# MAIZE SILAGE FOR DAIRY PRODUCTION — DESCRIPTION OF A FARM OPERATION

R.W. Linton
Dairy farmer, Ohaupo

In good grass growing areas of New Zealand, such as the eastern Waikato, 400 kg of milk fat per hectare can be produced from permanent pasture with 95% of the total cow requirement grazed **in situ**. It is difficult to imagine a more efficient system.

But in many dairying areas, hard winters or dry summers substantially reduce the period over which pasture production meets animal requirements.

Our problem arises from farming on droughty soils in an area of low summer rainfall. In seven out of nine years we have farmed in the Ohaupo area, supplementary feeding, usually extending from mid-February to the end of August, has been necessary to prevent severe production declines and loss of condition in stock. Clearly, large quantities of supplementary feed are necessary.

Until 1974, we had purchased hay on a routine basis, but at $1.00 per bale it was expensive, the quality variable, and weed introduction more than a possibility.

Maize silage promised a cheaper alternative; but what is the cost of growing maize for silage on a grassland farm?

Looking at a real farm situation, this is a very complicated calculation, because it is very difficult to assess the opportunity value of land which is taken out of pasture within a farm.

I have sidestepped this issue by costing maize silage in the following two ways:

1. I have assumed that land can be obtained for an annual rental of $200 per hectare outside the farm. To this I have added the cost of growing and harvesting the crop at current Waikato contract rates. The results are shown in Table 1.

TABLE 1. Costs of maize silage production

| | Years out of pasture | |
|---|---|---|
| | 1st | 5th |
| Growing standing crop | $166 | $290 |
| Harvesting silage | 105 | 105 |
| Rental value of land | 200 | 200 |
| Total cost | **$411** | **$595** |
| Cost per kg dry matter in pit (at 17,000 kg DM/ha) | 2.8 cents | 3.5 cents |
| Cost per kg DM of purchase hay at $1.00 per bale | 5.0 cents | |

Detailed costings are shown in Appendix

TABLE 2: Composition of various feedstuffs

| | DM% | Crude protein % (on DM basis) | Digestibility % |
|---|---|---|---|
| Maize silage | 33 | 8 | 65 |
| Grass silage | 20 | 18 | 65 |
| Hay | 85 | 13 | 55 |
| Winter pasture | 14 | 30 | 80 |

This information emphasises the considerable increase in costs as one continuously crops the same area of land. These costs result from more expensive weed control and higher inputs of N fertilizer.

2. The alternative way of evaluating maize silage is to value the crop for grain and work out the opportunity cost of foregoing the grain to get silage. This works out at 3.7 cents per kg DM when the grain is valued at 1975 Waikato rates ($83 tonne). Allowance has been made for the cost of harvesting the grain, cartage, drying, and the value of stover grazing (see Appendix).

## THE NUTRITIONAL VALUE OF MAIZE SILAGE FOR DAIRY STOCK

Maize silage is deficient in protein, though this is balanced by winter/spring pasture which contains protein in excess of animal requirements (Table 2).

Maize silage is also low in some important minerals, expecially when fed to cows in early lactation. It is low in calcium, phosphorous, magnesium, sodium and some trace elements. Spring grass, while it has an excess of protein, may also be marginal in mineral content for animal requirements. Mineral additions may be required when maize silage is fed to milking cows as a supplement to early spring pasture.

## OUR EXPERIENCE WITH MAIZE SILAGE

### GROWING THE CROP.

We plant exactly as for grain; in 76 cm rows, using the best hybrid seed, with fertilizer, weedicides and insecticide as recommended to get high yields of grain.

This gives us flexibility. We can feed direct, we can ensile the crop, or we can harvest for grain.

### YIELDS

We have no accurate measure of the yields of silage, but I am told we can assume that silage yields in dry matter equal 1.9 times the grain yield at 14% moisture.

On this basis we have achieved the following yields of silage dry matter; based on similar crops harvested for grain.

| | | |
|---|---|---|
| On mineral soil | 1st year out of pasture | 21,500 kg/ha |
| | 5th year out of pasture | 16,000 |
| Peat | 1st year out of pasture | 18,000 |

The yield from mineral soil following continuous maize cropping for a number of years has been disappointing, due mainly to infestation with Californian thistle — a weed particularly difficult to deal with in maize.

However, the yield on our very acid peat soil has been pleasing, especially when one considers the crop replaced pasture yielding probably less than 9,000 kg DM. This was our first year growing maize on peat. It remains to be seen whether this performance can be repeated.

FEEDING THE CROP

We have fed the crop to the dairy herd in a dry autumn as a supplement to available pasture. Milk yields have depended on the quality of pasture available, probably reflecting the low protein levels of withered drought pasture when fed with low protein maize silage.

By contrast, dry cows, replacement heifers and beef cattle have performed well when fed 50% of their requirements as maize silage with winter pasture, and although we do not weigh stock, improvement this winter has been very pleasing.

