TOLERANCE OF SEEDLING FORAGE LEGUMES TO HERBICIDES

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Seedling alfalfa, red clover and sweet clover showed tolerance to 1.1 - 2.2 kg ha^{-1} of trifluralin, ethalfluralin, EL 5261 (trifluralin + ethalfluralin at 1:1) and 3.3 - 6.6 kg ha^{-1} of EPTC applied pre-plant incorporated to Melfort silty clay loam in 1983. In a second experiment established in 1984, these treatments caused slight stunting of the legumes in the early stages of growth, but there was no stand thinning and the stunting effect had disappeared by August. All rates of these treatments provided satisfactory control of green foxtail, wild oats and seedling bromegrass. Control of volunteer wheat was satisfactory at the higher rates and that of barley was satisfactory only with the higher rates of ethalfluralin and EPTC. Alfalfa dry matter yield obtained in the following year was not affected by pre-plant incorporated treatments. Red clover yield increased with applications of trifluralin and EL 5261 at 2.2 kg ha^{-1}. Sweet clover yields increased 34 to 104% of the check with applications of ethalfluralin at 2 kg ha^{-1}, EL 5261 at 2.2 kg ha^{-1}, trifluralin + triallate at 0.84 + 1.4 kg ha^{-1} and EPTC at 6.6 kg ha^{-1}. Post-emergence applications of sethoxydim up to 0.8 kg ha^{-1} were safe on all the three seedling legumes. Propanil, tank-mixed application of sethoxydim + 2,4-DB and split application of sethoxydim + bentazon injured the legumes in the establishment year, however, recovery was complete in the following year and alfalfa yields were increased by 32% with applications of sethoxydim + 2,4-DB and sethoxydim + bentazon. Complete control of annual broadleaf and grass weeds were achieved with propanil at 2 kg ha^{-1} and sethoxydim + bentazon at 0.35 + 1.08 kg ha^{-1}.

INTRODUCTION

Weed control is essential for successful establishment of forage legumes. Seedling legumes are not vigorous in the early stages of growth and offer little competition to aggressive weeds. EPTC has been used for alfalfa seedling establishment for more than 25 years in the U.S. (Dawson 1983). The dinitroaniline herbicides have also been used for this purpose (Fawcett and Harvey 1978). In Canada, there are very few herbicides registered for broadleaf weed control in seedling alfalfa and even fewer for use in other seedling legumes. EPTC, asulam, MCPB + MCPA and 2,4-DB are the only

RESULTS AND DISCUSSION

In 1983, all pre-plant incorporated herbicide treatments showed excellent selectivity on alfalfa (Table 1). Red clover was slightly stunted by the Higher rates of trifluralin, ethalfluralin, EL 5261 and both rates of EPTC. Sweet clover was slightly stunted by the higher rate of EL 5261 and both rates of EPTC. However, the crops recovered later in the season. Bentazon, 2,4-DB and both rates of propanil caused moderate injury to alfalfa and red clover and severe injury to sweet clover. However the crops recovered successfully the following year. Injury to seedling alfalfa, adverse effects on yield of first cutting and increased yields compared to check at second cutting, have been reported for dinitroaniline herbicides (Fawcett and Harvey 1978) and for 2,4-DB tested in combination with EPTC or sethoxydim (Wilson 1986).

All treatments provided satisfactory control of annual grasses, however, control of broadleaf weeds, mainly stinkweed, was very poor except for 2,4-DB, bentazon and propanil treatments. Treatments which resulted in significantly increased yields of sweet clover compared to check included trifluralin at 2.2, EL 5621 at 2.2, trifluralin + triallate at 0.84 + 1.4, sethoxydim + bentazon at 0.35 + 1.08, and EPTC at 6.6 kg ha^{-1} (Table 2). Alfalfa yields increased with applications of sethoxydim + 2,4-DB and sethoxydim + bentazon. Red clover yields increased with applications of sethoxydim + 2,4-DB, sethoxydim + bentazon, EL 5261 at 2.2 kg ha^{-1}, and propanil at both rates. The lowest sweet clover yield was obtained from plots that had been treated with sethoxydim at 0.35 kg ha^{-1}. This was associated with 44 g m^{-2} of broadleaf weeds which was significantly higher than the amount of weeds hand-separated from check plots. Sweet clover plots which contained 2 g m^{-2} or less weeds included trifluralin at 2.0, trifluralin + triallate at 0.84 + 1.4, sethoxydim + bentazon at 0.35 + 1.08 and propanil at 2.0 kg ha^{-1}. Red

clover plots treated with ethalfluralin at 2.2 kg ha^{-1} the previous year contained the highest amount of weeds, whereas plots treated with propanil at 2.0 and EL 5261 at 1.1 kg ha^{-1} were virtually free of weeds. Some volunteer sweet clover was found in alfalfa plots and its yield ranged from nil in sethoxydim + 2,4-DB-treated plots to 100 g m^{-2} in sethoxydim-treated plots.

