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Weed Infestation in Direct Seeded and Transplanted Aus Rice as Affected by Method of Planting and Weeding Regime

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Abstract: The experiment was conducted to determine the weed vegetation due to the effect of planting methods and weeding regime. Two factors included in the experiment were: methods of planting and weeding regime. The results revealed that weed vegetation in the two methods of planting varied remarkable. Fifty-five weed species belonging to 17 families infested the crop. Among the weed species, *Fimbristylis miliacea* (L.) Vahl was the principal weed in direct seeded aus rice and *Panicum repens* L. in the transplanted aus rice. Twenty-four weed species were found to grow only in the direct seeded crop and only eight in the transplanted crop. Weed density and weed dry weight was significantly affected by the method of planting and weeding regime. Weed density and dry weight was significantly higher in direct seeded than in transplanted crop.

Key words: Weed, infestation, planting method, regime

Introduction

Weed is one of the most important negative factors of aus rice production. Against this pest farmers generally spend much of their valued time, energy and labour and a considerable amount of their hard-earned cash money. According to Mamun *et al.* (1986) weed causes a loss of 38.66% grain yield in aus rice, if weeding is not done. However, complete failure of the crop due to weed infestation is not uncommon in Bangladesh. On the other hand, in India, the loss caused by the weeds in upland rice ranges from 74-100% (Makhopadhya *et al.*, 1972; Leonard, 1976). Weed control accounts for about 34% of the total input cost in aus rice (Bhuiya, 1974).

Weed infestation in aus rice is the result of cropping season, crop, cropping system, land topography and management practices viz., time of land preparation, degree of land preparation, cultivar, method of planting, time of planting, fertilization, weeding methods, weeding intensities and so on (Mamun, 1990). The humid climate, which prevails during aus season in Bangladesh, encourages the growth and development of weed. Weed control in direct seeded aus rice often becomes difficult and costly (Anonymous, 1985).

Rice growers generally follow two main planting practices in rice cultivation, broadcasting and transplanting. In Bangladesh aus rice is usually directly seeded but now a days with the availability of irrigation water transplanting method of planting is also used for this crop. With the change of method of planting, weed vegetation growing in association with this crop is also changed. Similarly proper time and frequency of weeding are also changed. This study has been undertaken to know the changes and to have a comparative assessment on weed vegetation.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, BAU, Mymensingh, during the period from March to August 1998 in the medium high land. The experiment was laid out in a split-plot design. Planting methods were placed in the main plot and weeding regime in the sub plot. The unit plot size was 4x2.5 m^2. The treatments in this experiment were methods of planting and weeding regime. The methods of planting were: I) direct seeding and ii) transplanting and weeding regime included: I) no weeding, ii) one weeding (20 DAS or DAT), iii) two weeding (20 and 40 DAS or DAT) and iv) three weeding (20, 40 and 60 DAS or DAT). The crop was fertilized as per recommendation. Weeds grown in each plot were identified species wise and their density per square meter were counted by using a quadrate of 0.25x0.25 m^2 in three places at random in each plot. The average number of three samples was converted to No./m^2 multiplying by 4. Weed density was counted on 20, 40 and 60 DAS or DAT. Weeds in each quadrate were uprooted, washed and dried in the sun and in an electrical oven for 24 h maintaining a temperature of 105°C. After drying, weight of each species was taken and converted to g m^{-2}. Weed dry weight was taken on similar interval of weed density. Relative dry weight or importance value (I.V) of weed species growing with the crop was determined by the following formula according to Sajise *et al.* (1976):

$$I.V = \frac{\text{Weight of individual weed species in the community}}{\text{Weight of all weed species in the community}} \times 100$$

Co-efficient of similarity of weed vegetation between the successive growth stages in the direct seeded and transplanted aus rice was computed out by the following formula:

$$C = \frac{2W}{a + b} \times 100$$

Where, C = Co-efficient of similarity (%) of the two communities
w = Sum of lower I.V's of species common to two communities
a = Sum of I.V's of all species in the first community
b = Sum of I.V's of all species in the second community

Co-efficient of dissimilarity (%) D = 100-C

Where, D = Co-efficient of dissimilarity
C = Co-efficient of similarity

The collected data on weed density and weed dry weight were statistically analyzed and the mean differences were adjudged by DMRT (Steel and Torrie, 1980).

