RESIDUAL EFFECT OF VARIOUS HERBICIDES ON JAPANESE MILLET

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Abstract

Eight trials were conducted over three seasons to determine the control of Japanese millet (*Echinochloa frumentacea* (Roxb.) WF Wright) by residues of acetochlor (2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide), alachlor (2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)acetamide), metazachlor (2-chloro-N-(2,6-dimethylphenyl)-N-(1H-pyrazol-1-ylmethyl) acetamide, and metolachlor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide). These herbicides were sprayed and Japanese millet planted afterwards at regular intervals. The percentage control was assessed visually. Metolachlor provided the longest duration of control. Alachlor and acetochlor provided the shortest duration of control. Metazachlor provided somewhat longer control than the short duration group, but considerably less than metolachlor.

Introduction

Weeds compete with sugarcane for nutrients, water, space and light and this could result in substantial yield losses. The farmer is not only interested in the initial control of the herbicide, but also in the duration of control. The ideal situation would be to keep the crop free of weeds at least until it has reached the canopy stage. A herbicide with a long residual effect is therefore advantageous.

Herbicide persistence in the soil is an important factor determining duration of weed control (Cornelius[2]). Herbicides with the greatest persistence are capable of affecting germinating weeds over an extended period. Laboratory and greenhouse trials have shown that metolachlor is more persistent than alachlor (Gerber *et al.*[4]). This was confirmed in field trials (Dixon *et al.*,[3] Jooste and Van Biljon,[5]). A number of new grasskiller type herbicides have appeared on the South African market recently. The purpose of this study was to compare the most important grasskiller herbicides with respect to their residual effects on Japanese millet.

Materials and Methods

Eight trials were conducted at different locations on the highveld over three seasons, to determine the residual effects of various grasskiller herbicides. The herbicides used with their half-lives are given in Table 1.

Table 1
The half-lives of the herbicides

Herbicide	Half-life (days)
metolachlor	26[1]/23,9[2]
alachlor	9[1]/7,4[2]
metazachlor	13,2[1]

[1] Gerber *et al.*[4]
[2] Source: Anon,[1] and Le Baron *et al.*[6]

These trials were conducted under a wide variety of soil and climatic conditions. A randomised complete block design with four replications was used. The trials were laid out in such a way that each plot could be compared with an adjacent control strip. A plot size of 20 m^2 was used. Herbicides were applied pre-emergence by means of specially designed small plot sprayers with a 4 m boom fitted with six 9502 or 9504 flat fan spray nozzles, delivering a spray mixture of 200 to 400 l/ha at a pressure of 200 kPa. The herbicides were applied at rates applicable to the particular soil type. The application rates of metolachlor and acetochlor were 1,5 kg ai/ha, alachlor 1,92 kg ai/ha, and metazachlor 0,56 kg ai/ha. In all the trials the application of the herbicides was followed by 15 mm irrigation. Two rows of Japanese millet were planted as the indicator plant. In each season the plantings were made at the following intervals: 1985/86 season, three, five and six weeks after application; 1986/87 and 1987/88 seasons, at the time of application and two, four, six and eight weeks later. In order to calculate the mean control over all seasons, the mean of the first planting of the 1985/86 season (three weeks after application) was added to the mean of the second planting (two weeks after application) of the 1986/87 and 1987/88 seasons. The mean of the second planting (five weeks after application) was added to the mean of the third planting (four weeks after application) of the 1986/87 and 1987/88 seasons. Each planting was followed by 15 mm irrigation. The percentage control was assessed visually by comparing the treated plots with the untreated control strips, two, four, six and ten weeks after planting.

A separate analysis of variance was carried out for each year. Localities, replicates within localities and herbicides were the main effects. In addition, all the trials were combined and an overall analysis of variance carried out. Year/locality combinations, replicates within these combinations and herbicides were the main effects. For the abovementioned, each planting was analysed separately. The Tukey test (P=0,05) was used to compare treatment means (Steel and Torrie[7]). Coefficients of variation were calculated over localities for herbicides individually when locality x herbicide interactions were significant.

