SEEDING FORAGE CROPS INTO CHEMICAL SUMMERFALLOW

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In the arid and semiarid areas of the Prairie Provinces, the practice of summerfallowing to preserve moisture for a succeeding crop is well established. During the summerfallow year it is of paramount importance to control weed growth and so reduce moisture loss. Heretofore, weed control has been accomplished by cultivation with the attendent risks of soil erosion following soil disturbance (Molberg et al. 1967). Consequently, interest has been growing concerning the use of herbicides as a substitute for weed control by cultivation (Wiese et al. 1967).

Very few workers have examined the use of herbicides on fallow in the year prior to seeding perennial forage crops. The majority of the studies of chemical summerfallow have concentrated upon the wheat-fallow rotation. Initial studies concentrated upon the use of 2,4-D applied in the fall to control winter annuals in grain stubble (Anderson 1971). This practice was found to reduce the number of tillage passes required in the ensuing summerfallow year. More recently the more persistent triazine compounds such as atrazine have attracted attention because of their potential for longer lasting weed control. Unfortunately, residual levels of atrazine, whilst providing good weed control, have contributed to reduced grain yields in the ensuing year (Molberg and Hay 1968). In contrast, atrazine has been shown in one instance not to affect grass stands (Eckert and Evans 1967).

Tillage in the seeding year has been used as a method of weed control as well as providing a seed bed. Recent work by Anderson (1971) has shown that such preseeding tillage was not necessary for spring wheat although Eckert et al. (1972) in the U.S.A. have used preseed tillage to remove soil contaminated by residual herbicides from the seeding environment. Since so little work has been done on this subject, an investigation was initiated. The objectives of the present study were to compare the effectiveness of four different chemical herbicides and the subsequent tolerance of forage crops, established with and without preseed tillage, to the herbicide residues.

Procedure

Two 30 metre strips of wheat stubble were sprayed with six herbicide treatments as follows: (1) 1.1 kg/ha of atrazine in October with no subsequent tillage; (2) 0.84 kg/ha of atrazine in October with no subsequent tillage; (3) 2.2 kg/ha of glyphosate [N-(phosphonomethyl) glycine] in June of the fallow year; (4) 0.42 kg/ha of 2,4-D in October with tillage as required in the following fallow year; (5) 1.1 kg/ha of EL103 (unregistered Elanco herbicide) in October with tillage as required in the following fallow year; and (6) 1.1 kg/ha of EL103 in October and

no subsequent tillage. A seventh untreated check plot was included. The treatments were arranged in a four replicate, randomized complete block design.

In the spring following the fallow year one half of the plot area was subjected to normal preseeding tillage with the other half being left uncultivated. Cross seeded into each half of the plots were four rows of alfalfa (*Medicago media* Pers. cv Drylander), Russian wild ryegrass (*Elymus junceus* Fisch. cv Mayak), and Altai wild ryegrass (*Elymus angustus* Trin. cv Prairieland). The rate of seeding was equivalent to 75 seeds/ metre length of row.

Plant counts were made on the centre two rows of each plot in August of the seeding year and dry matter yields were determined in June of the second year. The data from each crop were analyzed separately as a split plot with herbicides as the main plots and preseed cultivation treatments as the subplots. Duncans Multiple Range test was applied to mean values of the four replicates.

Within herbicide treatments, the experimental herbicide EL103 was completely toxic to the establishment of any vegetation including annual weeds. The effect of this herbicide has continued to persist into the third year. Because of this long term residual toxicity, Elanco has withdrawn this formulation from licensing considerations.

The four other herbicide treatments had no significant establishment differences (Table 1) and the number of plants per metre length of row were no different from the check value. There are indications, however, that the higher rate of atrazine, particularly where Altai wild ryegrass had been seeded, could result in a drier year in residues that have a deleterious effect upon forage establishment, a similar result to that found in wheat (Molberg and Hay 1968).

