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WEED INFESTATION IN *BORO* RICE IN *HAOR* AGRO-ECOSYSTEM AS AFFECTED BY RICE CULTIVARS AND GROWTH STAGES

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Abstract

Phytosociology of weeds were studied in *boro* rice in *haor* areas in relation to cultivars and crop growth stages through weed survey. *Scirpus juncoides* was the most important weed speciaes in all the rice cultivars. Perennial weeds dominated over annuals and broadleaf weeds usually dominated over sedges or grasses. Diversity of species increased with the age of crop plant up to 60 DAT when it declined. *S. juncoides* was also the most important weed species at all crop growth stages. At these growth stages perennial weeds dominated over annuals and broadleaf weeds usually over sedges or grasses.

Key words: Weeds survey, *boro* rice, *haor*, relative abndance, coefficient of similarity.

Introduction

Weeds and the methods of weed control vary with crop, soil type, moisture, land preparation, and other cultural practices. Any crop variety with its specific canopy may favour specific weeds to grow. Shah *et al.* (1990) mentioned the change in ecological profile of weed flora with the introduction of high yielding dwarf rice varieties. On the other hand crop age also affects weed infestation pattern in crop field. These factors act in different ways in different agro-ecosystem. In *haor*, which is a depressed vast area remains flooded during monsoon and becomes cultivable during winter when water recedes from its upper parts, topography and water regime together with other factors determine weed infestation pattern. To effectively control weed understanding of its ecology is important. Therefore, a weed survey was done to study the phytosociology of weeds in *boro* rice in *haor* area in relation to rice variety and different growth stages.

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Materials and Methods

The weed survey was conducted in the *boro* fields of *haor* area of Jawar village of Tarail *thana* under Kishoreganj district. The area is situated in Old Brahmaputra agroecological region under 9e subregion (UNDP/FAO, 1988). The survey was conducted during November 1987 to April 1988. Fifty *boro* fields situated in different elevation and belonged to 50 different farmers were selected for weed survey. The average size of these fields was $1500m^2$.

A strip of five meter land at one side of each field was kept unweeded. Data were recorded from ten spots in each field from the unweeded strip of land and each spot was a quadrated of 0.5mX0.5m in size. To avoid biasness a definite procedure of data collection was followed. According to the procedure the first spot was selected five steps away from the levee of any side of the unweeded area of a field. Then turning at right angles to the first one the second spot was selected also five steps away to the first one and subsequent sampling was done in the same way giving rise to a zigzag pattern. Each sample spot was 0.5mX0.5m in size. Weeds collected from the spots were recorded specieswise.

Rice varieties used and the cultural operations done in the 50 selected fields were recorded. After 60 days of transplanting, the effect of different rice varieties on weed infestation pattern was observed through weed survey done in those fields. Weed survey was also done in those fields at different growth stages of rice on 15, 30, 45, 60, 75 and 90 days after transplanting (DAT) and the effect was observed on weed infestation. Data collected from weed survey were analysed using the following quantitative measure as per methods described by Thomas (1985).

Frequency (F) : It is the number of fields in which a species occurred. It is expressed as a percentage of the total number of fields.

$$F_k = \frac{\sum_{i}^{n} Y_i}{n} \times 100 \text{ where,}$$

F_k = Frequency value for species k.

Y_i = Presence (1) or absence (zero) of species k in field i.

n = number of fields surveyed.

Field uniformity (FU) : It is the number of sampling locations (10 quadrates per field) in which a species occurred. It is expressed as a percentage of the total number of samples. This measure is used to estimate the area infested by a species.

$$U_k = \frac{\sum_{n}\sum_{10} X_{ij}}{10n} \times 100 \text{ where,}$$

U_k = Field uniformity value for species k.

X_{ij} = Presence (1) or absence (zero) of species in quadrate j in field i.

n = Number of field surveyed.

Mean field density (MFD) : It is the number of an individual weed species occurred in one square meter area. The mean field density value is obtained by totaling each field density (D) and dividing by the total number of fields.

$$D_i = \frac{\sum_{j}^{10} Z_j}{10} \times 4$$

$$MFD_k = \frac{D_i}{n} \quad \text{where,}$$

D_i = Density (number / m^2) value of species in field i.

Z_j = Number of plants in quadrate j.

MFD_k = Mean field density for species k.

n= Number of field surveyed.

