ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

JOURNAL OF AGRONOMY

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Journal of Agronomy 5 (2): 248-250, 2006
ISSN 1812-5379

Agronomic and Morphological Parameters of Rice Crop as Affected by Date of Transplanting

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Abstract: An experiment to determine the effect of date of transplanting on the agronomic and morphological parameters of rice crop was conducted at Agricultural Research Institute, Dera Ismail Khan during Kharif season of 2003. A total of six transplanting dates; divided into two groups (early and late) were used. Most of the yield and yield contributing parameters (days to 50% heading, leaf folder, stem borer incidence, plant height, tillers $hill^{-1}$, 1000 grain weight, sterility % and harvest index %) were significantly affected by the two group of dates of rice transplanting. Highest paddy yields (4.53, 4.03 and 4.53 t ha^{-1}) were obtained in early transplanted rice group while seedlings transplanted late were heavily infested by stem borer thereby reducing yield to a larger extent (1.56, 1.94 and 2.24 t ha^{-1}). It has been concluded that early sown rice is a significant contributor towards farmers' livelihood status by giving them increased paddy yields as compared to late transplanted rice.

Key words: Rice (*Oryza sativa*), date of transplanting, early rice transplanting, late rice transplanting

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the world's most important staple food crops and is a leading crop in irrigated agriculture in Pakistan. It is grown in 111 countries ranging from the flood plains of Bangladesh to the Himalayan foothills of Nepal and from the rain forests of Indonesia to the desert plains of Australia (IRRI, 1995). It is an important cereal crop of Pakistan and ranked third in terms of area and production after wheat and cotton. It accounts for 6.7% in value added item in agriculture, 1.6% in GDP and also a major export item accounting for 6.1% of total export earnings (Shaikh and Kanasro, 2003).

Although rice in Pakistan is consuming large acreage, Pakistan is still far behind other rice producing countries. The average yield is very low (2 t ha^{-1}) as compared to Egypt (8.4 t ha^{-1}) and USA (6.6 t ha^{-1}). There are many reasons for this low yield. Optimum time of transplanting is very important factor in achieving increased rice productivity. When crop is planted at the right time, tillering and growth proceeds normally. Ghosh and Singh (1998) reported that timely planting; adequate nutrition and proper plant protection are essential for improving the growth variables responsible for high paddy yield. High temperature (32-40°C) at harvesting results in decrease in panicle weight and increase in the number of empty grains in ten cultivars (Zakria *et al*., 2002). Hari *et al.* (1999) observed that the Crop Growth Rate (CGR) of rice was higher in July planted crop than in June transplanting. Bhambhro (2000) reported that the April sown rice nursery mostly escaped pest's attack and this practice is getting popular due to the rising cost of pesticides. But the most serious yield-limiting factor associated with the early transplanted crop is sterility. Stake and Yoshida (1978) observed that spikelet sterility is induced by high temperature. The late-sown crop, although, harbours more pests, yet produced high quality rice as compared to the early sown crop which gives very low quality rice from the milling point of view (Bhambhro, 2000). Hassan *et al.* (2003) also reported the attainment of highest paddy yield in rice crop sown at an early date.

Keeping in view the importance of transplanting of rice crop on a suitable date, that is very important in getting higher rice yields. A research project was, therefore, formulated to find out an optimum rice transplanting date under the agro-ecology of D.I. Khan.

MATERIALS AND METHODS

An experiment to find out a suitable transplanting date to boost rice yields was conducted during Kharif season of 2003 at Agricultural Research Institute, Dera Ismail Khan. Rice variety IRRI-6 was transplanted at six different dates (May 01 to July 15 at an interval of 15 days) in a Randomized Complete Block (RCB) design having three replications. Thirty days old seedlings were used in each transplanting date. The experimental net plot size was 3×5 m^2 by maintaining a 20×20 row-row and

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Table 1: Scheme of different nursery sowing and transplanting dates of experimental treatments

Treatments	Date of nursery sowing	Date of transplanting
D_1	1st April	1st May
D_2	15th April	15th May
D_3	1st May	1st June
D_4	15th May	15th June
D_5	1st June	1st July
D_6	15th June	15th July

plant-plant spacing. Water and nutrient management was applied as optimum and equally to all treatments. The time of nursery sowing started from 1st April to 15th June at an interval of 15 days comprising six treatments while transplanting of 30 days old rice seedlings in each treatment was adopted. The schematic representation of treatments is described in Table 1.

RESULTS AND DISCUSSION

The treatment means showed significant differences regarding Days After Transplanting (DAS) taken to 50% heading. Rice seedlings transplanted on 1st April (D_1) took maximum DAS to 50% heading (100.7) followed by D_2 (102.7) as compared to minimum of 76 DAS taken to 50% heading by D_5 which was comparable to 79 DAS taken by D_6 (Table 2). It was evident from the data given in Table 2 that significant differences existed among transplanting dates pertaining to percentage of Leaf Folder Incidence (LFI). Rice seedlings sown late; 15th June (D_6) was heavily attacked by leaf folders infesting 81.67% of the crop. However minimum infestation by leaf folders was recorded (0.50%) in early transplanted seedlings (D_1). The higher insect pests attack in late planted rice has already been reported by Bambhro (2000) and Hassan *et al.* (2003). Similarly percentage of Stem Borer Incidence (SBI) showed significant differences among treatment means. The early planted rice (D_1, D_2 and D_3) either escaped or minutely attacked by stem borer, whilst, late sown rice seedlings (D_4, D_5, D_6) were noted with heavy SBI. Minimal SBI was observed in seedlings transplanted on 1st of April (2.84%) as compared to intensely teemed (56.43%) rice sprouting transplanted on 15th of June which is at par (44.66%) with D5 (30th June). These results are in concurrence with Baloch (2004) whereby rice seedlings transplanted early were little infested by the attack of stem borer. Transplanting dates do not differ significantly regarding plant height (Table 2). The data exhibit that the plant height is influenced by the environment rather than under genotypic control. Statistically significant differences were observed among transplanting dates pertaining to tillers hill^{-1} (Table 2). D_3 produced maximum tillers hill^{-1} (15.67) and is statistically at par with D_4 which produced similar number of tillers hill^{-1}. Minimum numbers of tillers hill^{-1} were recorded in D_6 (91.67). These results are in agreement with those of Iftikhar *et al.* (2002) and Hassan *et al.* (2003).

