WEED CONTROL IN MAIZE

G. L. B. CUMBERLAND, L. J. MATTHEWS and E. N. HONORE
*Research Division, Department of Agriculture, Auckland and
Hamilton*

Summary

This paper reviews previous work on weed control in maize. In more detail, current trials are discussed, and five conclusions are drawn:

- (1) Control of weeds in maize increases grain yields. Chemical control is generally superior to hand-weeding or traditional mechanical methods.
- (2) Weed control not only increases the grain yield but also the number of plants surviving to harvest and the average number of cobs produced by each plant.
- (3) Atrazine alone, for broadleaf weeds, and in combination with other chemicals for the more difficult grass types, gives the most reliable control of weeds. The addition of oil to atrazine reduces the amount of the chemical needed.
- (4) Mixtures of atrazine and propachlor or methachlor are satisfactory with moderate rainfall. Atrazine combined with soil-incorporated butylate is superior during dry seasons.
- (5) Chemicals including cypromid, linuron, "DW 3418" and S6115 have also proved successful in controlling weeds in maize.

The importance of rainfall and the correct timing of chemical applications are discussed briefly. Recommendations for weed control in maize are made.

INTRODUCTION

PLANT POPULATION TRIALS on maize grown for grain or silage indicate that higher plant numbers and closer rows produce greater yields (Cumberland *et al.*, 1970). Mechanical damage caused by traction and cultivation equipment is thought to be responsible for some loss of production in maize crops. Consequently, chemical control of weeds in maize has become the rule rather than the exception.

In maize crops common weeds are broadleaf species redroot (*Amaranthus hybridus*), willow weed (*Polygonum persicaria*), black nightshade (*Solanum nigrum* complex), and fathen (*Chenopodium album* agg), and grass weeds, particularly barnyard grass (*Echinochloa crus-galli*), summer grass (*Digitaria* spp.) and witchgrass (*Panicum* spp.). Normally grasses are not troublesome until the second and subsequent maize crops after pasture.

TABLE 1: MAIZE WEED CONTROL — TRIAL FA 52/1

Treatment (lb)	Weed Control* Jan. 1969	Grain Yield at Harvest May 1969 (bu./acre)	Plant Populations at Harvest (No./acre)	Av. No. of Cobs per Plant
Untreated control	...	47 dD	15900 bB	0.80 dC
Inter-row cultivation	...	96 cB	18900 aA	0.97 bBC
amine 2,4-D 1	...	116 bAB	19200 aA	1.05 bAB
atrazine 2/2 gal oil	...	136 aA	19000 aA	1.23 aA
Hand-weeded control	...	126 abA	19300 aA	1.08 bAB
CV	...	13.9%	9.3%	9.9%

*1 to 10 scale. 1 = poor control, 10 = excellent control.

In 1955, McKee reported that harrowing and inter-row cultivation was the method of weed control in the maize crops of the Gisborne district. He commented that more progressive growers had started using between 0.5 and 1 lb of 2,4-D (all rates in lb a.i. per acre) as a directed band application.

The use of triazines for weed control in maize was first reported about ten years ago. Patterson (1960, 1961) showed that atrazine gave better control of broadleaf weeds than simazine. At rates up to 1.5 lb, atrazine did not control grass weeds. Heavy rates of atrazine (4 lb) had some effect on grass weeds if applied at weed emergence. The addition of non-phytotoxic oil to atrazine reduced the rates required for broadleaf weed control, and in some instances rendered the chemical more effective against grass weeds. Atrazine proved better as a pre-emergence application on soils with a high clay and low organic matter content (Gregory and Weiss, 1963).

Sumich (1963, 1966) has reported good kills of barnyard grass in maize with post-emergence applications of either 2 lb linuron plus 0.5% surfactant or 3 lb linuron alone. Other chemicals were not tried and grain yields were not measured.

RECENT TRIALS

Recent trials have been specifically designed to test further the importance of weed control and its effect on grain yield. New chemicals have also been tested. In all cases the trials are of the randomized block design; at least five replications are used. Most of the plots consist of four rows of maize, the outside rows being necessary for guard rows.

TRIAL MANAGEMENT

Trials are normally laid down in commercial maize crops. Farmers' hybrids and basic cultivation and fertilizer practices are employed. Weed control treatments are applied by hand with Oxford Precision equipment at 30 lb/sq. in. in 40 gal of water.

Yields which are taken from the centre rows of each plot are expressed in the subsequent tables as bushels of grain per acre corrected to 15% moisture. At the time of harvest plant counts, weed observations and lodging measurements are taken. Grain samples for moisture determinations are collected.

RESULTS AND DISCUSSION

As plant numbers and row spacings are adjusted in maize crops to maximize grain and silage yields, chemical control of weeds becomes the only practical method.

Trials confirm the contention that mechanized weed control in maize reduces production. Some chemical treatments are better than hand-weeding, and inter-row cultivation. Table 1 shows the results from a trial conducted in the 1968-9 season which illustrates these two points. This trial was sited on volcanic soil, and the paddock had been cropped for a number of years. Broadleaf weeds were more prevalent than grass weeds. Rainfall during the growing season was adequate. Excellent weed control was achieved with hand-weeding and atrazine treatments.

