Cruiciferae Weed Control In Canola Through the Use of Triazine Resistant Varieties

K.J. KIRKLAND
Agriculture Canada
Experimental Farm
Scott, Sask.

Introduction

Weed control in canola (rapeseed) has been highly successful in most areas due primarily to the use of trifluralin on approximately 80% of the acreage. Trifluralin controls a wide spectrum of both annual grassy and broadleaved weed species. Two species not controlled by trifluralin; stinkweed (*Thlaspi arvense* L.) and wild mustard (*Sinapis arvensis* L.) have increased dramatically in recent years and now infest extensive areas of the prairie rapeseed region.

The discovery of a wild rapeseed type (*Brassica campestris*) which thrived in the triazine treated corn fields of Quebec has led to the incorporation of this "triazine resistance" factor into several of the commonly grown domestic lines. During 1980 and 1981 extensive investigations have been undertaken to determine if triazine herbicides and triazine resistant rapeseed have potential as a weed control technique for Canola production in the prairies.

Methods

Growthroom screening in the winter of 1979-80 indicated that metribuzin, cyanazine and atrazine were three commonly available triazines which appeared to have acceptable tolerance when applied to triazine resistant rapeseed.

Field studies in 1980 and 1981 were randomized complete block in design with 4 replicates. Methods of applying the triazines included; postemergent applications at the rapeseed 3-4-leaf stage, Pre- Plant with shallow (2.5 to 5.0 cm) incorporation, and Pre-plant with deep (7.5 to 10.0) incorporation. Twelve months following the application of triazines, all treated areas were seeded to cereals (wheat,barley and oats) to determine if triazine residue was a factor in succeeding crops.

Results and Discussion

Growthroom experiments - Screening indicated that the triazine resistant rapeseed had a much greater inherent tolerance to some triazines than others. Atrazine and cyanazine appeared to have no effect on the rapeseed even with extremely high application rates. While metribuzin produced phototoxic symptoms at higher rates but seemed acceptable at lower rates. Velpar however, completely destroyed the triazine resistant rapeseed at all rates of application.

Efficacy on stinkweed with growth room applications varied widely between herbicides and between rates (Table 1)

Table 1 Efficacy of Triazines applied postemergent to stinkweed - Growthroom

Treatment	Rate kg/ha	Control % injury
Atrazine	0.3	60
Atrazine	0.5	100
Atrazine	1.0	100
Cyanazine	0.1	5
Cyanazine	0.3	50
Cyanazine	0.5	57
Metribuzin	0.07	15
Metribuzin	0.10	88
Metribuzin	0.3	100

Field experiments - In 1980 and 1981 method of application had little effect on the efficacy of cyanazine, atrazine or metribuzin to either the resistant rapeseed or stinkweed, therefore data from the postemergent applications are presented in Tables 2,3 and 4.

In 1980, rapeseed tolerance was excellent to cyanazine and atrazine at all rates of application (Table 2). Metribuzin produced some phytotoxic symptoms which were reflected in reduced rapeseed yields at the end of the growing season. Control of stinkweed with Metribuzin was excellent, while control with cyanazine and atrazine was not acceptable at any rate tested except, atrazine at 0.75 kg/ha (Table 2)

Table 2 Stinkweed control and crop tolerance in triazine resistant <u>Brassica campestris</u> - Scott 1980.

Treatment	Rate kg/ha	Rapeseed Tolerance *	Stinkweed Control **	Rapeseed yield gm/2
Check (untreated)	-	9.0	0.0	120
check (handweeded)	-	9.0	9.0	139
Metribuzin	0.15	9.0	8.7	105
Metribuzin	0.20	8.1	8.9	103
Metribuzin	0.30	6.8	9.0	102
Cyanazine	0.30	9.0	2.0	109
Cyanazine	0.50	9.0	3.0	126
Cyanazine	0.75	9.0	4.5	125
Atrazine	0.30	9.0	1.5	127
Atrazine	0.50	9.0	4.4	122
Atrazine	0.75	9.0	7.7	130

