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EFFECT OF BUTACHLOR, THIOBENCARB AND PENDIMETHALIN ON *ECHINOCHLOA COLONUM* IN DRY SEEDED BUNDED RICE (Var.) BHAVANI

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A field experiment was conducted in dry seeded banded rice for two seasons at Tamil Nadu Agricultural University, Coimbatore. The intensity of annual grass *Echinochloa colonum* during the first and second monsoon was 52 and 165/sq.m under moderately clay soil with 1.3 per cent organic matter. Either individual application of herbicides viz. butachlor 1.0 kg a.i/ha, thiobencarb 1.0 kg a.i/ha and pendimethalin 0.75 kg a.i/ha at 8 d.a.s or as mixture with propanil 2.00 kg a.i/ha at 16 d.a.s was effective in controlling the above grass weed and recorded low weed dry matter production. Eighth day application of pendimethalin gave higher mean grain yield of 4012 kg/ha. It was on par with butachlor, thiobencarb applied on eighth day and herbicides mixtures at 16 d.a.s and superior to twelfth day application of herbicides.

Direct seeding in upland banded condition is practised in the East coast areas of Tamil Nadu and the area under cultivation is about 2 lakh hectares. It is the only possible method in areas of uncertain distribution of rainfall or inadequate availability of irrigation water. Weeds compete with rice primarily for nutrients, water and light. The extent of yield redu-

ction due to weeds is estimated to be over 50 per cent in direct sown upland condition. In the case of upland condition, the failure of germination due to moisture stress, uneven stand and establishment and slow growth rate of rice provide room for annual grass *Echinochloa colonum*. It is difficult to identify the above weed with rice crop in the early stage and

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to maintain a weed free situation even by repeated hand weeding in upland rice. Hence a field trial was laid out to find out the effect of application of herbicides, butachlor thiobencarb and pendimethalin individually and in combination with propanil in direct sown upland bunded rice.

MATERIALS AND METHODS

Field experiments were conducted for two seasons from 1975 to 1977 at Tamil Nadu Agricultural University, Coimbatore. The mean annual rainfall is 644 mm and the maximum and minimum temperature are 35.9° C and 18.5° C respectively. The soils of the experimental area were deep and moderately clay. The soils were low in available nitrogen and medium in available phosphorus and high in available potassium. The details of the treatments are given as follows.

1. Pre-emergence — butachlor 1.0 kg a.i/ha at 8 d. a. s.
2. " " — thiobencarb 1.0 kg a.i/ha at 8 d. a. s.
3. " " — pendimethalin 0.75 kg a.i/ha at 8 d. a. s.
4. " " — butachlor 1.0 kg a.i/ha at 12 d. a. s.
5. " " — thiobenthocarb 1.0 kg a.i/ha at 12 d. a. s.
6. " " — pendimethalin 1.0 kg a.i/ha at 12 d. a. s.
7. Early post-emergence — mixture of butachlor 1.0 kg/ha + propanil 2.0 kg a.i/ha at 16 d. a. s.
8. " " — mixture of Thiobencarb 1.0 kg/ha + propanil 20 kg/ha at 16 d. a. s.
9. " " — mixture of pendimethalin 0.75 kg/ha + propanil 2.0 kg a.i/ha at 16 d. a. s.
10. Hand weeding once at 20 d. a. s.
11. Hand weeding twice at 28 and 40 d. a. s.
12. Unweeded control

One late hand weeding was given at 40 d a. s. to all herbicide treatments from 1 to 9. The treatments were replicated four times. The gross and net plot size adopted was 5 x 3 m² and 4.5 x 2.0 m². A seed rate of 100 kg/ha was adopted. Rice (var) Bhavani sowing and harvesting date are 7-8-75 and 1-1-76 for first monsoon and 9-7-76 and 20-11-76 for second monsoon respectively. The land was prepared by dry ploughing and levelled before sowing. Pregerminated seeds were broadcasted and covered. Irrigation were given once in every four days.

Pre-emergence herbicides were sprayed in drained field with help of Bak-pak sprayer fitted with flat fan nozzle with a pressure of 0.7 kg/sq. m. Irrigation was given one day after pre and post emergence application. Calculated quantity of herbicides was mixed with water at the rate of 600 litre/ha.

There was adequate weed population in the field selected for the experiment and as such there was no need for sowing weed seeds in the experimental field. A total quantity of 100 kg N and 45 kg each of P₂O₅ and K₂O was applied to the crop. The entire quantity of P₂O₅ and K₂O was applied basally in the form

of single superphosphate and muriate of potash respectively. Nitrogen was applied in the form of urea in three equal split at 20, 40 and 80 d. a. s. Following the methods described by Burnside and Wicks (1965) population of weeds per sq. m. and the dry matter production of weeds were recorded at 20 days after sowing.

