Indian J. Weed Sci. **42** (1 & 2) : 30-34 (2010)

Competitive Ability of Rice Genotypes against Weeds in Direct Seeding Production System

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ABSTRACT

Field experiments were conducted at Research Farm of the Department of Agronomy, PAU, Ludhiana during 2006, 2007 and 2008 on loamy sand soil. The performance of different genotypes of rice under direct seeded conditions were variable. During 2006, performance of PR-115 and PR-113 was found to be significantly superior to other tested genotypes because of more smothering effect on weeds by these cultivars. Among IRRI biotypes, the performance of IR-72164-13-7-2 and IR-71703-587-1-3 was found satisfactory. During 2007, PAU-201, PR-115 and PR-116 recorded higher grain yield both under weedy and weed free conditions but among IRRI varieties 17 A/R 10 produced highest seed yield. During 2008, PAU-201 and PR-115 performed better than other varieties and among rice hybrids RH-257 outyielded other tested hybrids and it was followed by Arize-6444 and Arize-6129. These hybrids smoothered weeds as indicated by less dry matter accumulation by the weeds.

Key words : Crop-weed competition, direct seeded rice, crop canopy

INTRODUCTION

In Punjab, rice is mostly grown with puddled transplanted technique. During 2008, rice occupied 2.61 mha with total production of 10.5 mt with an average yield of 4019 kg/ha (Anonymous, 2008). With continuous puddling, a hard pan can develop below the plough layer which hinders the percolation of water resulting in suffocation of many succeeding crops especially wheat. Also the underground water table of the state is going down every year with continuous cultivation of rice. Scientists have reported decline of 55 cm underground water per year which is very unfortunate for the people of Punjab. So, in order to conserve natural resources especially underground water, direct seeding technique of rice in place of transplanted one is the only option. With direct seeding of rice, there is not only saving of irrigation water but also improvements in soil physical and chemical properties. The initial growth of direct seeded rice is very slow due to which weeds overpower the crop resulting in failure of this technique. Thus, there is a need to select quick growing and smothering varieties for the successful cultivation of direct seeding rice. The present investigation was undertaken with the objective to identify quick growing rice genotypes, so that they can compete well with the weeds.

MATERIALS AND METHODS

Field experiments were conducted at Research Farm of the Department of Agronomy, PAU, Ludhiana during three years i. e. **kharif** 2006, 2007 and 2008. The experimental field was loamy sand in texture with 76.7% sand, 9.2% silt and 14.0% clay. During 2006, 2007 and 2008, 13, 16 and 11 genotypes of rice were grown under weedy and weed free conditions, respectively. Sowing of these varieties was done on 23 June 2006, 11 June 2007 and 7 June 2008 during three years under dry conditions followed by irrigations by keeping row to row spacing of 22.5 cm and by using seed rate of 50 kg/ha for all the genotypes. The experiment was laid out in split plot design by keeping genotypes in main plots and weed control treatments i. e. weedy and weed free in sub-plots. The genotypes include advanced lines from IRRI, hybrids and varieties recommended by PAU. During 2006, 13 genotypes i. e. IR-72164-13-7-2, IR-71703-587-1-3, IR-72158-11-5-3-2, IR-72669-14-3-5, IR-72158-68-6-3, PR-118, PR-2769, PR-106, PR-108, PR-111, PR-113, PR-114 and PR-115; during 2007, 16 genotypes i. e. IR-72164-13-7-2, IR-71703-587-1-3, IR-72158-11-5-3-2, IR-72669-14-3-5, IR-72158-68-6-3, 17A/R10, Aeron-39, PR-118, PR-116, PAU-201, PR-106, PR-108, PR-111, PR-113,

Table 1 Performance of rice genotypes under direct seeded production systems (2006)

Varieties	Plant height (cm)			Tillers/m row length			Panicle length (cm)			Grain yield (kg/ha)			Per cent yield reduction due to weeds
	Weed free	Weedy	Mean	Weed free	Weedy	Mean	Weed free	Weedy	Mean	Weed free	Weedy	Mean	
IR-72164-13-7-2	58.9	47.9	53.4	66.5	11.0	38.8	21.5	11.7	16.6	4954	2986	3970.0	39.7
IR-71703-587-1-3	57.2	48.3	52.8	67.1	12.5	39.8	20.5	12.1	16.3	5938	3095	4516.5	47.8
IR-72158-11-5-3-2	53.3	42.2	47.8	59.9	7.4	33.7	20.7	12.9	16.8	2548	1656	2102.0	35.0
IR-72669-14-3-5	53.3	42.2	47.8	53.9	6.1	30.0	20.9	12.6	16.8	2219	1297	1758.0	41.5
IR-72158-68-6-3	48.9	39.0	44.0	44.1	4.6	24.4	21.7	11.8	16.8	1547	1486	1516.5	4.0
PR-118	47.0	39.4	43.2	43.0	4.8	23.9	21.3	12.1	16.7	1798	797	1297.5	55.7
PR-2769	54.4	40.8	47.6	49.5	8.5	29.0	22.5	11.8	17.2	4048	1578	2813.0	61.0
PR-106	50.1	44.9	47.5	37.5	9.5	23.5	21.5	12.3	16.9	1609	1110	1359.5	31.0
PR-108	55.5	45.0	50.3	41.1	8.0	24.6	21.1	12.2	16.7	2032	688	1360.0	66.1
PR-111	52.7	45.4	49.1	36.6	6.0	21.3	20.9	14.0	17.5	3814	1313	2563.5	65.5
PR-113	54.1	48.1	51.1	50.1	7.3	28.7	20.9	13.7	17.3	4408	1921	3164.5	56.4
PR-114	51.9	50.3	51.1	41.6	11.6	26.6	20.4	12.9	16.7	2766	2063	2414.5	25.4
PR-115	54.1	51.1	52.6	49.9	13.3	31.6	21.0	13.9	17.5	6198	3204	4701.0	49.0
Mean	53.2	45.0	49.1	49.3	8.5	28.9	21.1	12.6	16.9	3375	1784	2579.7	53.2
LSD (P=0.05) for varieties	4.27			NS			NS			885			
LSD (P=0.05) for weed control treatments	2.23			5.33			0.67			441			

