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Studies on the Pre-emergence Herbicides in Sunflower (*Helianthus annus* L.) Under Graded Doses of Nitrogen

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ABSTRACT

A field experiment was conducted in sunflower to compare the selectivity and efficiency of herbicides with that of conventional method of weed control under graded doses of nitrogen. Pre-emergence application of prometryne at 1.0 kg a. i./ha was the best weed control treatment and it was on par with the conventional method in seed yield. The oil content in seed was not affected due to herbicides. Prometryne application gave the highest net return per rupee invested on weeding.

INTRODUCTION

For early season weed control, Gill and Jaswal (1973) recommended two hoeings, first at three weeks after sowing and the second before the initiation of flowers in sunflower. Singh and Singh (1972) recommended two or three hoeings and weedings for sunflower depending upon the intensity and frequency of weed emergence. Lyubenov (1965) found that application of prometryne at 2.4 kg / ha as pre-emergence treatment gave an effective weed control in sunflower. The efficiency of prometryne has also been reported by other workers (Mallet *et al.*, 1965; Brasesco, 1964 and Ulinici, 1968). Other herbicides reported to be promising for the weed control in sunflower were chloropropham and nitrofen (Mallet *et al.*, 1964), EPTC (Robinson, 1960), terbutryne (Lucas, 1971) and alachlor (Coelho, 1972).

Application of nitrogen for increasing the yield of sunflower has a direct effect on the growth and spread of associated weeds. It is, therefore, useful to study the effect of levels of nitrogen on the growth of weeds and the crop. A field experiment was initiated to study the efficiency of weed control by pre-emergence herbicides and manual weeding under graded doses of nitrogen in sunflower.

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MATERIALS AND METHODS

The experiment was conducted at the Tamil Nadu Agricultural University Farm, Coimbatore during July-December, 1972 in sunflower, (Var. Armavirskiij) on a clayey loam soil. The weed control treatments in the main plots of the split plot design were: Unweeded control (TO), two hoeing and weedings at 15 and 30 days (T1), alachlor at 1.5 kg/ha (T2,) alachlor at 2.0 kg/ha (T3), nitrofen at 1.5 lit/ha (T4), nitrofen at 2.0 lit/ha (T5), prometryne at 1.0 kg/ha (T6) and terbutryne at 1.0 kg/ha (T7). All the herbicides were applied by the pre-emergence method and the doses indicated were on active ingredient basis. The four subplot treatments were nitrogen at 0, 30, 60 and 90 kg/ha which were denoted by symbols N0, N1, N2 and N3 respectively. The gross and net plot sizes were 4.8 × 3.6 m and 3.6 × 2.8 m respectively. The treatments were replicated thrice and the seeds were sown on 25th July, 1972 with a spacing of 60 × 20 cm. The crop was harvested on 24th December, 1972.

A basal dose of 60 kg phosphorus and 50 kg of potash was applied for all the treatments. Half the quantity of nitrogen in the form of urea was applied at basal and the reminder 30 days after sowing The data on weed and crop growth attributes and the seed yield were recorded.

RESULTS AND DISCUSSION

The experimental observations on weed and crop growth and yield in relation to the influence of different weed control treatments and graded doses of nitrogen are presented in Table 1.

I. Growth characters of weeds:

i) Weed flora: The weed flora in the experimental field were predominantly annuals like *Trianthema portulacastrum* L., *Digeria arvensis* Forsk., *Lagasca mollis* Cav. and *Gynandropsis pentaphylla* DC. and a very few perennials like *Cyperus rotundus* L.

ii) Weed count: The total weed number per square metre was the highest under unweeded control. Prometryne and terbutryne treatments were markedly superior to all the treatments in controlling the weed population. Application of nitrogen had positive effect on the weed population.

iii) Dry weight of weeds: The dry matter production of weeds mostly followed the same pattern as that of weed population under different weed control treatments. The manual weeding treatment was the most efficient and it was followed by prometryne and terbutryne treatments. The dry matter accumulation in weeds had progressively increased with the successive increments of nitrogen.

