

Effect of Herbicides on Weed Control and Seed Yield Parameters in *Coreopsis lanceolata*

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ABSTRACT The studies were undertaken at P A U Ludhiana during 2001-2002 on *Coreopsis lanceolata* to find out effective herbicide with optimum concentration. Fluchloralin, trifluralin @0.75 kg/ha, 1.0 kg/ha, @0.75 kg/ha + 2 hand weeding at 45 and 90 days of transplanting and pendimethalin @ 0.50 kg/ha, 0.75 kg/ha, @0.50 kg/ha + 2 hand weeding at 45 and 90 days of transplanting were sprayed two days prior to transplanting. These treatments were also compared with unweeded treatment and hand weeded plot at 15 day interval throughout the period of experiment. Pendimethalin @0.50 kg/ha + 2 hand weeding was found to be the best control measure in terms of weed population, weed fresh and dry matter. Hand weeded treatment resulted in maximum plant height (85.18 cm), plant spread (68.93 cm), branches (22.89/plant) and the longest flowering duration (51.5 days). Fluchloralin @0.75 kg/ha + 2 hand weeding resulted in maximum seed yield 62.87 g/m² followed by pendimethalin @ 0.50 kg/ha + 2 hand weeding. Seed germination was recorded highest (79%) under hand weeded plot which was closely followed by fluchloralin @ 0.75 kg/ha + hand weeding. The weed population of 111.25 /m² and 113.56 /m² was recorded due to fluchloralin @0.75 kg/ha and pendimethalin @0.50kg/ha respectively.

Keywords: *Coreopsis lanceolata*, weed control, herbicides and seed production

Flower seed production is one of the commercially adopted field especially in Punjab, Haryana, Himachal Pradesh and Andhra Pradesh. Majority of the flower seed crops are grown in winter season in sub-tropical climatic conditions. The chilling days of December- January retard the growth of crop plants but some weed species like *Cyperus rotundus*, *Poa annua*, *Lepidium sativa*, *Stellaria media*, etc. flourish well suppressing the crop plants. Although a large number of herbicides with different formulations are available which have been reported to be used successfully in many flower crops without adversely affecting the crop [9]. However due to meager information on flowering annuals, the present study was undertaken to find out the effect of herbicides on weed intensity, plant growth, flowering and seed production of *Coreopsis lanceolata*.

MATERIALS AND METHODS

The present study was conducted in the Department of Floriculture & Landscaping, Punjab

Agricultural University, Ludhiana during the year 2001-2002. The soil of experimental plot was sandy loam with pH 8.0 EC (0.20 mmhos/cm) available N (31.97 kg/acre), P (4.6 kg/acre) and P (67.05 kg/acre). Five-week old seedlings of *Coreopsis lanceolata* were transplanted on 21st November at 60x40 cm geometry in RBD and replicated thrice. Both fluchloralin and trifluralin @ 0.75 kg/ha, 1.0 kg/ha, 0.75 kg/ha + 2 hand weeding (at 45 and 90 days of transplanting), pendimethalin @ 0.50 kg/ha, 0.75 kg/ha and 0.50 kg/ha + 2 hand weeding (at 45 and 90 days of transplanting) were sprayed two days prior to transplanting. One plot was left unweeded as control and one was hand weeded at 15 day interval throughout the period of experiment. These herbicides were used as pre-emergence and sprayed two days before transplanting. Fluchloralin and trifluralin sprayed plots were properly raked and harrowed to thoroughly incorporate the herbicide into the soil, while pendimethalin sprayed plots were kept undisturbed till transplanting. The observations were recorded on plant height, spread, days of

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flowering, duration of flowering, branches/plant, seed yield, thousand seed weight and seed germination per cent. Weed population per unit area and weed fresh and dry matter were also recorded after 45 and 90 days of transplanting. The fresh weight of uprooted weeds from respective treatment was immediately recorded with electronic balance. The weed samples taken for fresh weight were then kept in sunlight for two days till they loose maximum moisture and then in hot air oven for 48 hours at 55°C.

RESULTS AND DISCUSSION

Plant height and spread:

The results of Table 1 show that the tallest plants (85.18 cm) were produced under hand weeded plots followed by trifluralin @ 0.75 kg/ha (84.18 cm) and pendimethalin @ 0.50 kg/ha + 2 hand weeding (83.93 cm). There were significant differences between weed free treatments and unweeded plots with respect to plant spread also. The vigorous plants (68.93 cm) were recorded under hand weeded plots as compared to control (43.06 cm). Trifluralin @ 0.75 kg/ha + hand weeding and pendimethalin @ 0.50 kg/ha + hand weeding resulted in better plant spread i.e. 67.93 cm and 66.18 cm, respectively. Trifluralin @ 0.75 kg/ha and chlorthal @ 11.2 kg/ha produced vigorous gladiolus plants and large sized cormels [1]. Plant spread due to herbicidal application along with hand weeding was more because of reduced weed competition of flowering crop with weeds.

