A QUANTITATIVE STUDY ON THE LENGTH OF TIME OF FALLOW REQUIRED FOR SEED-BED PREPARATION FOR MAIZE IN THE WAIKATO

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SUMMARY

An evaluation of the length of time of fallow required for a maize crop grown on land in the Waikato that was previously involved in either pasture or a cropping regime was undertaken. The trials assessed the effect that paraquat had on length of fallow, on subsequent ploughing or rotary hoeing and the plants need for nitrogen after a succession of three crops.

Results from these trials indicate that for land which was cultivated from a permanent pasture a minimum period of four weeks fallow prior to planting was required. If a farmer was not able to fallow his land for a month prior to planting then the use of paraquat as an aid to cultivation has a compensatory effect on both plant numbers and on grain yield.

The minimum length of fallow required for land which was already involved in a cropping regime was two weeks. A reduction in the length of fallow fron two weeks without use of a chemical aid to cultivation resulted in a significant decline in plant numbers, height and grain yield. The use of paraquat followed by subsequent ploughing in conjunction with a fourteen day fallow resulted in a highly significant increase in grain yield.

INTRODUCTION

The length of fallow required to provide adequate breakdown of a previous crop is an important consideration for the farmer who is contemplating the sowing of spring maize. A fallow period of one month prior to sowing is considered adequate for the cultivation of pasture land in the Waikato. The shortening of the fallow period from a month to one week can cause a significant decline in grain yield in the established crop. (Palmer, Mackay and O'Connor 1972).

The introduction of a system which encompassed a reduction in the standard fallow period and permitted an adequate breakdown of the previous green crop without severly affecting crop yield would have the following farm management benefits:

First, the farmer may obtain two or three weeks extra grazing from the land which would have beeen cultivated.

Secondly, such a technique would be less prone to the disadvantages of wet weather which may delay an early start to cultivation. Often a farmer has to reduce the fallow period from a month to one week or less in an endeavour to meet requirements of a contract sowing date.

Thirdly, it appears that there are few farmers who are sufficiently adept in the techniques of cultivation who can completely bury all the green residue of the previous crop. In the Waikato it is not uncommon to see between 40 and 60% of the previous crop left on the surface after cultivation. Subsequent regrowth of such material may compete with the germinating maize, thus involving the need for higher rates of agricultural herbicides.

Fourthly, complete breakdown of the previous green crop is desirable to reduce the risk of pest damage in the ensuing crop. Agentine stem weevil is on pest which will remain viable in the unburied green trash. This pest is capable of causing severe damage to young maize crops in the Waikato/South Auckland district. Thus it may be argued that an aid to cultivation which allows reduction in the standard fallow period without a corresponding decline in yield, and permits adequate breakdown of the previous crop, would be of real value to the farmer contemplating the sowing of spring maize.

Blackmore (1967) has demonstrated cereal yield increases following the use of paraquat as a desiccant prior to cultivation. Palmer et al., (1972) supported the view that satisfactory yields may be obtained following a reduction in the fallow period from one month to seven days provided a pre-cultivation application of paraquat (2.8 litres in 337 litres of water per hectare) is made.

Such results as are published to date, do not quantify the term "adequate" fallow within a period of one month in relation to the use of a desiccant aid to cultivation. Nor do these results distingush between land which was previously in permanent pasture and that involved in a cropping regime.

METHODS

1970 Trial

The first trial undertaken in September of 1970 studied the length of fallow, the type of cultivation equipment used and the relationship that paraquat had with these factors on land which had been in pasture for a period of 30 years.

The treatments involved were as follows:

1. Ploughed one month prior to sowing
2. Ploughed one month prior to sowing plus paraquat 2.8 L/ha
3. Ploughed one week prior to sowing
4. Ploughed one week prior to sowing plus paraquat 2.8 L/ha
5. Rotary hoed one week prior to sowing plus paraquat 2.8 L/ha

The paraquat was applied as a spray in water at a dilution rate of 337 L/ha 6 days prior to the initiation of cultivation.