Results and Discussion

This study will reflect the actual weed vegetation in direct seeded and transplanted aus rice. Dry weight of weed has been taken into consideration to determine the importance value or relative dry weight. Important weed means the weed species which scored higher importance value or higher relative dry weight.

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Weeds in direct seeded aus rice: Forty-seven weed species belonging to 15 families were found to grow in the direct seeded no weeding treatments (Tables 1, 3). In terms of density and dry weight *Fimbristylis miliacea* topped the list and it constituted 22.59% of the total weed population and 21.01% of the total dry weight. In terms of importance value the five most important weeds in direct seed aus rice occupied 59.56% of the total dry weight. The rest 42 weed species shared only 40.44% of the total dry weight (Table 4). Similar views of weed vegetation in direct seeded aus rice was reported by Mamun *et al.* (1986).

Weeds in transplant aus rice: Thirty-one weed species of 10 families were found to grow in transplant no weeding treatment (Tables 2, 3). In terms of density and dry weight *Panicum repens* topped the list and it contributed 18.84% of the total weed population and 24.27% of the total dry weight. In terms of I.V the five most important weeds in this treatment contributed 59.29% of the total dry weight and the rest 26 species shared only 40.71% of the total dry weight (Table 4). In two experiments with the same rice cultivar, in the same season and location with the only difference in the method of cultivation, a remarkable difference in weed vegetation was reported by Mamun *et al.* (1986) and Ahmed *et al.* (1986), which is more or less similar with the findings of this study.

Comparison of weed vegetation in direct seeded and transplanted aus rice: A great difference in weed vegetation was observed in these two methods of planting. Co-efficient of similarity of weed vegetation was 53.71% and dissimilarity of 46.29%. These findings are in agreement with the findings of Mamun (1993), which was 53.16% (co-efficient of similarity). The number of weed species and families in direct seeded aus rice was much more than in transplant aus rice. Weeds of the family Rubiaceae, Eriocaulaceae, Hydrophyllaceae, Leguminosae, Euphorbiaceae and Heliotropiaceae present in direct seeded aus rice were absent in the transplant aus rice. But, the weeds of only two families like Lythraceae and Labiaceae were present in transplant aus rice were absent in the direct seeded aus rice (Table 3). Twenty-four weed species were found to grow only in direct seeded (Table 5) and only eight in transplant aus rice *viz.*, *Amania bacciera, Lindernia procumbens, Leucas aspera, monochoria hastrata, Murdania nudiflora, Paspalam distichum, Rotala ramosior* and *Spilanthes iabadicensis*. The density and dry weight of the common weed species in both the methods of planting also differed considerably (Tables 1, 2).

Effect of method of planting on weed density and weed dry weight: Weed density and weed dry weight was significantly affected by the method of planting. Weed density was higher in

Table 1: Weed density and weed dry weight in direct seeded aus rice cv. BR26 in no weeding treatment at the maximum flowering stage

