

EVALUATING NEW HERBICIDES IN CANOLA

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ABSTRACT

*The following 4 new herbicides were tested in canola fields including Butisan Top (quinmerac 12.5% + metazachlor 37.5%); Teridox (dimethachlor 500 EC); Colzor Trio (dimethchlor 18.75% + napropamid 18.75% + clomazone 3%) and Lasso (alachlor 48% EC). The trials were set in Tehran, Mazandaran, Fars and Khuzestan provinces, Iran, in a Randomized Complete Block Design with 4 replications and the following treatments: trifluralin (Treflan 48% EC) ppi at 2 L/ha + haloxyfop-R- methyl ester (Galant Super 10.8% EC) at 0.75 L/ha. post (as standerd recommended treatment); Butisan Top at 2 and 3 L/ha. pre.; Teridox at 2 and 3 L/ha., pre.; Colzor Trio at 3.5 and 4 L/ha., pre.; Lasso at 5L/ha, pre.; 9- weed free check. Half of each plot was used as weedy check. Results showed that in Tehran, all treatments caused yield increase, but the new herbicides caused much higher yields. In Mazandaran, the new herbicides controlled *Sinapis arvensis* between 36-50% which was much higher than the results for Treflan + Galant Super. In Fars, the new herbicides did not show any satisfactory results. In Khuzestan, Butisan Top at 3L/ha and Lasso produced highest yields, and Teridox at 2 L/ha gave satisfactory results. General outcome of the present trials is recommendation of Butisan Top at 2-3 L/ha and Teridox at 2-3 L/ha for weed control in canola fields.*

Key words: canola, quinmerac + metazachlor, dimethchlor,alachlor,dimethachlor +napropamid + clomazone

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INTRODUCTION

Presently, trifluralin, clopyralid, cycloxydim, sethoxydim and haloxyfop are officially recommended in canola fields of Iran (Mosalla-Nejad *et al.*, 2002). After testing ten herbicides in canola fields, Shimi *et al.* (2002) reported that trifluralin was the best recommendable herbicide. But many farmers do not like herbicide incorporation into the soil, as they have to do with trifluralin. Clopyralid has recently been registered and is a good broad leaf controller for the limited number of species that it can control (Shimi, 2004). The graminicides cycloxydim, sethoxydim and haloxyfop control all grassy weeds, including volunteer wheat and barley in canola fields (Shimi *et al.*, 2004). The new herbicides tested in this experiment claim to do the job of all the above herbicides, applied pre-emergence on canola, without incorporation into the soil.

Butisan Top is a mixture of two herbicides, quinmerac and metazachlor. Quinmerac is a quinolinecarboxylic acid herbicide which is a systemic, synthetic auxin that controls broad leaf weeds including *Galium aparine* and *Veronica* spp. (Tomlin, 2004). Metazachlor is a chloroacetamide herbicide which inhibits germination of annual broad leaf and grass weeds including *Avena fatua*, *Echinochloa crus-galli*, *Polygonum* spp. and *Sinapis* spp. (Tomlin, 2004). Shimi *et al.* (2006) have reported that 2.5 L/ha of Butisan Top has been able to control annual broad leaf and grass weeds in canola fields of Khuzestan, Mazandaran and Qazvin provinces in Iran. Krawczyk and Adamczewski (2002) reported that this herbicide controls weeds very well in canola fields including *Galium* spp., *Veronica* spp., and *Stellaria* spp. Butisan Top has been recommended in canola fields by Palmer (1994) at 1.5 L ha⁻¹; Montvilas (1997) Hallgren (1991) and Petzoldt and Muhling (1984) at 2 L ha⁻¹; Bernotas and Kalvaitiene (1997), Person (1996) at 2.5 L ha⁻¹; and Roslin (1991), at 3 L ha⁻¹.

