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EFFECT OF SOIL INCORPORATED HERBICIDES ON WEEDS AND YIELD OF CANOLA (*BRASSICA NAPUS* L.)

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Abstract

The effect of two soil incorporated herbicides viz., trifluralin @ 0.90,1.20,1.50 kg a.i. ha^{-1} and acetochlor @ 0.094, 0.124 and 0.312 kg a.i. ha^{-1} on weeds and yield of canola was evaluated in a field trial at Agronomic Research Area, University of Agriculture, Faisalabad. Trifluralin @ 1.50 kg a.i. ha^{-1} was very effective in controlling the weeds and reducing their fresh and dry weight. Application of trifluralin @ 1.5 kg a.i. ha^{-1} reduced the weed density ($7.00m^{-2}$) significantly as compared to control ($32.67m^{-2}$) reducing the weed dry weight from 8.1 gm^{-2} to 1.7 gm^{-2}. Trifluralin @ 1.5 kg a.i. ha^{-1} showed maximum increase (34%) in canola seed yield by increasing the number of pods per plant, seeds per pod and 1000-seed weight.

Introduction

National average seed yield of canola (1236 kg ha^{-1}) is far below than its potential yield of 3689 kg ha^{-1} (Anony., 2001). Presence of weeds in canola fields is one of the main reasons of its low yield. Weeds affect growth and development of crop plants by competing with crop plants for water, light and nutrients which ultimately leads to low yield. Weed control by manual hoeing is not feasible and has become expensive due to non-availability of labour. Chemical weed control is the best alternative being less laborious, time saving and more effective.

According to Munir *et al*., (1987) fluazilop-butyl (Fusilade) used @ 0.5 kg a.i. ha^{-1} significantly reduced the weed density and dry weight of *Cynodon dactylon* and economically appeared to be the best dose. Flusilade @ 0.5 kg a.i. ha^{-1} also gave significantly higher seed yield of mustard cultivar "Peela Raya" than 0.25 kg a.i. ha^{-1}. Blackshaw (1989) achieved best control of *Brassica kaber + Sinapis arvensis + Thlaspi arvense* with 20-30 g ha^{-1}, *Descurainia sophia* with 15 g ha^{-1} and *Amaranthus retroflexus* with 30 g ha^{-1} of DPXA 7881 (methyl 2-[(4-ethoxy-6-methylamino-1,3,5-triazin-2-yl) carbamoylsulfanoyl] benzoate) at the 2-leaf stage. Control of weeds increased canola yields without altering oil content and 1000-seed weight.

Toll (1989) stated that Butisan S (metazachlor) @ 2 L ha^{-1} applied at the cotyledon stage of spring rape gave 78-87% control of *Atriplex* spp, *Stellaria media* and *Matricaria inodora* and increased the seed yield by 240 kg ha^{-1} on clay soil. The same herbicide @ 2.5 L ha^{-1} gave 58-76% kill of *Polygonum tomentosum*, *Galeopsis* spp., and *Atriplex* spp., and increased seed yield to the extent of 290 kg ha^{-1}. Weed control also increased oil content.

Increase in seed yield of winter rape with different herbicides was 10.2% (Wahmhoff, 1990). Anderson & Bengtsson (1992) reported 6% increase in seed yield of winter oilseed rape in both the narrow (12cm) and hoed wide row (48cm) spacing with Lasso (alachlor) @ 5 L ha^{-1}, Teridox-500 EC (dimethachlor) @ 4 or 5 L ha^{-1} by reducing weed number and weight. According to Rana & Angiras (1992), pendimethalin was best

for weed control and gave maximum grain yield of *Brassica napus* L., when fertilized @ 65 kg P_2O_5 ha^{-1}, whereas, Yadav *et al*., (1999) found metribuzin @ 0.219 or 0.175 kg a.i. ha^{-1} and isoproturon @ 0.75 kg a.i. ha^{-1} PPI as most effective in reducing weed dry weight. The present report describe the effect of soil incorporated herbicides on weed and yield of canola (*Brassica napus* L.).

