Pak. J. Agri. Sci., Vol. 39(1), *2002*

BIOLOGICAL RESPONSE OF DIRECT-SEEDED COARSE RICE TO SEEDING DENSITY AND PLANTING TIME

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Field experiments were conducted at the University of Agriculture, Faisalabad to determine the effect of seeding density and planting time on yield and yield attributes of direct-seeded coarse rice cv. IRRI-6 during 1996 and 1997. The seeding density comprised 75, 100 and 125 kg ha^{-1}, while the planting times were 1st and 3rd week of June and 1st week of July. Planting during the lst or 3rd week of June @ 100 kg ha^{-1} produced grain yields of3.91 and 3.29 t ha^{-1} in 1996 and 4.28 and 4.10 t ha,l in 1997. Increase in grain yield were due to increased number of panicle bearing tillers m^{-2}, number of spike lets panicle^{-1} and 1,000-grain weight. Late planting with a seed rate of 125 kg ha^{-1} gave minimum yield of2.32 t ha^{-1} in 1996 and 3.02 t ha^{-1} in 1997.

Key words: agronomic traits, direct-seeded coarse rice, seeding density, planting time

INTRODUCTION

Potential yield of rice *(Oryza saliva* L.) obtained at different research stations is much higher than that obtained at farmer's field i.e. 1929 kg ha^{-1} (Anonymous, 1999), which clearly indicates the scope of improving the yield through better agro-management practices. The agronomic constraints identified for low productivity are poor plant stand and improper sowing time. Many factors account for poor plant density. Of which improper plantation technique and untimely planting of the crop are the most important in our rice growing areas. Studies have shown that it is possible to increase rice yield at farm level by about 50-60% by ensuring an optimum plant density (Chaudhry, and Iqbal, 1986 and Miller et al., 1991).

Previous studies (Pedroso 1984a and Park, 1990) have indicated that rice yield can be improved by increasing plant density and early sowing. This necessitates to work out the optimum level of seeding density and planting time for direct-seeded rice in different rice growing areas for getting high paddy yield. Consequently, the present study was designed to determine the effect of different seeding densities and planting times on different agronomic traits of coarse rice under the agro-ecological conditions of Faisalabad in irrigated environments.

MATERIALS AND METHODS

The experiment was conducted during Kharif 1996 and 1997 at the Agronomic Research Area, University of Agriculture, Faisalabad. The cultivar IRRI-6 was used as a test crop. The soil at experimental site was sandy-clay loam having pH 7.8, organic matter 0.72%, total nitrogen 0.05%, available phosphorus 5.99 ppm and K 183 ppm.

The treatments consisted of three seeding densities (75, 100 and 125 kg ha^{-1}) and three planting times (1st week of June, 3rd week of June and 1st week of July). The experimental design was randomized complete block in split plot arrangement with four replications. The net plot size was 2 m x 3 m. The planting times were randomized in main plots and seeding densities in subplots. Seed was soaked in water for 24 hours prior to seeding. The seed was treated with fungicide Topsin-M @ 3 g kg^{-1} seed. A uniform dose of 150-90-75 kg NPK ha^{-1} was applied in the form of urea, single super phosphate and sulphate of potash, respectively. The whole quantity of P and K and half of N were applied prior to seedling and the remaining half of N was applied in two equal splits each at tillering and panicle initiation. Zinc sulphate was applied @ 25 kg ha') 30 days after seeding. A granular insecticide Sunfuran-3G (Carbafuran) was applied twice @ 20 kg ha') against leaffolder and stem borer.

Data on paddy yield and different components of yield were recorded using standard procedure and were analysed statistically by using Fisher's analysis of variance technique. Least significant difference test (LSD) was employed to compare the treatment means (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

1. Number of Tillers: Interaction between seeding density and planting time was significant ($P<0.05$) during 1996 in respect of number of tillers m'2 (Table 2). The crop seeded @ 125 kg ha^{-1} and sown during the 1st week of June (S3DI) produced the maximum number of tillers m^{02} (903.30) against the minimum of 652.28 in S_1D_2 (seeded during 3rd week of June with a seed rate of 75 kg ha,I). During 1997, the crop seeded @ 125 kg ha^{-1} (S3) produced significantly the maximum tillers m'2 (869.53) against the minimum of 730.37 in that seeded @ 75 kg ha') (S,). Higher number of tillers m,2 in S3 was attributed to higher seedling density m^{-2}. Similar results have been reported by Sharrna (1992). Planting during the 1st week of June (D_1) produced significantly more number of tillers m'2 (837.00) than D_2 and D_3 during 1997 due to longer growth period because of early seeding.