Alachlor is an old herbicide registered for corn fields in Iran to control broad leaf and grassy weeds (Mosalla -Nejad *et al.*, 2002). Alachlor, like metazachlor, is a chloroacetamide herbicide which is absorbed mainly by germinating shoots controlling annual broad leaf and grass weeds (Tomlin, 2004). Bakuniak and Ziminska, 1991 have reported that this herbicide has performed well in Polish canola fields. Maataoui *et al.*, 1998 from Morocco have shown that alachlor has been able to control the important weeds in their canola fields including *Polygonum aviculare*, *Ammi majus*, *Convolvulus arvensis*, *Sinapis arvensis* and *Sonchus oleraceus*.

Dimethachlor, is a chloroacetamide herbicide which is absorbed by shoots and roots of germinating seeds and controls annual broad leaf and grass weeds (Tomlin, 2004). Kostrzewska (1998) has reported from Poland that 3.5 L ha⁻¹ of this herbicide can control weeds in canola fields satisfactorily. Coulon (2001) mentions that metazachlor gives a good control of annual broad leaf and grass weeds in canola fields which include *Vicia* spp., *Veronica persica*, *Stellaria media*, *Sinapis arvensis*, *Polygonum convolvulus*, *P. persicaria*, *Fumaria officinalis* and *Capsella bursa-pastoris*.

Colzor Trio is a mixture of three herbicides: dimethchlor, napropamid and clomazone. Napropamide, is an alkanamide herbicide which is systemic, absorbed by the root, inhibits root development and controls broad leaf and grass weeds in many crops including oilseed rape (Tomlin, 2004). Clomazone is an isoxazolidinone herbicide which inhibits biosynthesis of carotenoids in susceptible emerging annual broad leaf and grass weeds in many crops including oilseed rape (Tomlin, 2004). Coulon (2000) is of the opinion that this herbicide is able to control the following broad leaf and grass weeds in canola fields at the rate of 3.5-4 L ha⁻¹: *Veronica persica*, *Alopecurus myosuroides*, *Poa annua*, *Lolium* spp. *Stellaria media*, *Sonchus* spp., *Sisymbrium officinalis*, *Lamium purpureum*, *Capsella bursa-pastoris*, *Papaver rhoeas* and *Senecio vulgaris*. Frank and Rola (2001) have reported that Colzor Trio acts selectively in canola fields and can control *Stellaria media*, *Capsella bursa-pastoris*, *Galium aparine*, *Chenopodium album*, *Lamium amplexicaule*, and *Veronica persica*. They however, pointed out that *Fumaria officinalis* is resistant to this herbicide.

An experiment was designed to evaluate the new herbicides as compared to the standard recommended trifluralin + haloxyfop-R-methyl ester treatment in four different climate zones of warm and humid (Mazandaran), hot and dry (Kuzestan), warm and dry (Fars) and moderate cold and dry (Tehran) regions.

MATERIALS AND METHODS

The experiments were carried out during the growing season of 2005-2006 in Randomized Complete Block Design with 4 replications and plot size of 16 m². The trial consisted of 9 treatments which included spray application of 2 L ha⁻¹ trifluralin (Treflan 48% EC) pre plant incorporated to 10cm depth of soil + 0.75 L ha⁻¹ haloxyfop-R-methyl ester (Galant Super 10.8% EC) post emergence of grass weeds before stem elongation (T+H); 2 and 3 L ha⁻¹ Butisan Top (quinmerac

12.5%+ metazachlor 37.5%), pre-emergence of weeds when canola was at cotyledon stage (M+Q); 2 and 3 L ha⁻¹ dimethachlor (Teridox 50% EC) pre-emergence of weeds and canola (D); 3.5 and 4 L ha⁻¹ of Colzor Trio (dimethachlor 18.75% + napropamid 18.5% + clomazone 3%) pre-emergence of weeds and canola (D+N+C); 5 L ha⁻¹ alachlor (Lasso 48% EC) pre-emergence of weeds and canola (A) and hand weeding as check.

