Paper 6

MAIZE GROWING PRACTICES

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INTRODUCTION

Most of the New Zealand maize grain crop is grown under contract to a maize grain merchant, who works closely with growers in deciding growing policies. Virtually all chemicals, seed and fertilisers are purchased or charged through merchants.

A survey was conducted among Waikato maize merchants to determine the predominant practices and trends in maize growing. The area surveyed consisted of 40% of the Waikato maize crop, spread from eastern to western areas, including most of the soil types used to produce maize in the region. Practices relate to the 1983/84 season.

The results of the survey are presented and discussed in relation to research information currently available. Recommendations are made for improvements in stubble management, cultivars, soil and herbage testing, and fertiliser recommendations.

STUBBLE MANAGEMENT

At maturity, approximately 50% of the dry matter in a high yielding crop of maize is in the leaves, stems, husks and cobs. A large portion of the nitrogen and phosphorus taken up by the plant is removed in the grain, but most of the potassium remains in the leaves and stalks (Larson and Hanway, 1977). This means that the method used to manage the stubble can have a marked effect on following crops.

In this survey, the stubble from 71% of crops was grazed by cattle for from 1 to 8 weeks after harvest. The stubble from 60% of crops was mulched, 21% disced, 10% rotary hoed or power harrowed and 7% ploughed directly.

A survey in 1979 showed that 80% of crops were grazed by cattle (N.T. Dawbin, personal communication), so there has been a decline in the proportion of crops grazed, and also probably in the intensity of grazing. From my observations, and those of Dawbin, there is a relationship between pugging and crop yield decline, especially on heavier soils. Problems caused by pugging include soil structure deterioration and slow stubble decomposition. When hay is fed on maize stubble, volunteer grass weeds often grow during the winter and early spring. These weeds harbour Argentine stem weevils (*Listronotus bonariensis*) which can attack maize seedlings later in the spring.

When grazing is extended into spring, incorporation of the stubble into the soil is delayed. More research is needed on extended grazing, but my observations suggest that early mulching and incorporation of stubble produces substantially higher yields than late incorporation.

In this survey, most mulching and incorporation was carried out in July, August and September. This was about two months after harvest. The reasons for this delay are unknown because 1984 was a dry winter so delays should not have occurred because of wet weather.

New maize cultivars, especially Pioneer brand, have a tough stubble. The effect of cultivar on rate of stubble decomposition following incorporation is unknown and is a topic requiring further research.

CULTIVATION

Main cultivation

The implements used for the main cultivation operation were:

- plough — 35% of area;
- jumbo buster — 42% of area;
- heavy discs — 16% of area;
- chisel plough — 6% of area.

The heavy ripper, or jumbo buster, and chisel plough are now firmly established in the industry, especially on rolling or heavier soils where plough pans or impeded drainage have been a factor. The use of any particular implement was related to the merchant advising the grower, rather than the soil type of the farm. Personal preference of the merchant and implement availability are probably the important factors determining implement usage.

No chemical tillage systems were used on farms in this survey.

Final seed bed preparation

The implements used for the final seed bed preparation were:

- disc and tyned implement — 42% of area;
- roller tiller only — 30% of area;
- power harrow and roller tiller — 28% of area.

As with the main cultivation implements, there was great variation among growers and among districts, again suggesting that implement availability and merchant preference determine implement usage.

WEED CONTROL

The herbicides commonly used in the Waikato are listed in Table 1. For a complete list of herbicides see Rahman (1985).

Table 1: Herbicides used by Waikato maize growers surveyed in 1983/84.

Common name	Trade name	Usage (% of area)	Major weed spectrum
Atrazine	various	97	broadleaf weeds
Dicamba	various	34	broadleaf weeds
Cyanazine	various	1	broadleaf weeds
EPTC + R-25788	Eradicane	52	grass weeds
Alachlor	Lasso	26	grass weeds
Metolachlor	Dual	11	grass weeds
Pendimethalin	Stomp	5	grass weeds
Atrazine + metolachlor	Primextra	5	broadleaf weeds + grass weeds

Atrazine has close to full acceptance. Most of it was applied separately from other herbicides several weeks after planting. In 13% of the maize area surveyed, crop oil was used with atrazine to improve activity against grass weeds. Dicamba was also mixed with atrazine, but was sometimes applied alone.

