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Control of weeds in canola gobhi sarson cultivars and their tolerance to herbicides

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ABSTRACT

A field study was carried out at the Punjab Agricultural University, Ludhiana for two seasons to study the weed control in three canola gobhi sarson cutlivars and tolerance of these cultivars to different herbicides. Three canola gobhi sarson cultivars '*GSC 5*', '*GSC 6*' and '*Hyola PAC 401'* in main plots and five weed control treatments -fluchloralin at 0.75 and 1.5 kg and trifluralin at 0.75 and 1.5 kg/ha and hand weedings in sub-plots were evaluated in a split plot design. Fluchloralin and trifluralin at 0.75 and 1.5 kg/ ha recorded effective control of annual weeds and recorded canola seed yield similar to hand weeded control. All the three cultivars of canola gobhi sarson tolerated both the herbicides at 0.75 and 1.5 kg/ha. The study indicated that fluchloralin and trifluralin could safely be used to control weeds in canola gobhi sarson cultivars '*GSC 5*', '*GSC 6*' and '*Hyola PAC 401'*.

Key words: Canola, Cultivars, Fluchloralin, Trifluralin, Weed Control

Gobhi sarson (*Brassica napus* L.) is the third most important oilseed crop in the world, after soybean and palm oil. In India also, it is one of the main oil producing crops among rapeseed and mustards. Gobhi sarson plants are very sensitive to weed competition during the initial stages of growth and weed suppression by shading only begins after the canopy has grown over the rows and covered the field. Gill *et al.* (1984) reported that yield losses due to weeds vary from 30-50%, weeds also reduce oil quality and market value. Isoproturon, fluchloralin and trifluralin have been used for controlling weeds in traditional gobhi sarson cultivars GSL 1 and GSL 2 in Punjab. Canola is a registered trade mark of Canadian Oil Association which denotes the seeds having less than 2% erucic acid in its oil and less than 30 micro-moles of glucosinolate per gram of its deoiled meal. Canola oil has the lowest level of saturated and highest level of mono and poly unsaturated fatty acids which are nutritionally desirable for human health. Recently, three canola gobhi sarson cultivars *viz*. '*GSC 5*', '*GSC 6*' and '*Hyola PAC 401'*, have been recommended for cultivation under irrigated conditions in Punjab. Yield losses in canola due to weeds vary form 20-30% (Saeed *et al.* 2011). Weeds reduced canola seed quality by increasing the level of erucic acid in the extracted oil and increasing the glucosinolates content of the remaining meal (Rose and Bell 1982).

Canola cultivars are genetically different from the traditional cultivars of gobhi sarson, and may have differential weed smothering potential and tolerance to herbicides. In the absence of any information on the tolerance of these new canola cultivars to herbicides, the weeds are controlled by manual weedings, which is uneconomical and time consuming. Hugh *et al.* (2008) revealed that yellow mustard was best able to suppress weed growth, followed in decreasing order of weed competitiveness by oriental mustard and hybrid canola, open-pollinated canola, and canola quality mustard. Roshdy *et al.* (2008) recorded significant interaction between canola varieties and weed control treatments with regard to weed control and seed yield. Weeds are needed to be removed by the four leaf stage of the crop (17–38 days after emergence) to prevent more than 10% yield loss due to weed interference in spring canola (Martin *et al.* 2001). Pre-emergence herbicides are more effective than post-emergence or manual control methods (Rapparini 1996). Triflrualin recorded effective control of weeds in canola gobhi sarson (Khan *et al.* 2008). In the present study, weed smothering potential and tolerance of three canola cultivars '*GSC 5*', '*GSC 6*' and '*Hyola PAC 401'* to fluchoralin and trifluralin was evaluated.

MATERIALS AND METHODS

A field experiment was conducted at Punjab Agricultural University Ludhiana during winter seasons of 2006-07 and 2007-08. Ludhiana is situated in Trans-Gangetic Agro-Climatic zone, representing the Indo-Gangetic Alluvial plain at 30° 56' N latitude,

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75° 52' E longitude and at an altitude of 247 m above mean sea level. The maximum temperature above 38 °C is common during summer and frequent frosty spells are experienced during winters, especially in December and January. The experimental soil was loamy sand with pH 7.43 and EC 0.22 dS/m and it was low in organic carbon and available nitrogen (170 kg/ha) and medium in available phosphorus (20.5 kg/ ha) and available potassium (185 kg/ha). The experimental design was split-plot with four replications. Three canola gobhi sarson cultivars (‘*GSC 5*’, ‘*GSC 6*’ and ‘*Hyola PAC 401’*) were assigned to main plots and the five weed control treatments (fluchloralin and trifluralin each at 0.75 and 1.5 kg/ha and hand weeded control) in sub-plots.

The crop was sown manually using 3.75 kg seed/ha in 45 cm spaced rows in third week of October during first year and in the first week of November during second year. The herbicides were applied before sowing and incorporated in the soil. Two hand weeding were done at 20 and 40 days after sowing (DAS) in hand weeded control treatment. The crop emergence was recorded 15 DAS. Weed population and weed dry matter accumulation was recorded at 60 DAS by using 50 x 50 cm quadrat from each plot. The samples were sun dried and then oven dried at 65 °C. The data on crop growth, yield attributes and seed yield was recorded at harvest in April. Benefit-cost ratio was calculated by dividing gross returns with variable cost of cultivation. The data were statistically analyzed by using statistical procedures as prescribed by Cochran and Cox (1967). The comparisons were made at 5 per cent level of significance.

