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CRITICAL PERIOD OF WEED COMPETITION IN TRANSPLANT AUS RICE cv. BRRI dhan27 UNDER NON-SALINE AGRO-ECOSYSTEM

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Abstract

A study was conducted to determine the critical period of weed competition in transplant *Aus* rice for var. BRRI dhan27. Among the treatments, weed free condition, competition of weed for first 10, 20, 30, 40, 50, 60 and 70 days and weed free later on, unweeded condition, one weeding at 20 days after transplanting and one weeding at 40 days after transplanting, the unweeded control plots showed the poor performance result in case of maximum parameters where grain yield was reduced the highest percentage (38.54%). On the basis of cost benefit ratio it was observed that the critical period of crop weed competition extended up to 30 days after transplanting of aus var. BRRI dhan27.

Introduction

Rice is one of the most important staple foods for more than half of the world's population (IRRI, 2006) and influences the livelihoods and economies of several billion people. In Asia, more than 80% of the people live on rice, and their primary food security is entirely dependent on the volume of rice produced in this part of the world (Kabir, 2006). It is estimated that 40% of more rice production will be required by 2030 to satisfy growing demand with no increases in cropping areas (Khush, 2005).

Weeds are at present the major biotic constraint to increase rice production world wide (Zhang, 1996). About 33% of this loses are caused due to weeds alone (Mukherjee and Singh, 2005). The yield losses due to uncontrolled weed growth in lowland and upland rice ranged from 12 to 81% (Chopra and Chopra, 2003; Mukherjee and Singh, 2005). Normally the loss in rice yield ranges between 15-20% yet in severe cases the yield losses can be more than 50% depending upon the species and intensity of weeds (BRRI, 2006). To develop a comprehensive control program for the weed, it is important to know its critical period of competition in transplant rice. The critical period of weed competition depends on several factors like species of weed, life time duration of crops, climatic factors, crop species, environmental factors etc. Critical period of weed control is an integral part of integrated weed management (IWM) and can be considered the first step to design weed control strategy (Anonymous, 2003). In general critical period of crop weed competition is throughout in direct seeding situation and in transplanted it vary from 15 to 45 days (Singh and Bhan, 1988). The most critical period for competition between rice and weeds is when the rice is in the vegetative phase and the yield components of rice are being differentiated (Mukherjee and Singh, 2003). Though critical period of weed–crop competition is an important component of weed management technology package for any crop but for aus variety BRRI dhan27 it has not been investigated to find out the critical period of weed competition in transplant *Aus* rice cv. BRRI dhan27.

Materials and Methods

The study was conducted at the field Laboratory of the Department of Agronomy, Patuakhali Science and Technology University, Patuakhali during the period of April to August 2012. Geographically, the Patuakhali Science and Technology University is situated at 20°20″ N latitude and 90°20″ E longitude. It belongs to the Agro Ecological Zone (AEZ)-13 named Ganges Tidal Flood Plain. The experimental site was about 1.5 m above the sea level. The field of the experimental site was characterized by Non calcareous Grey Floodplain soil with silty clays. It was well drained and medium high. The soil was mildly alkaline, non-saline, loam in texture and having soil P^H ranges from 5.50 to 6.50. Organic matter content was low (1.1%) (SRDI, 2005). The experiment was laid out in a randomized complete block design with three replications and eleven treatments as: T_1 = Weed free condition, T_2 = Competition of weed for first 10 days and weed free later on, T_3 = Competition of weed for first 20 days and weed free later on, T_4 = Competition of weed for first 30 days and weed free later on, T_5 = Competition of weed for first 40 days and weed free later on, T_6 = Competition of weed for first 50 days and weed free later on, T_7 = Competition of weed for first 60 days and weed free later on, T_8 = Competition of weed for first 70 days and weed free later on, T_9 = Unweeded condition, T_{10} = One weeding at 20 days after transplanting (DAT) and T_{11} = One weeding at 40 DAT. The area of a unit plot was 4 m × 2.5 m.

