THE GROWING AND UTILISATION OF MAIZE FOR GREEN FEED AND SILAGE

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ABSTRACT

Maize is being grown for greenfeed and silage on an increasing number of New Zealand pastoral farms. Dry summers, high yields, and alternative end uses, are encouraging farmers to grow maize for fodder.

A limited number of maize varieties are available for green feed silage and silage crops, and of those which are available doubt is cast as to their suitability. Maize varieties have been selected for grain yield and not whole plant yield.

All three basic planting methods, broadcasting, drilling, and precision sowing are used by farmers. These methods, along with row spacing must be compatible with harvesting machinery, if used.

Five maize greenfeed and five maize silage crops were assessed for dry matter yield and notes taken on utilisation methods and wastage. Greenfeed yields ranged from 6,300 to 14,800 kg D.M./ha. Silage yields ranged from 12,300 to 20,005 kg D.M./ha. Various sowing dates, plant populations, and row spacings were recorded.

Considerable research effort in New Zealand has been directed into maize growing for grain. While some of the results from this research can be applied to growing maize for greenfeed and silage, there are still many gaps in basic knowledge in the growing, utilisation, feeding value and economics of greenfeed or silage maize. Knowledge on varieties, row spacings, plant populations and sowing dates, to achieve the most economic yields, is required.

INTRODUCTION

Maize for greenfeed and silage is being grown on an increasing number of New Zealand dairy farms and to a lesser extent, intensive sheep and/or beef farms in the North Island. This increasing popularity of maize being sown for supplementary fodder is due to five main reasons.

1. The recent series of dry summers, causing farm production, especially dairy production to fall in the latter half of the season.
2. Greenfeed maize can yield large quantities of green fodder per hectare relative to most other alternative summer fodder crops, and summer pasture.
3. Maize silage yields can equal, and often exceed, annual pasture yields of dry matter per hectare.
4. Maize is a crop with three alternative end uses — green feed, silage, or grain.
5. In the Waikato district, the area of maize crop planted for grain has increased many fold over the past six years, and this popularity has influenced non-maize growers to try growing maize for fodder or grain.

The potential of maize as a forage crop for livestock feeding has been discussed by Mitchell (1966).

Considerable research effort in New Zealand has been directed into maize growing for grain. While some of the results from this research can be applied to growing maize for greenfeed and silage, there are still many gaps of basic knowledge in the growing, utilisation, feeding value and economics of green feed or silage maize.

High yields are often quoted and used to produce encouragingly low costs per kilogram dry matter, but such information takes no account of wastage in the field, feeding value, or animal feed conversion efficiencies.

Unfortunately, most overseas data on animal performance from maize green feed or silage, has little application to pasture fed animals. Relatively little research on this subject has been done in New Zealand.

VARIETIES

A very limited number of maize varieties are available for growing maize green feed or silage. In the case of green feed, a farmer virtually takes what he is given, a situation which farmers would seldom tolerate for other crops. "Green feed" seed is second generation hybrid seed from a high grain yielding variety. Little or no consideration is given to selecting varieties on dry matter yield as a green feed crop.

Varieties for maize silage

It has been shown that 50 to 60 percent of maize silage yield is from the cob portion of the crop (Menalda & Kerr 1973). Present thinking is to use a variety which has the best grain yielding characteristics. For this reason, first generation hybrid seed has been generally recommended by scientists and advisers for maize silage.

So, in most North Island districts PX 610 or XL 45 have been the varieties most often sown for maize silage in the last two years. In the South Island, earlier maturing varieties such as XL 306 or KC 3 were preferred.

Once again, varieties have not been selected for total dry matter yield, or more desirably, total yield in terms of essential animal nutrients.

Preliminary results from a Ministry of Agriculture and Fisheries trial in the Gisborne district (pers. comm. N. Brown), indicates that there may be little or no yield advantage in using the more expensive first generation hybrid seed. Crib dried second generation seed produced similar yields of cob and total crop to that from first generation seeded crops.

TABLE 1: Effect of first and second generation hybrid seed (PX 610) at three different plant populations, on cob and total plant yield. (000 kg/ha).

		Plant Population		
		Low	Medium	High
Cob	(1st generation	13.6	13.3	11.7
	(2nd generation	12.4	12.0	12.1
Total Plant	(1st generation	21.3	21.0	19.3
	(2nd generation	18.8	18.9	20.5

Plant populations were:	Low	Medium	High
1st generation	58000	82000	130000
2nd generation	63000	95000	147000

CROP PLANTING METHODS

Three basic planting methods used for maize are broadcasting, drilling or precision sowing.

