Why Lontrel Shouldn't Be Used In Mustard Crops

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INTRODUCTION

Current low grain prices have forced producers to look for alternative crops. Brown, oriental, and yellow mustard are drought tolerant, short season crops well adapted to the Brown and Dark Brown soils, areas where cropping options tend to be more limited. Mustard seed is currently produced primarily for the condiment market, although the future holds promise of oilseed quality mustard.

Good weed control is essential to prevent yield reductions and reduced market value of the seed due to contamination by weed seeds. At present, the only broad-leaved weed herbicides registered for use in mustard, trifluralin and ethalfluralin, must be applied before seeding and incorporated into the soil. This practice destroys crop residues, dries the seedbed and leaves the soil prone to erosion.

Lontrel and Muster, two postemergence herbicides, have proven to be safe and effective in canola whether applied individually or as a tankmix (Blackshaw 1989, Swanton and Chandler 1989). Seven of the fifteen most abundant weeds in Saskatchewan mustard fields are controlled by these two herbicides, including stinkweed, wild buckwheat, Canada thistle and perennial sowthistle (Douglas and Thomas 1986).

Muster has shown promise for controlling wild mustard in tame mustard (Blackshaw and Derksen 1992), but little is known about domestic mustard tolerance of Lontrel, either alone or with Muster. Research was conducted at Lethbridge, Alberta and Indian Head, Saskatchewan to determine the effects of dose and time of application of Lontrel, alone or mixed with Muster, on seed yield and quality of brown, yellow and oriental mustard.

MATERIALS AND METHODS

Two field studies were conducted at Lethbridge Research Station, Lethbridge, Alberta and at Indian Head Experimental Farm, Indian Head, Saskatchewan in 1989 and 1990. The soil at Lethbridge was a Dark Brown Chernozem of sandy loam texture: 57% sand, 17% silt, 26% clay, pH 8.0 and 2.0% organic matter. At Indian Head, the soil was a Black Chernozem of silty clay texture: 4% sand, 24% silt, 72% clay, pH 7.6 and 4% organic matter. The tests were fertilized according to soil test recommendations. Ethalfluralin was applied overall at 1.1 kg ha^{-1} and incorporated as recommended to a depth of 10 cm to control grassy and broad-leaved weeds. In early May, yellow mustard, cv. 'Kirby'; oriental mustard, cv. 'Cutlass'; and brown mustard, cv. 'Common' were seeded on fallowed land at 8 to 10 kg ha^{-1} to a depth of 3 cm with 15-23 cm row spacing. Furadan (0.27 kg ha^{-1}) was applied with the seed to control flea beetles.

In the first experiment, Lontrel was applied at 0.10, 0.15, 0.20, 0.30 and 0.60 kg a.i. ha^{-1} at the 4- or 10-leaf stage of mustard. It is currently registered for weed control in canola at 0.15 - 0.30 kg a.i. ha^{-1}, applied at the 3-to 6- leaf stage of the crop. The 4- and 10-leaf stages were chosen to represent the recommended stage, and a late application (just before canopy closure), respectively. A randomized complete block design was used. The other, a factorial experiment, was conducted with Lontrel applied at 0, 0.10, 0.20, and 0.30 kg a.i. ha^{-1} and

Muster at 0, 0.01, 0.02 and 0.03 kg a.i. ha^{-1}. Muster is currently registered for weed control in canola at rates of 0.015- 0.023 kg a.i. ha^{-1}. Herbicides were applied when the mustard was in the 4- to 6-leaf stage. A randomized complete block design was used.

Agral 90 was included at 0.25% v/v in all Muster treatments. Hand-weeded controls were included in both experiments. All treatments were applied with a CO_2 - pressurized sprayer delivering 110 and 170 L ha^{-1} at Indian Head and Lethbridge, respectively. Mustard cultivars were sown perpendicular to the herbicide plots in 2m parallel strips forming a split block design. Experiments had four replicates. Subplot sizes were 2 by 7 m at Lethbridge and 2 by 6 m at Indian Head.