* 0 = no tolerance 9 = complete tolerance
** 0 = no control 9 = complete kill

In 1981 rapeseed tolerance to the three herbicides at all rates of application was acceptable (Table 3). No yield reductions resulted from any treatment including cyanazine at 3 kg/ha. Why metribuzin resulted in yield reductions at all rates of application in 1980, but showed no phytotoxic effects in 1981 is difficult to explain. Differences in environmental conditions between years such as soil moisture (which influences root uptake) may be a factor. Another possibility is the major adaptation process which took place in the triazine resistant line between 1980 and 1981. The seed sown in 1980 was obtained from a winter increase in New Zealand and while germination was excellent a lack of vigor was obvious, with yields averaging approximately 65% of Candle. In 1981 seed from the 1980 increase was planted with considerable increase in plant growth, vigor and yield (85% of Candle) noted.

Table 3 Tolerance of triazine resistant Brassica campestris to postemergent applications of metribuzin, cyanazine and atrazine, Scott 1981.

Treatment	Rate kg/ha	Rapeseed Tolerance*	Rapeseed Yield g/m^2
untreated check **	-	9	131
handweeded check	-	9	137
Metribuzin	0.10	9	142
Metribuzin	0.15	9	133
Metribuzin	0.20	9	131
Cyanazine	1.0	9	127
Cyanazine	2.0	9	141
Cyanazine	3.0	9	135
Atrazine	0.50	9	134
Atrazine	0.75	9	143
Atrazine	1.0	9	127
LSD (.05)	--		NSF

* Tolerance 9 = complete tolerance 0 = complete kill

** Stinkweed failed to germinate, all treatments weed free.

Soil residue of triazines One of the major concerns in applying triazines to soils in the prairies is the possibility of carryover, affecting the growth of succeeding crops. The cereals are particularily sensitive to triazines with oats being the most sensitive followed by wheat and barley. Soils treated in 1980 and 1981 were sampled each fall and bioassayed in a growthroom study utilizing cereals each winter. In both years neither cyanazine or metribuzin produced any phytotoxic effects on the cereals. However, atrazine was present in sufficient amounts to severely restrict the growth and often cause death of the cereals.

Recropping studies on the 1980 treated plotes were carried out in 1981 and the results presented in Table 4. The field study tends to support the growthroom results very closely. No phytotoxic effects were observed on oats, wheat or barley grown on soils treated with metribuzin or cyanazine. Atrazine produced crop injury on all 3 cereals at all rates of application. At the 0.75 kg/ha rate which is the minimum amount of atrazine required for acceptable weed control, cereal injury ranges from 62% in barley to 92% in oats (Table 4).

Table 4 The effect of metribuzin, cyanazine and atrazine residue on cereal crops seeded 12 months later

Treatment	Rate kg/ha	% crop injury* Oats	Wheat	Barley
untreated check	-	0	0	0
handweeded check	-	0	0	0
metribuzin	0.15	0	0	0
metribuzin	0.20	0	0	0
metribuzin	0.30	0	0	0
cyanazine	0.30	0	0	0
cyanazine	0.50	0	0	0
cyanazine	0.75	0	0	0
atrazine	0.30	20	10	10
atrazine	0.50	45	35	30
atrazine	0.75	92	80	62

* = % injury (0 = no injury. 100 = complete kill)

Summary

1. Brassica campestris - triazine resistant rapeseed has shown excellent tolerance to cyanazine and atrazine. Metribuzin has produced some phytotoxic effects, but

considerable variability between growing seasons has been noted.

2. All three herbicides will control stinkweed and wild mustard within the following rate of application ranges.

Metribuzin	0.2 - 0.30	kg/ha
Cyanazine	1.5 - 3.0	kg/ha
Atrazine	0.75 - 1.5	kg/ha

3. Atrazine residues in lower organic matter ($<5\%$) soils are sufficient to cause severe reductions in cereal growth the year following application. Further investigations are required in high organic matter ($>5\%$) soil.

4. Presently available triazine resistant rapeseed cultivars yield approximately 15% less than the commonly grown Canola varieties.

5. The use of triazines to control problem broadleaved weeds in rapeseed shows considerable promise.