Eradicane was widely used to control grass weeds (Table 1). Problems of weed control efficiency have been observed with Eradicane (Rahman *et al.*, 1979; Rahman *et al.*, 1981). The use of a new formulation with extended activity should have increased the efficiency of Eradicane (Rahman and James, 1983), but weed control with this herbicide was below expectations in the 1983-84 season. This may have been due to the exceptionally wet October in 1983; nevertheless, the survey indicated that less Eradicane would be used in 1984, with growers changing to alachlor, metolachlor or pendimethalin for the control of grass weeds.

The use of bromofenoxin (Faneron), instead of dicamba, may occur on maize paddocks near horticultural enterprises in 1984. Bromofenoxin has provided control of atrazine-resistant broadleaf weeds in recent field trials (Rahman et al., 1983).

CULTIVARS

The Pioneer hybrids, 3709, 3591 and 3901, marketed in New Zealand by Arthur Yates and Co. Ltd., occupied 77% of the area surveyed (Table 2).

Due to a shortage of seed of 3709 and 3591, 3901 was grown in some areas where it was not the first choice of the growers. In 1984/85, more of the later maturing hybrids, 3709 and 3591, are expected to be grown at the expense of 3901 (Table 2).

Table 2: Hybrid cultivars used by Waikato maize growers surveyed in 1983/84.

Hybrid	1983 planting (% of area)	Expected 1984 planting (% of area)
3709	33	43
3591	22	38
3901	22	12
PX74	12	6
XL45A	6	1
PX49	4	-

The merchants' representatives were asked to list, in priority order, the characteristics they desired in a new cultivar. The categories specified in the survey were high yield, standability, rapid dry down and cool tolerance. The mean scores were:

- standability 2.75
- high yield 2.25
- rapid dry down 1.00
- cool tolerance 0.75

Cool tolerance is a mechanism for obtaining high yields in the New Zealand environment (Eagles, 1979). This survey indicates that standability is rated highly by New Zealand merchants, so any new higher yielding, cool tolerant cultivar should have a standability at least equivalent to the popular Pioneer hybrids.

PLANTING DATE

The range in planting dates in the survey was from October 3 to November 30, with half the crops planted by October 29 in the last two seasons.

McCormick (1971, 1974), working with hybrids no longer grown in New Zealand, recommended planting before November 1. Taking cultivation time and weed control into consideration, I consider that the optimum time to plant the current hybrids in the Waikato is between October 20 and November 7. Late maturing hybrids, which require a longer frost-free period than early maturing hybrids to produce maximum yields, should be planted first. Late November plantings should be confined to early maturing hybrids.

PLANT POPULATION

The average planting rate for the 3 Pioneer hybrids was 83,700 seeds/ha. The average establishment population was 78,700 plants/ha, or 94% of the initial sowing rate.

For PX74, a later maturing hybrid, the sowing rate was 74,000 seeds/ha and the established population was 65,900 plants/ha, or 89% of the sowing rate.

Douglas *et al.* (1982), working in the Poverty Bay region with PX610, a hybrid no longer produced in New Zealand, obtained maximum grain yields in the range of 80,000 to 90,000 plants/ha. The response curves obtained from their experiments gave no indication of any marked change in grain yield over the range of 70,000-100,000 plants/ha. In one season, following pasture, lodging increased markedly with increasing plant population. This suggests that the plant populations obtained by growers in the Waikato are probably close to the optimum, but this cannot be confirmed without research information from currently grown cultivars.

SOIL FERTILITY

Soil and herbage analysis

Soil samples from 54% of the farms were tested each year for pH, calcium, potassium, phosphorus and magnesium levels. Leaf analyses were made on crops from 31% of the farms surveyed.

A nitrogen soil test (Steele *et al.*, 1982a) was made on few farms. This was because of doubts about the reliability of the test and because the samples need to be collected in late September and early October, one of the busiest times of the year on Waikato farms. A further reason given for not using a nitrogen soil test was the lack of sampling equipment for taking the 60 cm depth samples required for the test.