Flowering

The number of days taken for the appearance of first flower did not vary significantly among different treatments. Relatively less time (138.9 days) was taken under fluchloralin @ 0.75 kg/ha + 2 HW and it was closely followed by hand weeding (141.0 days). The unweeded plot took maximum time (146.6 days) to produce flower. No significant differences were recorded in flowering duration due to different treatments. However the pendimethalin @ 0.50 kg/ha and trifluralin @ 0.75 kg/ha + 2 hand weedings prolonged the flowering duration as compared with trifluralin without hand weeding. (Table 1). These results are also in proximity with the findings of Gilreath [2] in gladiolus showing normal flower production due to oryzalin spray.

Branches / plant

The higher number of branches were recorded from hand weeded plot (22.89) followed by

trifluralin treated plot @ 0.75 kg/ha + hand weeding (21.22) and pendimethalin treated plot @ 0.50 kg/ha + hand weedings. Where as minimum branches (9.93) were produced in unweeded treatment. These results are in conformity with the findings of Ivonova [3] who recorded higher branches with pendimethalin (1.32 kg/ha) and trifluralin (0.96 kg/ha) in *Helichrysum bracteatum*.

Seed yield

Fluchloralin @ 0.75 kg/ha + hand weeding produced the highest seed yield (12.57g/plant) followed by pendimethalin @ 0.50 kg/ha + hand weeding (12.35 g/plant). Hand weeded plot produced 12.16g/ plant and trifluralin @ 0.75 kg/ha + hand weeding also gave good seed yield viz. 12.03 g/plant (Table 2). This might be due to weed free conditions or low weed intensity provided by herbicides which resulted in healthy, vigorous plants and in turn also gave higher seed yield. These results are in line with the findings of Ivonova [3] who reported that pendimethalin in *helichrysum* resulted in higher seed yield than control. These results corroborates the findings of Duezma [4] who reported higher seed yield in *helichrysum*, *antirrhinum* and *zinnia* due to trifluralin @ 3.0-4.0kg/ha. Seed yield per unit area also showed the same trend.

1000-Seed weight

1000 seed weight obtained from herbicidal application along with hand weeding was significantly higher than that obtained from herbicidal alone of same dose. It was maximum (2.69 g) under hand weeded plot followed by trifluralin treatment of 0.75 kg/ha + hand weeding (2.66 g). Pendimethalin @ 0.50 kg/ha + hand weeding and fluchloralin @ 0.75 kg/ha + hand weeding gave the equal seed weight of 2.64 g. 1000 seed weight from hand weeded treatment and all herbicidal treatments incorporated with hand weeding were at par. The lowest seed weight (2.31 g) was however obtained from unweeded control plot.

Per cent germination

The seed germination per cent from weed free treatment (79.0%) and that from fluchloralin treatment of 0.75 kg/ha + hand weeding (78.6%) are at par with each other. The seed germination from trifluralin @ 0.75 kg/ha + hand weeding (75.02%) and fluchloralin @ 0.75 kg/ha + hand weeding (78.60%) were statistically at par.

Table 1. Effect of herbicides on plant growth of *Coreopsis lanceolata*.

Treatment	Plant height (cm)	Plant spread (cm)	Days to flowering	Duration of flowering (days)	Branches/plant
Unweeded (control)	54.56	43.06	146.60	44.30	9.93
Hand weeded	85.18	68.93	141.00	50.10	22.89
Fluchloralin @ 0.75 kg/ha	66.43	52.68	144.80	46.60	14.50
Fluchloralin @ 0.75 kg/ha+ 2 HW	78.50	62.12	138.90	50.40	17.10
Fluchloralin @ 1.0 kg/ha	70.12	55.68	143.10	47.00	16.00
Trifluralin@ 0.75 kg/ha	68.93	53.93	145.00	46.10	15.16
Trifluralin @ 0.75 kg/ha+2 H W	84.18	67.93	143.20	51.20	21.22
Trifluralin @ 1.0 kg/ha	79.50	58.94	143.90	48.30	18.95
Pendimethalin @ 0.5 kg/ha	69.75	57.75	144.60	46.90	16.78
Pendimethalin @ 0.5 kg/ha + 2 HW	83.93	66.18	141.50	51.50	20.35
Pendimethalin @ 0.75 kg/ha	77.94	60.68	142.60	49.40	18.51
CD (P-0.05)	7.90	4.29	NS	4.68	2.67

* HW-Hand weeding

Table 2. Effect of herbicides on seed yield and quality parameters of *Coreopsis lanceolata*.