Visual crop tolerance ratings were taken in mid-July. These ratings were based on a scale of 0-9, where 9 = no injury and 0 = complete kill. According to this scale the maximum injury rating for commercial acceptance is 7. Mustard cultivars were harvested by cutting a 1 m^2 area by hand at Lethbridge and by combining a 2.4 m^2 area with a small plot combine at Indian Head. Thousand seed weights were calculated at Lethbridge in 1989 and 1990 and at Indian Head in 1989. Nuclear magnetic resonance (NMR) was used to determine oil content of the seed. SAS was used for all data analysis.

RESULTS AND DISCUSSION

Below normal precipitation occurred at both locations in 1989. At Lethbridge, test plots were irrigated with 50 mm of water at seeding time to aid in establishment. As a result, the relative yield of the three types of mustard was similar in both years. At Indian Head, where plots were not irrigated, yellow mustard seed yield was less than brown or oriental mustard in 1989. However, in 1990 when precipitation was 115% of normal, yellow mustard out yielded both brown and oriental mustard. The *B. juncea* types, brown and oriental are known to be particularly drought tolerant. Brown and oriental mustard oil content was generally higher in 1989 than in 1990, while yellow mustard oil content was generally lower in 1989 than in 1990. The change in oil content from one year to the next differed in magnitude between locations. This explains the site-year by variety interactions (Table 1).

Although there were differences in response related to location and year in both experiments, there was a general linear decline in yield and oil content of all three mustards as Lontrel rate increased (Tables 2-4). The rate of decline in yellow mustard yield and oil as Lontrel rate increased was less than that of the brown and oriental indicating that the *B. hirta* species is less sensitive than *B. juncea*. A reduction in oil content alone is not necessarily undesirable, since low oil content is desirable in the condiment mustards, but yield reductions are not acceptable.

Very little injury was visible in either experiment when injury ratings were taken in July however, at maturity, seed pods appeared shorter. Application of 0.15 kg a.i.ha^{-1} of Lontrel (the lowest rate registered for weed control in canola) resulted in an increase in thousand seed weight of 2% in brown, oriental, and yellow mustard (data not presented). When mixed with Muster, this rate of Lontrel resulted in a 13% increase in brown mustard thousand seed weight, 9% increase in oriental thousand seed weight and 6% increase in yellow thousand seed weight.

Brown mustard tended to be the most affected when application was made at the 10 leaf rather than the 4 leaf stage, oriental mustard was intermediate and yellow mustard was the least affected by time of application (Tables 2-4). According to single degree of freedom contrasts, brown mustard yield reductions were significantly greater when clopyralid was applied at the 10 leaf rather than the

4 leaf stage at Indian Head in 1990 and Lethbridge in 1989. As well, oriental mustard yield was significantly lower when clopyralid was applied at the later growth stage in both years at Indian Head. Significant differences between leaf stage in yellow mustard occurred only at Indian Head in 1990.

Yellow mustard oil content was significantly affected by growth stage at time of application in 3 of 4 site-years. According to oil content estimates, however, the difference in oil content was less than 1% when Lontrel was applied at the 10 leaf rather than the 4 leaf stage.

Tolerance to Muster, in general, was greatest in brown mustard, intermediate in oriental and poorest in yellow mustard. This confirms an earlier report by Blackshaw and Derksen (1992). As was the case in their work, tolerance was influenced by site-year, however, the reason for this is unknown.

Mustard yield, oil content and thousand seed weight were affected by Lontrel application regardless of whether or not it was applied with Muster. In general, however, the addition of Muster resulted in greater yield and oil content reductions. Mixtures of these two herbicides have been reported to act synergistically in controlling redroot pigweed and common lamb's-quarters, without increasing canola injury (Blackshaw 1989).

SUMMARY

Mustard species displayed differences in the tolerance to Lontrel and mixtures of Lontrel with Muster. However, in this study, crop tolerance was never acceptable. Yellow mustard was the most tolerant with yield reductions of 9% and 8%, respectively, when Lontrel was applied at 0.15 kg a.i. ha^{-1} alone or with Muster. This same rate applied to oriental mustard resulted in average yield reductions of 22 and 35%, alone or with Muster, respectively. In brown mustard, average yield reductions were 20 and 30%, respectively, when Lontrel was applied at 0.15 kg a.i. ha^{-1} alone or with Muster. Although Lontrel and Lontrel + Muster provide good weed control in canola, these products cannot be used safely in mustard.

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REFERENCES

Blackshaw, R.E. 1989. Synergistic mixes of DPX-A7881 and clopyralid in canola (*Brassica napus*). Weed Tech. 3: 690-695.