All interactions are non-significant.

Table 2. Performance of rice genotypes under direct seeded production systems (PAU, Ludhiana, 2007)

Varieties	Plant height (cm)			Tillers/m row length			Panicle length (cm)			Seed yield (kg/ha)			Per cent yield reduction due to weeds
	Weed free	Weedy	Mean	Weed free	Weedy	Mean	Weed free	Weedy	Mean	Weed free	Weedy	Mean	
IR-72164-13-7-2	53.1	44.8	49.0	63.8	22.8	43.3	25.2	22.34	23.8	3932	2234	3083	43.2
IR-71703-587-1-3	50.5	46.4	48.5	51.5	25.8	38.7	24.6	17.19	20.9	3516	1719	2618	51.1
IR-72158-11-5-3-2	50.3	44.1	47.2	38.9	10.5	24.7	22.2	9.84	16.0	1729	984	1357	43.1
IR-72669-14-3-5	47.9	40.5	44.2	31.4	14.1	22.8	20.2	10.10	15.2	1271	1010	1141	20.5
IR-72158-68-6-3	50.8	42.0	46.4	35.5	13.1	24.3	19.6	9.74	14.7	1536	974	1255	36.6
17A/R10	59.4	59.5	59.5	66.8	54.0	60.4	26.9	20.73	23.8	5682	2073	3878	63.5
Aeron-39	52.6	43.0	47.8	58.0	11.9	35.0	23.8	13.33	18.6	3875	1333	2604	65.6
PR-118	46.4	38.6	42.5	38.4	9.3	23.9	18.5	9.69	14.1	2052	969	1511	52.8
PR-116	63.4	62.7	63.1	82.3	62.1	72.2	25.7	40.05	32.9	6771	4005	5388	40.1
PAU-201	61.4	59.8	60.6	75.0	58.6	66.8	25.5	31.77	28.6	6458	3177	4818	50.8
PR-106	57.0	53.8	55.4	53.4	43.0	48.2	20.8	21.04	20.9	4219	2104	3162	50.1
PR-108	56.1	51.9	54.0	74.4	41.3	57.9	24.7	20.42	22.6	4354	2042	3198	53.1
PR-111	50.4	48.6	49.5	66.6	40.9	53.8	23.9	19.17	21.5	4479	1917	3198	57.2
PR-113	52.0	48.4	50.2	66.5	37.3	51.9	23.7	25.26	24.5	4427	2526	3477	42.9
PR-114	51.1	47.3	49.2	42.9	25.0	34.0	18.4	26.56	22.5	3776	2656	3216	29.7
PR-115	55.1	47.8	51.5	65.8	19.3	42.6	23.8	20.73	22.3	5078	2073	3576	59.2
Mean	53.6	48.7		57.0	30.6		23.0	19.9		3947	1987		
LSD (P=0.05) for varieties	7.8			22.4			3.5			98			
LSD (P=0.05) for weed control treatments	3.8			9.8			2.0			60			

PR-114, PR-115 and during 2008 11 genotypes i. e. PR-118, PR-116, PR-111, PAU-201, PR-115, RH-257, Areon-55, Aeron-60, Sarbati, Arize-6444 and Arize-6129 were kept in main-plots and two weed control treatments i. e. weedy and weed free were kept in sub-plots. Crop was raised by recommended production and plant protection techniques of PAU.

RESULTS AND DISCUSSION

During 2006, among the various genotypes under direct seeded conditions, the performance of PR-115 was found to be significantly superior to all the tested genotypes except IR-71703-587-1-3 and IR-72164-13-7-2 when raised under weedy and weed free situations i. e. on mean basis (Table 1). Among the recommended rice genotypes, the yield potential of PR-118, PR-106 and PR-108 was found poor under direct seeded conditions. However, there is lot of yield variations among different tested varieties or genotypes. The yield potential of PR-113 variety of rice was also found at par with PR-115. Gill *et al.* (2006) evaluated four rice cultivars (PR-111, PR-115, PR-116 and IR-64) under direct sown conditions at Ludhiana, Punjab and found that a short duration and early maturity rice variety PR-115 was superior in terms of grains/panicle.

