higher level of N (202.5 kg/ha) in low N soils. The response equation was worked out and is as follows:

$$Y = \frac{59.3}{1+e^{-(-1.84+1.48)}}$$

Y = yield (g/pot)

X = applied N (g/pot)

The genetic potential and varietal characters might be the probable reasons for this type of curve. Krogman *et al.* (1980) observed a maximum whole-plant yield at 225 kg N/ha level.

ii) Medium N soils: The straw yield was enhanced by 35 per cent over control with the addition of 202.5 kg N/ha. The response was quadratic in nature and equation worked out for this curve is:

$$Y = 35.3 + 28.5x - 16.5x^2$$

Y = yield (g/pot)
X = applied N (g/pot)

From the above response equation, the physical optima was found to be 173 kg N/ha (0.864 g/pot). Soil factors such as high initial N status, lower efficiency of added N at higher levels might have resulted into quadratic response.

It is concluded that the grain and straw yields increased upto 202.5 kg N/ha in low N soils while in medium N soil, the optimum dose to get the highest grain and straw yield was 148 and 173 kg N/ha, respectively.

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EFFECT OF NEW HERBICIDES IN LOW LAND RICE

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ABSTRACT

Pre-emergence application of anilofos at 0.4 kg ha^{-1} and piperophos at 1.0 kg ha^{-1} at 4th day after transplanting were effective in controlling Echinochloa crus-galli and other rice weeds. Fluoroxypyr at 0.8 kg ha^{-1} was found to control broad leaved and aquatic weeds effectively. Highest grain yield of 5808 kg ha^{-1} and 7034 kg ha^{-1} was recorded in piperophos at 1.0 kg ha^{-1} and anilofos at 0.4 kg ha^{-1} treated plots in Kharif and summer respectively.

Weeds are bane to crop productivity. Chang (1970) found that *Echinochloa crus-galli* at densities of 100-200 plants m^{-2} reduced rice yield by 86-91 percent respectively. Park and Kim (1971) reported 48 percent yield reduction in rice due to weeds. Weeds compete with the crop for light, space and nutrients.

Pre-emergence herbicides like butachlor and thiobencarb are in vogue for the control of rice weeds. The performance of weedicides varies with climate, dose, nature of weed flora and intensity. A detailed study was conducted during *Kharif* 1985 and summer 1986 in IR 50 paddy with a view to evaluate the performance of new

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e 1. Weed population on 40 DAT-Summer (NU.M^{-2})

Treatments		E. crus.qalli		Other Grasses		Sedges		Broad leaved and aquatics		Total Weeds	
		Q	T	Q	T	Q	T	Q	T	Q	T
Pretilachlor	0.5 kg ha^{-1}	47	1.669	29	1.453	28	1.433	43	1.627	147	2.165
Pretilachlor	0.75 "	35	1.553	25	1.398	28	1.365	37	1.572	122	2.085
Pretilachlor	1.0 "	28	1.447	16	1.403	12	1.111	20	1.283	77	1.883
Piperophos	0.5 "	59	1.764	25	1.380	18	1.251	57	1.750	158	2.200
Piperophos	0.75 "	28	1.426	21	1.313	16	1.193	30	1.466	94	1.973
Piperophos	1.0 "	23	1.355	14	1.149	10	0.996	27	1.424	74	1.867
Anilofos	0.4 "	26	1.405	16	1.93	16	1.193	19	1.278	77	1.884
Fluoroxypyr	0.4 "	81	1.192	24	1.371	19	1.278	22	1.336	146	2.159
Fluoroxypyr	0.4 "	58	1.754	18	1.262	15	1.174	17	1.219	108	2.034
10 Molinate	0.75 "	60	1.774	27	1.416	26	1.408	588	1.760	171	2.230
11 EPTC+2,4-D(1.0+0.5)"		53	1.713	31	1.486	35	1.538	25	1.399	144	2.155
12 Thiobencarb	1.5 "	27	1.433	19	1.271	25	1.376	36	1.547	107	2.024
13 Butachlor	1.5 "	33	1.517	27	1.421	15	1.170	43	1.627	118	2.068
14 Hand weeding Twice		16	1.179	15	1.166	10	0.970	26	1.396	67	1.814
15 Unweeded check		90	1.956	42	1.626	43	1.617	71	1.849	246	2.401
CD (P=0.05)			0.144		0.210		0.183		0.151		0.088

