | 13.10 | 12.20 | 14.97 | 11.40 | 11.00 | 11.40 | 11.43 | 11.10 | 10.40 |
| Masuri | 13.43 | 10.53 | 13.53 | 11.17 | 10.37 | 12.67 | 11.77 | 9.73 | 9.43 |
| **Date of Transplanting** | | | | | | | | | |
| SE (±) | | 0.28 | | | 0.23 | | | 0.21 | |
| CD ($P = 0.05$) | | 1.11 | | | 0.90 | | | 0.82 | |
| **Cultivars** | | | | | | | | | |
| SE (±) | | 0.35 | | | 0.35 | | | 0.42 | |
| CD ($P = 0.05$) | | 0.99 | | | 0.99 | | | 0.62 | |
| **Date of Transplanting × Cultivars** | | | | | | | | | |
| SE (±) | | 0.60 | | | 0.60 | | | 2.30 | |
| CD ($P = 0.05$) | | 1.71 | | | 1.71 | | | 6.29 | |

plot design and replicated thrice. The nursery transplanting dates were maintained in main plots while

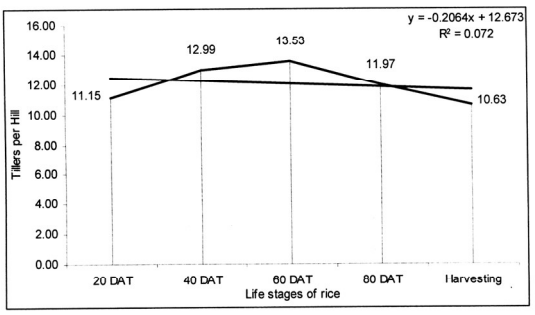


**Figure 1.** Tillering pattern of rice during *kharif* season.

the cultivars were kept in 3 m × 5 m sub-plots. A spacing of 15 cm × 20 cm was maintained in the plots with two seedlings per hill ; 28-day nursery of well adopted eight cultivars namely Doodh kalam, Swarna, Changa, Malseera, Tulaipanji, Hasansarai, Kalonunia and Masuri were transplanted on 14 July, 3 and 23 August of each year.

Fertilizers were applied at 120, 90 and 50 kg/ha of N, $P_2O_5$, and $K_2O$ respectively in the form of urea, single super phosphate and muriate of potash. Half of N and full dose of $P_2O_5$ , and $K_2O$ were applied at the time of transplantation, while the second half of N was applied one month after transplanting. Data were recorded on agronomic parameters including number of effective tillers/hill at 20, 40, 60, 80 days after transplanting (DAT), and during harvest, plant height (cm), 1,000 grain weight (g) number of grain/ panicle and yield (t/ha). The data were analyzed statistica-lly for comparing the treatment means i.e. date of transplanting and cultivars.

## Results and Discussion

### *Plant Height*

Plant height shows significant variation betw-een the dates of transplanting. Plant height of the cultivars was not considered here as the plant height differs from variety to variety. Highest plant height (120.54 cm) was recorded from the 14 July transplant-ing followed significantly by 3 August transplanting (108.67) and lowest being from 23 August transplant-ing (93.96).

**Table 2.** Effect of date of transplanting on number of grains/panicle, 1000-grain weight and yield of some rice cultivars during *kharif* season.

| | Number of grain/panicle | | | 1000 grain weight (g) | | | Yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14 July | 3 August | 23 August | 14 July | 3 August | 23 August | 14 July | 3 August | 23 August |
| **Cultivars** | | | | | | | | | |
| Doodh kalam | 141.67 | 120.00 | 92.67 | 25.00 | 24.00 | 23.00 | 2.55 | 1.88 | 1.45 |
| Swarna | 199.33 | 175.00 | 151.00 | 29.00 | 28.00 | 27.00 | 2.75 | 2.37 | 2.23 |
| Changa | 110.00 | 104.00 | 87.67 | 25.00 | 24.00 | 23.00 | 2.13 | 1.71 | 1.43 |
| Malseera | 118.67 | 114.00 | 82.67 | 26.00 | 25.00 | 23.00 | 2.57 | 2.14 | 1.88 |
| Tulaipanji | 125.00 | 108.00 | 88.33 | 24.00 | 23.50 | 23.00 | 1.75 | 1.64 | 1.28 |
| Hasansarai | 133.33 | 84.00 | 66.33 | 24.00 | 23.00 | 23.00 | 1.69 | 1.15 | 1.01 |
| Kalonunia | 262.00 | 152.00 | 75.00 | 24.00 | 24.00 | 23.50 | 2.74 | 1.48 | 1.21 |
| Masuri | 296.00 | 199.33 | 122.00 | 25.50 | 24.00 | 23.50 | 2.59 | 1.89 | 1.33 |
| **Date of Transplanting** | | | | | | | | | |
| Se (±) | | 1.46 | | | 0.51 | | | 0.12 | |
| CD ($P$ = 0.05) | | 5.74 | | | 2.05 | | | 0.46 | |
| **Cultivars** | | | | | | | | | |
| SE (±) | | 3.19 | | | 1.36 | | | 0.36 | |
| CD ($P$ = 0.05) | | 9.11 | | | 5.61 | | | 1.02 | |
| **Date of Transplanting × Cultivars** | | | | | | | | | |
| SE (±) | | 5.23 | | | 3.29 | | | 0.62 | |
| CD ($P$ = 0.05) | | 15.77 | | | 8.22 | | | 1.76 | |

*Effective Tillers Per Hill*

Among the yield components, productive tillers are important because the final yield is mainly a function of the number of panicles bearing tillers per unit area. The data indicated that in all the transplanting dates the total numbers of effective tillers/hill increased upto 60 DAT and then decreased gradually (Tables 1). Highest number of tiller hill at 80 DAT was found when crop was transplanted at 23 August (12.52).