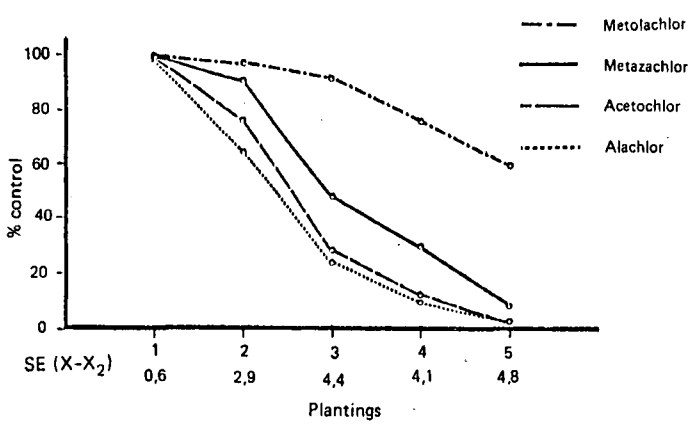

FIGURE 1 *Echinochloa frumentacea* control over three seasons.

Results

The mean percentage Japanese millet control obtained in all the trials and over all the seasons was calculated, and is shown in Figure 1.

The initial control was equally good in all treatments. At the time of the second planting, metolachlor (97%) was with the exception of metazachlor (91%), significantly superior when compared with the other treatments. In planting 3 (28 days after application) metolachlor (92%) proved to be the only herbicide which gave control in excess of 90%, and was significantly superior when compared with all other treatments. With planting 4 (42 days after application) and planting 5 (56 days after application) all the herbicides gave control of less than 90%. The control obtained with metolachlor was, however, still significantly superior when compared with the other treatments.

At plantings 2, 3, 4 and 5 a significant interaction between locality-year combinations and herbicides was observed. The interaction means for planting 2 are given in Table 2. Coefficients of variation were calculated for each treatment over the different locations. These indicate the variability and thus reliability of a specific treatment. Except for planting 5, the CVs for metolachlor were the lowest in comparison with the other treatments at all plantings.

Table 2
Interaction means for planting 2, all years considered

Localities	Herbicides			
	acetochlor	alachlor	metazachlor	metolachlor
	% Control			
1	45,50	37,5	87,25	97,75
2	96,25	95,25	97,0	99,5
3	80,0	50,0	96,25	98 ,75
4	84,25	70,25	96,75	98,50
5	71,75	52,5	89,0	98,75
6	92,25	87,75	93,0	100,0
7	84,25	77,5	90,75	98,75
8	55,0	43,25	75,0	84,75
Mean	76,16	64,25	90,63	97,09
CV %	23,35	33,39	8,0	5,18

Discussion

These results illustrate the excellent residual control of Japanese millet by metolachlor when compared with the other treatments. Matazachlor proved to be the most effective chloroacetanilide after metolachlor. The results obtained seem to agree reasonably well with the half-lives of the herbicides as indicated in Table 1.

The low CVs of interaction means (Table 2) and the fact that metolachlor was significantly superior in plantings 3-5 (Figure 1) clearly illustrated that, irrespective of location and conditions, metolachlor is the most reliable herbicide of those tested with regard to duration of the effect on Japanese millet.

Although the soil half-life is dependant on soil type and environmental conditions, no build-up following repeated annual applications of metolachlor is expected. All biological evidence indicates that when applied at recommended rates, metolachlor does not persist from one season to the next in sufficient quantity to injure sensitive crops (Anon[1]). The rate of dissipation of metolachlor is sufficiently rapid under almost all normal field conditions to avoid any phytotoxicity or carry-over to rotational crops the next season (Le Baron *et al.*[6]).

Conclusions

Under a wide variety of soil and climatic conditions, metolachlor provided longer residual activity compared with acetochlor, alachlor and metazachlor.

Acknowledgements

The authors are grateful to Mrs SM Hugo of the Biometric and Datametric Services for assistance with the statistical analysis. Thanks are due also to Messrs H Wiese, F Roos, J Swanepoel and J Beyers, Ciba-Geigy Research and Development, for conducting these trials in the field.

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