'able 2. Weed population on 40 DAT (NO M^{-2}) - Kharif

	Treatments	Dose (kg ha^{-1})	E. crus.galli		Other Grasses		Sedges		Broad leaved and aquatics		Total Weeds	
			O	T	O	T	O	T	O	T	O	T
1	Pretilachlor	0.5	39	1.585	14	1.226	13	1.106	27	1.424	92	1.967
2	Pretilachlor	0.75	32	1.496	12	1.075	11	1.011	20	1.307	75	1.873
3	Pretilachlor	1.0	23	1.365	10	0.982	7	0.861	17	1.230	58	1.761
4	Piperophos	0.5	39	1.587	15	1.168	12	1.089	31	1.488	98	1.990
5	Piperophos	0.75	22	1.324	12	1.045	9	0.947	14	1.131	56	1.744
6	Piperophos	1.0	13	1.118	8	0.903	5	0.661	12	1.075	38	1.578
7	Anilofos	0.4	11	1.053	8	0.916	4	0.625	12	1.063	36	1.576
8	Fluoroxypyr	0.4	53	1.733	13	1.124	13	1.091	8	0 .894	87	1.929
9	Fluoroxypyr	0.4	37	1.569	13	1.121	11	1.047	8	0.903	70	1.849
10	Molinate	0.75	43	1.633	16	1.212	10	1.013	20	1.308	90	1.954
11	EPTC+2,4-D 10x	0.5	28	1.462	17	1.238	10	1.013	15	1.164	71	1.849
2	Thiobencarb	1.5	13	1.102	7	0.793	5	0.661	17	1.215	41	1.661
3	Butachlor	1.5	20	1.300	7	0.735	7	0.795	11	1.218	51	1.706
4	Hand weeding Twice		11	1.040	5	0.678	2	0.301	11	1.016	29	1.403
5	Unweeded check		61	1.782	23	1.356	20	1.301	36	1.560	140	2.149
	CD (P=0.05)			0.116		0.259		0.237		0.132		0.080

O - Original values
T - Transformed values

ble 3. Productive tillers, panicle length, filled grains per panicle and grain in yield.

ymbol	Treatments	Kharif				Summer			
		Productive tillers ($No.m^{-2}$)	Panicle length (cm)	Filled grains $panicle^{-1}$	Grain yield ($kg\ ha^{-1}$)	Productive tillers ($No.m^{-2}$)	Panicle length (cm)	Filled grains $panicle^{-1}$	Grain yield ($kg\ ha^{-1}$)
	Pretilachlor 0.5 $kg\ ha^{-1}$	401	19.4	74	5135	476	20.8	75	5932
	Pretilachlor 0.75 "	392	19.8	64	4966	468	20.9	74	5512
	Pretilachlor 1.0 "	371	19.5	71	5051	460	20.6	74	5879
	Piperophos 0.5 "	391	20.4	77	5008	477	21.0	76	5938
5	Piperophos 0.75 "	520	22.0	81	5766	512	22.0	82	6352
6	Piperophos 1.0 "	492	21.2	78	5513	589	21.7	85	7034
7	Anilofos 0.4 "	533	21.3	89	5808	542	21.8	85	6967
T8	Fluoroxypyr 0.4 "	367	19.9	65	4798	462	20.7	74	5669
T9	Fluoroxypyr 0.4 "	349	20.8	68	4798	460	20.7	74	5723
T10	Molinate 0.75 "	415	20.4	69	5177	491	21.0	76	6037
T11	EPTC+2,4-D (1.0+0.5)"	387	19.8	69	4966	493	21.7	80	6102
12	Thiobencarb 1.5 "	519	21.8	83	5598	538	21.9	82	6772
T13	Butachlor 1.5 "	470	21.4	85	5471	504	21.4	78	6352
T14	Hand weeding Twice	525	21.2	85	5598	548	22.3	83	6824
T15	Unweeded check	343	19.0	63	4503	401	20.3	72	4552
	CD (P=0.05)	34	1.2	11.0	525.9	32	1.01	8.8	888.0

DAT: Days after transplanting

per-emergence herbicides in controlling the rice weeds in general and *Echinochloa crus-galli* in particular under lowland transplanted condition.

MATERIALS AND METHODS

The experiments were laid out in wet lands, College of Agriculture, Tamil Nadu Agricultural University, Coimbatore. The soil type is clay loam, low in available nitrogen and high in available phosphorus and available potassium. The rice variety was IR 50 for both *Kharif* 1985 and summer 1986. A spacing of 15 cm x 10 cm was followed. A common fertilizer dose of 50 kg each of N, P_2O_2 and K_2O per hectare was applied as basal at the time of transplanting in the form of urea, super phosphate and muriate of potash respectively. 50 kg ha^{-1} of nitrogen was top dressed in two equal splits during tillering and panicle initiation stages. Plot sizes of 5 m x 4 m (gross plot) and 4.1 x 3.4 m (net plot) were adopted.

The weed control treatments included individual application of pretilachlor and piperophos each at 0.5, 0.75 and 1.0 kg ha^{-1}, anilofos at 0.4 kg ha^{-1}, fluoroxypyr at 0.4 and 0.8 kg ha^{-1}, molinate at 0.75 kg ha^{-1}, EPTC + 2,4-D at 1.0 + 0.5 kg ha^{-1} along with standard herbicides butachlor and thiobencarb each at 1.5 kg ha^{-1} on 4th day after transplanting in comparison with handweeding twice (20 and 40 DAT) and unweeded check. Field experiments were laid out in randomised block design with three replications.