The sprouted seeds were sown in the prepared seed beds on 5th April, 2012. The seedlings were transplanted in the main field @ 2 seedlings hill^{-1} with 20cm × 15 cm spacing on 30th April, 2012. Fertilizers were applied @ 168 g Urea, 60 g TSP, 30 g MoP, 17 g Gypsum and 5 g $ZnSo_4$ to the plots. The whole amount of fertilizers except N was applied before final land preparation. Urea was top dressed @ 56 g in three equal splits at 15, 30 and 45 days after transplanting. Proper crop protection measures were taken during the entire course of crop production. Weeds were collected at every 10 days interval according to the treatments mentioned. Number of weed plant of each species in the unit plot was counted with the help of a plant counter. The intensity of infestation of each species of weed was calculated as the number of weed stands per unit area divided by the number of hills per unit area. Three weed sample plot^{-1} were collected at the time of weeding. The plant counter was placed at random in the unit plot and all the weeds within each 1 m^2 were uprooted, dried first in the sun and thereafter, 24 hours in an electric oven maintaining a constant 105^0 C. After drying weeds weight of each sample was measured and expressed in g m^{-2}. Three weed sample plot^{-1} were collected at the time of harvesting. The crop of all plots was harvested on 3 July 2012. Crop and yield contributing were also recorded.

Results and Discussion

Seven species of weeds under four different families were found in the experimental field. Three species belonged to the family Cyperaceae, two from Gramineae and one from each of Onagraceae and Pontederiaceae (Table 1). Among those weed species, *Cyperus difformis* L., *Jussiaea decurrens* (Watt.) DC. *Cynodon dactylon* (L.) Pers. were predominated, and constituted about 84% of the total weed vegetation. Only *Cyperus difformis* L. constituted 63.82 percent of total weed infestation and it was followed by *Jussiaea decurrens* (Watt.) DC. (11.40 percent). In total 14.26 weeds competed against one hill of rice of which 10.16 belonged to the family Cyperaceae, 1.88 belonged to the Gramineae family and rest small portion was belonging to other two family. Thirteen types of weeds were found in direct seeded and transplanted aus rice as affected by method of planting and weeding regime by Sarker *et al.* (2002). Individually the highest intensity of weed infestation (9.09 hill^{-1}) was recorded in *Cyperus difformis* L. *Fimbristylis miliacea* (L.) Vahl. showed the lowest intensity and numerically it was only 0.38 weeds hill^{-1}. *Jussiaea decurrens* (Watt.) DC. and *Cynodon dactylon* (L.) Pers. was produced in an intensity of 1.63 and 1.22 weeds hill^{-1}. In case of weed population per square meter space total 456 weeds were found m^{-2} and the highest and lowest number of weeds belonged to the family *Cyperus difformis* L. and *Fimbristylis miliacea* (L.) Vahl. respectively as percent of total weed vegetation and intensity of weed infestation at weeding. In a study Ahmed *et al.* (1986) found that the principal weeds were *Monochlora vaginalis, Scirpus mucrontus* and *Cyperus iria* in case of BR3 cultivation in Aus season. In another study in case of direct seeded upland rice cultivation *Cyperus rotundus* and *Echinochloa crusgalli*

was the principal weed (Mamun *et al.,* 1986). Mercado (1979) found that competition of *Echinochloa crusgalli* was found to be the highest at a density of 20 plants m^{-2} within the critical period of crop-weed competition. This difference might be due to climatic change, varietal change and other cultural management.

