Madras Agric. J., 82(5): 383-387 May, 1995
https://doi.org/10.29321/MAJ.10.A01214

EFFECT OF POST-EMERGENCE HERBICIDES DICAMBA AND 2, 4-D EE ON WEEDS AND YIELD OF LOWLAND TRANSPLANTED RICE

C.R.CHINNAMUTHU

Department of Agronomy, Agricultural College and Research Institut
Tamil Nadu Agricultural University, Coimbatore 641 003.

ABSTRACT

Field experiments were conducted on the clay loam soils of Tamil Nadu Agricultural University, Coimbatore during *kharif* (June-Sep) and *rabi* (Oct-Jan) seasons of 1984-85. The herbicide treatments were dicamba at 0.075, 0.125, 0.200, 0.300, and 0.500 kg ha^{-1} and 2, 4 -D EE at 0.200, 0.300, 0.600 and 0.800 kg ha^{-1} during *kharif* and 0.200, 0.300, and 0.500 kg ha^{-1} of dicamba and 0.300, 0.600 and 0.800 kg ha^{-1} of 2,4-D EE during *rabi* applied individually and in all combinations. Butachlor 1.5 kg ha^{-1} and hand weeding twice treatments were included in *rabi* for comparison. Dicamba + 2,4-D EE mixture at 0.300 + 0.600 gave the highest grain yield of 5261 and 4892 kg ha^{-1} during *kharif* and *rabi* seasons, respectively. The grain yields with hand weeding twice (4798 kg ha^{-1}) and butachlor treatments (4816 kg ha^{-1}) were comparable with higher doses of individual application of these herbicides during *rabi* season. The highest weed control efficiency and index were observed in dicamba + 2,4-D EE mixture at 0.5 + 0.8 kg ha^{-1} applied in both seasons closely followed by 0.3 + 0.60 kg ha^{-1}

KEY WORDS : Herbicides, Dicamba, 2, 4 - D EE, Effect, Weeds, Rice Yield

Low land conditions of rice fields favour the growth and reproduction of both aquatic and semiaquatic weeds. Weed competition can be serious in rice and in the extreme case, uncontrolled weed growth can cause complete crop failure. Gill and Kolar (1980) reported that yield reduction was mainly due to the weed competition during the period of 4 to 6 weeks after transplanting rice. To maximise the rice yield, weeds should be controlled during this period. The weed competition during this period can be reduced markedly by the use of post-emergence herbicides. Post-emergence herbicides of phenoxy and benzoic-acid groups like 2,4-D and dicamba are effective in controlling broad leaved weeds, aquatics, sedges and to some extent grass weeds. Moody (1982) reported that combined application of two or more herbicides will be effective for longer periods than single herbicides. With this background, experiments were conducted to find out the effective dose of herbicide mixture for weed control in transplanted rice.

MATERIALS AND METHODS

The experiments were conducted in the wetlands of the Central Farm, Agricultural College and Research Institute, Coimbatore. The soil type of the experimental area was moderately drained deep clayloam with low, high, and high content of available nitrogen, phosphorus and potassium. The pH, EC and CEC of the soil was 7.6, 0.45 m mhos cm^{-1} and 38.2 me 100 g^{-1}, respectively. The treatments consist of dicamba at 0.0, 0.075, 0.125, 0.2, 0.3 and 0.5 kg ha^{-1} and 2, 4-D EE at 0.0, 0.2, 0.3, 0.6 and 0.8 kg ha^{-1} during *kharif* and 0.0, 0.2, 0.3 and 0.5 kg ha^{-1} of dicamba and 0.0, 0.3, 0.6 and 0.8 kg ha^{-1} of 2,4-D EE during *rabi* applied individually and in all combinations. In addition, hand weeding twice (20 and 40 days after transplanting) (DAT) and butachlor 1.5 kg ha^{-1} were included for comparison during *rabi*. The experiments were laid out in strip plot and randomised block design replicated three times with a plot size of 6 x 2.5 m and 5 x 4 m during first and second season, respectively. Varieties ADT 36 and IR 20 were planted at a spacing of 15 x 10 cm and 20 x 10 cm during first and second seasons respectively. Fertilizer was applied at the rate of 100:50:50 kg of N, P_2O_5 and K_2O Kg ha^{-1}. Phosphorus and K_2O were applied basally and N was applied in three split doses *viz.*, 50 per cent at basal, 25 per cent at tillering and the remaining at panicle initiation stage. The field was maintained with 5 cm water throughout the growing period. Pre-emergence herbicide butachlor was applied three days after planting by mixing with 50 kg of sand ha^{-1} and the post -emergence herbicides dicamba and 2,4-D EE were mixed with water at the rate of 600 l ha^{-1} and sprayed 21 days after transplanting in a sequential method of 2,4-D EE