During 2007, among the various varieties recommended by PAU, the performance of PR-116, PAU-201 and PR-115 was found to be significantly superior to all the other tested varieties i. e. PR-118, PR-116, PR-106, PR-108, PR-111, PR-113, PR-114 and all the former varieties recorded 67.6, 64.6 and 50.8 q/ha seed yield under weed free direct seeded conditions, respectively (Table 2). PAU-201, PR-115 and PR-116 recorded higher rice grain yield under both weedy and weed free conditions. This could be due to good smothering effect on rice weeds (Anonymous, 2007). All these three varieties also yielded better under weedy conditions, thus had good smothering effect on rice weeds. Among the IRRI lines 17A/R10 produced highest seed yield (56.8 q/ha) followed by IR-72164-13-7-2, Aeron-39 and IR-71703-587-1-3. The performance of all other evaluated genotypes was found poor under direct seeded conditions. Singh *et al.* (2004) studied the performance of 20 genotypes and concluded that rice cultivars JM-50, OR-1550-23, CR-778-95, OR-1531-RGA-2-1-3 and Sudha could be adopted for direct sowing under medium deep waterlogged situations to enhance the productivity of rice. However, there were lot of yield variations among different tested varieties or genotypes indicating differential smothering potential of these genotypes on weeds.

Table 3. Performance of rice genotypes under direct seeded production systems (2008)

Varieties	Dry weight of weeds (q/ha)			Plant height (cm)			Panicle length (cm)		
	Weed free	Weedy	Mean	Weed free	Weedy	Mean	Weed free	Weedy	Mean
PR-118	1.00	6.26	3.63	60.67	54.23	57.45	23.17	20.10	21.64
PR-116	1.00	6.11	3.56	74.67	57.60	66.14	22.82	19.91	21.37
PR-111	1.00	6.81	3.91	61.27	52.80	57.04	23.39	19.00	21.20
Sarbati	1.00	3.49	2.25	81.80	72.20	77.00	25.05	22.53	23.79
PAU-201	1.00	6.12	3.56	74.07	59.47	66.77	24.51	21.87	23.19
PR-115	1.00	4.89	2.95	73.80	59.60	66.70	24.01	20.80	22.41
Arize-6444	1.00	3.09	2.05	81.33	74.53	77.93	24.54	22.97	23.76
Arize- 6129	1.00	4.93	2.97	76.93	60.87	68.90	23.73	20.98	22.36
RH-257	1.00	4.72	2.86	78.47	62.20	70.34	24.19	20.97	22.58
Areon-55	1.00	4.88	2.94	81.40	69.27	75.34	24.49	21.23	22.86
Areon-60	1.00	3.59	2.30	83.73	80.87	82.30	24.93	22.69	23.81
Mean	1.00	4.99	3.00	75.29	63.97	69.63	24.08	21.19	22.63
LSD (P=0.05) for varieties	NS			7.32			1.58		
LSD (P=0.05) for weed control treatments	0.09			3.30			0.61		

NS–Not Significant.

During 2008, among the various genotypes under direct seeded conditions, seed yield of rice hybrid RH-257 was found to be significantly superior to all the genotypes on mean basis. Among the recommended varieties, PAU-201 recorded higher grain yield under both weedy and weed free conditions followed by PR-118, PR-116, PR-115 and PR-111 (Table 4). However, in case of dry weight of weeds, hybrid variety i. e. Arize-6444 recorded least dry weight than other genotypes (Table 3). Among hybrids, highest yield was recorded in RH-257 which was followed by Arize-6444 and Arize-6129.

Table 4. Performance of rice genotypes under direct seeded production systems (2008)

Varieties	Effective tillers/m row length			Seed yield (q/ha)			
	Weed free	Weedy	Mean	Weed free	Weedy	Mean	Per cent reduction over weedy
PR-118	66.17	35.17	50.67	43.65	18.09	30.87	58.86
PR-116	69.00	32.83	50.92	41.27	19.05	30.16	53.84
PR-111	67.33	19.67	43.50	40.48	11.35	25.92	71.96
Sarbati	77.17	39.33	58.25	24.05	12.46	18.26	48.19
PAU-201	72.67	46.17	59.42	40.48	21.35	30.92	47.26
PR-115	71.67	33.50	52.59	37.70	20.08	28.89	46.74
Arize-6444	74.17	50.17	62.17	35.95	25.71	30.83	28.48
Arize-6129	75.00	35.33	55.17	37.62	23.09	30.36	38.62
RH-257	69.50	37.17	53.34	36.90	32.38	34.64	12.25
Areon-55	70.33	42.17	56.25	33.93	22.14	28.04	34.75
Areon-60	73.00	57.17	65.09	37.86	24.76	31.31	34.60
Mean	71.46	38.97	55.22	37.26	20.95	29.11	-
LSD (P=0.05) for varieties	NS			4.49			
LSD (P=0.05) for weed control treatments	5.57			1.63			
LSD for interaction of seed yield–5.66.							

NS–Not Significant.

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