II. Growth characters of crop:

i) Plant height: The plant height was significantly influenced by the weed control treatments and the levels of nitrogen. Nitrofen at 2.0 lit/ha (T5) and nitrogen application at 90 kg/ha

TABLE 1. Effect of weed control treatments and graded doses of nitrogen on weed and crop attributes

Treatments	Weed attributes				Plant height in cm at harvest	Leaf No./plant at 70 days	Leaf area index at 70 days
	Weed count per sq m. at 90 days		Mean dry weight of weeds at 90 days (kg/ha)				
	Trans-formed	Original mean	Trans formed	Original mean			
Main plots							
T0	8.21	329.3	57.7	2654	199	29.8	3.71
T1	7.77	60.8	17.3	298	212	30.8	5.35
T2	12.91	166.9	35 8	1288	216	31.5	5.13
T3	12.89	166.0	34.5	1196	221	30.5	4.69
T4	11.61	134.9	35.5	1283	219	31.1	4.95
T5	11.12	123.8	33.0	1083	226	30.8	5.15
T6	3.51	12.5	17.6	327	224	30.7	5.44
T7	3.70	13.9	18.1	390	209	30.7	5.50
S. E.	0.12		0.26		4.1	0.43	0.09
C. D. at 5%	0.36		0.8		12.0	...	0.27
'F' Test	Sig.		Sig.		Sig.	N. S.	Sig.
Sub plots							
N0	10.07	122.1	29.6	498	209	29.9	4.17
N1	10.16	124.9	30.5	1110	215	30.9	4.23
N2	10.27	126.8	30.7	1071	221	30.8	5.36
N3	10.37	130.9	31.3	1103	220	31.3	5.67
S. E.	0.07		0.18		2.9	0.40	0.08
C. D. at 5%	0.20		0.5		8.0	...	0.23
'F' Test	Sig.		Sig.		Sig	N. S.	Sig

Table 1 [Continued]

Treatments	Crop attributes							
	Stem diam in cm at harvest	Flowering index	Head diam (cm)	Head/Stem ratio	Head weight in gm (200 seeds)	Seed yield in kg		Oil content in seed (per cent)
						Pot	Ha	
Main plots								
T0	1.83	58.25	13.9	1.50	7.18	1.21	1199	40.92
T1	2.13	58.25	14.4	1.57	9.15	1.91	1892	42 96
T2	2.08	58.16	15.6	1.53	9.29	1.74	1724	42.59
T3	2.00	58 14	14.7	1.51	8.07	1.63	1615	42.74
T4	2.08	57.25	16.5	1.55	8.68	1.66	1645	42.50
T5	2.18	57.58	14.9	1.56	9.49	1.87	1853	42.70
T6	2.24	58.33	16.2	1.65	9.65	1.95	1932	42.78
T7	2.15	57.91	15.3	1.57	9.55	1.90	1882	42.85
S. E.	0.07	0.28	0.64	0.018	0.06	0.055		0.16
C. D. at 5%	0.21	...	...	0.05	0.18	0.16		0.49
'F' Test	Sig.	N.S.	N.S.	Sig.	Sig.	Sig.		Sig.
Sub plots								
0	1.91	58 70	14.8	1.35	7.56	1.42	1407	41.31
N1	2.06	57.95	15.0	1.43	8.43	1.70	1684	42.73
N2	2.20	57.87	15.1	1.64	9.84	1.90	1882	43.69
N3	2.17	57.54	15.9	1.80	9.86	1.92	1901	42.14
S. E.	0.05	0.16	0.39	0.036	0.045	0.044		0.12
C. D. at 5%	0.14	0.45	...	0.10	0.13	0.12		0.34
'F' Test	Sig.	Sig.	N.S.	Sig.	Sig.	Sig.		Sig.

