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Agronomic and Physiological Parameters of Rice Genotypes as Affected by Planting Dates

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Abstract: An experiment was conducted at BRRI Gazipur in T. Aman season, 2016 to find out optimum planting time of different advanced lines. The promising lines were: BR7528-2R-HR16-12-3-P1, BR7528-2R-HR16-12-23-P1, IR 84750-213-2-2-3-1, BR7895-4-3-3-2-3, BR8445-54-6-6 including check varieties of BRRI dhan72, BRRI dhan39 and BRRI dhan49. Planting times were from 15th July to 13th September with 15 days interval. The treatments were distributed in split plot design (planting time in main plot and genotype in sub plot) with three replications. Except BR7528-2R-HR16-12-23-P1 other promising lines did not give higher yield than check variety BRRI dhan49 in all planting dates. BR7528-2R-HR16-12-23-P1 gave higher yield than all check varieties in all planting dates except in 13 September that gave similar yield to BRRI dhan49. The growth duration of BR7528-2R-HR16-12-23-P1 was 9-11 days less than BRRI dhan49 in different planting dates. At 30 July planting BR7528-2R-HR16-12-23-P1 performed best after that the yield was reduced gradually. Planting time 15 July, 30 July and 14 August gave statistically similar yield with BR7528-2R-HR16-12-23-P1. Therefore, the optimum planting time for BR7528-2R-HR16-12-23-P1 should be 15 July to 14 August.

Key words: Planting time · Genotypes · Micronutrient enriched advanced lines

INTRODUCTION

Maintaining proper planting time is very much crucial for higher yield of rice, so before releasing a variety optimum planting time should be identified. Rice productivity is highly influenced by planting date. When rice is planted under ideal conditions with favorable air and soil temperatures and appropriate soil moisture, the performance of the crop drastically improves. Planting too early can expose the crop to cold temperatures and result in poor germination, low seeding vigor and seedling mortality [1 - 3]. Planting too late often causes reduced yields and grain quality as the reproductive phase coincides with the height of the summer heat and rice grain yield and quality are negatively affected [4, 5]. Thus, determining the optimal planting time is critical to maximize yield and grain quality.

Optimum time of planting is very important factor in achieving increased rice productivity. When crop is planted at right time, tillering and growth proceeds normally. Khakwani *et al*. [6] reported that timely planting, adequate nutrition and proper plant protection are essential for improving growth variables responsible for high paddy yield. The most serious yield-limiting factor associated with the late transplanted crop is lower panicle number and higher sterility.

Choosing when to plant is crucial to establishing the crop in the field. Timely planting into a well-prepared seedbed will help produce a fast growing, uniform crop that will have higher yields and better competition against weeds and other pests. The best time to plant depends on locality, variety, weather, water availability and the best harvest time. Planting at the same time (or within a 2-week window) as the neighboring fields can help to minimize insect, disease, bird and rat pressure on individual fields.

Determining the optimum time of planting of rice promising lines, is important to obtain higher grain yield before releasing a new variety. The promising lines have high yield potentials to be selected by planting rice seedling under varied planting dates in a particular season.

MATERIALS AND METHODS

The field trial was conducted at BRRI Farm, Gazipur at T. Aman season, 2016 to find out optimum planting time

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and to select the best promising line(s). The promising lines were: BR7528-2R-HR16-12-3-P1, BR7528-2R-HR16-12-23-P1, IR 84750-213-2-2-3-1, BR7895-4-3-3-2-3, BR8445-54-6-6 including check varieties of BRRI dhan72, BRRI dhan39 and BRRI dhan49 were planted from 15th July to 13th September with 15 days interval. Twenty-five-days old seedlings were transplanted at 20-x 20 cm spacing. The treatments were distributed in split plot design (planting time in main plot and genotype in sub plot) with three replications. The BRRI recommended fertilizers (N-P-K-S = 68-11-41-10 kg ha^{-1}) were applied in the experiment. All fertilizers except urea were applied during final land preparation. Urea was applied at 15 DAT, 25 DAT and finally at 5-7 days before panicle initiation (PI) stage. Irrigation, weeding, disease and insect control were done as and when necessary. Yield data were recorded during harvesting.

Statistical analysis was done by Star 2.0.1 program.

RESULTS AND DISCUSSION

Plant Height and Leaf Area Index: Transplanting date had a significant effect on plant height. BRRI dhan72 have the highest plant height (144 cm) at 30 July and the lowest (93 cm) was at 13 September for BRRI dhan49 (Table 1). The highest plant height belonged to the first (15 July) to third (14 Aug.) transplanting date. Plant height decline on the fourth to fifth transplanting date can be attributed to lower environmental temperatures during the vegetative and reproductive period [7]. The panicle development and grain filling are dependent on the support receive from the leaves. The highest Leaf Area Index (Table 2) observed from 15 July to 14 August transplanting for all genotypes and grain yield also highest in this time. After 14 July, transplanting LAI as well as grain yield gradually decreased. Thus, LAI decides the level of crop performance in a given situation [8]. Like plant height, LAI also have effect on environmental temperature.