Scientific names	Family	Types	Density (No./m^2)	Dry weight (g/m^2)	Relative dry weight (%)
Alternanthera sessilis	Amaranthaceae	A,BL	6.67	2.61	1.36
Alternanthera pronichioides	Amaranthaceae	A,BL	4.00	1.41	0.73
Alternanthera philoxeroides	Amaranthaceae	P,BL	4.00	1.21	0.63
Amaranthus tenifolium	Amaranthaceae	A,BL	1.33	2.20	1.14
Cyperus difomis	Cyperaceae	A,S	13.33	4.19	2.18
Cyperus iria	Cyperaceae	A,S	69.33	30.15	15.66
Cyperus halpans	Cyperaceae	P,S	4.00	0.39	0.20
Cyperus rotundus	Cyperaceae	P,S	22.67	4.17	2.17
Cynodon dactylon	Gramineae	P,G	10.67	3.61	1.88
Commelina bengalensis	Commelinaceae	P,BL	2.67	0.81	0.42
Depertium junceum	Scrophulariaceae	A,BL	6.67	2.31	1.20
Digitaria sanguinalis	Gramineae	A,G	37.67	15.66	8.14
Dentalla repens	Rubiaceae	P,BL	4.00	0.33	0.17
Desmodium trifolium	Leguminosae	P,BL	5.33	0.31	0.16
Echinochloa crus-galli	Gramineae	A,G	6.67	3.51	1.82
Echinochloa colonum	Gramineae	A,G	29.33	7.01	3.64
Eclipta alba	Compositae	A,BL	4.00	2.40	1.25
Eriocaulon cinereum	Eriocaulaceae	A,S	9.33	2.17	1.13
Eleocharis atropurpurea	Cyperaceae	A,S	6.67	1.91	0.99
Euphorbia prostrata	Euphorbiacdae	A,BL	1.33	0.60	0.32
Eragrostis gangetica	Gramineae	P,G	1.33	0.17	0.09
Fimbristyslis miliacea	Cyperaceae	A,S	124.00	40.44	21.01
Fimbristyslis diphylla	Cyperaceae	P,S	4.00	1.41	0.73
Fimbristylis squarrosa	Cyperaceae	A,S	1.33	0.14	0.07
Hydrolea zeylanica	Hydrophyl laceae	A,BL	1.33	0.11	0.06
Hemerthrina sp.	Gramineae	A,G	1.33	0.33	0.17
Hedyotis corymbosa	Rubiacea	A,BL	2.67	2.93	1.52
Heliotropium indicum	Heliotropiaceae	A,BL	1.33	0.53	0.27
Leersia hexandra	Gramineae	A,G	4.00	0.61	0.32
Lindernia hyssopioides	Scorphulariaceae	A,BL	2.67	1.53	0.79
Ludwigia perennis	Onagraceae	A,BL	4.67	2.60	1.35
Lindernia antipoda	Scorphulariaceae	A,BL	10.67	3.91	2.03
Ludwigia parviflora	Onagraceae	A,BL	1.33	0.13	0.07
Lindernia procumbens	Scrophulariaceae	A,BL	1.33	0.14	0.07
Lindenia anagalis	Scrophulariaceae	A,BL	1.33	0.12	0.06
Leptochola panicea	Gramineae	A,G	1.33	0.04	0.07
Ludwigia prostrata	Onagraceae	A,BL	2.67	0.31	0.16
Monochoria vaginalis	Pontederiaceae	A,BL	5.33	1.71	0.89
Paspalum scrobiculatum	Gramineae	A,G	41.33	12.41	6.46
Panicum repens	Gramineae	P,G	49.33	15.93	8.28
Physalis minima	Solanceae	A,BL	2.67	2.13	1.11
Phylanthus niruri	Euphorbiaceae	A,BL	1.33	0.21	0.11
Setaria glauca	Gramineae	A,G	17.33	4.13	2.15
Scoparia dulcis	Scrophulariaceae	A,BL	1.33	0.49	0.25
Sirpus juncoides	Cyperaceae	A,S	6.67	2.11	1.10
Scirpus articulatus	Cyperaceae	A,S	2.66	0.21	0.11
Urinia dulcis	Scrophulariaceae	A,BL	4.00	0.49	0.25

Relative dry weight = Importance value, A = Annual, P = Perennial, BL = Broad leaves, S = Sedge, G = Grass

Table 2: Weed density and weed dry weight in transplant aus rice cv. BR26 in the no weeding treatment at the maximum flowering stage