Table 1. Effect of weed control treatments on weed dry matter production (DMP) (kg ha^{-1}) during *kharif*

Treatments	Dicamba (kg ha^{-1})							Dicamba (kg ha^{-1})						
	0.0	0.075	0.125	0.200	0.300	0.500	Mean	0.0	0.075	0.125	0.200	0.300	0.500	Mean
2,4-D EE (kg ha^{-1})	Weed DMP (kg ha^{-1}) 40 DAT							Weed DMP (kg ha^{-1}) 60 DAT						
0.0	225.47	206.88	185.61	159.72	128.36	109.24	174.21	495.79	407.99	382.09	335.73	275.60	230.49	354.6
0.200	193.56	178.31	162.46	139.37	123.34	100.50	149.59	382.46	353.49	337.37	296.08	238.83	225.39	305.6
0.300	163.82	152.45	138.22	127.29	109.70	86.57	129.67	344.90	315.70	284.03	256.09	231.77	222.21	275.7
0.600	120.54	117.14	98.89	93.67	74.24	67.13	95.27	265.16	258.03	242.72	229.68	199.72	191.89	231.2
0.800	90.63	86.47	74.86	70.32	66.06	56.09	74.07	227.88	214.63	208.15	197.92	184.41	181.20	202.3
Mean	164.80	148.25	132.01	118.08	100.34	83.91	124.56	343.24	309.97	290.87	263.10	226.07	210.24	273.9

	40 DAT SE_d	40 DAT CD (P-0.05)	60 DAT SE_d	60 DAT CD (P=0.05)
Dicamba	1.38	3.08	1.69	3.77
2,4-D EE	0.70	1.61	2.36	5.43
Interaction	6.64	13.44	7.81	15.99

NS-Not significant

followed by dicamba during the first season and as tank mixture in the second season respectively.

RESULTS AND DISCUSSION

Broad leaved weeds and aquatics were the predominant weeds (74%) in both the seasons. The predominant weeds were *Marsilea quadrifoliata* (L.) (33%), *Monochoria vaginalis* (L.) (24%) and *Eclipta alba* (L.) (11%) in broad leaved weeds and aquatics. *Echinochloa crus-galli* (L.) Beauv (12%) and *Echinochloa colonum* (L.) Link (3%) in grasses and *Cyperus difformis* (L.) (6%) and *Cyperus iria* (L.) (3%) in sedges.

Dry matter production of weeds (DMP)

During *kharif* at 40 DAT, the lowest weed dry matter of 56 kg ha^{-1} was recorded in the dicamba + 2,4-D EE at 0.5 + 0.8 kg ha^{-1} mixture which was comparable with 0.3 + 0.6 kg ha^{-1} mixture of dicamba + 2,4-D EE (Table 1). The highest DMP was in the unweeded control (225 kg ha^{-1}). Among the herbicides, 2,4-D EE at 0.8 kg ha^{-1} registered minimum weed dry matter followed by dicamba a 0.5 kg ha^{-1}. At 60 DAT also, the mixture of dicamba + 2,4-D EE at 0.5 + 0.8 kg ha^{-1} recorde the lowest dry matter of weed, which was on pa with that at 0.3 + 0.6 kg ha^{-1} of dicamba + 2,4-D EE mixture. Next to unweeded control, the lowe doses of dicamba and 2,4-D EE produced th highest dry weight of weeds.

In *rabi*, at early stage, pre-emergenc application of butachlor recorded the lowest DM of weeds (Table 3). But at 40 DAT, the lowes DMP of weeds was observed in the dicamba 2,4-D EE mixture of 0.5+0.8 kg ha^{-1} followed b 0.3 + 0.6 kg ha^{-1}. The highest DMP was in th unweeded control. Hand weeding and butachlc were comparable with each other in respect c weed DMP. Individual application of 2,4-D EE an dicamba resulted higher DMP than their mixture At 60 days after planting, hand weeding recorde the lowest DMP of weeds. Unweeded contrc maintained the highest DMP. Among the herbicid mixtures, dicamba +2, 4-D EE at 0.5 + 0.8 kg ha

Table 2. Effect of herbicide treatments on weed control efficiency (WCE) and weed control index (WCI) during *kharif*

