

## EFFECT OF PRE-PLANT INCORPORATED AND POST-EMERGENCE HERBICIDES ON GROWTH AND YIELD OF SUNFLOWER (*Helianthus annuus* L.)

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A field experiment was conducted to study the effect of pre-plant incorporated and post-emergence herbicides on the growth and yield of sunflower cv. Hysun-33, sown in single rows 70 cm apart. Treatments in the experiment were control (weedy check), gramoxone (paraquat) @ 3 lit ha<sup>-1</sup> as directed post-emergence, Dual 500 E.C. (metolachlor) @ 3 lit ha<sup>-1</sup> as pre-plant incorporated, Sonalon (ethalfluralin) @ 3.75 lit and 5 lit ha<sup>-1</sup> pre-plant incorporated. The results revealed that ethalfluralin was the most effective herbicide in controlling weeds and improving sunflower yield of seed oil contents significantly.

**Key words:** Sunflower, Yield, Herbicides.

### Introduction

Pakistan is facing a chronic shortage of edible oils and the situation is getting worse with alarming increases in population. Domestic oil production can only meet 20% of total demand. Under these conditions non-conventional oilseed crops can play a vital role to increase oil production in the country. Sunflower is one of the most promising non-conventional oilseed crops due to its high yield potential and ability to fit in our present cropping patterns. Weeds are one of the major causes of low productivity of sunflower because these compete with the crop plants for space, light, moisture, nutrients and affect the photosynthetic efficiency by intercepting solar radiation and in some situations may reduce crop yield by more than 50% [1]. The chemical control of weeds can increase the yield of sunflower crop by upto 25% [2].

Chaudhry [3] revealed that the lowest weed density i. e. 3 weeds/m<sup>2</sup> was noted in Stomp (pendimethalin) @ 1.5 lit acre<sup>-1</sup> treated sunflower plots. However, the highest seed yield of sunflower (625.5 kg acre<sup>-1</sup>) was obtained from the plots where weeds were removed by hoeing after second irrigation. Aziz [4] reported that weed control in sunflower crop showed reduction of many species with Treflan (trifluralin) applied at 10 kg ha<sup>-1</sup>, Devrinol (napropamide) @ 7 kg or Best (a mixture of napropamide + prometryn 50% WP) @ 4 and 3 kg ha<sup>-1</sup> before sowing.

Critical weed competition in sunflower crop usually falls in early stages of growth. Application of herbicides at the time when they are most effective in controlling weeds with no ill effects to the crop, is of primary importance; it not only reduces weed crop competition but also makes the conditions suitable for crop growth. The present study has been conducted to evaluate different herbicides for their weed control efficiency.

### Materials and Methods

To determine the effect of pre-plant incorporated and post-emergence herbicides, investigations were carried out at agronomic research area, University of Agriculture, Faisalabad. Sunflower cv. Hysun-33 was sown on a clay loam soil in single rows 70 cm apart with a single row hand drill. A plant to plant distance of 25 cm was maintained by thinning. Plots were seeded at the rate of 10 kg ha<sup>-1</sup>. The experiment was laid out in a randomized complete block design with four replications at a plot size of 6 m x 2.8 m. The experiment comprised five treatments; control (weedy check), gramoxone (paraquat) @ 3 lit ha<sup>-1</sup> as directed post-emergence, dual 500 E.C. (metolachlor) @ 3 lit ha<sup>-1</sup> as pre-plant incorporated, Sonalon (ethalfluralin) @ 3.75 lit and 5 lit ha<sup>-1</sup> pre-plant incorporated. Metolachlor and ethalfluralin were sprayed on the field and immediately the field was cultivated and planked to incorporate these herbicides. The post-emergence herbicides were applied after the first irrigation by spraying with a nozzle fitted with a shield to protect the crop from herbicidal effects.

The data collected on desired parameters was tabulated and analysed statistically using the analysis of variance technique, and Duncan's Multiple Range Test at 5% probability was applied to test the significance of treatment means as outlined by Steel and Torrie [5].

### Results and Discussion

The most important weeds noted were *Cyperus rotundus*, *Cynodon dactylon*, *Convolvulus arvensis* and *Trianthemamonogyna*. The weed population was suppressed significantly in all the treatments as compared with control. Ethalfluralin was found to be the most effective herbicide in controlling different types of weeds. However, none of the herbicides controlled *Cyperus rotundus* effectively; it is relatively resistant to herbicides. The high population of all weeds



(20 days after spraying) in paraquat treatment was due to the fact that paraquat was sprayed after this stage (Table 1).

The plant population at harvest was partly a result of germination of seeds per unit area and the plant to plant distance maintained after thinning. Plant numbers might be affected by toxicity of the herbicide. Data pertaining to plant population showed that none of the herbicides had toxic effects on the plants (Table 2). Similar results were also reported by Law and Arnold [6].