Treatments	Seed yield/plant (g)	Seed yield/m ² (g)	1000 Seed weight (g)	Seed Germination (%)
Unweeded (control)	8.56	42.82	2.31	69.69
Hand weeded	12.16	60.84	2.69	79.00
Fluchloralin @ 0.75 kg/ha	10.62	53.15	2.42	76.95
Fluchloralin @ 0.75 kg/ha+ 2 HW	12.57	62.87	2.64	78.60
Fluchloralin @ 1.0 kg/ha	11.41	58.07	2.50	71.24
Trifluralin @ 0.75 kg/ha	10.48	52.41	2.43	73.08
Trifluralin @ 0.75 kg/ha+2 HW	12.03	60.19	2.66	75.02
Trifluralin @ 1.0 kg/ha	11.35	56.74	2.55	70.32
Pendimethalin @ 0.5 kg/ha	10.22	51.14	2.38	71.01
Pendimethalin @ 0.5 kg/ha + 2 HW	12.35	61.79	2.64	72.44
Pendimethalin @ 0.75 kg/ha	11.18	55.95	2.50	70.70
CD (P-0.05)	0.78	3.90	0.21	3.83

*HW-Hand weeding

Weed Population / m² (45 days after transplanting):

The results of table 3 indicate that weed population from the lower herbicidal dose was significantly more than that from the higher dose, but the weed population from the lower doses of every herbicide were at par with each other. Among the herbicidal treatments, the minimum weed population (37.71) was recorded from pendimethalin

@ 0.75 kg /ha which was followed by (40.72) by fluchloralin treatment of 1.0 kg/ha and were at par with each other. Trifluralin of 1.0 kg /ha gave 45.67 weed/unit area which was at par with fluchloralin @ 1.0 kg/ha but significantly lower than that from pendimethalin treatment of 0.75 kg/ha. Pre-emergence application of trifluralin (4.2 kg/ha) in *Limonium sinuatum* recorded 87% control of weeds [5].

Table 3. Effect of herbicides on different weed characters in *Coreopsis lanceolata*.

Treatment	Weed population/m ²		Fresh matter (g/m ²)		Dry matter (g/m ²)	
	45 DAP	90 DAP	45 DAP	90 DAP	45 DAP	90 DAP
Unweeded (control)	103.30	188.05	378.14	634.43	142.45	220.81
Hand weeded	0.00	0.00	0.00	0.00	0.00	0.00
Fluchloralin @ 0.75 kg/ha	54.71	111.25	197.63	260.43	69.40	125.00
Fluchloralin @ 0.75 kg/ha +2 HW	52.67	82.11	208.80	279.55	68.61	96.87
Fluchloralin @ 1.0 kg/ha	40.72	96.96	173.60	311.85	59.37	109.98
Trifluralin @ 0.75 kg/ha	58.06	98.57	190.47	329.29	65.97	114.23
Trifluralin @ 0.75 kg/ha+2H W	58.96	67.14	188.28	270.00	67.20	93.75
Trifluralin @ 1.0kg/ha	45.67	86.34	161.74	299.18	56.90	103.82
Pendimethalin @ 0.5 kg/ha	54.11	113.56	201.17	374.65	75.44	129.86
Pendimethalin @0.5kg/ha + 2 HW	56.22	64.86	196.53	269.84	80.69	83.34
Pendimethalin @ 0.75 kg/ha	37.71	79.86	168.50	295.22	59.33	99.37
CD (P-0.05)	5.22	11.8	11.18	16.68	7.49	8.54

*HW-Hand weeding, DAP-days after planting

The highest weed population (103.30) was recorded from unweeded (control) plot.

Weed Population / m² (90 days after transplanting):

Pendimethalin treatment of 0.75 kg/ha + hand weeding resulted in lowest weed population (64.86) followed by trifluralin treatment of 0.75 kg/ha + hand weeding (67.14). Both of these were at par but significantly lower (82.11) than that under fluchloralin of 0.75 kg/ha + hand weeding. The weed population from lower herbicidal doses of fluchloralin and pendimethalin were at par (111.25 & 113.56, respectively) with each other but significantly lower than trifluralin @ 0.75 kg/ha (98.57).