Yield and Yield Components: The interaction effect indicated that micronutrient enriched rice (MER) line BR7528-2R-HR16-12-3-P1 gave statistically similar grain yield against check BRRI dhan72 but 4-5 days earlier than the check (Table 4) and considerably grains $panicle^{-1}$ and panicle m^{-2} also similar with the check (Table 2 & 3). In addition, thousand-grain weight of BR7528-2R-HR16-12-3-P1 was lower than BRRI dhan72 (Table 3). BR7528-2R-HR16-12-23-P1 gave higher grain yield than check varieties in different time of planting, whereas growth duration was similar with BRRI dhan39. In contrast, panicle per m^2 was similar with the check BRRI dhan49 but thousand-grain weight was lower than BRRI dhan72. IR 84750-213-2-2-3-1 showed similar grain yield against check BRRI dhan72 from 15 July to 29 August transplanting and panicle m^{-2} with thousand grain weight also similar with BRRI dhan72. BR7895-4-3-3-2-3 gave statistically similar grain yield in 15 and 30 July transplanting against check varieties BRRI dhan49 and BRRI dhan72. Panicle m^{-2} of BR7895-4-3-3-2-3 was similar with BRRI dhan72 but thousand-grain weight was lower than the check BRRI dhan72. BR8445-54-6-6 showed early maturity among all the entries and grain yield was lower than the check varieties, whereas panicle per m^2 was similar with BRRI dhan39 but thousand-grain weight was lower than check BRRI dhan72. The productive tiller is highest in 15 July to 14 August transplanting and after 14 August, it was gradually reduced. Therefore, percentage of panicle production from tiller was highest at 15 July to 14 August transplanting. The number of panicles decreased due to temperature reduction on the fourth and fifth planting date. [9, 10] studied the effect of environment, temperature, genotype and found variation for yield and productive tiller percentage and find the similar result.

Growing Degree- Day and Growth Duration: The maximum growing degree-day was found in BRRI dhan49, whereas the lowest was for BR8445-54-6-6 (Table 5). Therefore, BRRI dhan49 required more temperature and duration for its growth and development than BR8445-54-6-6. BR7528-2R-HR16-12-23-P1 showed the highest grain yield in kg ha^{-1} day^{-1} in 30 July transplanting but the lowest was found in BRRI dhan39 (Table 6). Because after 30th July grain yield of BR7528-2R-HR16-12-23-P1 as well as other genotypes also decreased but growth duration increased. When genotypes were transplanted in 15 July that time temperature is high so genotypes can easily fulfill their requirements (GDD) (Table 5) in a short growth duration (Table 4) and their dry matter production is also high which is convert into grain yield (kg ha^{-1} day^{-1}) (Table 6) is also higher. On the other hand, after 15 July temperature is gradually decreasing and plant need more time to fulfill their requirements. Therefore, field duration increases slowly which effect the dry matter production by the plant. As a result, grain yield (kg ha^{-1} day^{-1}) is also regularly decreased [11].

Table 1: Interaction effect of planting time of micronutrient enriched advanced lines (MER) on Plant height in T. Aman, 2016 at BRRI farm, Gazipur

	Plant Height (cm)				
Advanced lines/varieties	15 July	30 July	14 Aug.	29 Aug.	13 Sept.
BR7528-2R-HR16-12-3-P1	119	122	121	109	103
BR7528-2R-HR16-12-23-P1	135	139	138	133	114
IR 84750-213-2-2-3-1	116	122	118	117	97
BR7895-4-3-3-2-3	127	135	137	119	119
BR8445-54-6-6	128	131	123	121	111
BRRI dhan72	143	144	139	132	113
BRRI dhan39	108	121	112	110	103
BRRI dhan49	123	118	113	113	93
$LSD_{0.05}$			6.72		
CV(%)			3.4		

Table 2: Interaction effect of planting time of micronutrient enriched advanced lines (MER) on Leaf Area Index (LAI) and grains panicle^{-1} in T. Aman, 2016 at BRRI farm, Gazipur

	LAI					Panicle m^{-2}				
Advanced lines/varieties	15 July	30 July	14 Aug.	29 Aug.	13 Sept.	15 July	30 July	14 Aug.	29 Aug.	13 Sept.
BR7528-2R-HR16-12-3-P1	15 July	30 July	14 Aug.	29 Aug.	13 Sept.	179	196	181	157	141
BR7528-2R-HR16-12-23-P1	3.52	3.29	3.19	3.03	2.64	207	214	208	187	162
IR 84750-213-2-2-3-1	3.98	4.17	4.02	3.51	3.04	189	184	183	177	150
BR7895-4-3-3-2-3	4.16	3.74	3.34	3.87	2.73	183	190	188	180	154
BR8445-54-6-6	3.75	3.83	3.13	2.46	2.23	165	162	166	150	134
BRRI dhan72	3.07	2.73	2.89	2.58	2.16	186	198	187	179	146
BRRI dhan39	4.13	3.74	3.73	3.77	2.81	163	165	163	158	134
BRRI dhan49	3.81	3.13	2.97	3.38	2.73	203	204	201	197	157
$LSD_{0.05}$			4.32					9.76		
CV(%)			0.84					5.43		