RESULTS AND DISCUSSION

The major weed flora in the experimental field included *Phalaris minor, Rumex dentatus, Medicago denticulata, Coronopus didymus* and *Chenopodium album* (Table 1). All the three cultivars recorded similar weed count and dry matter indicating similar weed smothering potential, though ‘*Hyola PAC 401’* plants were significantly taller than ‘*GSC 5*’ and‘*GSC 6*’, but it did not reflect in higher smothering of weeds. During first season, trifluralin and fluchloralin at both the levels recorded significantly lower polulation of *P. minor R. dentatus* and *M. denticulata* as compared to hand weeded control. Population of weeds was similar under herbicidal and hand weeded treatments during the second year. *C. didymus* was similar under herbicidal and hand weeded treatments during first year while hand weeded control was superior to herbicidal treatments during the second year. Intensity of *C. album* was similar among herbicidal and hand weeded control. The weed dry matter varied significantly among weed control treatments during first years only. The higher doses of herbicides significant reduced the weed dry matter as compared to their respective lower doses and hand weeded control; lower does were at par with hand weeded control (Table 2) The higher population of weeds in hand weeded plots was due to string trimming of the soil and they germinated in more number which increased the population as compared to herbicidal treatments during the first year; during the second year, the weed population was low as compared to first year and hence it was similar among all the weed control treatments. Higher

Table 1. Effect of canola cultivars and weed control treatments on weed population at 60 days after sowing

Treatment	Weed population/m^2								
	P. minor		*R. dentatus*		*C. didymus*		*M. denticulata*		*C. album*
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2007-08
Canola cultivars									
GSC 5	6.1	2.8 (8)	5.5	1.2 (1)	18.9	2.4 (6)	5.0	1.5 (2)	2.4 (5)
GSC 6	6.2	3.3 (11)	7.9	1.1 (0)	32.8	2.7 (8)	6.3	2.0 (4)	2.4 (5)
Hyola PAC 401	7.9	3.3 (10)	7.4	1.9 (1)	27.3	2.7 (8)	8.3	1.9 (4)	2.5 (5)
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Weed control									
Fluchloralin 0.75 kg/ha	3.3	2.9 (8)	4.0	1.1 (0)	35.9	2.8 (7)	5.6	1.7 (3)	2.2 (4)
Fluchloralin 1.5 kg/ha	3.8	3.2 (9)	4.2	1.1 (0)	27.8	3.2 (9)	3.1	2.1 (4)	2.7 (6)
Trifluralin 0.75 kg/ha	4.4	2.9 (8)	5.1	1.1 (0)	26.0	3.2 (10)	5.1	1.9 (4)	2.4 (5)
Trifluralin 1.5 kg/ha	5.1	2.8 (7)	6.4	1.0 (0)	22.4	3.4 (10)	4.2	1.7 (3)	2.5 (5)
Two hand weedings (20 and 40 DAS)	24.4	2.1 (4)	22.9	1.4 (1)	25.6	1.8 (3)	19.3	1.7 (2)	2.3 (5)
LSD (P=0.05)	4.0	0.7	4.3	NS	7.5	0.8	2.7	NS	NS

Figures in parentheses are means of original values. Data subjected to square root (x + 1) transformation

Table 2. Effect of herbicides on weeds, growth and seed yield of canola type of gobhi sarson

Treatment	Weed dry matter (g/m^2) at 60 DAS		Plant height at harvest (cm)		Number of branches/ plant	Number of siliqua/ plant	Canola seed yield (t/ha)		B:C ratio (mean of two years)
	2006-07	2007-08	2006-07	2007-08	2006-07	2006-07	2006-07	2007-08	
Canola cultivars									
GSC 5	22.0	30.1	125.7	95.6	5.5	214.8	1.26	1.60	1.4
GSC 6	24.4	32.2	130.9	95.6	5.4	215.3	1.38	1.79	1.5
Hyola PAC 401	24.4	28.0	143.3	126.1	6.8	222.1	1.61	1.96	1.8
LSD (P=0.05)	NS	NS	6.5	4.7	NS	NS	NS	NS	-
Weed control									
Fluchloralin 0.75 kg/ha	29.9	29.9	131.3	104.9	5.9	221.0	1.42	2.01	1.7
Fluchloralin 1.5 kg/ha	14.4	28.1	134.5	107.0	5.9	218.0	1.50	2.00	1.6
Trifluralin 0.75 kg/ha	28.8	28.0	132.0	108.7	5.6	208.2	1.40	2.08	1.7
Trifluralin 1.5 kg/ha	22.1	30.8	134.8	108.1	5.9	219.5	1.43	2.07	1.6
Two hand weedings (20 and 40 DAS)	28.7	24.4	131.1	106.2	6.0	229.0	1.44	1.91	1.3
LSD (P=0.05)	6.3	NS	NS	NS	NS	NS	NS	NS	-

germination of weeds after hand weeding increased the dry matter in this treatment as compared to herbicidal treatments. Effective weed control with triflurlain 1.5 kg and fluchloarlin 1.5 kg/ha have been reported earlier (Singh and Singh 1998, Khan *et al*. 1995). The herbicides did not influence the emergence of the crop (data not shown) indicating that fluchloralin, trifluralin at 0.75 and 1.50 kg/ha were safe to all the three cultivars of canola gobhi sarson. '*Hyola PAC 401'* attained significantly higher plant height than the other two cultivars and herbicidal treatments recorded similar plant height to that of hand weeded control. All the three canola cultivars recorded similar seed yield during both the years. Fluchloralin and triflurlain at 0.75 and 1.5 kg/ha recorded similar seed yield to that of hand weeded control during both the years. This also indicated that both the herbicides are safe for use on all the three cultivars of canola gobhi sarosn. Beneficial effect of trifluralin on canola seed yield have been recorded earlier (Tanveer *et al.* 2005).

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