All treatments were disced, rolled and harrowed before being precision sown with the maize variety PX610.

The trial was designed as a random block containing four replications; each plot measured 6 x 10 metres.

The plots were subjectively assessed for weed infestation using a 1 to 10 scale where 1 represented complete weed cover and 10 represented bare ground some six weeks after sowing.

Plant population was assessed by counting the total number of plants present in the two centre rows of each plot.

Grain yield was determined by harvesting an area of 10 x 1.5 metres from each plot.

1972 Trial

An experiment to evaluate the effect of nitrogen and length of fallow on a subsequent maize crop was initiated in October 1972. The trial was sited on Ohaupo silt loam on a paddock with a previous cropping history as follows:

Permanent pasture 1951-71
Manurial programme 376 kg/ha 30%K superphosphate
Lime = 2.5 t/ha at five year intervals
1971 February ploughed and sown with Tama ryegrass 28 kg/ha plus white clover 3.4 kg/ha. From March through until October the paddock was grazed by dairy stock.
October 1971 ploughed and sown down with barley (Carlesberg)

188 kg/ha plus 376 kg/ha 30% potassic superphosphate.
February 1972 the barley yield was 5331 kg/ha.
The paddock was then double disced and sown with 28kg/ha of Italian ryegrass plus clover seed 4.5kg/ha. Another 376 kg/ha of 15% potassic superphosphate was applied with seed.
The area was then grazed with dry stock until the trial commenced in October 1972.

The trial design was a plit-plot randomised block containing five treatments with four replications.

The main-plot treatments were as follows: with a plot size of 64m x 9m
Ploughed one month prior to planting (26/9/72)
Plough fourteen days pre-planting 12/10/72
Apply paraquat 4.2 L/ha14 days pre-planting plough 10 days pre-planting.
(Treatment ploughed 16th October 1972)
Plough 7 days pre-planting 19/10/72.
Apply paraquat 4.2 L/ha 7 days pre-planting, plough 3 days pre-planting treatment ploughed 23/10/72.
Nitrogen in the form of Urea was applied by hand at rates of 0, 58 and 116 kgN/ha to the sub-plots at planting.

All of the plots were rolled after ploughing to consilidate the turf. The area received a final discing and levelling on the 25th October 1972. Sowing took place on the 26th October 1972 with an eight-row International precision planter. The maize seed variety PX610 was sown at a rate of 86450 per hectare.

A weed seedling germination assessment was carried out in November using a one-third of a metre suare quadrant placed at 10 random postions in the plot.

The plant population assessment was made by counting the total number of seedlings present in the middle two rows of each plot on the 14th November 1972.

Plan height assessments were made from twenty plants selected at random on the no nitrogen sub plot.

Grain yield was harvested in May 1973 from an area of 25 x 1.5 metres. The cobs from each sub plot were kiln dried, dekernelled and corrected for moisture.

RESULTS

1970 Trial

Data obtained are given in Table 1

TABLE 1: 1970 Trial

Treatment	Weed Infestation	Plant Population Plants/ha Thousands/ha	Grain Yield 000 kg/ha at 14%
Ploughed one month prior to sowing	7.3 ab A	65.9 a A	11.9 a A
Ploughed one month prior to sowing plus paraquat 2.8 L/ha	7.8 a A	65.7 a AB	12.4 a A
Ploughed one month prior to sowing	6.0 b A	52.4 c C	10.2 bc AB
Ploughed one week prior to sowing plus paraquat 2.8 L/ha	8.5 a A	60.5 ab ABC	12.1 a A
Rotary hoed one week prior to sowing	2.8 c B	53.4 bc BC	9.2 c B
Rotary hoed one week prior to sowing plus paraquat 2.8 L/ha	3.3 c B	57.8 abc ABC	11.6 ab A

This trial established that by shortening the length of fallow from one month to one week, there was a significant increase in weed infestation and a decline in plant population and grain yield.

Rotary hoeing was considered to be an inferior form of cultivation in comparison with ploughing and discing.