RESULTS AND DISCUSSION

Weed flora of the experimental field:

The weed flora of the experimental field are *Echinochloa colonum* (L.) Link *Cynodon dactylon* (L.) Pers., *Dactyloctenium aegyptium* (L.) Richter, *Panicum repens* L., *Paspalum sanguinale* Lamk *Chloris barbata* Swartz, *Dinela arabica* Jacq in grass and *Cyperus iria* L. and *Cyperus rotundus* L in sedges and *Eclipta alba* (L.) Hassk. *Trianthema monogyna* L., *Amaranthus viridis* L. *Asteracantha longifolia*, *Chrozophora rotteri* Klotzsch, *Spilanther paniculata* wall. *Euphorbia hirta* L., *Phaseolus trilobus* Ait, *Tridax procumbens* L., *Phyllanthus niruri* L., *Comphrena decumbens* Jacq., *Cleome chelidonii* L. f., *Sesbania exaltata* (Raf.) Cory, and *Corchorus olitorius* L. in broad leaved weeds.

The total weed flora of the experiment was 92 and 181/sq.m for first and second monsoon respectively. The total monocot population was 59 and 178 and dicot was 33 and 3 for first and second monsoon respectively. Annual grass weed *Echinochloa colonum* was the major weed and it accounted to 52 and 165 for the first and second monsoon season respectively.

Effect of herbicide on Echinochloa colonum

The *Echinochloa Colonum* population recorded at 20 d. a. s. is presented in Table. 1 Application of the thiobencarb mixture at 16 d. a. s. effectively controlled grass weeds (2/s q. m) in monsoon 1975 In monsoon 1976 eighth day application of butachlor registered the least population (33/sq.m) followed by eighth day application of pendimethalin and thiobercarb mixture

Application of butachlor, thiobencarb and pendimethalin was effective in controlling grass weeds. Among the different treatments mixtures and eighth day application of herbicides were more effective in controlling the grass weeds. Twelfth day application recorded less control of grass weeds. Effective weed control with herbicide mixture was due to contact and residual action of herbicides on both emerged and emerging grasses in the early stage. Eighth day application of butachlor, thiobencarb and pendimethalin effectively controlled the grass due to contact action of herbicides on germinating weeds and absorption by roots and shoots of emerging weeds.

Baker (1960) reported that selective control of barnyard grass in rice by surface applied carbamate herbicide was due to elongation of mesocotyl of the grass. The work of Parker (1966) showed the shoot as the site of entry of carbamate herbicides. According to Singh and Singh (1977) pendimethalin was selective to rice and effective in controlling barnyard grass.

Table 1. Effect of time of application of herbicides on *Echinochloa colonum* total / monocot and total dicot and total weed population at 20 d. a. s. (No/Sq. m)

Treatment	<i>Echinochloa colonum</i> (No./Sq. m)			Total Monocot weed population (No./Sq. m.)			Total Dicot Weed popu- lation (No./Sq. m.)			Total weed population (No./Sq. m.)		
	1975	1976	Mean	1975	1976	Mean	1975	1976	Mean	1975	1976	Mean
	O	T		O	T		O	T		O	T	
1	5	33	19	10	34	22	15	2	9	25	36	31
	0.87	1.55		0.92	1.42		0.99	0.56		1.40	1.55	
2	10	99	55	17	103	60	28	8	18	45	111	78
	0.95	1.92		1.19	1.95		1.39	0.50		1.61	1.04	
3	8	69	39	10	70	40	28	5	17	38	75	57
	0.92	1.65		0.95	1.79		1.44	0.70		1.59	1.87	
4	7	110	59	24	112	68	31	9	20	55	121	83
	0.89	2.05		1.25	1.92		1.51	0.95		1.74	2.06	
5	17	159	88	18	165	91	35	7	21	53	172	113
	1.24	2.17		1.18	2.12		1.56	0.80		1.72	2.12	
6	14	83	49	14	90	52	28	3	16	42	93	68
	1.05	1.95		1.05	1.89		1.44	0.63		1.63	1.96	
7	8	113	61	15	117	68	26	3	15	41	120	81
	0.92	2.01		1.09	2.00		1.44	0.52		1.63	2.03	
8	2	75	39	2	80	41	16	3	10	15	83	49
	0.56	1.90		0.50	1.81		0.72	0.53		1.15	1.91	
9	11	86	48	15	90	53	1	3	2	16	93	65
	1.21	1.97		1.11	1.85		0.40	0.40		1.24	1.96	
10	27	238	133	29	241	135	19	12	16	48	253	151
	1.28	2.36		1.49	2.29		1.31	1.35		1.55	2.38	
11	41	169	105	46	175	111	23	21	22	69	196	133
	1.37	2.17		1.59	2.19		1.36	1.38		1.68	2.25	
12	52	165	109	59	178	119	3	3	18	92	181	137
	1.62	2.17		1.69	2.20		1.54	0.60		1.90	2.19	
S.E.D	0.22	0.20		0.10	0.12		0.21	0.28		0.21	0.20	
C.D. (P=0.05)	0.45	0.40		0.21	0.24		0.43	N.S.		0.42	N.S.	

T = Transformed log (X+2)

O = Original

Similar result was obtained in the present study also.