Relative abundance (RA) : In order to summarize the abundance of species, the above mentioned three measures were combined into a single value. This value referred to as relative abundance and is calculated from relative frequency, relative field uniformity and relative mean field density measured as follows.

Relative frequency for species k (RF_k) = $\frac{\text{Frequency value of species k}}{\text{Sum of frequency value for all species}} 100$

Relative field uniformity for species k (RFU_k) = $\frac{\text{Field density value of species k}}{\text{Sum of field uniformity values for all speci}} 100$

Relative field density for species k ($RMFD_k$) = $\frac{\text{Mean field density of species k}}{\text{Sum of field density values for all species}} 100$

Relative abundance for species K (RA_k) = $RF_k + RFU_k + RMFD_k$.)

The relative abundance measure will have a value of 300. This calculation assumes that the frequency, field uniformity and field density measures are of equal importance in estimating the abundance of a species. If only one species occurs in a community, the relative abundance value will be 300. If more than one species occur, the total value of 300 will be shared by them. The greater the share of a species the greater the importance it marks. In this paper, only relative abundance values are presented in tables rather than frequency, field uniformity and mean field density as relative abundance value was derived from these values.

Coefficient of similarity (%) : The weed community found to grow in different topographic situations studied, were compared on the basis of coefficient of similarity (%) as per the methods described by Newsome and Dix (1968). It was determined using the following formula :

$$C = \frac{2w}{a+b} \times 100 \quad \text{where,}$$

C= Coefficient of similarity (%) of two communities.

w= The sum of the lower of the two mean field densities for species shared by the two communities.

a= The some of all values for the first community.

b= The some of all values for the second community.

Table 1: Relative abundance of weeds in boro rice as affected by rice cultivars in Jawar Village.

Sl. No.	Scientific name	Family	Relative abundance						
			BR 3	Hazi-Sail	Pajam	Lahya	Madhab-sail	Tepi boro	Ketchli boro
1.	*Scirpus juncoides* Roxb	Cyperaceae	111.71	89.54	130.39	49.67	112.21	77.19	21.32
2.	*Aponogeton natans* Engl & Brause	Aponogetonaceae	33.61	11.43	-	15.83	28.16	36.97	36.14
3.	*Monochoria hastata* Solms.	Pontederiaceae	29.42	20.12	41.94	52.13	26.62	53.90	8.15
4.	*Hygrorhyza aristata* (Retz. Nees	Gramineae	18.82	18.09	-	18.77	14.98	36.89	53.87
5.	*Echinochloa crusgalli* (L.) Beauv.	Garamineae	16.16	35.93	40.75-	35.68	33.02	22.21	-
6.	*Lindernia anagallis* (Burm f.) Pennell	Scrophulariaceae	17.68	34.13	14.58	53.71	-	16.95	14.47
7.	*Limnanthemun indicum* (L.) Griseb.	Gentinaceae	16.34	-	-	15.69	17.43	5.01	93.27
8.	*Jussiaea repens* L. Dc.	Onagraceae	15.44	10.31	16.30	6.97	10.14	20.02	14.49
9.	*Alternanthera philoxeroides* (Mart) Grise	Amaranthaceae	14.72	17.64	20.69	15.99	18.01	22.06	31.66
10.	*Oxalis corniculata* L,.Dc.	Oxalidaceae	5.65	8.21	9.69	5.70	19.66	4.42	6.51
11.	*Sagittaria trifolia* L.	Alismataceae	5.55	-	-	-	-	-	-
12.	*Cyperus compressus* L.	Cyperaceae	5.22	-	-	-	-	-	-
13.	*Limnophilla sessiliflora* Bl,	Scrophulariaceae	2.23	-	-	-	-	-	-
14.	*Echinochloa colona* (L,) Link	Gramineae	-	10.12	-	8.44	-	-	-
15.	*Cyperus difformis* L.	Cyperaceae	7.45	9.91	10.60	-	-	-	-
16.	*Finbristylis miliacea* (l,.)Vahl.	Cyperaceae	-	6.59	-	7.77	-	-	-
17.	*Rottboellia protensa* Hack.	Gramineae	-	6.08	-	-	-	-	-
18.	*Cyperus exaltatus*	Cyperaceae	-	5.38	-	-	-	-	-
19.	*Leersia hexandra* Swartz.	Gramineae	-	4.09	-	2.99	-	4.38	6.88
20.	*Pseudoraphis minuta* (Mex.) Pilger	Gramineae	-	3.70	9.73	-	19.77	-	-
21.	*Echinocloa stagnia* (Retz.) Beauv.	Gramineae	-	3.43	-	-	-	-	-
22.	*Eclipta alba* Hassk	Compositae	-	2.56	-	-	-	-	-
23.	*Centipeda minima* Willd.	Compositae	-	2.52	-	-	-	-	-
24.	*Utricularia setellaris* L. f.	Lentibulariaceae	-	-	5.33	-	-	-	-
25.	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	-	-	-	-	-	-	7.98
26.	*Sagittaria guyanensis* H.B.K.	Alismataceae	-	-	-	-	-	-	5.26