The method of sowing and row width is not only important from the yield aspect but also from the point of view of being compatible with harvesting machinery. Some harvesters for instance, can only handle 76 cm rows.

Broadcasting maize seed followed by discing and rolling is a "hit and miss" method not recommended unless the "seedbed" is rough with sticks and stumps and damage to drilling machinery is likely.

Drilling with conventional disc or hoe coulter drills at 15 cm, 30 cm and 45 cm row widths in the Te Awamutu district has produced variable results, but in the main disappointing. Disappointing because many contractors can not drive straight, cannot set their machines to sow a given seeding rate within tolerable limits (say + 10%), and their machines drop seed too haphazardly within rows, resulting in alternate gaps and clusters of plants.

Straight rows are essential to get complete pick up by mechanical harvesters. Some fine chop maize harvesting machines can not harvest plants which are lying down, and if, when harvesting one row, this type of machine knocks plants over in the next row, then wastage will occur.

Little is known about plant spacing for maize green feed and silage crops. Douglas **et al.** (1971) have shown that an 8-13% increase in maize grain can be obtained from 38 cm rows compared to 76 cm rows.

To the author's knowledge, there has been only one trial in New Zealand on plant populations for green feed maize crops (Ruakura Report 1972-73). It has been generally accepted that maximum dry matter yield will be obtained with high plant populations of around 250,000/ha. Planting this in 15 cm rows limits utilisation to break feeding or hand cut and carrying. To ensure maximum utilisation the whole plant has to be palatable to stock, and must therefore be fed at a very immature stage, no more than, say, 2 m high.

More mature green maize, is best fine chopped before feeding. Row spacing and harvester must be compatible, and the question then arises, as to the best plant population for 30, 46 or 76 cm rows. As row width is increased, I would imagine, maximum dry matter yields of green feed maize would be achieved with lower plant populations.

A farmer has the option of growing three or four crops each planted, say, ten days apart during November-December and breakfeed these when 1.5 to 2 m high, or grow a smaller area and use a more expensive machine harvesting method when 2.5 to 3 m high.

The economics of these two options are difficult to calculate when yield data and animal response data is so scarce. Digestibility data would also need to be considered, because digestibility of the dry matter does change with crop maturity (Bartlett **et al.** 1971).

GOOD CROP HUSBANDRY

There is no intention in this paper, to review fertiliser practices or weed and pest control. The importance of correct fertiliser application, and adequate weed and pest control can not be over emphasised. Unfortunately, farmers who grow maize as a fodder crop, often give insufficient attention to these basic crop husbandry practices and yields are depressed as a result, especially where weed control is poor.

YIELDS AND UTILISATION

Five maize greenfeed and five maize silage crops were selected at random in the Te Awamutu advisory district as well as a maize crop planted for grain, but harvested for green feed. Dry matter yields were assessed on these crops and an interest taken in how these crops were utilised. This mini-survey was done to see if farmers were achieving the high dry matter yields often quoted for maize.

Method

A diagonal line was taken through each crop and twenty random sites were cut, approximately 10 cm above ground level. Plants from each site were weighed, counted, and a random sample taken for dry matter assessment and length measurement. The sites were one metre square for green feed crops and one row wide by 2 m long for silage crops. Information on sowing date, fertiliser, weed control etc. was gathered from each farmer.

Greenfeed maize

The results of the greenfeed crop survey are summarised in Table 2. The survey was carried out during the middle fortnight of February 1974.

TABLE 2: Greenfeed crop data

Crop	Sowing Date	Sowing Rate kg/ha	Row Spacing cm	Height m	Plant Population '000/ha	Green Weight 000kg/ha	D.M. %	Dry Matter kg/ha
A	29.11.73	125	30	2.8	322	115	12.9	14800
B	8.11.73	125	15	2.1	282	70	19.9	13900
C	1.12.73	157	B.C.	1.8	212	57	19.2	10900
D	5.11.73	95	15	2.0	259	73	18.9	13800
E	10.12.73	125	15	1.8	276	49	12.9	6300
F	25.10.73		76	3.3	69	81	26.0	21000

Note: Wet weight, dry matter precentage and dry matter have been corrected to nearest thousand, one decimal place, and nearest hundred respectively. Crop F was sown originally for grain. B.C. = Broadcast.