Each plot was divided into two equal parts. The upper part of the plot was considered as weedy check of that plot and the lower part was treated as mentioned above. Data collected from each treatment was calculated as percentage of the weedy section. Two fixed 1x1m² quadrates were set in each section and all weed data which included weed number 30 days after treatment, and weed dry weight, before harvest, were collected from these quadrates. Canola yield was determined from a 2 m² area in the middle of each treatment, not including the quadrate area.

Canola varieties used in these experiments included Okapy in Tehran, Hyola 401 in Mazandaran, RGS 003 in Kuzestan and Licord in Fars. Data were analyzed statistically using SAS software, and mean comparisons were performed using Duncan's Multiple Range Test (DMRT). Data for each province was analyzed separately because weed species varied in all provinces

RESULTS AND DISCUSSION

The dominant weeds of the experiment included garden rocket (*Eruca sativa*) in Tehran; ryegrass (*Lolium rigidum*), black barley (*Hordeum spontaneum*), wild mustard (*Sinapis arvensis*) and trefoil (*Trifolium* sp.) in Fars; wild oat (*Avena* spp.), canarygrass (*Phalaris* spp.) and wild mustard in Mazandaran; and, trefoil (*Trifolium alexandrinum*) and plantain (*Plantago lanceolata*) in Khuzestan

Results of the experiment are summarized in Table-1. The data reveal that in Tehran, the best control of garden rocket was observed in M+Q at 2 L ha⁻¹ (91%). The runners up treatments were M+Q at 3 and D at 3 L ha⁻¹ with about 70% control. However, these treatments did not show highest yields which were observed in D+N+C at 3.5 L ha⁻¹ (59% as compared to 16 and 20% for M+Q and D). Altogether, all treatments ended in a yield increase, but none was as high as hand weeded check which showed a significant 100% yield increase as compared to weedy check. The 2 L ha⁻¹ of M+Q conforms with Montvilas (1997), Hallgren (1991), and Petzoldt and Muhling (1984)

findings who recommended this dosage for the herbicide in canola fields. Coulon (2000), has recommended D+N+C at 3.5-4 L ha⁻¹ in canola fields which is similar to the results observed in Tehran region. Altogether, The new herbicides seem to have performed better than the standard M+H practiced.

In Fars, ryegrass was controlled by T+H, M+Q at 2 and 3 L ha⁻¹ and D at 2 L ha⁻¹ by between 69 and 78% and significantly higher from other treatments. The highest control of black barley was 81% with M+Q at 3 L ha⁻¹. The best control of wild mustard occurred in T+H and M+Q at 3 L ha⁻¹ treatments with 75-80% control. The highest control of trefoil was in M+Q treatments with 73-78% control. Increase of yield was achieved in all treatments compared to weedy check. However, no treatment was comparable to the hand weeded check (125%). The next highest yield occurred in T+H (108%) which was significantly higher than the next best two treatments, M+Q at 2 and 3 L (76 and 80% respectively). Thus, contrary to Tehran, in Fars the best herbicide treatment was observed in the standard T+H. Shimi, *et al.* (2002) have reported that among the five herbicides (trifluralin, propyzamide, napropamide, ethametsulfuron and diuron) tested in three provinces of Iran, trifluralin at 2 L ha⁻¹ proved to be the best. Bagherani and Shimi (2002) have also reported that among five herbicides (trifluralin, ethalfluralin, cyanazine, alachlor and propyzamide), the most efficient treatment was trifluralin. Results of the present experiment in Fars, therefore, are in agreement with the present canola herbicide recommendations in Iran.

In Mazandaran, all treatments controlled wild oat and canarygrass satisfactorily, while wild mustard was at best controlled by about 50% by the new herbicides as compared to 27% for the standard treatment of T+H. As far as the yield is concerned, no treatment could achieve the 65% boost in the weed-less plots. The next highest yield was observed in M+Q at 2 L ha⁻¹ (36%) and the other treatments showed a yield increase of about 25%. Due to the fact that wild mustard is one of the major weed problems in canola fields, and M+Q at 2 L ha⁻¹ showed one of the highest control of this weed beside resulting in the highest yield next to the hand weeded check treatment. This treatment is declared as the most favorite treatment of the experiment in Mazandaran.