2. Panicle Bearing Tillers: Both seeding density and planting time significantly affected the number of panicle bearing tillers during 1996 (Table 1). The crop seeded @ 125 kg ha^{-1} and sown during 3rd or 1st week of June ($S3D_2$ and S3D,) produced the maximum number (440.22 and 434.92) of panicle bearing tillers m'2 against the minimum of 273.44 in S_1D_3 (seeded during 1st week of July with a seed rate of 75 kg ha^{-1}), During 1997, the maximum number of 451.25 panicle bearing tillers m'2 was recorded in S3 (125 kg seed ha^{-1}) against the minimum of 378.54 in S, (75 kg seed

Table 1. Effect of seeding density and planting time on yield and yield attributes of direct-seeded coarse rice (cv/IRRI-6) during 1996 and 1997

	No. of Tillers m,2	Panicle bearing tillers m'2	No. of Spikelets Panicle')	1000-grain weight (g)	Normal kernels panicle"	Grain yield (t ha")
1996						
Seedina density						
SI = 75 kg ha'	630.54 c	334.52 c	107.68 a	21.66 a	65.34 a	2.92 b :
S2 = 100 kg ha')	722.28 b	352.75 b	105.68 a	21.34 a	61.45 b	3,45 a
S3 = 125 kg ha')	304.09 a	392.93 a	95.39 b	19.44 b	53.41 c	2.75 c
LSD (0.05)	12.96	11,28	2.10	0.59	0.68	0.11
Planting time						
0, = 1st week of June	801.43 a	399.43 a	118.23 a	20.07 a	67.88 a	3.53 a
O2 = 3rd week of June	742.24 b	392.85 a	113,43a	21.34 a	62.12 b	3.14 b
03 = 1st week of July	613.25 c	287.89 b	75,48 b	19.00 b	50.21 c	2,46 c
LSD (0.05)	17.95	31,14	6,48	1.04 .	1,47	0.15
1997						
Seeding density						
S) = 75 kg ha"	730.37 c	378.54 c	122.86 a	22.90 a	68.26 a	3.24 b
S2= 100 kg ha')	806.44 b	417.82 b	120.17a	21,69 b	66,23 b	4.00 a
S3 = 125 kg ha')	869.53 a	451,25 a	101,00 b	19.61 c	59.03 c	3.16 b
LSD (0.05)	9,46	13.96	3.51	0.50 .	0.59	0.11
Planting time						
01 = 1st week of June	837.00 a	403.71	117.53 a	21,85 a	67,54 a	3.61 a
02 = 3rd week of June	794,32 b	417.09	114.73 ab	22.10 a	65.80 b	3.55 a
03 = 1st week of July	775.00 c	403.71	111,75b	20.25 b	60.21 c	3.24 b
LSD (0.05)	18.10	NS	4.10	0,43	1,39	0.18

ha"). Higher number of panicle bearing tillers m') in S3 was ascribed to higher initial seeding density m'2 in this treatment.. Sharma (1994) also reported that as seeding rate in rice was increased, panicle bearing tillers m'2 increased significantly.

3. Number of Spikelets Panicle": The maximum number of spikelets panicle') (122.02) was recorded when the crop was seeded during 1st week of June @ 100 kg ha') (Table 2). In contrast, the minimum number of spikeletspanicle" (68.45) was recorded in S3D3 (crop seeded @ 125 kg ha"' and sown during 1st week of July). During 1997, the maximum number of spike lets panicle"' (122.86) was found in seeding density of 75 kg ha') (S,), which was at par with S2 (100 kg ha") recording 120.17 number of spikelets panicle"' against the minimum of 101.00 in S3 (125 kg ha"'). This could be attributed to comparatively lower number of panicle bearing tillers m'2 resulting in better development of panicle. These results are in conformity with those of Gravois and Helms (1992) who also reported lower number of florets pabicle" with increasing density. The higher number of spikelets panicle" (I 17.5) was recorded for planting in the 1st week of Jnne (D)) against the lowest of 111,75 in 03 (1st week of July) during 1997, mainly due to longer growing season. Lee and Jun (1998) stated that reduction in spikelet number panicle"' was due to delayed seeding.

