THE POTENTIAL OF DIRECT DRILLED MAIZE *(Zea mays* L.*)* FOR GREENFEED AND SILAGE PRODUCTION

P.P. WILLIAMS, I.C. LOGAN AND
J.G. WHITTLES
I.C.I. NEW ZEALAND LIMITED

SUMMARY

The significant feature of direct drilling crops is production per unit of time per unit of land. A direct drilled maize crop followed by direct drilled ryegrass produced 19.650 kg DM per hectare (22,000 lb DM per acre) as compared to 9.375 kg (10,500 lb) from permanent pasture in a Waikato trial. The technique has since been used successfully on farms in the Waikato. Machinery is being developed to suit the direct drilling technique. Direct drilled maize is a cheap feedstuff. It allows flexibility in both decision making and in feed budgeting on intensive dairy and beef farms. There is a need to determine the optimum method of utilisation of maize, either greenfeed or silage, for various classes of stock.

INTRODUCTION

Farmers in the intensive grass farming districts of New Zealand, such as the Waikato, are looking very closely at alternative methods of fodder production to supplement or substitute for pasture. Becoming fashionable are such inputs as concentrate feeding, irrigation, nitrogenous fertilizers and high yielding crops, especially maize. One possible explanation for this trend is the occurrence of a succession of almost unprecendented droughts coupled with a level of pasture utilisation which is calculated to equate supply and demand in the seasons of maximum pasture yields. This paper looks at the introduction of one of these inputs, maize, into predominantly grass farming enterprises.

The level of stocking, or butterfat (or meat) yield, at which complete pasture utilisation is reached on any one farm depends not only on the amount of dry matter produced, but also on the ability of the farmer to manage his stock and pasture. Thus whereas Farmer A and his farm may be fully extended to convert 10.700 kg DM per hectar (12,000 lb DM per acre) to 190 kg (420 lb) butterfat from 3.7 (1½) cows per hectare, his neighbour, Farmer B, may be equally extended at 125 kg (280 lb) butterfat from

1 (2.5) cow per hectare. This point is made because, if it is assumed that the maize crop can be justified only when full pasture utilisation has been achieved, it is important to realise that the use of maize cannot be restricted to a particular level of stocking. In the cases just mentioned, both Farmers A and B may be equally justified in looking to maize as the next step to be taken to increase each one's income.

Whereas the farmer is showing interest in maize for greenfeed or silage, it is considered that research agronomists are lagging behind. Farmers are entitled to ask - why should they grow maize how should they grow it and how should they use it?

DIRECT DRILLED MAIZE : THE TECHNIQUE

The Concept:

In this paper the term direct drilling will be used to describe the establishment of a crop by drilling seed into pasture which has been sprayed immediately beforehand with a herbicide, such as paraquat.

This method enables the crop to be sown virtually the day stock are removed from the paddock. Consequently, direct drilling can be regarded as a means of injecting a bulk of feed into a predominantly grass farming enterprise, without interfering with production of the pasture at either end of the crop's life. This distinction between direct drilling and cultivation for crop establishment can be represented diagrammatically as in Figure 1.

Production per unit of time per unit of land is the principle feature of the direct drilling technique.

Dry Matter Yields

A trial was laid down in December 1968 to study this feature of direct drilling. Maize was one of the crops grown. Dry matter yields are summarised in Figure 2.

Direct drilled maize, followed by perennial ryegrass (sown into the stubble as soon as the crop was harvested) yielded more than twice the dry matter produced from permanent pasture in the one year period of the trial.

Reliability

Direct drilling was extended on to a few farms in the Waikato in 1969/70, and in 1970/71 maize was grown by this method of fifty farms in that