Materials and Methods

A field experiment was conducted to study the effect of two soil incorporated herbicides namely trifluralin (Treflan 48-EC) @ 0.90, 1.20 and 1.50 kg a.i. ha^{-1}, and acetochlor (Acetochlor-50 EC) @ 0.094, 0.125 and 0.312 kg a.i. ha^{-1} and weedy check on weeds and yield of canola at Agronomic Research Area, University of Agriculture, Faisalabad. The experiment was laid out in randomized complete block design having three replications and a plot size of 1.2 x 6 m. The crop was sown on 4th October, 2000 using a seed rate of 5 kg ha^{-1} in 30 cm apart rows with a single row hand drill on a well prepared seedbed. Nitrogen @ 90 kg ha^{-1} and phosphorus @ 60 kg ha^{-1} were applied in the form of urea and diammonium phosphate, respectively. Whole of P and half of N was broadcast and incorporated at sowing time and remaining half of N was broadcast at flowering. Thinning was done 15 days after sowing to maintain a plant to plant distance of 15cm. The herbicides were sprayed before sowing by Knapsack sprayer using flat fan nozzle and incorporated into soil with spade. All other agronomic practices were kept uniform and normal for all the treatments. Crop was harvested on 26th March, 2001 and left in the field for sun drying for 4 days and was threshed manually by stick beating. Yield parameters like number of plants m^{-2}, number of pods $plant^{-1}$, number of seeds pod^{-1}, 1000-seed weight (g) and seed yield (kg ha^{-1}), and weed parameters like weed density (m^{-2}), weed fresh weight (m^{-2}) and weed dry weight (m^{-2}) were recorded following standard procedures. Data collected were analysed by using Fisher's analysis of variance technique and treatment means were compared by applying least significant difference (LSD) test at 5% probability level (Steel & Torrie, 1984).

Results and Discussion

Weed density: Application of herbicides decreased the weed density over control (Table 1). Maximum reduction in weed density was observed in the treatment where trifluralin was applied @ 1.5 kg a.i. ha^{-1}. It was statistically at par with other treatments except weedy check and acetochlor @ 0.094 kg a.i. ha^{-1}. Significantly maximum weed density was observed in control. Effectiveness of herbicides in controlling weeds has been reported by Blackshaw (1989), Toll (1989), Anderson & Bengtsson (1992) and Yadav *et al*., (1999).

Fresh weight of weeds (gm^{-2}): Fresh weight of weeds was also influenced significantly by different herbicide treatments (Table 1). Significantly minimum fresh weight (10.78 gm^{-2}) was observed in treatment where trifluralin was sprayed @ 1.50 kg a.i. ha^{-1} against maximum (50.29 g m^{-2}) in weedy check. Maximum fresh weight of weeds in weedy check was due to presence of weeds throughout the growth period of crop. On the other hand variation in fresh weight of weeds in treated plots was due to their different effectiveness in controlling weeds.

Table 1. Effect of soil incorporated herbicides on weeds of canola.

Treatment	Dose (kg a.i. ha^{-1})	Weed density (m^{-2})	Weed fresh weight (g m^{-2})	Weed dry weight (g m^{-2})
Control (Weedy check)	-	32.67a	50.29a	8.093a
Trifluralin	0.90	12.67bc	19.49c	3.153bc
Trifluralin	1.20	9.33bc	14.36d	2.323cd
Trifluralin	1.50	7.00c	10.78e	1.743d
Acetochlor	0.09	15.00b	23.10b	3.737b
Acetochlor	0.125	13.00bc	18.99c	3.060bc
Acetochlor	0.312	9.00bc	13.86d	2.210cd

Means sharing the same letter(s) in a column do not differ significantly by LSD test at 5% probability level.