Fertiliser is one of the grower's major production costs (Steele *et al.*, 1981), so it is worth spending some money on accurate tests to ensure that optimum quantities of fertiliser are applied. Methods for assessing the most economical amounts of each nutrient to apply have been determined (Steele *et al.*, 1982a and b; Steele, 1985). Once the amount of each nutrient required has been determined, the cheapest form of the nutrient should be purchased because differences in price among fertilisers supplying the same nutrient can be large.

Pre-plant fertiliser application

In my survey, 26% of growers used "plough down" nitrogen at an average rate of 46 kg N/ha. The reason given was the need to increase the rate of stubble decomposition. This practice does not appear warranted, unless there is a problem with large amounts of undecomposed stover present in the soil close to planting (Steele, 1984). Early incorporation of stubble should eliminate the need for "plough down" application of nitrogen fertiliser.

Pre-plant application of nitrogen fertiliser near planting was made by 51% of growers. The average rate was 100 kg N/ha.

Pre-plant application of phosphatic fertiliser was made by 72% of growers. The most popular fertiliser was 15% potassic superphosphate (Table 3), with an average rate of application of 464 kg/ha. This rate of phosphorus application vastly exceeds the requirements of the maize plant (Steele, 1985). However, comparison with rates of 900 kg/ha used 5 years ago shows some progress has been made towards economic fertiliser application.

Lime is applied on 38% of farms each year; the average rate of application is 2.4 tonnes/ha each third year. The objective is to obtain a soil of pH 5.8 to pH 6.4.

Table 3: Pre-plant phosphatic fertilisers used by Waikato maize growers surveyed in 1983/84.

Fertiliser	Usage (% of area)
15% potassic superphosphate	36
30% potassic superphosphate	18
Superphosphate	5
Special phosphatic mixtures	13
Nil	28

Starter fertiliser application

All growers surveyed used starter fertiliser. However, the type of fertiliser used varied among growers (Table 4). The rates of application varied from 250 kg/ha to 375 kg/ha.

Table 4: N:P:K starter fertilisers used by Waikato maize growers surveyed in 1983/84 and prices of N in these fertilisers.

N:P:K fertiliser analysis	1983/84 usage (%)	1983 price cents/kg N	1984 price cents/kg N
12:10:10	36	215	227
18:20: 0[1]	38	102	149
10:18: 7	30	149	211
11:19: 0	3	-	-
urea	-	86	86

[1] Commonly called diammonium phosphate or DAP.

The cost per kilogram of nitrogen varies considerably among starter fertilisers and changes from year to year (Table 4).

Growers should buy the cheapest starter fertiliser which will provide the required nutrients. Because urea is a much cheaper source of nitrogen than compound fertilisers it should be used as the main source of nitrogen.

Side-dressed fertiliser application

Side-dressed nitrogen as urea was used on 49% of the area surveyed. The average rate was 100 kg N/ha.

Table 5: Insecticides used by Waikato maize growers surveyed in 1983/84.

Insecticide	Usage (% of area)
Phorate	40
Izazophos	37
Carbofuran	2
Other[1]	18
Nil	27

[1] Post-emergence cutworm (*Agrotis* sp.) control chemical.

INSECT CONTROL

Insecticides are widely used to control insect pests of maize in the Waikato (Table 5). However, 27% of growers surveyed did not use any insecticide. Clean, early cultivation could further reduce the need for insecticides (Watson and Hill, 1985).

COMMENTS AND CONCLUSIONS

Early mulching and incorporation of stubble could raise maize yields, eliminate the need for plough-down nitrogen application, and reduce the need for chemical insecticides. The higher economic returns from crops following early stubble incorporation should far outweigh the lost income from grazing.

New cultivars specifically bred for New Zealand conditions would boost the confidence of Waikato growers. However, new cultivars will need to stand as well as existing cultivars, if they are to be accepted.

The number of growers using soil sampling for nutrients other than nitrogen was reasonable, but there is much room for improvement. The number of growers using ear-leaf analysis for a complete assessment of nutrient status was disappointing. Growers should be encouraged to take a more active interest in sampling their own crops rather than leaving the sampling to their merchant's representatives. Excessive fertiliser usage was common in Waikato crops. Growers should carefully consider the fertiliser requirements of their crops and use the extensive research results available for estimating optimum quantities of fertiliser.

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