

A Comparison of Herbicides to Control Wild Oats in Wheat

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

Prior to 1960 control of wild oats in wheat was restricted to cultural practices like; delayed seeding, post seeding rodweeding, green-feed crops, etc. In 1960 barban (Carbyne) was registered for commercial use in Western Canada, marking the first major advance in selective wild oat control. Over the ensuing 20 yr, one preemergent, triallate (Avadex) and four postemergent herbicides, benzoylprop ethyl (Endaven), flamprop methyl (Mataven), diclofop methyl (Hoegrass) and difenzoquat (Avenge) have been registered and widely used to control wild oats in wheat. These 6 herbicides were tested extensively prior to registration to determine; efficacy on wild oat and wheat, residue in soil, straw and seed, and toxicity to mammals, birds, and fish. However, comparative information on the effectiveness of these six herbicides is virtually non-existent.

This study was initiated in 1976 to obtain data on yield responses possible in wheat when a wild oat population is removed or its growth severely restricted by using available chemical controls.

Materials and Methods

Trials were conducted at Saskatoon in 1976 - 77 and Scott 1978 - 79. The wheat variety used throughout was Neepawa. Experimental design was a randomized complete block with 4 replications. All herbicide treatments were applied at recommended rates, water volumes and growth stages (Table 1). Two check treatments were maintained, one untreated or weedy, where no control method was employed and the wild oats allowed to grow without disturbance. In the second, weed free, the wild oats were removed as soon as they appeared above the soil surface and the crop allowed to grow without competition from other plants throughout the growing season.

Table 1 Herbicides, rate and stage of application

	Rate kg/ha	Wild oat leaf stage
Triallate (Avadex liquid)	1.40	pre-emerge
Barban (Carbyne)	0.30	2
Diclofop methyl (Hoegrass)	0.70	2-3
Flamprop methyl (Mataven)	0.55	4
Difenzoquat (Avenge)	0.85	4
Benzoylprop ethyl (Endaven)	1.40	4

Results and Discussion

Growth room response

The effect of the 5 postemergent herbicides on the growth and development of wild oat was studied in the greenhouse. Diclofop and flamprop methyl virtually eliminated all wild oat plants (Table 2). Benzoylprop ethyl, barban and difenzoquat produced a severe initial set back but in the absence of crop competition the wild oats elongated, formed panicles, and produced some seed.

Table 2 Efficacy of post emergent herbicides on wild oat -Growth room

Treatment	Mature wild oat			
	Total plant weight	% of untreated		Seed weight
		Panicles formed	Seeds /panicle	
Diclofop methyl	4	0	0	0
Flamprop methyl	7	7	4	3
Benzoylprop ethyl	55	63	47	22
Difenzoquat	59	39	55	22
Barban	80	65	65	43

Yields from field application

The application of herbicides produced yield increases in all years except 1978, when a relatively light wild oat infestation was late emerging and did not become competitive with the wheat crop (Table 3). Diclofop methyl and flamprop methyl produced significant yield increases in each of the 3 remaining years. Barban controlled wild oats effectively in 1976 when wild oat emergence was uniform and application made when the majority were in the 2-leaf stage.

Wild oat is a very strong competitor with grain crops. It competes with wheat and other crops for soil moisture, plant nutrients and light. At two locations in North Dakota over a 3 yr period, an infestation of about 100 wild oat plants/m² decreased the yield of wheat by 30%. Recently D.A. Dew of the Lacombe Research Station in Alberta developed an "index of competition" which predicts losses due to wild oats when population in a given crop is known. Using the Lacombe "index" for wheat, and the wild oat population in table 3 losses of 34, 13, and 15% would have been predicted for 1977-78-79 respectively. Actual yield reductions measured were 28, 0 and 26% respectively. The apparent differences between the predicted and actual yield reductions in the latter 2 yr can largely be explained by time of emergence of the wild oats. In 1978 the wild oats emerged 7 to 10 days after the wheat and were not competitive throughout the growing season whereas, in 1979 the wild oats emerged 5 - 7 days prior to the wheat and provided vigorous competition throughout. The average yield reduction over the 3 yr period was 18% which is approximately 7% less than predicted by the Lacombe index.

Table 3 Effect of wild oat herbicides on wheat yield. 1976-79

Saskatoon, Scott

Treatment	Yield g/m ²				Mean
	1976	1977	1978	1979	
Untreated	148	180	187	274	197
Weed Free	-	230	181	344	-
Triallate	176	203	196	312	222
Barban	184	186	194	287	213
Diclofop	221	232	187	335	244
Benzoylprop ethyl	156	220	194	312	221
Flamprop methyl	189	218	180	323	228
Difenzoquat	-	-	187	318	-
LSD (.05)	35	31	N.S.	40	
Wild oats/m ²	100	100	15	20	59

Returns from wild oat control

Treating with Diclofop methyl increased yields 24% (Table 4) or 416 lbs/ac/yr, while barban produced yield increases of 8% or 142 lbs/ac/yr. Using wheat values of \$160.52/tonne (\$4.37 bushel) annual increases in crop value/ac ranged from \$30.30 for diclofop methyl to \$11.58 for barban.

Table 5 outlines the yearly increases in yield and economic return. With two exceptions; benzoylprop ethyl in 1976, and barban in 1977, returns from applying a wild oat herbicide were greater than the cost of the treatment in 1976, 1977, and 1979. No increases occurred in 1978 when only a small population of non-competitive wild oats were present. Applying a herbicide in this situation could not be recommended on the basis of "short run" economic benefits but, may be agronomically desirable to prevent seed set and future population increases.

Table 4 Returns from wild oat control, 1976-79

Treatment	<u>Increase over untreated</u>			Herbicide cost 1979 \$
	%	lb/ac	\$ Value **	
Diclofop methyl	24	416	30.30	10.80
Flamprop methyl	16	275	20.03	10.75
Difenzoquat*	16	389	28.36	11.32
Triallate	13	222	16.17	7.00
Benzoylprop ethyl	12	213	15.51	10.00
Barban	8	142	11.58	4.78

* based on 1979 yield data only

** wheat priced at \$4.37/bushel

Table 5 Yield increase and economic return from wild oat control

Treatment	Return per acre							
	1976		1977		1978		1979	
	lbs	\$*	lbs	\$	lbs	\$	lbs	\$
Diclofop methyl	646	(47.05)	460	(33.50)	N O T S I G N I F I C A N T		540	(39.33)
Flamprop methyl	443	(32.27)	336	(24.47)			434	(31.61)
Difenzoquat	-	-	-	-			389	(28.33)
Triallate	248	(18.06)	204	(14.86)			336	(24.47)
Benzoylprop ethyl	71	(5.17)	354	(25.78)			336	(24.47)
Barban	319	(23.23)	53	(3.86)			115	(8.38)
Wild oats ² / _{m²}	100		100			15		20

* Wheat priced at \$4.37 for all years