Dry weight of weeds (gm^{-2}): Herbicide treatments showed a significant effect on dry weight of weeds (Table 1). Maximum dry weight (8.093 g m^{-2}) was obtained from weedy check whereas, the minimum dry weight (1.743 g m^{-2}) was observed in trifluralin @ 1.5 kg a.i. ha^{-1}. Variation in dry weight of weeds in different treatments might have resulted from different effectiveness of herbicides in controlling weeds. Anderson & Bengtsson (1992) also reported reduction in weed dry weight as a result of alachlor and dimethachlor application.

Number of plants (m^{-2}): Different herbicide treatments did not significantly affect the number of plants of canola (Table 2). It, however, ranged from 18.66 to 20.33 in different treatments. The non-significant results may be attributed to uniform seeding rate and maintaining of plant population at thinning.

Number of pods per plant: Application of herbicide trifluralin @ 1.5 kg a.i. ha^{-1} significantly influenced the number of pods $plant^{-1}$ which produced 352.60 pods $plant^{-1}$ against the minimum (274.47) in weedy check. Lower number of pods in weedy check might have been due to greater weed-crop competition. The results are similar with those of Yadav *et al*., (1999) who observed that number of pods $plant^{-1}$ increased where weed population was reduced by herbicide application.

Number of seeds per pod: Number of seeds per pod was significantly affected by different herbicide treatments (Table 2). Trifluralin @ 1.5 kg a.i. ha^{-1} produced maximum number of seeds pod^{-1} (33.91) and was statistically at par with acetochlor @ 0.312 kg a.i. ha^{-1} (32.72) and trifluralin @ 1.2 kg a.i. ha^{-1} (32.66). Significantly minimum number of seeds pod^{-1} (25.92) was recorded in control. More number of seeds per pod with herbicides application can be attributed to better weed control resulting in better utilization of environmental resources by crop plants.

1000-grain weight (g): Weedy and non-weedy treatments had significant effects on 1000-seed weight (Table 2). Maximum seed weight (4.30g) was obtained with application of trifluralin @ 1.5 kg a.i. ha^{-1} whereas, significantly minimum seed weight (3.11 g) was recorded in weedy check. Severe weed-crop competition in weedy check might be the reason for lighter weight of seeds.

Table 2. Effect of soil incorporated herbicides on yield components and yield of canola.

Treatment	Dose (kg a.i. ha^{-1})	No. of Plants (m^{-2})	No.of pods $plant^{-1}$	No.of seeds pod^{-1}	1000-seed weight(g)	Seed yield (kg ha^{-1})	Increase in seed yield over check (%)
Control (Weedy check)	-	18.66^{NS}	274.47c	25.92d	3.11d	2718f	-
Trifluralin	0.90	19.33	318.90ab	28.60bc	3.68c	3491c	28.44
Trifluralin	1.20	20.33	344.56a	32.66a	4.06b	3554b	30.75
Trifluralin	1.50	19.66	352.60a	33.91a	4.30a	3657a	34.54
Acetochlor	0.094	20.00	290.07bc	27.52cd	3.72c	3241e	19.24
Acetochlor	0.125	20.33	315.80abc	29.64b	4.06b	3449d	26.89
Acetochlor	0.312	20.33	329.50ab	32.72a	4.11b	3574b	31.49

Means sharing the same letter(s) in a column do not differ significantly by LSD test at 5% probability level.

Seed yield (kg ha^{-1}): Seed yield was affected significantly by different weed control treatments (Table 2). Significantly maximum seed yield of 3657 kg ha^{-1} was recorded when trifluralin was applied @ 1.5 kg a.i. ha^{-1} compared with control which gave significantly minimum seed yield (2718 kg ha-1). Higher seed yield in trifluralin @ 1.5 kg a.i. ha^{-1} can be attributed to decreased weed population, decreased weed crop competition and increased yield components of canola. The results are similar to the findings of Blackshaw (1989), Toll (1989), Wahmhoff (1990), Anderson & Bengtsson (1992) and Yadav *et al*., (1999) who reported that herbicide application increased seed yield by reducing weed dry weight.

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