Scientific name	Family	Types	Density (No./m^2)	Dry weight (g/m^2)	Relative dry weight (%)
Alternanthera sessilis	Amaranthaceae	A,BL	9.33	1.94	1.90
Alternanthera philoxeroides	Amaranthaceae	P,BL	5.33	0.91	0.89
Ammania baccifera	Lythraceae	A,BL	6.67	1.21	1.18
Cyperus halpans	Cyperaceae	P,S	6.677	1.61	1.58
Cyperus iria	Cyperaceae	A,S	22.67	9.03	8.87
Cynodon dactylon	Gramineae	P,G	5.33	1.40	1.37
Departium junceum	Scrophulariaceae	A,BL	8.00	1.49	1.46
Digitaria sanguinalis	Gramineae	A,G	4.00	1.57	1.54
Echinochloa crus-galli	Gramineae	A,G	17.33	7.17	6.69
Echinochloa colonum	Gramineae	A,G	6.67	2.18	2.14
Eclipta alba	Compositae	A,BL	6.67	2.81	2.76
Eleocharis atropurpure	Cyperaceae	A,S	5.33	2.08	2.04
Eimbristylis miliacea	Cyperaceae	A,S	41.33	13.01	12.77
Eimristylis dephylla	Cyperaceae	P,S	10.67	3.09	3.04
Leersia hexandra	Gramineae	A,G	4.00	1.13	1.11
Lindernia hyssopioides	Scrophulariaceae	A,BL	5.33	1.71	1.68
Ludwigia perennis	Onagraceae	A,BL	5.33	2.21	2.18
Lindernia procumbens	Scrophulariaceae	A,BL	1.33	0.25	0.24
Lindernia antipoda	Scrophulariaceae	A,BL	37.33	6.54	6.42
Ludwigia parviflora	Onagraceae	A,BL	9.33	2.97	2.92
Leucas aspera	Labiatae	A,BL	1.33	0.08	0.08
Leptochloa panicea	Gramineae	A,G	1.33	0.06	0.06
Monochoria vaginalis	Pontederiaceae	A,BL	17.33	3.97	3.88
Monochoria hastrata	Ponterdriaceae	A,BL	6.67	1.16	1.14
Murdania mudiflora	Comelinaceae	A,BL	1.33	0.08	0.08
Paspalum scrobiculatum	Gramineae	A,G	12.00	4.03	3.95
Panicum repens	Gramineae	P,G	65.33	24.73	24.27
Paspalum distichum	Gramineae	P,G	5.33	0.44	0.43
Rotala ramosior	Lythraceae	A,BL	1.33	0.12	0.12
Spilanthes iabadicensis	Compositae	A,BL	6.67	1.60	1.57
Scirpus juncoides	Cyperaceae	A,S	9.33	1.42	1.39

Relative dry weight = Importance value, A = Annual, P = Perennial, BL = Broad leaves, S = Sedge, G = Grass

Table 3: Family-wise and type-wise distribution of weed species in direct seeded and transplant no weeded aus rice at the maximum flowering stage

	Direct seeded			Transplanted		
Family names	A	P	Total	A	P	Total
Gramineae	7	3	10	6	3	9
Cyperaceae	7	3	10	4	2	6
Amaranthaceae	3	1	4	1	1	2
Lythraceae	-	-	-	2	-	2
Scrophulariceae	7	-	7	4	-	4
Rubiaceae	2	1	3	-	-	-
Compositae	1	-	1	2	-	2
Eriocaulaceae	1	-	1	-	-	-
Hydrophyllaceae	1	-	1	-	-	-
Onaraceae	3	-	3	2	-	2
Pontederiaceae	1	-	1	2	-	2
Commelinaceae	-	1	1	1	-	1
Leguminposae	-	1	1	-	-	-
Euphorbiacae	2	-	2	-	-	-
Solanaceae	1	-	1	-	-	-
Labiaceae	-	-	-	1	-	1
Heliotropiaceae	1	-	1	-	-	-
Total	37	10	47	25	6	31

A = Annual, P = Perennial

direct seeding than in transplanting method which were 276.66 and 181.98 No. m^{-2} respectively. Dry weight of weed was 80.34 g m^{-2} in direct seeded aus rice and 43.09 g m^{-2} in transplanted aus rice (Table 6).

Effect of weeding regime on weed density and weed dry weight: Weed density and weed dry weight was significantly affected due to weeding regime (Table 6). It has been observed that weed density (467.49 No.m^{-2}) and weed dry weight (147.98 g m^{-2}) was the highest in the no weeding treatment. It showed a significant decreasing trend with the increasing number of weeding in both the cases (weed density, weed dry weight).