RESULTS AND DISCUSSION

The weed flora of the experimental fields revealed the dominance of grasses followed by broad leaved and aquatics and sedges in that order. Among the grass weeds *Echinochloa crus-galli* (L). Beauv. was the dominant weed constituting 37 percent of the total weed population. The other predominant weeds were *Cyperus difformis* L. in sedges and *Eclipta alba* (L) Hassk in broad leaved weeds. Application of anilophos at 0.4 kg ha^{-1} were on par with hand weeding in controlling *E. crus-qalli* both in summer and *Kharif.* At 40 DAT anilofos at 0.4 kg ha^{-1} during *kharif* and piperophos at 1.0 kg ha^{-1} during summer recorded 11.3 m^{-2} and 22.7 m^{-2} of *E.crus-qalli* respectively among the herbicide treated pots. However, hand weeding twice recorded 11.0 m^{-2} and 15.7 m^{-2} during *Kharif* and summer respectively (Tables 1 and 2). Both the chemicals continued with good persistance upto 60 DAT in controlling *E.crus-qalli.* These herbicides were found on par with the standard herbicides thiobencarb and butachlor at 1.5 kg ha^{-1}.

Piperophos at 1.0 and 0.75 kg ha^{-1} anilofos at 0.4 kg ha^{-1}, butachlor at 1.5 kg ha^{-1} were effective comparable with handweeding twice for the control of sedges.

Pre-emergence application of flyoroxypyr at 0.8 and 0.4 kg ha^{-1} gave effective control of broad leaved and aquatics, on par with anilofos at 0.4 kg ha^{-1} and piperophos at 1.0 kg ha^{-1}.

Effective control of *E.crus-qalli* and other grasses, sedges and broad leaved weeds, reduced weed DMP and increased WCE and MCI was piperophos at 1.4 kg ha^{-1} and piperophos at 1.0 kg ha^{-1}.

Piperophos at 0.75 kg ha^{-1} and thiobencarb at 1.5 kg ha^{-1} were on par with hand weeding twice with respect to productive tiller production. Increased number of productive tillers was found to be associated with effective weed control treatments (Table 3). The results were in confirmation with Gill and Mehra (1981). The reason for decreased number of productive tillers in un-weeded check may be attributed to the severe competition by weeds leading to low dry matter production and LAI resulting in less

This finding also agrees with Kenchiah et al (1983) and Biswas at al (1983). Almost a similar trend was noticed for the other yield components like number of filled grains per panicle, length of panicle and thousand grain weight (Table 3).

In *Kharif* ,anilofos at 0.4 kg ha^{-1} recorded the highest grain yield of 5008 kg ha^{-1} and was on par with piperophos at 0.75 kg ha^{-1}, thiobencarb at 1.5 kg ha^{-1}, hand-weeding twice, piperophos at 1.0 kg ha^{-1} and butachlor at 1.5 kg ha^{-1} in order.

In summer crop, piperophos at 1.0 kg ha^{-1} recorded the highest grain yield with 7034 kg ha^{-1} and was on par with other herbicides applied and hand weeded plots as in *Kharif* (Table 3). In general, the yield of summer crop was higher than in *Kharif*. This may be due to the increased weed control efficiency coupled with bright sunshine hours favouring increased photosynthetic activity leading to efficient grain filling.

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COMBINING ABILITY FOR YIELD AND ITS COMPONENTS IN COWPEA

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ABSTRACT

Combining ability analysis, involving four lines and three testers was made in cowpea and studied for ten quantitative characters. The variance due to g.c.a. and s.c.a. showed that gene action was predominantly non-additive for days to 50 per cent flowering, days to maturity, plant height, pod length, seeds per pod, 100 grain weight and yield per plant and primarily additive for primary branches per plant, clusters per plant and pods per plant. The genotypes Co 4, C 87, C,152 and CoVu 4 were found to be the good general combiners. The crosses co 3 x C 152, Co 3 x CoVu 4, Co 4 x C 152, V 87 x C 152 and KC 199 x KC 195 were observed to have higher s.c.a effects for some of the yield components.

Cowpea (*Vigna unguiculata* (L.) Walp.) is one of the major pulse crops of our country. Genetical studies in cowpea are far from adequate in the literature (Kheradnam and Niknejad, 1971; Singh and Jain, 1972; Lal *et al.*, (1975). To isolate high yielding genotypes, an understanding of genetic architecture of the crop is obligatory to the plant breeder. Combining ability analysis is useful to assess the ability of the parents in selfpollinated crops and at the same time to elucidate the nature of gene action involved. Therefore,

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