Treatments	Dicamba (kg ha^{-1})						Dicamba (kg ha^{-1})					
	0.0	0.075	0.125	0.200	0.300	0.500	0.0	0.075	0.125	0.200	0.300	0.500
2,4-D EE (kg ha^{-1})	WCI 40 DAT						WCI 40 DAT					
0.0	0.00	25.69	32.24	42.46	52.13	60.90	0.00	19.02	27.35	37.48	49.76	57.24
0.200	26.99	34.34	40.33	45.77	57.38	64.92	24.23	30.20	36.41	45.45	51.72	60.66
0.300	38.48	45.39	48.26	54.06	62.16	71.82	35.88	40.33	45.90	50.17	57.06	66.11
0.600	52.40	56.82	58.20	64.09	71.55	76.80	52.82	54.15	61.29	63.33	70.94	73.72
0.800	63.18	67.04	69.70	72.38	76.90	80.94	64.52	66.09	70.70	72.47	74.14	78.04

Data not analysed statistically

Table 3. Effect of weed control treatments on weed dry matter production (DMP) (kg ha^{-1}), weed control efficiency (WCE) and weed control index (WCI) during *rabi*

Treatments Dicamba + (kg ha^{-1})	2,4-D EE (kg ha^{-1})	Weed DMP (kg ha^{-1})		WCE	WCI
		40 DAT	60 DAT	40 DAT	60 DAT
0.200	-	80.24	168.78	57.71	52.77
0.300	-	65.13	162.37	63.69	61.67
0.500	-	54.54	145.67	74.66	67.90
0.200	0.300	67.01	164.89	66.92	60.56
0.300	0.300	56.41	161.12	73.58	66.80
0.500	0.300	50.23	130.69	77.67	70.43
0.200	0.600	54.11	149.18	73.73	68.15
0.300	0.600	36.21	126.75	80.18	78.69
0.500	0.600	33.78	125.08	82.44	80.12
0.200	0.800	46.50	148.39	76.45	72.63
0.300	0.800	35.88	125.41	81.11	78.88
0.500	0.800	30.13	123.84	83.62	82.27
-	0.300	77.58	167.82	60.68	54.34
-	0.600	63.06	161.42	70.61	62.88
-	0.800	53.93	144.16	77.06	68.26
Butachlor		70.52	176.27	72.16	58.49
Hand weeding twice (20 and 40 DAT)		75.65	80.53	50.29	55.47
Unweeded check		169.90	326.37	0.00	0.00
	SE_d	3.24	5.00	Data not analysed statistically	
CD (P=0.05)		6.59	10.17		

registered the least dry weight of weeds but was on par with that at 0.3 + 0.6 kg ha^{-1}. The DMP of weeds was higher in *kharif* than in *rabi* season. This was due to the favourable climate prevailed during *kharif*.

During *kharif* and *rabi* seasons, the herbicide mixture of dicamba + 2, 4-D EE reduced the DMP of weeds than individual applications. This shows the synergistic effect of these two herbicides.

Weed Control Efficiency (WCE)

The highest WCE of 83 per cent was obtained in the dicamba + 2, 4-D EE mixture applied at 0.5 + 0.8 kg ha^{-1} followed by 71 and 80 per cent in 0.3 + 0.6 kg ha^{-1} at 40 days during *kharif* and *rabi* seasons respectively. This was due to the high susceptibility of broadleaved weeds and aquatics to post- emergence herbicides (Rao, 1983). The individual application of dicamba and 2, 4-D EE recorded lesser WCE than their mixture in both the seasons. At 60 days also, the same trend was observed. Butachlor and hand weeding twice recorded 72 and 50 per cent of WCE at 40 days respectively in *rabi* (Tables 2, 3)

Weed Control Index (WCI)

Dicamba + 2, 4-D EE applied at the rate of 0.5 + 0.8 kg ha^{-1} recorded the highest WCI at 40 DAT during the *kharif* and *rabi* seasons. (Tables 2, 3), followed by 0.3 + 0.6 kg ha^{-1} of dicamba + 2,4-D EE. At early stage, the WCI was less in the hand weeding (56%) but it reached the highest (75%) at later stage due to the second weeding at 40 DAT. Butachlor recorded 58 and 46 per cent WCI at 40 and 60 days, respectively.