4. lOOO-Grain Weight: Different seeding densities and planting times significantly influenced 1000-grain weight in both the seasons (Table 1). The higher IOOO-grain weight of 21.66 g (1996) and 22.98 g (1997) was recorded at a seeding density of 75 kg ha"' (S)) against the minimum at 125 kg ha' (S3)' This was due to more number of normal kernels panicle" resulting in high density grains in S) than in S2' Decrease in 1000-grain weight with higher seeding density has also been reported by Karim etal.. (1992). Planting in the 1st week (D)) or third week of June (02) gave the maximum but statistically similar 1000-grain weight (Table I) against the minimum in 03 (1st week of July) which was attributed to more normal kernels in D) during both the years.

5. Normal Kernels Panicle": The crop seeded @ 75 kg ha') and sown during 1st week of June (S)D,) produced significantly higher percentage of normal kernels (72.43 and 70.58) than that seeded @ 125 kg ha') and sown during 1st week of July (S3D3) producing 42.87% and 13.53% of normal kernels during 1996 and 1997 respectively (Table2~ The main effects as well as their interactions were significant in affecting paddy yield in both the years. The crop sown during the 1st or 3rd week of June with a seed rate of 100 kg ha" (S2D)) and S2D2) produced significantly higher paddy yield 00.91 and 3.79 t ha" during 1996 and 4.28 and 4.10 t ha') during 1997. By contrast, minimum paddy yield of 2.32 and 3.02 t ha') was recorded when crop was seeded @ 125 kg ha') and sown during 3rd week of July in 1996 and 1997 respectively. It was observed that number of panicle bearing

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rji	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
rJl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
rfj	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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tillers m,2, number of spike lets panicle"' and normal kernels panicle' significantly contributed to final grain yield. Similar results have been reported by Pedroso (1984a) and Park et at. (1990) who indicated that rice paddy yield can only be improved by increasing plant density and early sowing and it tended to decrease at the highest density and with late sowing.

REFERENCES

Anonymous. 1999. Economic Survey 1998-99. Statistical Supplement, Economic Advisor's Wing, Finance Div., Govt.. of Pakistan, Islamabad.

Chaudhry, A.M. and M.S. Iqbat.. 1986. Production technology for Basmati-385. Progressive Farming 16(1): 17-24. PARC,, Islarnabad, Pakistan.

Gravois, K.A. and R.S. Helms. 1992. Path analysis of rice yield and yield components as affected by seeding rate. Agron. J. 84(I): 1-4.

Karim, MA, A. Ali, L. Ali, S.S. Ali, A. Mahmood, A. Majid and TA Akhtar.. 1992. Effect of plant density on rice grain quality. IRRN. 17(6): 12. [Rice Absts. 16(3), 1556,1993].

Lee, K.S. and J.H. Jun. 1998. Identifying optimum seeding time for direct seeding on a wet field surface in reclaimed saline soil in Korea. IRRN. 23(2): 29-30.

Miller, B.C"., J.E. Hill and S.R. Roberts. 1991. Plant population effects on growth and yield in water-seeded rice. Agron. J. 82(2): 291-297 [Rice Absts. 14(5): 2194, 1991].

Park, S.T., S.c.. Kim, Y. Son, S.K. Lee and G.S. Chaung. 1990. Studies on major cultivation methods for dry direct rice sowing in Yeongnam area. Research Reports of Rural Dev. Admin., Rice, 32(3), 18-28 [Rice Absts. 14: 2192,1991].

Pedroso, B.A. 1984a. Sowing density for irrigated rice. Empresa catarinensa de Fesquisa Agropecuarla: 242-246 [Rice Absts. 9(4): 1056, 1986].

Sharma, A.R. 1992. Effect of varying seed rates and transplanting colonal tillers on the performance of rice under intermediate deep water conditions (0-80 cm). J. Agri.. Sci. India, 119(2): 171-177 [Field Crop Absts. 46: 3339, 1993].

Sharma, A.R. 1994. Effect of seed rate and row spacing on the performance of early and late maturing rice eultivars in mixed crop systems under intermediate deep water conditions (15-50 cm). J. Agri. Sci. India. 122(2): 201-205 [Rice Absts. 17(4): 1581, 1994].

Steel, R.G.D. and J.H. Torrie. 1984. Principles and Procedures of Statistics. McGraw Hill Book Co. Inc., Singapore. 172-177.