Table 2. Total relative adundance value of weed types grown in association with different boro rice cultivars.

Cultivar	Life Cycle type (%)			Morphology type (%)									Grand Total
	A	P	Total	G rass			Sedge			Broadleaf			
				A	P	Total	A	P	Total	A	P	Total	
BRS	50.38	249.62	300	19.75	22.82	42.57	5.22	111.71	116.93	25.41	115.09	140.50	300
	(16.79)	(83.21)	(100)	(6.58)	(7.61)	(14.19)	(1.74)	(37.24)	(38.98)	(8.47)	(38.36)	(46.83)	(100)
Hazisil	133..5	166.5	300	49.48	31.96	81.44	19.42	89.54	108.96	64.6	45	109.6	300
	(44.5)	(55.5)	(100)	(16.49)	(10.65)	(27.14)	(6.47)	(29.85)	(36.32)	(21.53)	(15)	(36.53)	(100)
Pajam	87.56	212.44	300	40.75	9.73	50.48	9.19	130.39	140.30	36.9	72.32	109.22	300
	(29.19)	(70.81)	(100)	(13.58)	(3.24)	(16.82)	(3.30)	(43.46)	(46.76)	(12.3)	(24.11)	(36.14)	(100)
Lahya	127.9	172.1	300	44.12	21.76	65.88	18.37	49.67	68.04	65.41	100.7	166.08	300
	(42.63)	(57.37)	(100)	(14.71)	(7.25)	(21.96)	(6.12)	(16.56)	(22.68)	(21.80)	(33.56)	(55.36)	(100)
Madhabsail	43.16	256.84	300	33.02	34.75	67.77	0	112.21	112.21	10.14	109.88	120.02	300
	(14.39)	(85.61)	(100)	(11.01)	(11.58)	(22.59)	(0)	(37.40	(37.40)	(3.38)	(36.63)	40.01)	(100)
Tepi boro	59.18	240.82	300	22.21	41.27	63.48	0	77.19	77.19	36.97	122.36	159.33	300
	(19.73)	(80.27)	(100)	(7.40)	(13.76)	(21.16)	(0)	(23.73)	(12.32)	(40.79)	(53.11)	(100)	300
Ketchli	28.96	271.04	300	0	60.75	60.75	0	21.32	21.32	28.96	188.97	217.93	300
boro	(9.65)	(90.35)	(100)	(0)	(20.25)	(20.25)	(0)	7.11)	(7.11)	(9.65)	(62.99)	(72.64)	(100)

Figures in parenthesis indicate percent of relative abundance of weed type.
A = Annual, P=perennial.

Table 3. Coefficient of similarity (%) of weeds grown in association with different boro rice cultivars.

Cultivars	BR3	Hazisail	Pajam	Lahya	Madhabsail	Tepi boro
Ketchli boro	5.0	5.24	1.91	4.98	4.32	9.33
BR 3	-	72.09	80.17	35.42	86.02	24.18
Hazisail	-	-	64.38	53.57	70.91	39.35
Pajam	-	-	-	28.14	85.19	32.15
Lahya	-	-	-	-	30.18	59.69
Madhabsail	-	-	-	-	-	17.89

Table 4. Relative abundance of weeds in boro rice as affected by crop growth stage in Jawar village.