Blackshaw, R.E. and Derksen, D.A. 1992. Response of cultivated mustard species to DPX-A7881. Can. J. Plant Sci. 72: 203-207.

Douglas , D.W. and Thomas, A.G. 1986. Weed Survey of Saskatchewan Mustard, Lentil and Dry Pea Crops 1985. Weed Survey Series Publication 86-2. pp. 157. Available from: Agriculture Canada, Regina.

Swanton, C.J. and Chandler, K. 1989. Control of wild mustard in canola with postemergence herbicides. Can. J. Plant Sci. 69: 889-896.

Table 1. Analysis of variance of mustard yield and oil content response to Lontrel applied alone at the 4 or 10 leaf stage, or with Muster at the 4-6 leaf stage.

Lontrel at two different leaf stages:				Lontrel with Muster:			
Source of Variance	df	Yield P>F	Oil Content P>F	Source of Variance	df	Yield P>F	Oil Content P>F
Siteyear (S)	3	.0009	.0901	Siteyear (S)	3	.0111	.9207
Cultivar (V)	2	.0004	.0001	Cultivar (V)	2	.0098	.0251
S*V	6	.0013	.0138	S*V	6	.0001	.0001
Leaf Stage (LF)	1	.0198	.0910	Muster	3	.0007	.1438
Rate (R)	4	.0001	.0002	Lontrel (L)	3	.0001	.0017
LS*R	4	.8712	.1418	Muster*L	9	.1934	.5203
S*LS	3	.5935	.3528	S*Muster	9	.8693	.6660
S*R	12	.0327	.0220	S*L	9	.0035	.0039
S*LS*R	12	.0691	.4545	S*Muster*L	27	.1453	.0401
V*LS	2	.7063	.3137	V*Muster	6	.1426	.2414
V*R	8	.0013	.0262	V*L	6	.0001	.0057
V*LS*R	8	.0145	.8233	V*Muster*L	18	.9386	.9333
S*V*LS	6	.0687	.2476	S*V*Muster	18	.0152	.8058
S*V*R	24	.0806	.2305	S*V*L	18	.0011	.0001
S*V*LS*R	24	.7975	.8058	S*V*Muster*L	54	.3728	.2288

Table 2. Brown mustard yield and oil content response to Lontrel alone at the 4 or 10 leaf stage or with ethametsulfuron (Muster) at the 4-6 leaf stage.

		Yield response		r^2	Yield reduction[z]	Oil content response		r^2	Oil content reduction[z]
I. Lontrel applied at the 4 leaf stage									
Indian Head	1989	y=135-.21x	**[y]	.8634	15%	y=30.72-.01x	**	.8749	3.3%
	1990	y= 93-.10x	NS	.8029	11%	y=29.50-.002x	NS	.3687	0.6%
Lethbridge	1989	y=175-.23x	NS	.9013	13%	y=32.0-.01x	**	.9426	3.1%
	1990	y=212-.28x	**	.8487	13%	y=32.2-.01x	**	.7816	3.1%
II. Lontrel applied at the 10 leaf stage									
Indian Head	1989	y= 94-.11x	**	.5720	12%	y=29.7-.007x	**	.6667	2.4%
	1990	y= 73-.11x	**	.7731	15%	y=29.6-.004x	NS	.5316	1.4%
Lethbridge	1989	y=134-.19x	**	.8487	14%	y=29.8-.009x	**[w]	.8770	3.0%
	1990	y=205-.27x	**	.8693	13%	y=31.4-.009x	*	.8449	2.1%
III. Lontrel with Muster									
Indian Head	1989	y=171-.37x	**	.9883	22%	y=32.65-.02x	**	.9888	6.1%
	1990	y= 87-.15x	**	.8359	17%	y=31.18-.004x	NS	.9151	1.3%
Lethbridge	1989	y=221-.47x	**	.9853	21%	y=33.09-.02x	**	.9447	6.3%
	1990	y=233-.43x	**	.8803	19%	y=32.09-.017x	**	.8668	5.3%

[z]Potential yield or oil content reduction per 0.1 kg a.i. ha^{-1}.
[y]Based on single degree of freedom contrasts for linear response to increasing clopyralid rates: **, * and NS are significant at the 1% and 5% levels and not significant, respectively.
[w]Significant EMM*C interaction.