TABLE 2: MAIZE WEED CONTROL — TRIAL FA 52/2

<i>Treatment (lb)</i>	<i>Weed Control* May 1969</i>	<i>Grain Yield at Harvest May 1969 (bu/acre)</i>
Untreated control	2 cB	48 dD
Hand-weeded control	7 abAB	115 abABC
Inter-row cultivation	4 bcAB	92 bcBC
amine 2,4-D 1	7 abAB	121 aAB
atrazine 2/propachlor 3	10 aA	128 aAB
atrazine 2/2 gal oil	9 abA	132 aA
propachlor 4	5 bcAB	83 cC
linuron 2	7 abAB	123 aAB
dichlobenil 3	6 abcAB	105 abcABC
cypromid 3	9 aA	124 aAB
CV	43.1%	18.0%

*1 to 10 scale. 1 = poor control, 10 = excellent control.

This trial indicates that good weed control increases grain yield, the plants surviving to harvest, and the average number of cobs produced by each plant. A number of other recent trials have confirmed these measurements and indicated that the vigour and the height of the maize crops are also increased with good weed control. Grain moisture levels at harvest were not affected by weed infestations. This trial also shows that atrazine gave good weed control and high grain yield.

The trial shown in Table 2 was conducted in the 1968-9 season on Manawatu silt loam. The paddock had had one previous maize crop after good pasture. Broadleaf weeds were prevalent and rainfall during the season was adequate. The trial is typical of a number that demonstrated how atrazine treatments give good weed control and high grain yields.

Linuron, 2,4-D and cypromid give similar weed control and grain yields.

Atrazine is less effective on soils with a high organic matter content especially if incorporated into the soil or if applied as a pre-emergence treatment. Trials have shown that the chemical is quite satisfactory on soils with organic matter as high as 20% as a post-emergence application. It is also less effective in dry seasons.

Other chemicals which are more specific for grass weeds have been used successfully in combination with atrazine. The addition of 3 lb of propachlor or 3 lb of methachlor to atrazine applied at weed emergence has produced good results on broadleaf and grass weeds. More recently a soil-incorporated chemical — butylate — applied at 3 lb before sowing the crop and followed by atrazine at weed emergence, has produced worthwhile results. During the recent dry season, grass control with atrazine, methachlor and propachlor has been poor. With atrazine and butylate, the control has been very much better. The results of a trial demonstrating these points are shown in Table 3. This trial was conducted during the dry 1969-70 season on Ardmore peaty silt which has a high organic matter content of about 40%. There was no untreated control in this experiment and weeds present were predominantly grass, with some broadleaf species.

TABLE 3: MAIZE WEED CONTROL — TRIAL FA 52/5/69

Treatment (lb)	Weed Control* Apr. 70	Grain Yield at Harvest Apr. 1970 (bu/acre)	Ground Cover Percentage		
			Flat Weeds	Grass Weeds	Bare Ground
atrazine 1	3 cdCD	97 dB	6	90	4
atrazine 2/2 gal oil	5 bcABC	117 bcdAB	5	80	15
atrazine 1/propachlor 3	4 cBCD	104 cdB	24	54	22
atrazine 1/butylate 3	4 bcABCD	153 aA	5	85	10
"DW 3418" 6	7 abAB	131 abcAB	20	30	50
cypromid 3	8 aA	137 abAB	11	39	50
linuron 2	4 cdBCD	106 cdB	30	55	15
butylate 3	1 dD	103 cdB	92	4	4
butylate 3 followed by atrazine 1	5 bcABCD	128 abcAB	8	75	17
CV	42.3%	17.0%			

*1 to 10 scale. 1 = poor control, 10 = excellent control.

RECOMMENDATIONS

On the basis of experimental results, the following recommendations for weed control in maize are made (all chemicals should be applied in 30 to 40 gal carrier).

- (1) Where broadleaf weeds are troublesome, atrazine 1 lb plus 1 to 2 gal of non-phytotoxic oil should be applied at first weed emergence.
- (2) Where grass weeds are expected, atrazine 2 lb mixed with either 3 lb propachlor or methachlor 2 lb can be applied at weed emergence. Butylate 3 lb in drier areas can be soil-incorporated before sowing followed by 2 lb of atrazine at weed emergence.
- (3) Where climatic and other factors prevent spraying at the time of weed emergence, a directed band application of linuron 2 lb or cypromid 3 lb (shielded from the maize) may be used.

ACKNOWLEDGEMENTS

The recent trials would not have been possible without the assistance of technical staff B Burney, R. W. Lillywhite and C. A. Farrell, of the Field Research Section. The statistical analyses have been done by C. Dyson of the Biometrics Section. The contribution of these people is gratefully acknowledged.

REFERENCES

- Cumberland, G. L. B.; McCormick, S. J.; Douglas, J. A., 1970: *Proc. Ruakura Fmrs Conf.* (in press).
- Gregory, P.; Weiss, P. W., 1963: *Proc. 16th N.Z. Weed Control Conf.*: 81.
- McKee, J. G., 1955: *Proc. 8th N.Z. Weed Control Conf.*: 69.
- Patterson, T. M., 1960: *Proc. 13th N.Z. Weed Control Conf.*: 76.
- , 1961: *Proc. 14th N.Z. Weed Control Conf.*: 166.
- Sumich, F. N., 1963: *Proc. 16th N.Z. Weed Control Conf.*: 42.
- , 1966: *Proc. 19th N.Z. Weed & Pest Control Conf.*: 170.