We are feeding maize silage to lactating cows this spring at 5 kg DM per cow per day, or 33% of their requirements.

In all cases the crop is trailed out on pasture. Maize silage is very palatable and the clean up is generally good. I do not think we can justify the costs of feeding racks on concrete with the attendant stock movement and effluent disposal problems.

## FUTURE PLANS

Some of the costs of maize silage production have escallated in recent years faster than the general rate of inflation of dairy farm costs (Table 3).

TABLE 3: Cost increases: March 1973/March 1975

| | |
|---|---|
| Average dairy farm costs (Government statistician) | 30% |
| Nitrogen fertilizer | 170% |
| Atrazine weedkiller | 90% |
| Machinery costs (U.K. figure) | 60% |

In an attempt to control cost increases, particularly of fertilizer N and weedicides, we plan to limit maize production to two consecutive years on each area.

As a catch crop between successive maize crops, we have found the humble soft turnip to be cheap and reliable. Turnips have these advantages over the commonly recommended Tama or cereals:

1. They allow a once over grazing harvest with the ground cleared in ample time for spring cultivation for the following season's crop.
2. No N fertilizer required.
3. They do not overwinter Argentine stem weevil.

We are planning to plant lucerne on some of the area which has been under continuous maize cropping adjacent to the silage pits.

In comparison with maize plus turnips, lucerne will have a lower total annual yield, but in spite of this, it should have similar cost per kg DM, due to its considerably lower annual cost. If we can successfully ensile lucerne it will be a better feed in a dry autumn than maize silage, because of its higher protein content.

Nevertheless, maize has its attractions, the main one being a once over simple harvesting operation for the whole annual crop. Our final rotation could well be four or five years lucerne, then maize for two years, interspersed with a winter turnip catch crop. The lucerne would act as the nitrogen restoring crop.

## RESEARCH NEEDS

There remain many gaps in our knowledge on growing and using maize silage under New Zealand dairy farm conditions. Some of them, such as fertilizer requirements, weed and insect control, are common to maize for grain, and other people at this conference will no doubt comment on these requirements.

But as regards maize silage for dairy cows, studies are needed on:

1. Plant populations and row widths. If recent research results on a substantial (about 30%) yield advantage from planting in narrower than the current 76 cm row widths are confirmed in further trials, discussions should be held with machinery distributors with a view to adapting imported machinery to an agreed New Zealand standard row width.
2. Silage varieties. It has been suggested that similar, or even higher, silage yields may be obtained from the open pollinated varieties, at much lower seed cost. This needs to be checked out, and at the same time the importance of the percentage of grain in the silage needs to be checked by nutritional studies.
3. Direct drilling. Results of direct drilling have been extremely variable, but the attraction of being able to use a pasture in the critical September period right up to planting make this a worthwhile avenue of further research.
4. Ensiling methods. An investigation at Ruakura has shown that there is no advantage in endeavouring to crack the grain during harvesting as is commonly recommended. Nevertheless, further studies are needed to see whether the considerable extra power required in reducing the chop length from, say 10 mm to 4 mm, can be justified on any other grounds.

Many dairy farmers will continue to make maize silage from broadcast crops with a flail harvester because, in spite of many failures, it is no doubt worthwhile to attempt some form of conservation with a crop originally intended for greenfeed which has become surplus to requirements. As occasional success has been achieved in handling these crops, field studies should be undertaken to recommend the best methods.

5. Winter catch crops. The ideal winter catch crop is cheap and quick to establish, high yielding and suitable for grazing by both dry or lactating cattle. It should not host pests of maize.

Berseem clover would be ideal if it would grow — perhaps ecotypes could be found which would adapt to the milder areas of New Zealand. Other crops of interest are lupins and fodder raddish. Certainly we need to know the fertilizer requirements of the currently recommended cereals, ryegrasses and turnips, following the depleting effect of a maize silage crop.

6. Pasture re-establishment. To evaluate the economics of maize silage more clearly, we need to know the yields of pasture re-established after single or successive maize silage crops.
7. Animal nutrition. We need to know a lot more about the performance of different classes of stock fed different ratios of pasture/maize silage at different times of the year, and a clearer picture of the mineral balance of animals so fed. Only then will we be able to confidently

estimate maximum levels of maize silage supplementation which can be used without depressing animal performance compared with a whole pasture diet.
8. Storage. Investigations are needed on the fungi which attack maize silage, both on the exposed face where loading out is taking place and the odd bits of rot which occur, for example, where the polythene meets the pit walls. It would be interesting to know the nutritional losses at the feeding face, and the health risk to animals fed fungal contaminated silage.
9. Feeding out. From a practical point of view, it would be useful to know the recovery by cows of maize silage trailed out on pasture, if someone can devise a simple way of measuring this! Only then will we be able to give sound advice to farmers on the economics of trough or pad feeding.

In conclusion, I want to scotch any idea that I am a maize silage evangelist.

Maize silage is a complication to farming, and the strength of New Zealand farming is its simplicity.