Table 1. Mean number of plants established per m length of row

Treatment	Alfalfa		RWR		AWR	
	Preseed cult.	No preseed cult.	Preseed cult.	No preseed cult.	Preseed cult.	No preseed cult.
1.1 kg atrazine	3.0 ab†	3.0 ab	12.3 a	14.0 a	6.3 bc	4.9 a
0.84 kg atrazine	4.1 a	4.4 a	19.2 a	15.6 a	13.7 ab	8.2 a
2.2 kg glyphosate	4.1 a	3.8 a	19.2 a	15.6 a	16.2 a	20.0 a
1.1 kg 2,4-D	5.5 a	5.5 a	14.5 a	13.7 a	11.2 ab	7.1 a
1.1 kg EL103	0.0 b	0.0 b	0.0 b	0.0 b	0.0 c	0.0 a
1.1 kg EL103	0.0 b	0.0 b	0.0 b	0.0 b	0.0 c	0.0 a
Check	2.7 ab	4.9 a	16.2 a	8.4 ab	11.0 ab	4.6 a

†Values in the same column followed by the same letter are not significantly different at the 5% level of probability.

Preseed cultivation, in general, resulted in better establishment of the two grasses but had no effect upon alfalfa. The effectiveness of

preseed cultivation on seedling establishment was due to a change in the weed species and a reduction in weed competition during the establishment year. Weeds, particularly polygonums and other prostrate types, had developed into a virtual mat on the no-tillage half of each plot by the fall of the establishment year when plant counts were taken. In contrast, the preseed cultivated half harboured fewer weeds consisting primarily of upright forms such as Russian thistle and pigweeds.

In the succeeding year, when yields were determined, there was a marked yield increase in favour of the plots that had had preseeding tillage the previous year (Table 2). This almost fourfold difference in yields could not be explained in terms of stand differences but was probably due to a reduction in vigour as a result of weed competition the previous year. Such results favouring preseed cultivation are in contrast to the results of Anderson (1975) who reported that for wheat, preseed tillage gave no yield advantage.

Table 2. Mean yields (kg DM/ha) in the season following establishment

Treatment	Alfalfa		RWR		AWR	
	Preseed cult.	No preseed cult.	Preseed cult.	No preseed cult.	Preseed cult.	No preseed cult.
1.1 kg atrazine	1131 a†	140 ab	2058 a	486 a	1183 a	
0.84 kg atrazine	832 ab	171 ab	2023 a	342 ab	919 ab	No
2.2 kg glyphosate	597 abc	110 ab	1289 ab	315 ab	836 ab	
1.1 kg 2,4-D	971 a	244 a	1613 a	379 ab	986 ab	yields
1.1 kg EL103	0.0 d	0.0 b	0.0 c	0.0 c	0.0 c	
1.1 kg EL103	0.0 d	0.0 b	0.0 c	0.0 c	0.0 c	taken
Check	383 bc	25 b	579 bc	131 bc	593 b	

†Values in the same column followed by the same letter are not significantly different at the 5% level of probability.

Among the herbicide treatments, yield differences were not significant. However, comparison with the check yields show that except for the EL103 treatment, where the weeds had been controlled in the summerfallow year, higher yields resulted. The trend towards poorer establishment with the residual herbicide atrazine is reversed when yields are considered. The higher atrazine rate of 1.1 kg/ha, because of its residual phytotoxicity which tended to reduce the stand, depressed annual weed growth sufficiently to allow better plant development of the surviving forage plants. In addition, in the semiarid climate of the prairies it has been shown by Kilcher (1972) that a reduced grass stand yields better as there is less interplant competition for water. In contrast the use of the nonresidual glyphosate tended to give the lowest yields of the herbicide treatments.

The principal conclusions to be drawn from this study are that preseed cultivation is of great importance to the establishment and yield of forage crops. The control of weeds during the summerfallow year has little effect upon the establishment of forage plants but there is an effect upon the vigour of the plants which is reflected in the yield in

subsequent years. The use of herbicides for weed control in a completely chemical summerfallow has merit, although EL103 at the rates used was completely unsuitable. It also appears that the use of a chemical herbicide that has a residual effect extending into the seeding year will result in higher yields in the subsequent year when the forage would be utilized.

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