The number of seeds per head increased significantly under all the treatments over control. The maximum number of seeds head<sup>-1</sup> (1209) was found in plots treated with ethalfluralin @ 5 lit ha<sup>-1</sup> as pre-plant incorporated (Table 2).

The productive potential of sunflower is often reflected by the size of its head. Head size was significantly increased in all the treatments over control (Table 2). It was the highest in ethalfluralin @ 5 lit ha<sup>-1</sup> treatment followed by ethalfluralin @ 3.75 L ha<sup>-1</sup>.

Seed weight is also an important component of the yield. The data on 1000-seed weight showed that weed control treatments produced relatively heavier seeds (Table 2). The highest seed weight (68.4 g) was obtained in ethalfluralin @ 5 lit ha<sup>-1</sup> as pre-plant incorporated treatment. However, ethalfluralin @ 3.75 lit ha<sup>-1</sup> also showed significantly heavier

seeds as compared with other treatments and the control. Seed weights under paraquat and metolachlor did not differ from each other but were significantly greater than the control.

The yield of seeds varied considerably with the treatments. In general, all the treatments gave higher seed yields than the control that ranged from 18.09 to 64.32%. Ethalfluralin @ 5 lit ha<sup>-1</sup>, ethalfluralin @ 3.75 lit ha<sup>-1</sup>, paraquat @ 2 lit ha<sup>-1</sup> and metolachlor @ 3 lit ha<sup>-1</sup> gave 64.32, 48.99, 34.07 and 18.09% higher yield respectively than the control. All treatments were significantly different from each other, and the findings agreed with the research work reported by Chaudhry [3], Aziz [4] and Legha *et al.* [7].

All the treatments improved the oil contents as compared with the control (Table 2). Maximum oil contents were obtained for the ethalfluralin @ 5 lit ha<sup>-1</sup> treatment.

### Conclusion

It can be concluded from the results of present study, that herbicidal application is effective in controlling the weed infestation and improving the seed yield as well as oil contents of sunflower whereas ethalfluralin @ 5 lit ha<sup>-1</sup> is the most effective candidate amongst all the treatments under study.

TABLE 1. EFFECT OF DIFFERENT HERBICIDES ON WEED POPULATION (m<sup>-2</sup>).

Treatments	20 DAS				40 DAS				60 DAS			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
Control (weedy check)	77a	9a	4a	22a	80a	10a	4a	22a	82a	10a	5a	22a
Paraquat @ 2 lit ha <sup>-1</sup>	72a	7a	3ab	19a	41b	2b	2b	9bc	40b	2b	2b	11b
Metolachlor @ 3 lit ha <sup>-1</sup>	42b	2b	2bc	11b	43b	2b	3ab	11b	42b	2b	2b	8bc
Ethalfluralin @ 3.75 lit ha <sup>-1</sup>	36bc	2b	1cd	6bc	37bc	2b	1b	5cd	36bc	1b	1b	5cd
Ethalfluralin @ 5 lit ha <sup>-1</sup>	28c	1b	1d	2c	30c	1b	1b	2d	27c	1b	1d	1d

Means followed by similar letters do not differ significantly at the 0.05 level of probability according to Duncan's Multiple Range Test. DAS = Days after spray, W1 = *Cyperus rotundus*, W2 = *Cynodon dactylon*, W3 = *Convolvulus arvensis*, W4 = *Trianthema monogyna*.

TABLE 2. EFFECT OF PRE-PLANT INCORPORATED AND POST-EMERGENCE HERBICIDES ON GROWTH AND YIELD OF SUNFLOWER.

Treatments	Weed population per unit area (m <sup>-2</sup> )	Plant population at harvest	Number of seeds per head	Head size (cm)	1000-seed weight (g)	Seed yield (t ha <sup>-1</sup> )	Oil content (%)
Control	113a	91 NS	812 d	14 e	46 d	1.99 e	38 c
Paraquat @ 2 lit ha <sup>-1</sup>	110 a	93	1050 b	17 c	55 c	2.67 c	41 b
Metolachlor @ 3 lit ha <sup>-1</sup>	62 b	92	929 c	16 d	54 c	2.35 d	40 bc
Ethalfluralin @ 3 lit ha <sup>-1</sup>	47 bc	93	1090 b	19 b	61 b	2.97 b	43 ab
Ethalfluralin @ 5 lit ha <sup>-1</sup>	31 c	93	1209 a	21 a	68 a	3.27 a	45 a

Means followed by similar letters do not differ significantly at the 0.05 level of probability according to Duncan's Multiple Range Test. NS = Non-significant.

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