Table 1. Crop tolerance and visual weed control ratings for Experiment 1 recorded on July 27, 1983*

Treatments	Rate kg ha^{-1}	Crop tolerance			Broadleaf weed control
		Alfalfa	Red clover	Sweet clover	
Check	-	9	9	8	0
Trifluralin	1.1	9	8	8	0
Trifluralin	2.2	8	7	8	2
Ethalfluralin	1.1	9	8	8	1
Ethalfluralin	2.2	9	7	8	2
EL 5261	1.1	9	8	8	1
EL 5261	2.2	9	7	7	1
Trifluralin + Triallate	0.84 + 1.4	9	8	8	0
EPTC	3.3	9	7	6	1
EPTC	6.7	9	7	6	2
Sethoxydim + Assist	0.35 + 0.5%	9	9	8	1
Sethoxydim + Assist	0.80 + 0.5%	9	8	8	0
Sethoxydim + Assist + 2,4-DB**	0.35 + 0.5% + 1.0	7	5	1	7
Sethoxydim + Assist + Bentazon+	0.35 + 0.5% + 1.08	6	5	3	7
Propanil	1.0	7	4	3	8
Propanil	2.0	6	3	1	8
LSD ($P < 0.05$)		1	1	1	2

*Crop tolerance rating scale, 0-9; 9 = no effect, 0 = dead. Weed control rating scale, 0-9; 0 = no control, 9 = complete control.

**Tank-mixed

+Split-applied

Table 2. Dry matter yields of forage legumes and the weeds hand-separated from each crop in Experiment 1

Treatments	Rate kg ha-1	Dry Matter (g m-2), 19 July 1984					
		Sweet clover	Weeds	Red clover	Weeds	Alfalfa	Weeds
Check	-	384	16	748	11	520	116
Trifluralin	1.1	435	2	813	6	501	51
Trifluralin	2.2	490	10	852	13	514	82
Ethalfluralin	1.1	461	40	808	16	474	77
Ethalfluralin	2.2	476	29	813	44	510	61
EL 5261	1.1	456	39	820	0	509	81
EL 5261	2.2	513	32	847	21	552	24
Triallate + Trifluralin	1.4 - .84	524	1	811	10	551	43
EPTC	3.3	475	24	750	24	528	58
EPTC	6.6	546	6	776	2	564	46
Sethoxydim + Assist	.35 + .5%	356	44	762	12	511	62
Sethoxydim + Assist	.80 + .5%	451	8	696	15	474	34
Sethoxydim + Assist + 2,4-DB**	.35 + .5% 1.0	476	16	858	2	681	20
Sethoxydim + Assist + Bentazon+	.35 + .5% 1.08	528	2	848	15	689	7
Propanil	1.0	490	18	856	10	599	89
Propanil	2.0	460	2	860	0	547	89
LSD (P < 0.05)		98	30	95	28	130	72

**Tank-mixed
+Split-applied

In 1984, seedling alfalfa and the clovers seemed slightly stunted in the early stages of growth in all plots treated with pre-plant incorporated herbicides, but there was no stand thinning with any of the herbicide treatments, and the stunting effect had disappeared by August (Table 3). Complete control of wild oats and green foxtail was obtained with both rates of trifluralin, ethalfluralin, EPTC and the higher rates of EL 5261. Control of seedling bromegrass was complete with the higher rates of trifluralin, ethalfluralin, EL 5261 and both rates of EPTC. Control of volunteer wheat was satisfactory with the higher rates of all treatments, and that of barley was satisfactory only with the higher rates of ethalfluralin and EPTC. Since the

herbicides tested in 1984 did not have any residual activity against the broadleaf weeds, mainly stinkweed, that invaded the plots int the summer of 1985, the alfalfa and weed yields obtained were not different for the various treatments (Table 4). Sweet clover yields were increased 18 to 204% of check by the various herbicide treatments. The higher yields associated with the higher rates of ethalfluralin and EL 5261 were related to better weed control in the establishment year. Doubling the rate of trifluralin and EPTC did not result in increased yields of sweet clover. Sweet clover yields from trifluralin and EPTC treatments were comparable. The lowest weed yield of 51 g m^{-2} which was 50% of the amount obtained for the check was associated with EL 5261 at 2.2 kg ha^{-1}. Red clover was not harvested in 1985 because of stand reduction due to winter-kill and subsequent invasion of plots by stinkweed.

Table 3. Crop tolerance and visual weed control ratings for Experiment 2 recorded on 13 August 1984

Treatments	Rate kg ha^{-1}	Crop Tolerance*			Weed Control+				
		A	RC	SC	WO	GF	B	W	BR
Check	-	8	8	8	0	0	0	0	1
Trifluralin	1.1	8	8	8	9	9	1	4	8
Trifluralin	2.2	8	8	8	9	9	4	8	9
Ethalfluralin	1.0	8	8	9	9	9	5	6	7
Ethalfluralin	2.0	8	8	9	7	9	9	8	9
EL 5261	1.0	8	8	8	7	7	2	3	7
EL 5261	2.0	8	8	8	9	9	6	8	9
EPTC	3.4	8	8	8	9	9	2	7	9
EPTC	6.8	9	8	8	9	9	8	9	9
LSD (P < 0.01)		NS	NS	1	3	2	3	2	3

*Scale, 0-9; 9 = no effect, 0 = dead.
+Scale, 0-9; 0 = no control, 9 = complete control.
A = alfalfa; RC = red clover; SC = sweet clover; WO = wild oats; GF = green foxtail; B = barley; W = wheat; BR = bromegrass.

Table 4. Dry matter yields of forage legumes and the broadleaf weeds hand-separated from each crop in Experiment 2

Herbicide	Rate kg ha^{-1}	Dry Matter Yield (g m^{-2}) 16 July 1985			
		Alfalfa	Weeds	Sweet clover	Weeds
Check	-	338	46	174	101
Trifluralin	1.1	356	39	205	66
Trifluralin	2.2	339	38	206	84
Ethalfluralin	1.0	323	26	248	56
Ethalfluralin	2.0	379	49	356	71
EL 5261	1.0	393	25	213	54
EL 5261	2.0	303	29	247	51
EPTC	3.4	312	31	210	74
EPTC	6.8	347	29	209	106
LSD ($P < 0.05$)		NS	NS	84	NS

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