Sl No.	Scientific name	Family	Relative abundance					
			15 days	30days	45days	60days	75days	90days
1.	*Scirpus juncoides* Roxb	Cyperaceae	104.51	105.88	92.12	86.38	93.33	97.99
2.	*Aponogeton natans* Engl & Brause	Aponogetonaceae	40.49	36.18	23.86	14.75	13.11	5.34
3.	*Echinochloa crusgalli* (L.) Beauv.	Gramineae	38.51	29.66	28.75	30.08	24.21	24.48
4.	*Limnanthemun Indicum* (L.) Griseb.	Gentinaceae	26.26	18.64	10.22	9.00	4.21	-
5.	*Hygrorhyza aristata* (Retz.) Nees	Gramineae	22.56	25.21	24.31	20.80	24.16	30.62
6.	*Alternanthera philoxeroides* (Mart.)	Amaranthaceae	20.30	21.38	18.19	15.83	18.39	19.80
7.	*Monochoria hastata* Solms.	Pontederiaceae	13.40	29.94	30.62	36.65	28.91	31.97
8.	*Jussiaea repens* L. Dc.	Onagraceae	11.01	11.82	12.83	12.25	12.75	13.02
9.	*Oxalis corniculata*. Dc .	Oxalodaceae	80.23	8.20	8.62	6.86	9.12	9.95
10.	*Rottboellia protensa* Hack	Gramineae	4.87	1.17	1.23	2.18	2.74	-
11.	*Cypeerus comperessus* L.	Cyperaceae	3.55	1.02	1.08	1.19	-	-
12.	*Pseudoraphis minuta* (Mex,) Pilger	Gramineae	3.35	5.27	4.57	1.51	-	-
13.	*Leersia hexandra* Swartz.	Gramineae	1.86	1.01	3.05	4.00	2.48	-
14.	*Sagittaria trifolia* L.	Alismataceae	1.11	-	1.25	1.03	3.44	9.43
15.	*Lindeniia anagllis* (Burm. f.)pennell	Scrophulariaceae	-	2.50	2.20	39.62	4619	43.95
16.	*Echinochloa colona* (l.)Link	Gramineae	-	1.11	6.01	2.55	-	-
17.	*Sagittaria guyanensis* H.B.K.	Alismataceae	-	1.01	-	-	-	-
18.	*Cyperus difformis* L.	Cyperaceae	-	-	25.24	2.40	6.08	13.55
19.	*Fimbristylis miliacea* (L. Vahl.)	Cyperaceae	-	-	2.11	3.45	-	-
20.	*Eclipta alba* Hassk.	Compositae	-	-	1.23	-	1.51	-
21.	*Cyperus exaltatus*	Cyperaceae	-	-	1.23	1.52	2.20	-
22.	*Centipeda minima* Willd.	Compositae	-	-	1.22	-	1.74	-
23.	*Urticularia setellaris* L.f.	Lentibulariaceae	-	-	-	2.45	1.95	-
24.	*Echinochloa stagnina* (Retz.)Beauv	Gramineae	-	-	-	-	1.84	1.74
25.	*Hydrocotyle asiatica L.* Roxb.	Umbelliferae	-	-	-	1.44	-	--
26.	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	-	-	-	1.21	-	-
27.	*Limnophilla sessiliflora* Bl.	Scrophulariaceae	-	-	-	1.01	1.74	-

Table 5. Total relative abundance value of weed types grown in association with boro rice at different age of crop.

Age of Crop	Life cycle type (%)			Morphology type (%)									Grand total
				Grass			Sedge			Broadleaf			
	A	P	Total	A	P	Total	A	P	Total	A	P	Total	
15 DAT	54.17	245.83	300	38.51	32.64	71.15	3.55	104.51	108.06	12.11	108.68	120.79	300
	(18.06)	81.94)	(100)	(12.84)	(10.88)	(23.72)	11.18)	(34.84)	(36..02)	(4.04)	(36.23)	(40.27)	(100)
30DAT	35.3	264.7	300	30.77	32.66	63.43	1.02	105.88	106.90	3.51	126.16	129.67	300
	(11.77)	(88.23)	(100)	(10.26)	(10.89)	(21.15)	(0.34)	(35.29)	(35.63)	(1.17)	(42.05)	(43.22)	(100)
45DAT	81.73	218.27	300	34.76	33.16	67.92	30.72	91.12	121.84	16.25	93.99	110.24	300
	(27.24)	(72.76)	(100)	(11.59)	11.05)	(22.64)	(10.24)	(30.37)	(40.61)	(5.42)	(31.33)	36.75	(100)
60DAT	94.39	205.61	300	31.91	31.04	62.96	8.56	86.36	94.94	53.91	88.19	142.10	300
	(31.46)	(68.54)	(100)	(10.64)	(10.35)	(20.99)	(2.85)	(28.79)	(31.64)	(17.97)	(29.40)	(47.37)	(100)
75 DAT	100.09	199.91	300	25.95	29.38	55.33	8.28	93.33	101.61	65.86	77. 2	143.06	300
	(33.36)	(66.64)	(100)	(8.65)	(9.79)	(18.44)	(2.76)	(31.11)	(33.87)	(21.95)	(25.73)	(47.68)	(100)
90DAT	104.43	195.57	300	24.48	30.62	55.10	13.55	97.99	111.54	66..40	66.96	133.36	300
	(34.81)	(65.19)	(100)	(8.16)	(10.21)	(18.37)	(4.52)	(32.66)	(37.18)	(22.32)	(22.32)	(44.45)	(100)