Broad leaved weeds and aquatic weeds were effectively controlled by dicamba + 2, 4-D EE mixture resulting in lesser number and dry weight of total weeds. Higher WCE and WCI, resultant of the combined application of 2,4-D EE and dicamba

Table 4. Effect of herbicide treatments on grain yield and straw yield (kg ha^{-1}) during *kharif*

Treatments	Dicamba (kg ha^{-1})							Dicamba (kg ha^{-1})						
	0.0	0.075	0.125	0.200	0.300	0.500	Mean	0.0	0.075	0.125	0.200	0.300	0.500	Mean
2,4-D EE (kg ha^{-1})	Grain yield (kg/ha)							Straw yield (kg/ha)						
0.0	3054	3169	3304	3431	4289	4556	3644	3653	3783	3955	4183	5128	5428	4355
0.200	3329	3406	3505	3706	4387	4652	3831	3986	4062	4168	4421	5232	5570	4573
0.300	3559	3615	3781	3897	4658	4709	4037	4268	4335	4448	4654	5539	5674	4818
0.600	4371	4439	4478	4688	5261	5146	4731	5079	5212	5315	5480	6248	6118	5575
0.800	4633	4688	4778	4858	5158	5096	4869	5462	5542	5627	5753	6107	60055	5749
Mean	3789	3864	3970	4126	4753	4832	4222	4488	4587	4703	4898	5651	5759	5014
	SE_d			CD (P=0.05)						SE_d			CD (P=0.05)	
Dicamba	18			40						23			50	
2,4-D EE	34			79						34			79	
Interaction	51			110						59			124	

Table 5. Effect of herbicide treatments on grain and straw yield (kg ha^{-1}) during *rabi*

Treatments Dicamba + (kg ha^{-1})	2,4-D EE (kg ha^{-1})	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
0.200	-	2722	3283
0.300	-	3232	3762
0.500	-	4240	5002
0.200	0.300	3626	4358
0.300	0.300	3855	4623
0.500	0.300	4384	5073
0.200	0.600	4568	5303
0.300	0.600	4892	6059
0.500	0.600	4801	5922
0.200	0.800	4628	5551
0.300	0.800	4842	5977
0.500	0.800	4795	5868
-	0.300	2714	3355
-	0.600	3428	4062
-	0.800	4286	5148
Butachlor		4816	5940
Hand weeding twice (20 and 40 DAT)		4798	5895
Unweeded check		2039	2511
	SE_d	108	192
	CD (P=0.05)	219	390

till 60 DAT creates congenial conditions for the better growth and development of transplanted rice.

Grain and straw yield

The mixture of dicamba and 2,4-D EE at 0.3 ± 0.6 kg ha^{-1} resulted in the highest grain yield of 5261 kg ha^{-1} in *kharif* (Table 4). The grain yield resulted with 0.3+0.6 kg ha^{-1} of dicamba + 2, 4-D EE was at par with the above treatment. 2, 4-D EE at 0.8 kg ha^{-1} recorded 4633 Kg ha^{-1} of grain yield followed by dicamba at 0.5 Kg ha^{-1} (4556 kg ha^{-1}). The lowest grain yield was observed in the unweeded control. In *rabi* also, dicamba + 2,4-D EE mixture at 0.3+0.6 kg ha^{-1} resulted in the highest grain yield which was comparable with butachlor and hand weeding twice (Table 5).

The rice plant had the most favourable environment for growth at 0.3 + 0.6 kg ha^{-1} level of dicamba +2,4-DEE application. Individual application of dicamba and 2, 4-D EE recorded lesser grain yield than their mixture and this may be due to the ineffectiveness of the doses to control the broad spectrum of weeds. These two herbicides applied at 0.5 + 0.8 kg ha^{-1} as mixture exhibited slight phytotoxic effect on rice by lowering the tiller production and dry matter accumulation which can be seen from the lower straw yield in both the seasons (Tables 4, 5). Abud (1983) recorded the highest yield in rice with dicamba mixture. Moorthy and Manna (1982) reported that post-emergence application of 2, 4-D EE could be used as an alternate to pre-emergence herbicice use with additional benefit of lower cost. With the application of dicamba+2,4-D EE as post-emergence, weed free condition during critical period was achieved and led to higher grain and straw yield (Gill and Kolar, 1980).

The highest straw yields of 6118 kg ha^{-1} and 6059 kg ha^{-1} were recorded in the mixture of dicamba +2,4-D EE at 0.3 + 0.6 kg ha^{-1} in *kharif* and *rabi* respectively, which were comparable with butachlor and hand weeding twice (Tables 4, 5). The lower doses of dicamba and 2, 4-D EE registered lesser straw yield than their mixture. The unweeded control recorded the lowest straw yields of 3653 and 2511 kg ha^{-1} in *kharif* and *rabi* seasons respectively. Straw yield was higher in *kharif* than in *rabi*, due to the prevalence of favourable weather for dry matter production.