Out of the five crops planted for green feed in November or early December, three had surprisingly high yields of about 14,000 kg D.M./ha. These yields were achieved in 73-105 days, which indicates that maize green feed has the potential to yield higher than what is usually quoted by advisers (8000 to 10,000 kg D.M./ha).

Utilisation

These crops were utilised by the following methods: wastage was visually estimated in each case.

Crop	Method	% Wastage
A	Fine-chopped, self unloading trailer, dairy cows	10
B	Hand cut, carried to 6mth calves	5
B	Break grazed to 6 mth calves	15
C	Break grazed to dairy cows	10
D	Break grazed to dairy cows	20
E	Sicklebar mowed, carried to dairy cows	2

A variety of utilisation methods are used by farmers, depending on the quantity fed and machinery which is available, and wastage can amount to 20% or more, depending on crop maturity, (palatability and digestibility) intake of other feeds, total intake, type of stock and their feed requirements, etc.

Maize sown for silage

The results of the maize silage crop survey are summarised in Table 3. The survey was carried out during the first fortnight in April. The Te Awamutu district had experienced a dry spell from January to April — 150 mm rainfall recorded, and frosts were experienced in mid March. Maize crops matured more quickly than usual.

The time to harvest maize for maximum dry matter yield has been clearly defined by Johnson **et al.** (1966). This is when the grain is at a hard dent stage, or when the plant dry matter is 30 to 35%. On this basis crops A, C and D were harvested too late.

TABLE 3: Maize silage crop data

Crop	Sowing Date	Variety	Row Spacing cm	Height m	Plant Population OOO/ha	D.M. %	Dry Matter kg/ha
A	8.11.73	W 575	30	2.3	87.4	48.5	16167
B	20.11.73	XL 45	76	2.9	57.4	28.1	12300
C	5.11.73	Waxy	76	3.3	73.0	42.5	17244
D	28.10.73	XL 45	76	3.0	82.7	39.2	20005
E	26.11.73	W 575	30	2.7	87.2	27.0	18826

Note: Plant population and D.M. % have been corrected to nearest 1000 and one decimal place respectively.

Only one of the crops achieved the 20,000 kg D.M./ha yield so often quoted in farming circles. At $300 per hectare or more, maize is expensive to grow and ensile, so high yields are essential to achieve cheap conserved fodder (1.5 cents/kg D.M.)

Most of the kernels of the drier crops, A, C and D, were not broken, and considerable undigested grain was expected in the faeces of cattle being fed these silages. However, only one or two grains in some dung pats could be found, after a fortnight of feeding. The popular belief that all grain in maize silage should be cracked or broken at harvest is, perhaps, incorrect. Waghorn (1973) found that the undigested faecal kernal loss from both fine chop (mean particle size 1.24 cm) and coarse chop silage (2.20 cm) were negligible.

CONCLUSIONS

The aim of this paper is to show what has been achieved by a small selection of commercial farmers with maize for green feed or silage, and to indicate where research can be usefully directed.

Farm advisers and farmers want to know the varieties, row spacings, plant populations and sowing dates which will give the most economic yields for their locality. "Economic" is used to remind research workers and advisers that factors other than just dry matter yield must be considered. The time pasture is out of production, utilisation or wastage, feeding value or food conversion efficiency, the effect on pasture defoliation by

supplemented animals and costs of harvesting and feeding are all important.

The agronomist and animal nutritionist will have to get together to look at these inter-related factors.

While much maize grain research information can be extrapolated to growing maize for silage, more information is required to determine the best varieties, row spacing and plant populations, and perhaps sowing dates, also giving consideration to the feeding value of the resulting silage.

McCormick (1971) has shown over three successive years, that in the Waikato optimum sowing date for maize silage is November 1st, plus or minus a week. Menalda & Kerr (1973) showed that in the Manawatu, late November sowing should be confined to early maturing varieties.

Recommendations for optimum husbandry practices will often differ for different parts of New Zealand, therefore trials in various localities are needed.

Harvesting methods need further investigation (Waghorn, 1973) to determine the importance of chop size and kernel damage.

Maize for greenfeed and silage has much to offer livestock farmers in New Zealand as a means of increasing fodder production, however it must be carefully compared to alternatives such as better pasture utilisation, pasture silage and irrigation (Hutton, 1974).

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