Significant variation was observed among the cultivars and transplanting dates. Highest number of panicle bearing tillers were found when the crop was transplanted on 14 July (11.58) followed significantly by 3 August transplanting (10.54). Lowest number of panicle bearing tillers/hill (9.76) was recorded from the last transplanting date (23 August). Among the cultivars Swarna produced highest number of effective tillers/hill (11.64) and lowest numbers were recorded from Hasansarai (9.77).

*Number of Grain Per Panicle*

Crop planted on 14 July recorded the highest number of grains/panicle (173.25), significantly followed by 3 August with 132.04 number of grain/panicle. Lowest number of grain (95.71)/panicle was recorded from 23 August planting crop. Highest and lowest number of grain/panicle was found to differ significantly from Swarna (175.11) and Hasansarai (94.56) respectively.

*1000-Grain Weight (g)*

Thousand grains weight, an important yield-determining component, is a genetic character and least influenced by environment (2). Table 3 reveals that the grain weight was significantly higher (25.31 g) on 14 July than the August transplanted crop (24.44 and 23.63 g). Baloch et al. (3) at Dera Ismail Khan of Pakistan also found similar result. Among the cultivars, Swarna and Hasansarai produced highest and lowest weighted grains 28.00 and 23.33 gm respectively.

*Grain Yield (t/ha)*

Grain yield is a function of inter play of various yield components such as number of productive tillers, spikelets/panicle and 1,000-grain weight (4). Among planting dates significant variation was observed, maximum paddy yield (2.35 t/ha) was produced on 14 July followed by 3 August (1.78 t/ha) and 23 August (1.48 t/ha). Among the cultivars Swarna produced highest yield (2.45 t/ha) while Hasansarai produced lowest yield (1.28 t/ha).

The critical analysis of the data shows that the total number of tillers per hill increased up to a certain period due to profuse tillering during vegetative growth and then decreased gradually and lowest number of panicle bearing tillers was found due to non-effective side tiller mortality (Fig. 1). Plant height shows no significant co-relation with the yield of rice. Earlier transplanting dates produced more grain per panicle, as also reported earlier (3). Highest yield was recorded in earlier transplanting, the results are in conformity with the earlier findings of Hassan et al. (4) and Pal et al. (5). The earlier transplanting recorded highest grain yield. This may due to the availability of more sunshine hours during the critical periods, which ultimately had its pronounced effect on more number of productive tillers/hill ; 1,000-grain weight was found to be higher in earlier transplanting dates than others, this is due to higher conservation of light energy into chemical energy and its subsequent translocation from source to sink, higher in the earlier transplanting. Watanabe and Takeichi (6) also reported increase in grain yield during the period of more sunshine.

*Conclusion*

Thus time of transplanting influenced most of the growth and yield parameters, considerably. Among transplanting dates, 14 July planted crop gave higher grain yield and among the cultivars Swarna performed better in terms of growth, yield attributes and yield. Therefore, transplanting date 14 July with cultivars Swarna is recommended for successful rice production under the agro-climate conditions of the terai region of West Bengal.

**References**

1. Ghosh D. C. and B. P. Singh. 1998. Crop growth modeling for wetland rice management. *Environ. and Ecol.* 16 : 446—449.

2. Ashraf A., A. Khalid and K. Ali. 1999. Effect of seedling age and density on growth and yield of rice in saline soil. *Pak. J. Biol. Sci.* 2 : 860—862.
3. Baloch M. S., I. U. Awan and G. Hassan. 2006. Growth and yield of rice as affected by transplanting dates and seedling per hill under high temperature of Dera Ismail Khan, Pakistan. *J. Zhejiang Univ. Science B.* 7 : 572—579.
4. Hassan G., N. U. Khan and Q. N. Khan. 2003. Effect of transplanting date on the yield and yield components of different rice cultivars under high temperature of D. I. Khan. *Sci. Khy.* 16 : 129—137.
5. Pal S. K., K. M. Singh, R. Thakur, U. N. Verma and M. K. Singh. 1999. Growth and yield of rice (*Oryza sativa* L.) cultivars under different methods of planting in Bihar plateau. *J. Res. Birsa Agric. Univ.* 11 : 19—22.
6. Watanabe T. and Y. Takeichi. 1991. Flower sterility in paddy due to cool weather in the early season cultivation area. The relationship between light increasing characteristic and sterility. *Jap. J. Crop Sci.* 60 : 225—233.