Table 3: Interaction effect of planting time of micronutrient enriched advanced lines (MER) on panicle m^{-2} and thousand grain weight during T. Aman, 2016 at BRRI farm

	Grains panicle^{-1}					1000-grain weight				
Advanced lines/varieties	15 July	30 July	14 Aug.	29 Aug.	13 Sept.	15 July	30 July	14 Aug.	29 Aug.	13 Sept.
BR7528-2R-HR16-12-3-P1	103	105	108	104	99	21.8	21.9	21.8	21.7	21.3
BR7528-2R-HR16-12-23-P1	106	107	105	105	102	22.7	22.8	22.6	22.5	22.2
IR 84750-213-2-2-3-1	94	95	94	91	84	27.8	27.8	27.7	27.7	27.2
BR7895-4-3-3-2-3	96	97	91	86	84	26.9	26.9	26.8	26.7	26.3
BR8445-54-6-6	100	97	98	95	90	23.8	23.8	23.8	23.6	23.1
BRRI dhan72	90	92	90	88	81	27.6	27.6	27.5	27.4	26.9
BRRI dhan39	112	114	109	105	103	21.4	21.4	21.3	21.2	20.8
BRRI dhan49	114	116	120	110	109	19.7	19.8	19.8	19.7	19.4
$LSD_{0.05}$			9.76					NS		
CV(%)			5.43					4.6		

Table 4: Interaction effect of planting time on grain yield and growth duration of micronutrient enriched advanced lines (MER) during T. Aman, 2016 at BRRI farm, Gazipur

	Grain yield (t ha^{-1})					Growth duration (days)				
Advanced lines/varieties	15 July	30 July	14 Aug	29 Aug	13 Sept	15 July	30 July	14 Aug	29 Aug	13 Sept
BR7528-2R-HR16-12-3-P1	3.84	4.40	4.19	3.09	2.74	123	125	127	130	137
BR7528-2R-HR16-12-23-P1	4.61	4.92	4.79	4.19	3.15	124	126	129	133	139
IR 84750-213-2-2-3-1	4.01	4.28	4.09	3.72	2.86	119	120	122	126	132
BR7895-4-3-3-2-3	4.38	4.46	4.15	3.89	3.03	122	123	127	129	136
BR8445-54-6-6	3.37	3.30	3.63	3.11	2.53	107	108	109	112	116
BRRI dhan72	4.10	4.47	4.25	3.84	2.87	128	129	133	136	143
BRRI dhan39	3.81	3.90	3.51	3.28	2.55	124	125	127	131	139
BRRI dhan49	4.49	4.54	4.75	4.12	3.17	133	135	138	143	150
$LSD_{0.05}$			0.32					NS		
CV(%)			5.30					3.24		

Table 5: Effect of planting time of micronutrient enriched advanced lines (MER) on Growing Degree Days in T. Aman, 2016 at BRRI farm, Gazipur

	Growing Degree Days				
Advanced lines/varieties	15 July	30 July	14 Aug.	29 Aug.	13 Sept.
BR7528-2R-HR16-12-3-P1	3633	3650	3637	3617	3628
BR7528-2R-HR16-12-23-P1	3662	3675	3682	3680	3671
IR 84750-213-2-2-3-1	3509	3519	3520	3530	3523
BR7895-4-3-3-2-3	3602	3604	3637	3596	3606
BR8445-54-6-6	3175	3179	3193	3202.	3176
BRRI dhan72	3747	3753	3776	3742	3751
BRRI dhan39	3662	3650	3637	3639	3671
BRRI dhan49	3914	3906	3894	3896	3882

Table 6:Effect of planting time of micronutrient enriched advanced lines (MER) on Yield (kg ha^{-1} day^{-1}) in T. Aman, 2016 at BRRI farm, Gazipur

	Yield (kg ha^{-1} day^{-1})				
Advanced lines/varieties	15 July	30 July	14 Aug.	29 Aug.	13 Sept.
BR7528-2R-HR16-12-3-P1	31.2	35.2	32.9	23.8	20.0
BR7528-2R-HR16-12-23-P1	36.1	39.1	37.1	31.5	22.7
IR 84750-213-2-2-3-1	33.7	35.7	33.5	29.5	21.8
BR7895-4-3-3-2-3	35.9	36.7	32.7	30.2	22.3
BR8445-54-6-6	31.5	30.6	33.3	27.8	21.8
BRRI dhan72	32.0	34.6	31.9	28.2	20.1
BRRI dhan39	30.7	31.2	27.6	25.0	18.3
BRRI dhan49	33.7	33.6	34.4	28.8	21.1

CONCLUSION

BR7528-2R-HR16-12-23-P1 gave the highest grain yield than check BRRI dhan39, BRRI dhan49 and BRRI dhan72 with 15 July to 14 August transplanting and BR7895-4-3-3-2-3 gave the highest grain yield with 15 July transplanting against check variety BRRI dhan72 but growth duration was 5-7 days earlier. IR 84750-213-2-2-3-1 have the lowest growth duration among all the genotypes.

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