Table 3. Oriental mustard yield and oil content response to Lontrel alone at the 4 or 10 leaf stage or with ethametsulfuron (Muster) at the 4-6 leaf stage.

		Yield response		r^2	Yield reduction[z]	Oil content response		r^2	Oil content reduction[z]
I. Lontrel applied at the 4 leaf stage									
Indian Head	1989	y=142-.25x	**[y]	.8199	18%	y=32.4-.009x	**	.7881	2.8%
	1990	y=118-.15x	*	.5153	13%	y=31.7-.002x	NS	.3631	0.6%
Lethbridge	1989	y=190-.29x	**	.9871	15%	y=34.9-.01x	**	.8572	2.9%
	1990	y=289-.37x	**	.8824	13%	y=34.0-.007x	**	.7820	2.1%
II. Lontrel applied at the 10 leaf stage									
Indian Head	1989	y= 94-.15x	**	.8878	16%	y=30.9-.005x	**	.8533	1.6%
	1990	y= 92-.14x	**	.8533	15%	y=31.6-.001x	NS	.2838	0.3%
Lethbridge	1989	y=166-.23x	**	.8758	14%	y=35.0-.01x	**	.9710	2.9%
	1990	y=267-.34x	**	.9120	13%	y=33.8-.007x	**	.7737	2.7%
III. Lontrel with Muster									
Indian Head	1989	y=172-.51x	**	.9528	30%	y=34.5-.02x	**	.9406	5.8%
	1990	y=143-.27x	**	.9904	19%	y=33.4-.002x	NS	.4545	0.6%
Lethbridge	1989	y=220-.45x	**	.9154	21%	y=36.3-.023x	**[w]	.9499	6.3%
	1990	y=291-.67x	**[w]	.9782	23%	y=34.7-.017x	**	.9239	4.9%

[z]Potential yield or oil content reduction per 0.1 kg a.i. ha^{-1}.
[y]Based on single degree of freedom contrasts for linear response to increasing clopyralid rates: **, * and NS are significant at the 1% and 5% levels and not significant, respectively.
[w]Significant EMM*C interaction.

Table 4. Yellow mustard yield and oil content response to Lontrel alone at the 4 or 10 leaf stage or with ethametsulfuron (Muster) at the 4-6 leaf stage.

		Yield response		r^2	Yield reduction[z]	Oil content response		r^2	Oil content reduction[z]
I. Lontrel applied at the 4 leaf stage									
Indian Head	1989	y=171-.10x	NS[y]	.9882	6%	y=25.5-.004x	**[y]	.8327	1.6%
	1990	y=228-.08x	**	.9382	4%	y=24.9-.003x	NS	.5806	1.2%
Lethbridge	1989	y=228-.12x	NS	.5893	5%	y=25.7-.001x	**	.9649	2.3%
	1990	y=352-.23x	**	.8320	7%	y=28.7-.006x	NS	.8460	2.1%
II. Lontrel applied at the 10 leaf stage									
Indian Head	1989	y=167-.12x	**	.9851	7%	y=24.8-.005x	**	.9552	2.0%
	1990	y=214-.155x	**	.9292	7%	y=24.1-.0008x	NS	.2190	0.3%
Lethbridge	1989	y=239-.16x	NS	.7771	7%	y=24.5-.006x	**	.8606	2.4%
	1990	y=336-.214x	NS	.9126	6%	y=27.8-.006x	*	.7127	2.2%
III. Lontrel with Muster									
Indian Head	1989	y=150-.075x	**[w]	.8714	5%	y=25.8-.004x	**	.9818	1.6%
	1990	y=170-.083x	*	.4504	5%	y=26.4-.0007x	NS	.3630	0.3%
Lethbridge	1989	y=303-.183x	**	.9998	6%	y=25.9-.006x	**	.9963	2.3%
	1990	y=310-.185x	NS	.8061	6%	y=26.8-.006x	**	.9799	2.2%

[z]Potential yield or oil content reduction per 0.1 kg a.i. ha^{-1}.
[y]Based on single degree of freedom contrasts for linear response to increasing clopyralid rates: **, * and NS are significant at the 1% and 5% levels and not significant, respectively.
[w]Significant EMM*C interaction.