Table 1. Infested weed species and their population in transplant Aus rice cv. BRRI dhan27

Name of weeds			Family	Weed population m^{-2}	% of total weed	Intensity of weed ($hill^{-1}$)
Local Name	English Name	Scientific Name				
Sobuj nakful	Green flatsedge	*Cyperus difformis* L.	Cyperaceae	291	63.82	9.09
Pani morich	Winged water primorse	*Jussiaea decurrens* (Watt.) DC.	Onagraceae	52	11.40	1.63
Durba	Bermuda grass	*Cynodon dactylon* (L.) Pers.	Gramineae	39	8.55	1.22
Chechra	Bog bulrush	*Scirpus mucronatus* L.	Cyperaceae	22	4.82	0.69
Chela	Sheand grass	*Parapholis incurve* L.	Gramineae	21	4.61	0.66
Soto panikochu	Pickerel weed	*Monochria vaginalis* (Burm. F.) presl.	Potedariac-eae	19	4.17	0.59
Joina	Globe fringerush	*Fimbristylis miliacea* (L.) Vahl.	Cyperaceae	12	2.63	0.38

The weed population increased gradually from the competition of weed for first 10 to 60 days and weed free later on. The highest (598.00) weed population was found in T_7 (competition of weed for first 60 days and weed free later on) and the lowest one (77.00) was found in T_2 (for first 10 days and weed free later on). During harvesting time no weed was found in the experimental plot as the plots were kept weed free after every weeding treatment (Table 2). The highest (498.30) number of weeds were found in the plots which were kept unweeded (T_9) and the lowest (288.70) was found in T_{11} (One weeding at 40 DAT).

All the treatments had significant effect on weeds dry weight m^{-2} at weeding. Treatment T_7 produced the highest (254.20 g) weeds dry weight at weeding whereas T_2 produced the lowest (6.54 g). The treatments T_9 and T_{10} gave the highest (204.20 g) and the lowest (144.30 g) dry weight of weeds. Similar result was found by Sarker *et al.* (2002). On average 33.8% weed dry weight was reduced due to competition from Aus rice (Karim, 2000).

Table 2. Effect of duration of weed competition on the population and dry matter production of weeds in cultivation of transplant Aus rice cv. BRRI dhan27

Treatments	Weeds population (m^{-2})		Weeds dry weight (m^{-2})	
	At weeding	At harvest	At weeding	At harvest
T_1	0.00j	0.00d	0.00 i	0.00d
T_2	77.00 i	0.00d	6.54h	0.00d
T_3	152.00h	0.00d	7.69h	0.00d
T_4	218.00g	0.00d	51.84f	0.00d
T_5	361.00d	0.00d	147.30e	0.00d

T_6	415.00b	0.00d	168.60b	0.00 d
T_7	598.00a	0.00d	254.20a	0.00d
T_8	398.00c	0.00d	162.90c	0.00d
T_9	0.00 j	498.30a	0.00 i	204.20a
T_{10}	287.00f	311.70b	48.31g	144.30c
T_{11}	332.00e	288.70c	158.40d	165.20b
$LSD_{(0.05)}$	0.69	1.55	3.19	2.94

Different treatments had significant effect on the plant height of transplant Aus rice cv. BRRI dhan27. Numerically the plots which were kept weed free for whole the cultivation period (T_1) gave the highest (138.8 cm) plant height and it was followed (136.1 cm) by 10 days for weed competition. On the other hand, the plots which were allowed for competition of weed for first 60 and 70 days; and the plots which were weeded only once at 40 days after transplanting (DAT) gave the lower plant height than others (fig. 1). Perera *et al.* (1992) and Sultana (2000) also found similar reduction on rice plant height due to competition of *E. crusgalli.*