In Khuzestan, except for T+H and M+Q at 2 L ha⁻¹ which controlled trefoil under 80%, all other treatments controlled it by almost 100%. As for plantain, it was controlled by all treatments satisfactorily, except D+N+C which controlled the weed by 81%. While the highest yield increase was observed in M+Q at 3 L ha⁻¹ (51%) and

A (46%), T+H and D+N+C at 3.5 L ha⁻¹ showed no yield increase. Yield increase in other treatments varied between 36% for M+Q at 2 L ha⁻¹ (36%) and 11% for D+N+C at 4 L ha⁻¹. Hand weeded check had a yield increase of 27%. In this experiment, although dominant weeds were controlled well in all treatments, but yield varied. This may be due to undetected damages occurred in some plots, especially those of T+H and D+N+C at 3.5 L ha⁻¹ at the beginning of the growing season.

Overall results of above experiments indicate that the standard treatment of trifluralin+haloxyfop has performed well in Fars and Mazandaran, but not so satisfactorily in Tehran and Khuzestan. Different weeds and climates could be the explanation for this behaviour. On the other hand, metazachlor+quinmerac (Butisan Star) has not only controlled weeds well in all the four provinces but also increased yield quite well. We, therefore, strongly recommend this herbicide as an alternative to M+H. An advantage of M+Q over T+H is that it does not have to be mixed with soil after application.

Table-1. Percentage control of weeds (dry wt.), as compared to weedy check of each plot, and canola seed yield (%increase relative to weedy check of each plot) in different provinces and treatments.*

Treatments	Tehran		Fars				Mazandaran				Khuzestan			
	% <i>Eruca sativa</i> control	% yield increase	% <i>Lolium rigidum</i> control	% <i>Hordeum spontaneum</i> control	% <i>Sinapis arvensis</i> control	% <i>Trifolium</i> sp. control	%yield increase	% <i>Avena</i> spp. control	% <i>Phalaris</i> spp. control	% <i>Sinapis arvensis</i> control	%yield increase	% <i>Trifolium Alexandrinum</i> control	% <i>Plantago lanceolata</i> control	%yield increase
Trifluralin+haloxyfop	16 f	4 f	71 a	72 b	75 a	67 b	108 b	100 a	100 a	27 b	24 c	78 b	100 a	0 c
Metazachlor+quinmerac 2 L/ha	91 a	16 e	75 a	61 c	52 b	73 ab	76 c	90 b	91 c	44ab	36 b	77 c	100 a	36 b
Metazachlor+quinmerac 3 L/ha	65 b	32 d	78 a	81 a	80 a	78 a	80 c	100 a	100 a	36 ab	22 c	100 a	100 a	51 a
dimethachlor 2 L/ha	35 e	20 e	69 a	27 e	49 b	31 d	22 ef	88 b	94 bc	38 ab	24 c	100 a	100 a	34 b
dimethachlor 3 L/ha	70 b	36 cd	42 b	12 f	8 d	37 cd	25 e	100 a	99 ab	50 a	25 c	96 a	100 a	13 d
dimethachlor+napropamide+clomazone 3.5 L/ha	53 c	59 b	24 c	8 f	18 c	0 e	8 g	97 a	98 ab	48 a	27 c	100 a	81 b	0 c
dimethachlor+napropamide+clomazone 4 L/ha	46 cd	21 e	82 a	36 d	54 b	41 c	35 d	100 a	100a	44 ab	27 c	94 a	99 a	11 d
Alachlor 5 L/ha	42 d	40 c	43 b	23 e	14 cd	40 c	15 d	91 b	88 cd	42 ab	27 c	97 a	100 a	46 a
Weedless check	-	100 a	-	-	-	-	125 a	-	-	-	65 a	-	-	27 b

*In the same column, values followed by the same letter are not significantly different according to DMRT at $P \leq 0.01$.

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