The treatment means do not differ significantly as evident from the data presented in Table 3 concerning grains spike^{-1}. The data recorded on 1000-grain weight are presented in Table 3 showing significant differences among treatment means. Rice seedlings transplanted on 15th July (D_6) produced maximum grain weight of 26.44 g; however, all other transplanted dates are comparable to each other regarding 1000 grain weight. Similar results were stated by Soomro *et al.* (2001). Data regarding sterility percentage depicting unfertilized and unfilled spikelets are presented in Table 3 showed statistically significant differences among transplanting dates. Maximum sterility (27.79%) was observed in early transplanted rice (D_1), while, minimum sterility (12.14%) was noted in late transplanted rice seedlings (D_6) and is at par with D_3 (12.44%). Similar findings were reported by Baloch (2004) who recorded high percentage of sterility in rice seedlings which were transplanted late. The findings of Hassan *et al.* (2003) under D.I. Khan conditions also support the present results. Harvest index was significantly affected due to various transplanting dates. Mean values of the data shown in Table 3 revealed that early transplanted rice seedlings (D_1) had highest harvest index (53.33%) which is statistically at par with D_2 by having harvest index of 50.80%. The lowest harvest index was recorded in late transplanted (D_4 and D_5) rice seedlings with harvest indices of 24.33 and 26.00%. The early transplanted rice has a prolonged growing period; hence, despite inverting in photosynthetic tissues, it diverts more photosynthate towards grain yield. Paddy yield is the ultimate output of rice production and is most desired factor in influencing farmers for recommended rice planting. Paddy yield in the function of interplay of various factors noticeably number of tillers, grains spikes^{-1} and 1000 grain weight (Baloch, 2004). Present research advocated statistically significant effects of transplanting dates on paddy yield (Table 3). The highest paddy yielder were the early transplanted rice seedlings (4.53) which were at par with each others by producing 4.43 t ha^{-1} (D_1) followed by 4.53 (D_3) and 4.03 t ha^{-1} (D_2). The lowest paddy yield was recorded in D_4 (1.56 t ha^{-1}) which is comparable with D_5 (1.94) and D_6 (2.24 t ha^{-1}). These findings are in agreement with Hassan *et al.* (2003) who reported increased rice yields in early transplanted seedlings (June transplantation) as compared to late rice transplanting of July. Conformity to present research findings was also obtained from the results quoted by Baloch (2004) and Pal *et al.* (1999) who concluded that

Table 2: Effect of different dates of transplanting on DAS, LFI, SBI, plant height, tillers $hill^{-1}$ and grains $spike^{-1}$

Treatments	DAS (50%)	LFI (%)	SBI (%)	Plant height (cm)	Tillers $hill^{-1}$	Grains $spike^{-1}$
D_1	100.70A	0.50C	2.84C	94.33AB	12.00BC	126.667
D_2	102.70A	0.67C	23.04B	95.00AB	13.67B	114.333
D_3	91.00B	1.67C	20.65B	102.0A	15.67A	114.667
D_4	85.00C	5.33C	56.43A	96.33A	15.67A	106.333
D_5	76.00D	23.33B	44.66A	97.67AB	11.33C	132.667
D_6	79.00D	81.67A	26.31B	91.67B	9.33D	123.333
CV%	1.96	43.57	27.8	4.56	7.15	14.79
$LSD_{0.05}$	3.18	14.95	14.66	7.98	1.68	NS

Means followed by different letter (s) in the representative column are significant at 5% level of probability using LSD test
NS = Non-significant

Table 3: Effect of different dates of transplanting on 1000-grain weight, sterility, harvest index and paddy yield

Treatments	1000 grain weight	Sterility (%)	Harvest index (%)	Paddy yield t ha^{-1}
D_1	24.08B	27.79A	53.33A	4.53A
D_2	22.94B	15.08B	50.80A	4.03A
D_3	24.67AB	12.44C	44.00B	4.53A
D_4	22.83B	19.54B	24.33D	1.56B
D_5	23.39B	19.08B	26.00D	1.94B
D_6	26.44A	12.14C	33.67C	2.24B
CV%	5.40	18.22	7.69	14.01
$LSD_{0.05}$	2.362	5.858	5.404	0.7992

Means followed by different letter (s) in the representative column are significant at 5% level of probability using LSD test
NS = Non-significant

delayed rice transplanting produced lowest yields as compared to seedlings transplanted early in the season i.e., the month of June.

From the findings of present research, it has been concluded that rice transplanted at early dates favours high paddy yields, lowest LF incidence, less SB infestation, tallest plants, less occurrence of sterility and high harvest index. Hence early transplanting appears to be a promising way to improve grain yield in rice from ecological and economic perspectives in the NWFP region of Dera Ismail Khan.

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