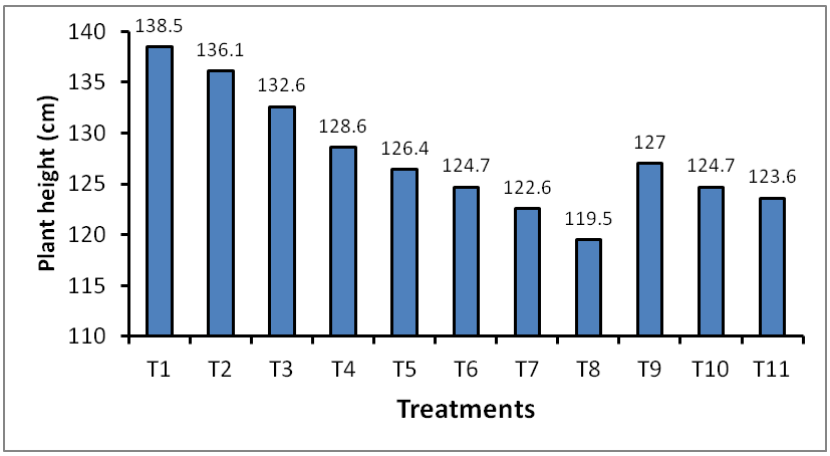

Fig. 1. Effect of duration of weed competition on plant height of transplant Aus rice cv. BRRI dhan27 ($LSD_{(0.05)}$ = 4.67)

All the plots except those were kept unweeded (T_9) for the entire cultivation period showed statistically at par in terms of panicle length. Treatments T_1 to T_4 produced higher panicle length than others where the longest (24.14 cm) panicle was produced where kept weed free throughout the cropping period (T_1). The plots in which first weeding were done after 40, 50, 60 and 70 days after transplanting and unweeded throughout the cropping period gave lower number of total tillers than others (Table 3).

Table 3. Effect of duration of weed competition on the yield contributing characters of transplant Aus rice cv. BRRI dhan27

Treatments	Panicle length (cm)	Total tillers $hill^{-1}$ (No.)	Filled grains $panicle^{-1}$ (No.)	Unfilled grains $panicle^{-1}$ (No.)	1000-grain weight (g)
T_1	24.14a	11.09a	108.0a	16.72a	31.55a
T_2	23.90ab	10.75a	104.7ab	14.46b	31.55a
T_3	23.77abc	10.82a	101.4bc	10.56d	31.58a
T_4	23.10bcd	9.557b	98.13c	14.60b	31.22ab
T_5	22.84cde	8.837c	98.54c	9.493e	31.54a
T_6	22.61def	8.820c	92.11d	16.49a	31.00abc

T_7	22.24def	8.297cd	84.40e	10.46d	30.77bcd
T_8	21.65f	8.543cd	78.31f	12.25c	30.46cd
T_9	19.14g	8.003d	74.42g	14.26b	30.15d
T_{10}	22.04ef	9.647b	84.84e	7.710f	30.73bcd
T_{11}	21.90ef	9.650b	86.75e	14.60b	30.53cd
$LSD_{(0.05)}$	1.01	0.65	3.56	0.64	0.66

The plots which were kept weed free throughout the whole cultivation period, and the plots in which first weeding were done at 10, 20, and 30 DAT i.e. T_1 to T_4 gave statistically higher number (9.865–10.37) of effective tillers (Fig. 2).

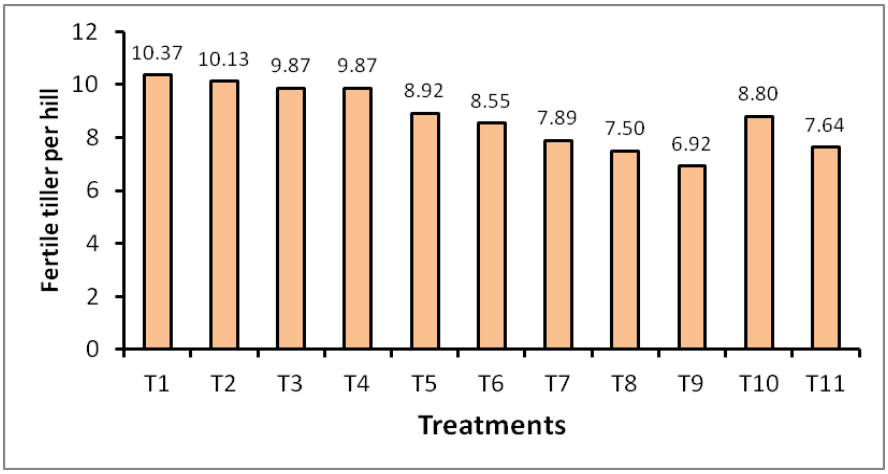

Fig. 2. Effect of critical period of rice weeds competition on effective tillers hill^{-1} of transplant *Aus* rice cv. BRRI dhan27 ($LSD_{(0.05)}$ = 0.80)