It has been observed that in general, pendimethalin controls the weeds in a better way than trifluralin and fluchloralin. Fluchloralin and pendimethalin control the weeds effectively till 45 days after transplanting but after that the weed control efficiency of fluchloralin decreases. Pendimethalin gave effective weed control as per the results of Table. Pendimethalin and some other herbicides provide excellent weed control in *Coreopsis lanceolata*, *Gaillardia aristata*, *Chrysanthemum superbum* & *Echinacea purpurea* [6].

Weed Fresh Matter (45 days after transplanting):

The lowest weed fresh matter (WFM) (161.74 g/m²) was recorded from trifluralin @ 1.0 kg/ha

followed closely (168.50 g/m²) by pendimethalin @ 0.75 kg/ha. The WFM (173.60 g/m²) from fluchloralin treatment of 1.0 kg/ha was at par with 168.50 g/m² from pendimethalin treatment of 0.75 kg/ha but was significantly more than (161.74g/m²) that from trifluralin treatment of 1.0 kg/ha. Trifluralin @ 0.75 kg/ha + hand weeding gave the 188.28 g/m² WFM and trifluralin @ 0.75 kg/ha alone gave 190.47 g/m². The maximum (378.14 g/m²) was recorded from unweeded control plot which was significantly higher than that of all the undertaken herbicidal treatments.

Weed Fresh Matter (90 days after transplanting):

The best weed control treatment with the lowest fresh matter (269.84 g/m²) was recorded as pendimethalin @ of 0.50 kg/ha + hand weeding and it was closely followed by trifluralin treatment of 0.75 kg/ha with weed fresh matter (270.00 g/m²). The highest weed fresh matter (634.43 g/m²) was recorded from unweeded control where no weeding was practiced. Among the higher herbicide dose alone, the lowest weed fresh matter (295.22 g/m²) was recorded under pendimethalin treatment of 0.75 kg/ha followed closely (299.18 g/m²) by trifluralin of 1.0 kg/ha. This is strongly justified by the findings of Porter [7] who showed effective control of broad spectrum weeds in *Coreopsis grandiflora* and *Chrysanthemum coccineum* with the application of trifluralin, isoxaben and oryzalin. The weed fresh

matter taken after planting of crop does not vary significantly from each other amongst many of the matching herbicidal treatments because even if the number of weeds in a particular plot were lesser than others, the fluffy weeds gave at par fresh matter to plots having grassy weeds in large number.

Dry matter of weeds (45 days after transplanting):

It was revealed by the data presented in Table 3 that the dry matter of weeds was significantly lower in the high herbicide dose as compared with low dose of herbicides. The maximum weed dry matter (142.45 g/m^2) was recorded from unweeded and it was significantly more than from rest of the treatments. The lowest weed dry matter (56.90 g/m^2) was recorded from trifluralin treatment of 1.0 kg/ha which was closely followed (59.37 g/m^2) by fluchloralin treatment of 1.0 kg/ha . In general pendimethalin gave higher weed dry matter at lower dose of 0.50 kg/ha than that from lower dose of fluchloralin and trifluralin. Metachlor (2.0 kg/ha) and pendimethalin (1.25 kg/ha) gave the lowest weed dry matter and higher flower yield in tuberose [8].

Dry matter of weeds (90 days after planting):

The weed dry matter was significantly lower from hand weeding and herbicidal application as compared with the herbicidal application alone. The maximum dry matter (220.81 g/m^2) was recorded from unweeded than the lowest (83.34 g) from Pendimethalin of 0.50 kg/ha + hand weeding suggesting the best weed control by this treatment. This was followed (93.75 g/m^2) by trifluralin of 0.75 kg/ha + hand weeding and (96.87 g/m^2) by fluchloralin of 0.75 kg/ha + hand weeding. Amongst the lower dose of herbicides, trifluralin of 0.75 kg/ha gave the minimum (114.23 g/m^2), among the higher herbicidal dose alone, the best weed control

in terms of lowest weed dry matter (99.37 g/m^2) was given by pendimethalin treatment of 0.75 kg/ha and it was at par with that of fluchloralin and trifluralin. It is quite evident that herbicides alone keep check on the weeds quite effectively when incorporated with hand weeding. Similar results have also been reported by Staatas & Klett [9] in *Coreopsis lanceolata*, *Phlox paniculata*, *Dahlia hybrida*, *Gypsophylla, pacifica* and *Wisteria sinensis*. Likewise in *Coreopsis lanceolata*, *Chrysanthemum, superbum*, *Gaillardia aristata* and *Echinacea purpurea* supported these findings [2].

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