The use of paraquat enabled a reduction in the fallow period from one month to one week without a corresponding decline in grain yield irrespective of the cultivation method employed.

1972 Trial

Data obtained are given in Table 2

TABLE 2:1972 Trial

Main Plots	Plant Population 000/ha			Plant Height cms			Plant Yield kg/ha at 14%		
four weeks fallow	82.4	a	A	86.4	a	AB	11690	b	BC
Two weeks fallow	80.2	ab	AB	89.1	a	AB	11910	b	B
Two weeks fallow plus paraquat	83.7	a	A	97.9	a	A	12380	a	A
One week fallow	73.5	c	C	76.3	b	B	10560	d	D
One week fallow plus paraquat	77.0	b	BC	92.5	a	AB	11370	c	C
Sub Plots									
No Nitrogen	77.57	a					11460	b	B
Nitrogen 58 kg/ha	77.21	a					11550	ab	AB
Nitrogen 116 kg/ha	78.62	a					11730	a	A
Min. significant difference 5% 1.52									
Main Plot Effects									
No paraquat	76.85	b	B	82.7	b	B	11230	b	B
Paraquat	80.95	a	A	95.2	a	A	11870	a	A
2 weeks fallow	81.95	a	A	93.5	a	A	12140	a	A
1 week fallow	75.25	b	B	84.4	b	A	10970	b	B
Interaction	N S			N S			N S		

No difference between the various treatments was recorded in weed population present.

The use of paraquat increased the plant population and plant height , though the differences were only significant for the one week fallow; yields were significantly increased by the use of paraquat in both the two and one week fallow treatments.

Regardless of whether or not paraquat was used, a reduction in the fallow period from two to one week significantly reduced both the plant population and the plant yield; plant height was reduced only in the absence of paraquat.

No advantage was measured from an extended fallow of one month in comparison with a two week fallow prior to planting.

The addition of paraquat one week prior to planting has not resulted in a grain yield response to compensate for an extra week's fallow.

Addition of nitrogen had no effect on the plant population but whereas there was no response to the lower rate there was an increased yield at the higher rate of application.

TABLE 3:1972 Trial Main Plot x Sub-plot interaction

	Nitrogen kg/ha	Population 000/ha			Yield kg/ha		
4 weeks fallow	0	81.55	ab	A	11610	a	
	58	80.29	b	A	11870	a	
	116	85.32	a	A	11590	a	
2 weeks fallow	0	80.09	a		11390	b	B
	58	79.65	a		12170	a	A
	116	80.93	a		12160	a	A
2 weeks fallow plus paraquat	0	83.30	a		12580	a	A
	58	82.47	a		12060	b	A
	116	85.19	a		12490	a	A
1 week fallow	0	73.19	a		10540	a	
	58	72.63	a		10390	a	
	116	74.58	a		10770	a	
1 week fallow plus paraquat	0	77.24	a		11200	a	
	58	78.19	a		11280	a	
	116	75.65	a		11630	a	
Min. significant Difference 5%		4.07			440		
Significant interactions		None			Paraquat x Nitrogen 5%		
					Length of fallow x Nitrogen 1%		

The plant yield results in Table 3 show a highly significant interaction betweeen the length of fallow and the addition of paraquat and nitrogen. This interaction overrides the paraquat nitrogen effect.

The increase in grain yield due to the addition of paraquat as an aid to cultivation was 1190 kg/ha at the two weeks fallow and 660 kg/ha at the week fallow prior to sowing.

CONCLUSION

These trials have defined the term "adequate fallow" and differentiated between land cultivated either from permanent pasture or from a short rotation crop.

The use of a chemical aid to cultivation can have a real advantage to the ensuing crop as measured in these trials.

The farm management inplications of such a technique are as follows:

(a) increased management flexibility with respect to the commencement of cultivation
(b) improved cultivation practices

Lastly, although these trials looked specifically at maize, it is the authors' belief that such a technique could be applied successfully, irrespectively of the type of crop or time of year that cultivation takes place.

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