EFFECT OF HERBICIDES ON TOTAL MONOCOT WEED

Thiobencarb mixture (2/sq. m) in monsoon 1975 and eighth day application of butachlor (34/sq. m) in monsoon 1976 effectively controlled the monocot weeds at 20 days. Twelfth day application of butachlor and thiobencarb were not effective in controlling monocot weeds. Broad spectrum weed control was accomplished by herbicide mixture by controlling both emerged and emerging weeds. Patil (1972) observed that butachlor 2 kg/ha applied on fourteenth day had little effect on already germinating weeds in upland condition.

EFFECT OF HERBICIDES ON TOTAL DICOT WEEDS

Pendimethalin mixture was effective in controlling the dicot weeds at 20 days. Herbicide mixture was the best treatment in controlling dicot weeds. Superiority of pendimethalin in controlling dicot weeds reported early by Mohamed Ali and Sankaran (1975) was also confirmed in the present investigation. Twelfth day application had comparatively reduced the control of dicot weeds in upland condition.

EFFECT OF HERBICIDE ON TOTAL WEED POPULATION

Thiobencarb mixture (15/sq.m) was effective in controlling total weed population at 20 days during monsoon 1975. In monsoon 1976

butachlor eighth day application had less number of weeds (36/sq m) followed by eighth day application of pendimethalin as compared to (137/aq m) unweeded control. This herbicide mixtures were highly effective in reducing total weed population. In upland condition where grasses predominate pendimethalin was also effective. Due to broad spectrum activity of mixture, they were highly effective in controlling total weed population.

Patil (1972) observed that propanil 2 kg a.i./ha at 14 days after sowing gave effective control of weeds. This is in accordance with present findings of mixtures of propanil at 2 kg a.i./ha applied as early post emergence. Smith (1973) and Yamane *et al.* (1975) reported that thiobencarb or mixtures of the thiobencarb, butachlor with propanil were effective on emerged weeds and those that germinate in 4 to 5 weeks after treatment. The present finding that mixtures have broad spectrum and season long - weed control falls in line with the above report.

EFFECT OF HERBICIDES ON TOTAL DRY MATTER PRODUCTION

The dry matter production of weeds at 20 days in monsoon 1975 revealed that the eighth day application of butachlor and butachlor mixture gave the low dry matter of weeds 3.3 and 3.5 kg/ha respectively. In monsoon 1976 the lowest dry matter of 3.0 kg/ha was observed in eighth day application of butachlor which was comparable with pendimethalin

Table 2. Effect of herbicides treatments on total weed dry matter production (kg/ha) at 20 DAS and grain yield (kg/ha)

Treatments	Total weed dry matter production (kg/ha)			Grain yield (kg/ha)		
	1975	1976	Mean	1975	1976	Mean
1	3.3	3.0	3.2	4356	3292	3824
2	4.6	8.0	6.3	4484	3381	3933
3	4.9	6.2	5.6	4512	3511	4012
4	6.4	14.3	10.4	3668	2614	3141
5	6.8	10.7	8.8	3367	2403	2885
6	7.8	16.0	11.9	3867	2856	3362
7	3.5	6.3	4.9	3729	3126	3428
8	5.1	4.6	4.9	3701	3451	3576
9	4.3	3.3	3.8	3450	3484	3467
10	10.9	31.5	21.2	1355	1090	1233
11	10.5	14.0	12.3	4004	3454	3716
12	12.2	10.7	11.5	555	459	522
SED	1.7	0.7		527	42	388
C.D. (P=0.05)	3.5	1.5		1079	84	670

mixture (3.3 kg/ha) and thiobencarp mixture (4.6 kg/ha).

GRAIN YIELD

The grain yield data is presented in Table 2. Eighth day application of pendimethalin gave high grain yield 4512 kg/ha in monsoon '75. It was on par with mixtures and superior to twelfth day application of thiobencarp (3367 kg/ha). During monsoon '76 eighth day application of pendimethalin gave higher grain yield of 3511 kg/ha and it was followed by pendimethalin mixture. The mean grain yield recorded in the hand

weeding twice was 3719 kg/ha as compared to 1233 kg/ha in we hand weeding once. The lowest mean grain yield of 522 kg/ha was recorded in unweeded control.

Kennard (1973) stated that application of thiobencarp at 2 or 3 kg/ha to dry sown rice 12 days after sowing was effective on broad leaved weeds, sedges and annual grasses. Mandal (1977) observed that butachlor at 3.6 kg/ha controlled annual grasses, sedges and broad leaf weed in dry land drilled rice. In this study where irrigation is given once in

every for days, eighth day application of individual herbicides with low dose (0.75 to 1.0 kg/ha) have recorded high grain yield than twelfth day application which had lesser control of *Echinochola colonum* and more of total weed dry matter production. Further eighth day application of individual herbicides in the above low dose is highly selective to seeded banded rice. There is no fear of phytotoxicity to rice seedling even with excess moisture or rainfall

immediately after herbicide application in the above low doses. Among the single herbicides pendimethalin gave higher yield in both the seasons due to prolonged broad spectrum weed control. Singlachor *et al* (1978) reported that pendimethalin under upland condition was effective in controlling weeds resulting in high rice yield. In this study also application of pendimethalin reduced the dry matter of weeds and increased the grain yield.

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