Table 4: Five most important weeds found in direct seeded and transplanted aus rice

Scientific names	Dry weight (g m^{-2})	Relative dry weight (%)
Direct seeding method		
Fimbristylis miliacea	40.44	21.01
Cyperus iria	30.15	15.67
Panicum repens	15.93	8.28
Digitaria sanguinalis	15.66	8.14
Paspalum scrobiculatum	12.41	6.46
Others (42)	77.88	40.44
Total (47)	192.47	100.00
Transplanting method		
Panicum repens	24.73	24.27
Fimbristylis miliacea	13.01	12.77
Cyperus iria	9.03	8.87
Echinochloa crus-galli	7.17	6.96
Lindernia antipoda	6.54	6.42
Others (26)	41.42	40.71
Total (31)	101.90	100.00

Relative dry weight = Importance value, Figures in the parenthesis indicate the number of species

Table 5: Weed species found to grow only in no weeding plots of direct seeded aus rice at the maximum flowering stage

Scientific names	Scientific names
Alternanthera pronichioides	*Hemerthrina* sp.
Amaranthus tenifolium	*Hedyotis corymbosa*
Cyperus diformis	*Heliotropium indicum*
Cyperus rotundus	*Lindernia procumbens*
Commelina bengalensis	*Lindenia anagalis*
Dentalla repens	*Ludwigia prostrata*
Desmodium trifolium	*Physalis minima*
Eriocaulon cinereum	*Phylanthus niruri*
Euphorbia prostrata	*Setaria glauca*
Eragrostis gangetica	*Scirpus articulatus*
Fimbristylis squarrosa	*Scoparia dulcis*
Hydrolea zeylanica	*Urinia dulcis*

Table 6: Effect of methods of planting and weeding regime on weed density and weed dry weight

Parameters	Weed density (No. m^{-2})	Weed dry weight (g m^{-2})
Methods of planting:		
Direct seeding	276.66a	80.34a
Transplanting	181.98b	43.09b
Weeding regime:		
No weeding	467.49a	147.98a
One weeding	392.66b	102.58b
Two weeding	179.74c	44.12c
Three weeding	106.70d	13.87d
Weed free	-	-

Table 7: Interaction effect of method of planting and weeding regime on weed density and weed dry weight

Methods of planting	Weeding regime	Weed density (No. m^{-2})	Weed dry weight (g m^{-2})
Direct seeding	No weeding	565.41a	190.76a
	One weeding	483.49b	138.02b
	Two weeding	210.99e	57.07e
	Three weeding	123.41g	15.84g
	Weed free	-	-
Transplanting	No weeding	369.58c	109.21c
	One weeding	301.83d	67.15d
	Two weeding	148.49f	31.18f
	Three weeding	89.99h	11.91g
	Weed free	-	-

In a column the figures having uncommon letter(s) differ significantly at 5% level by DMRT

Interaction effect of method of planting and weeding regime on weed density and weed dry weight: Weed density and weed dry weight was significantly affected by the interaction effect of method of planting and weeding regime. Weed density and weed dry weight decreased significantly with each increase in weeding intensity irrespective of method of planting. Weed density and weed dry weight in no weeding, one weeding, two weeding and three weeding treatments in direct seeding method was significantly higher than that of the respective treatment of the transplanting method. This means that weed density and weed dry weight was lower in transplanting method at each weeding level. The highest weed density and weed dry weight was produced in no weeded direct seeding method and the lowest from three weeded transplanting method (Table 7).

From the study it is clear that weed population or density and dry weight is much more or higher in direct seeding than in transplanting method. It is also observed that there is a difference in weed vegetation in both the method of planting. In the direct seeding method, 47 weed species belonging to 15 families and in the transplanting method 31 weed species belonging to 10 families were found to grow. The most important weed species for direct seeding was *Fimbristylis miliacea* and for transplanting it was *Panicum, repens*. Co-efficient of similarity of weed vegetation between direct seeding and transplanting method was 53.71% and dissimilarity was 46.29%. Differences in weed vegetation in these two methods of planting were found in the number of weed species and families. Density and dry weight of weed, common to both the methods of planting was also differed considerately.

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