The highest (108.00) number of filled grains panicle^{-1} was recorded from the plots which were kept weed free for the total cropping duration. Plots which were weeded for the first time at 20 DAT and kept weed free for later on (T_3) showed the highest 1000- grain weight (31.58 g). The plots which were weeded only once at 20 and 40 DAT (T_{10} and T_{11}) showed similar effect (3.29 and 3. 28 t ha^{-1}) in terms of grain yield of BRRI dhan27. Percent grain yield reduction was increased with the increasing of weed competition period and it reached to the highest as 34.54% in unweeded control plots. In case of one weeding, weeding at 20 and 40 days after transplanting reduced the grain yield of about 17% of that of the weeded control plots. Weed free plots and the plots in which the competition of weed were allowed for first 10, 20, 30 days and kept weed free for later on gave higher yield than others.

Grain yield of T. Aus rice cv. BRRI dhan27 was significantly affected by the treatments of weeding. The plots which were kept weed free from transplanting to harvesting gave the highest (3.97 t ha^{-1}) grain yield and it was followed (3.94 t ha^{-1}) by T_2 .The unwedded plots gave the lowest (2.44 t ha^{-1}) yield and it was followed by treatments (Table 4). When weed infestation is increased, the rice plants deprive from nutrient and other environmental components. As a result, the long time weed infested plot showed lower performance than short time weed infestation.

Table 4. Effect of duration of weed competition on the yield of transplant Aus rice cv. BRRI dhan27

Treatments	Grain yield		Straw yield	
	t ha^{-1}	% reduction	t ha^{-1}	% reduction
T_1	3.97 a	-	3.22 ab	-
T_2	3.94 a	0.76	3.36 a	-4.25

T_3	3.90 a	1.76	3.22 ab	0.00
T_4	3.89 ab	2.02	3.09 ab	4.04
T_5	3.76 b	5.29	2.86 bc	11.18
T_6	3.50 c	11.84	2.65 cd	17.70
T_7	3.05 e	23.17	2.53 cd	21.43
T_8	2.49 f	37.28	2.34 d	27.33
T_9	2.44 f	38.54	2.42 d	24.84
T_{10}	3.29 d	17.13	2.65 cd	17.70
T_{11}	3.28 d	17.38	2.57 cd	20.19
$LSD_{(0.05)}$	0.13	-	0.42	-

Weed population and their dry weight was increasing with the increasing of weed competition duration and weed removal delayed up to 60 days after transplanting and decreased thereafter. It might be due to death of some older weeds and thinning of newly germinated weeds. Unweeded control plots showed the poor result in case of maximum parameter where the grain yield reduced in the highest percentage (38.54%). In case of grain and straw yield the plots which were allowed for 10 days weed competition (T_2) showed the highest performance. Treatment T_2 gave better plant height (136.1), panicle length (23.90) and effective tillers hill^{-1} (10.13). On the other hand the plots in which competition of weed was allowed for first 20 days showed better performance in terms of total tillers hill^{-1} (10.82). In case of grain yield T_1 (control), T_2 (competition of weed for 10 days), T_3 (competition of weed for 20 days) and T_4 (competition of weed for 30 days) gave same and higher (3.89 – 3. 97 t ha^{-1}) yield than others.

Conclusion

The result obtained from the study showed that the percentage of grain yield reduction with the increasing of crop weed competition was negligible up to 30 days competition. So, crop weed competition for first 30 days could be a critical period in transplant Aus rice cv. BRRI dhan27.

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