Figures in parenthesis indicate percent of relative abundance of weed type.

A= Annual, P=Perennial.

Table 6. Coefficient of similarity (%) of weeds grown in association with different growth stage of boro rice.

	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT
90 DAT	24.05	54.74	64.58	74.10	73.83
15 DAT	-	84.97	75.06	59.34	62.46
30 DAT	-	-	80.91	72.52	73.90
45 DAT	-	-	-	80.47	82.09
60DAT	-	-	-	-	89.48

Results and Discussion

Effect of rice cultivar

Seven rice cultivars were found to be cultivated in those *boro* fields. These were BR3, Hazisail, Pajam, Lahya, Madhabsail, Tepi *boro* and Ketchli *boro*. *Scirpus juncoides* was the most dominant weed species in all rice varieties of *boro* except in Lahya and Ketchli field where *Lindernia anagalis* and *Limnumthemum indicum*, respectively were the most dominant species (Table 1). Highest number of weed species were recorded in the field of Hazisail whereas the lowest in Pajam.

Irrespective of *boro* varieties, importance of perennials, which showed high relative abundance values, as higher than that of annuals (Table 2). Broadleaf weeds dominated with high relative abundance values over sedges or grasses in case of all *boro* varieties except Pajam and Madhabsail where sedges were the most dominant weed type.

Coefficient of similarity (%) of weeds growing in association with different *boro* rice cultivars showed that the values ranged from 1.91 to 86.02 (Table 3). Therefore, a remarkable similarity as well as dissimilarity of weeds were observed in those fields.

Effect of rice growth stages

Weed community was found to relate with different days after rice transplanting i.e., with rice growth stages. After transplanting rice in a puddled soil weed starts to grow and weed infestation increases with days if it is not controlled. *Scirpus juncoides* was found to be the most dominant weed species at all days studied after *boro* transplanting (Table 4). Total number of weed species increased with age of rice plants and reached maximum at 60 DAT when it started declining and reached minimum level at 90 DAT.

Perennial weeds showed higher relative abundance values than annuals irrespective of all the days when weed survey was done (Table 5). Broadleaf weeds also dominated over sedges or grass at all growth stages except at 45 DAT when sedges dominated over broadleaf or grass weeds.

Coefficient of similarity (%) of weeds grown in association with different growth stages of rice is presented in Table 6. The value ranged from 24.05. to 89.48. Highest dissimilarity was recorded between 15 DAT and 90 DAT.

References

Bhan, V. M. 1983. Effects of hydrology, soil moisture regime, and fertility management on weed populations and their control in rice. *In:* Weed control in rice. IRRI. Laguna, Philippines. pp. 47-55.

Smith, R. J. Jr. 1983. Weeds of major economic importance in rice and yield losses due to weed competition. *In:* Proceedings of the conference on weed control in rice, 1981. IRRI. Laguna, Philippines. P. 24.

Newsome, R. D. and R. L. Dix. 1968. The forests of the Cypess hills. Alberta and Saskatchewan, Canada. The American Midland Naturalist 80 (1) : 137.

Shan, S. A., C. M. Singh, N. N. Angiras and S. K. Gautam 1990. Weed management in different rice cultivars. Indian J. Weed sci. 22(1 &2):104-1-6.

Thomas, A. G. 1985. Weed survey system used in Saskatchewan for cereal and oilseed crops. Weed sci. 33(1) 36-37.

UNDP/FAO. 1988. Land resources appraisal of Bangladesh for agricultural development. Agroecological regions of Bangladesh. Report. 2. FAO. Rome. pp. 105-229.