In both the seasons, higher straw yield was obtained in the mixture of dicamba + 2, 4 - D EE which provided the weed free condition at the critical stage of crop growth and better production resulting in higher dry matter accumulation. Biswas *et al.* (1983) also reported that the weed free condition favours the increasing dry matter accumulation of the crop.

ACKNOWLEDGEMENT

The author acknowledges the receipt of Velsicol Chemical Corporation fellowship during the tenure of this investigation.

REFERENCES

ABUD, J.K. (1983). Effect of mixtures of the herbicides bentazone, bentazone + dicamba with proponil on the control of the principal weeds in irrigated rice. **Weed Abstr., 33**: 3775.

BISWAS,K., SARKAR, P.A. and GHOSE, A.K. (1983). Competition of barnyard grass in transplanted rice hills. **Abstr. Ann. Conf., ISWS**, Varanasi, India. 18 pp.

GILL, G.S. and KOLAR, J.S. (1980). Efficiency of some dinitraaniline and other herbicides for barnyard grass in transplanted paddy. **Pesticides 14** (8): 32-34.

MOODY, K. (1982). Weed control in dryland crops after rice. In: **Report of a Workshop on Cropping Systems Research in Asia.**

MOORTHY, B.T.S. and MANNA,C.B. (1982). Weed control in transplanted rice by herbicides in dry season. **Abstr. Ann. Conf., ISWS** 13 pp.

RAO, V.S. (1983). **Principles of Weed Science.** Oxford and IBH publishing Co., New Delhi.

(Received : November 1993 Revised : November 1994)

Madras Agric. J., 82(5): 387-390 May, 1995

PHENOTYPIC STABILITY OF GRAIN YIELD AND ITS COMPONENTS IN CHICKPEA

P.K.SINGH and N.B.SINGH.
Dept of Plant Breeding, RAU, Bihar.

ABSTRACT

Twenty chickpea genotypes were grown in six environments to study the phenotypic stability of grain yield and its components. It was found that the linear component of G x E interaction was more important for yield and other characters. Four genotypes *i.e.*, SGM 84-104, IH 83-6, SG 2 and SGM 84-117 were found to have average response and high stability and high mean for grain yield. However, SGM 84-112 the highest yielding genotype was highly unstable. There was positive and significant correlation between the mean of the genotypes and the responsiveness for number of pods/plant, 100-grain weight and single plant yield which indicated that the genotypes with high mean were, in general, better responsive to favourable environments. There was lack of general association between stability of yield and its components which calls for cautious selection of genotypes based on yield alone.

KEY WORDS : *Cicer arietinum*, Chickpea, Phenotypic Stability, Genotype x Environment Interaction.

Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops of India. Development and adaptation of high yielding varieties appear to be the most important step for increasing production. Although number of improved varieties of gram have been evolved, the yield of these varieties is not stable over environments which is one of the reasons for their poor adaptation. Thus stability is one of the desirable properties of a genotype sought for in a variety. Though the information on genotype x environment (G x E) interaction has been adequately worked out in cereal crops, the relative basic information on chickpea is limited. Therefore, the present investigation was planned to collect the information about stability in chickpea.

MATERIALS AND METHODS

The experimental materials consisted of 20 genotypes of chickpea including 3 varieties *viz.*, BR 77, C 235 and SG 2 and 17 advance generation lines. In all, six environments were created by growing them in two dates of sowing at two different locations *i.e.*, Bhagalpur and Muzaffarpur during 1985-86 and 1986-87. The first sowing was done in the first week of November and second in the first week of December each year. The entries were sown in a randomised complete block design with three replications in 4m long rows, spaced 30 cm apart, with plant to plant distance of 10 cm. Recommended agronomical practices were followed throughout the crop season. Observations were recorded on five randomly selected plants in each entry on the number of pods/plant, 100 grain weight (g), single plant yield (g) and grain yield (q/ha). Grain yield was calculated from plot yield. The stability analysis was performed according to the model suggested by Eberhart and Russell (1966).

RESULTS AND DISCUSSIONS

Highly significant variances due to genotypes revealed the presence of considerable genetic variability among the genotypes for all the characters studied (Table 1). Highly significant mean squares due to environments and genotype x environment interactions suggested the presence of considerable interactions of the genotypes with the environmental conditions. Highly significant variances due to environment (linear) indicated that creations of the environments by manipulating dates of sowing, locations and years was effective.