The biggest problem for me has been growing the crop. It is a new and demanding skill to learn. Everything has to be right on time and if I am an average farmer, then the average farmer can make lots of expensive mistakes. I know no one using this expensive and complicated system who is achieving the production per acre obtained by our best all grass farmers, though possibly these farmers are in a better soil/climate situation than most.

## APPENDIX ONE
## MAIZE GROWING COSTS : 1974/75

CASH COSTS

| | Mineral Soil | | Peat |
|---|---|---|---|
| | 1st Year | 5th Year | |
| Paraquat | 13.65 | | |
| Seed | 20.20 | 20.20 | 20.20 |
| **Insecticides:** | | | |
| Furdan | 28.50 | 28.50 | |
| Cutworm | 6.13 | 6.13 | 6.13 |
| Armyworm (includ. application — one treatment) | 16.00 | 16.00 | 16.00 |
| **Weed Killers:** | | | |
| Atrazine | 15.18 | 15.18 | 22.77 |
| Agral LN | | | 1.36 |
| Lasso | | 40.20 | |
| **Fertiliser** | | | |
| Lime | | 7.40 (lt/ha) | 18.13 (2.5t/ha) |
| 15% potassic super at 700 kg | | 24.32 | |
| 30% potassic super at 700 kg | | | 27.34 |
| Sulphate of ammonia | | 45.54 (600 kg) | 18.93 (250 kg) |
| 100 kg of 14: 14: 8 | 15.00 | 15.00 | 15.00 |
| Planting | 17.50 | 17.50 | 15.00 (no insecticide) |
| Total Cash Costs to Standing Crop | **$132.16** | **$235.88** | **$160.86** |
| Contract Costs of Work Done with Our Own Equipment: | | | |
| Cultivation | 35.00 | 35.00 | 35.00 |
| Applying: | | | |
| Cutworm insecticide | 5.40 | 5.40 | 5.40 |
| Weedkiller | 5.40 | 5.40 | 5.40 |
| Lime | | 2.00 | 5.00 |
| Potassic super | | 3.32 | 3.32 |
| Sulphate of Ammonia | | 3.60 | 1.75 |
| | **$47.80** | **$54.72** | **$55.87** |
| Total all Costs to Standing Crop | $166.31 | $290.60 | $216.73 |
| Silage Harvesting Contract Costs: $105.00 ha | | | |
| **Total Cost Per Ha:** | $271.31 | $395.60 | $321.73 |
| Cost Per Kg D.M. In Pit: | **1.59 cents** | **2.32 cents** | **1.89 cents** |

(Ignoring opportunity cost of land producing pasture)

TURNIPS:

**Costs:**

| | |
|---|---|
| Seed | 1.50 |
| Fertiliser — 400 kg 15% | 13.88 |
| Contract Costs of Work With Our Own Equipment: | |
| Cultivation | 15.00 |
| Sowing | 5,00 |
| Fertiliser spreading | 2.50 |
| | **$37.88** |

At 4,000 kg D.M. cost per kg D.M. = 0.94 cents

**Maize Plus Turnips:**

Overall Cost Per Kg D.M. on Mineral Soil:

1st Year: 1.47 cents

5th Year: 2.06 cents

## VALUE OF CROP FOR GRAIN

| | | |
|---|---|---|
| GROSS | | 83.00 tonne |
| Less Drying (25% moisture) | | 7.50 |
| Cartage | 3.00 | 10.50 |
| | | $72.50 |
| 9 tonne per ha at $72.50 | | 652.50 |
| Less Harvesting at $55/ha | | 55.00 |
| | | 597.50 |
| Plus Stover Grazing | | 30.00 |
| | | **$627.50** |

NET PROFIT/HECTARE:

1st Year: $461.19 5th Year: $336.90 Peat: $410.77

## APPENDIX TWO
## OPPORTUNITY COST OF MAIZE SILAGE

When the alternative is to allow the crop to mature and harvest for grain.

CONSIDERATIONS:

1. If crop is harvested for grain, stover is available for grazing.
2. If crop is harvested for silage, it is off the ground in time for grassing or planting to winter crop.
3. Based on grain yield of 9 tonne/ha or equivalent silage yield of 17 tonne dry matter.

| | |
|---|---|
| Gross Return for Grain, Less Combine Harvesting, Grain Cartage and Drying Costs (See Apendix One) per ha | 597.50 |
| **Plus** Value of Stover Grazing | 30.00 |
| | 627.50 |
| **Add** Contract Silage Harvesting Costs | 105.00 |
| Cost of Establishing Turnips (contract cultivation) | 38.00 |
| | 143.00 |
| | **$770.50** |
| YIELDS: | |
| Maize Silage | 17,000 kg D.M. |
| Turnips | 4,000 |
| Total Per/Ha | **21,000** |

Therefore, opportunity cost of maize silage

= $770.50 divided by 21,000

= 3.67 cents/kg D.M.

= 73 cents/bale hay (20 kg D.M./bale)