(N2) recorded the maximum plant height while the unweeded control and no nitrogen application registered the least.

ii) Leaf number per plant: All the weed control treatments were significantly superior to unweeded check (T0) in increasing this plant attribute. Hand weeding (T1) produced the highest leaf number as compared to the other herbicide treatments. Application of nitrogen did not influence this character.

iii) Leaf area index: Pre-emergence soil application of prometryne at 1.0 kg/ha (T6) recorded the maximum LAI but this was on par with hand weeding (T1) and terbutryne (T7) treatments. Weedy crop registered the least LAI and this was markedly inferior to all the other treatments. The levels of nitrogen exerted a linear response on this character.

iv) Stem diameter: Application of prometryne (T6) contributed the maximum stem diameter and this was closely followed by terbutryne (T7), nitrofen (T5) and hand weeding (T1) treatments. The thickness of the stem was the least in the weedy plot (T0). Among the nitrogen levels, the stem width was the maximum at 60 kg nitrogen (N2) and further increase in the nitrogen level did not contribute to the development of the stem.

v) Flowering index: This is an index on earliness of flowering. The number of days taken for fifty per cent flowering under the different treatments were recorded and analysed. The weed control treatments had no influence on the flowering index of the crop. However, application of nitrogen caused earliness in flowering significantly.

III. Yield components and yield:

i) Head diameter: The diameter of the head was neither influenced by the weed control treatments nor by the nitrogen doses tried in this study.

ii) Head/Stem ratio: The weed control treatments and the doses of nitrogen tried had significant influence on the head/stem ratio. Prometryne treatment (T6) was outstandingly superior to the rest of the treatments. Application of 90 kg nitrogen recorded the maximum ratio but it was on par with 60 kg nitrogen / ha.

iii) Seed weight: The test weight of seeds was the highest in the prometryne (T6) and it was closely followed by terbutryne, hand weeding and nitrofen (2.0 lit/ha) treatments. The seed weight showed a linear response with the levels of nitrogen, however, the 90 and 60 kg doses were on par. This corroborates the findings of Massey (1971) in sunflower who obtained response in seed weight for nitrogen application.

iv) Seed yield: The seed yield was significantly influenced both by the weed control treatments and the nitrogen levels. Pre-emergence application of prometryne recorded the maximum yield and this was on par with hand weeding, terbutryne and nitrofen (2.0 lit/ha). These four treat-

TABLE 2. Economics of different weed control treatments in sunflower

Treatments	Seed yield (kg/ha)	Value of seeds	Total cost of cultivation	Profit	Net gain over unweeded control (T0)	Cost of weed control treatments	Return per rupee invested on weeding
		Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.
T_0	1199	1798.50	722.80	1075.70	...	...	..
T_1	1892	2848.00	915.00	1922.20	805.20	190.00	4.28
T_2	1724	2586 00	815.25	1770.75	695.05	82.50	8.24
T_3	1615	2422 50	832.25	1590.25	514.55	109.50	4.80
T_4	1645	2467.50	856.30	1611.20	535.50	139.00	3.80
T_5	1853	2779.50	903.80	1875.70	800.00	181.00	9.77
T_6	1932	2898 00	805.40	2092.60	1016.90	72.50	14.22
T_7	1882	2823.00	805.40	2017.60	942.90	72.50	13.82

Seed at Rs. 150.00/quintal; Alachlor at Rs. 27.50/lit; Nitrofen at Rs. 21.50/lit; Prometryne at Rs.50.00/kg

Cost of spraying – Rs. 10.00/ha

Manual weeding 38 women/ha at Rs. 2.50/woman

ments were efficient in checking the weed population and the dry matter production of weeds mostly in the same order. The yield components responsible for the high yield in prometryne treatment seemed to be the leaf area index and seed weight. The same yield components were responsible for the highest seed yield under the maximum dose of nitrogen. The results obtained in the present experiment confirm the findings of Vasilev and Bebek (1968).

v) Oil content: All the weed control treatments were significantly superior over unweeded check in increasing the oil content of the seed However, there was no marked difference among the herbicides and hand weeding treatment. Application of nitrogen upto 60 kg / ha recor-

ded the maximum oil content in the seeds and any further increase in the level of nitrogen had an adverse effect on the oil content.

IV. Economics of weed control methods:

The cost of different weed control methods and the net gain obtained in each treatment have been furnished in Table 2.

The data show that the cost of cultivation was the highest (Rs. 915.00) under manual weeding whereas the cost of cultivation was the minimum (Rs. 805.40) under prometryne and terbutryne treatments. Among the herbicides tested, prometryne gave the highest net return (Rs. 1016-90)/ ha.

The return per rupee invested on weeding was also the highest in the prometryne treatment (Rs 14.22) and it was roughly three times more than the return obtained in the hand weeing treatment (Rs. 4.28).

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