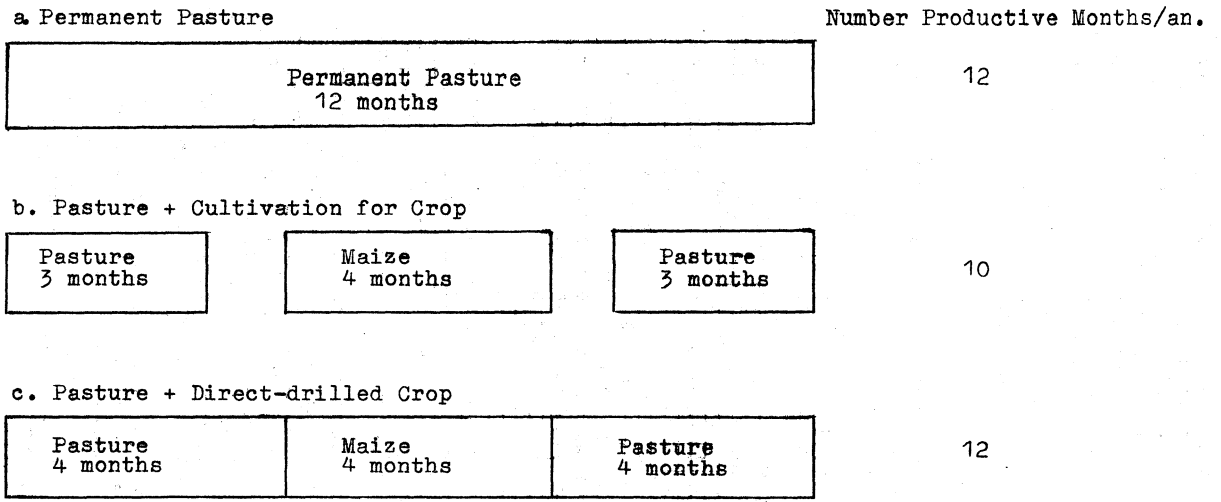

Fig. 1. Diagramatic depiction of concepts of a. permanent pasture. b. pasture + crop sown on cultivated seed-bed and c. pasture + direct-drilled crop and the number of productive months/annum for each system.

district. In the summer/autumn of '69/'70 the Waikato was affected by a severe drought and pasture production from January to April was virtually nil. Samples taken from the maize crops gave an estimated green yield of 40, (16), 79 (32) and 94 (34) tons per hectare (acre) after two months growth. In the 1970/71 season, only two of the fifty crops were unsatisfactory and in both these cases failure was associated with a heavy soil and soldier fly infestation followed later by competition from paspalum.

Machinery

The triple disc coulter system has been specifically designed for direct drilling. It consists of a front disc which cuts through the dead plant matter into the soil and a rear double disc unit which prises open the cut to allow the seed and fertiliser to be placed at the required depth.

In New Zealand the triple disc coulter has been incorporated in the Duncan 630 Multi-Seeder. In the 1970 season approximately 200 hectares (500 acres) of direct drilled maize were successfully established by the Multi-Seeder. However, it may be that, where plant population patterns are important, triple drills are not entirely suitable, for although row spacing can be varied in units of 15cm (6") seed placement along the row, cannot be accurately controlled. Thus, if it is shown that precision seeding improves either dry matter yield or feed quality then it may be necessary to consider other machines.

The direct drilling of maize is already extensively practised in the U.S.A. and is now in its first commercial year in France and Italy. In these areas the implements in use incorporate the precision seeding mechanisms employed in conventional planters.

Typical of the latest American planters for this technique is the Allis-Chalmers system incorporating the "No-til" coulter. This coulter consists of a 43cm (17") diameter wavy disc, which works a 6.00 cm (2½") band of soil. This unit is followed by a double disc coulter placing seed and fertiliser in the band of soil loosened by the wavy disc. The 6.00 cm (2½") strip enables side-banding of fertiliser.

In France and the U.K. machines based on rotary cultivators in place of the wavy discs have been developed. However, power requirement is high and machinery development in New Zealand should look to the modification of conventional planters to accept the wavy disc system.

DIRECT DRILLED MAIZE
ECONOMICS, UTILISATION AND POTENTIAL

Economics

The dry matter account in Table 1 is based on the results of the 1968/69 trial and illustrates the total additional costs incurred by the introduction of the maize programme, including the re-establishment of pasture.

The total cost of about $110 (45 per acre) per hectare represents approximately nine tenths (two fifths) of a cent per additional kilogramme (one pound) of dry matter. Compared with hay and meal, direct drilled maize is a relatively cheap feedstuff.

TABLE 1: Dry matter account for direct drilled maize programme

Direct drilled maize programme produced	24,630 kg DM/hectare/year (21,990 lb DM/acre/year)
Pasture produced	11,770 kg DM/hectare/year (10,510 lb DM/acre/year)
Additional Production	12,860 kg DM/hectare/year (11,480 lb DM/acre/year)

Costs of Direct Drilled Maize Programme

	per hectare $		per acre $	
(a) Grass to Maize				
Paraquat	14.08		5.70	
Spraying	4.32		1.75	
Drilling (maize)	9.88		4.00	
Maize Seed	12.35		5.00	
2 cwt Sulphate Ammonia	12.35		5.00	
Harvesting and Ensiling	37.05		15.00	
Army Worm Spraying	9.88		4.00	
		$99.91		$40.45
(b) Maize to Grass				
New Pasture Seed	8.89		3.60	
Drilling	7.41	16.30	3.00	6.60
		116.21		47.05

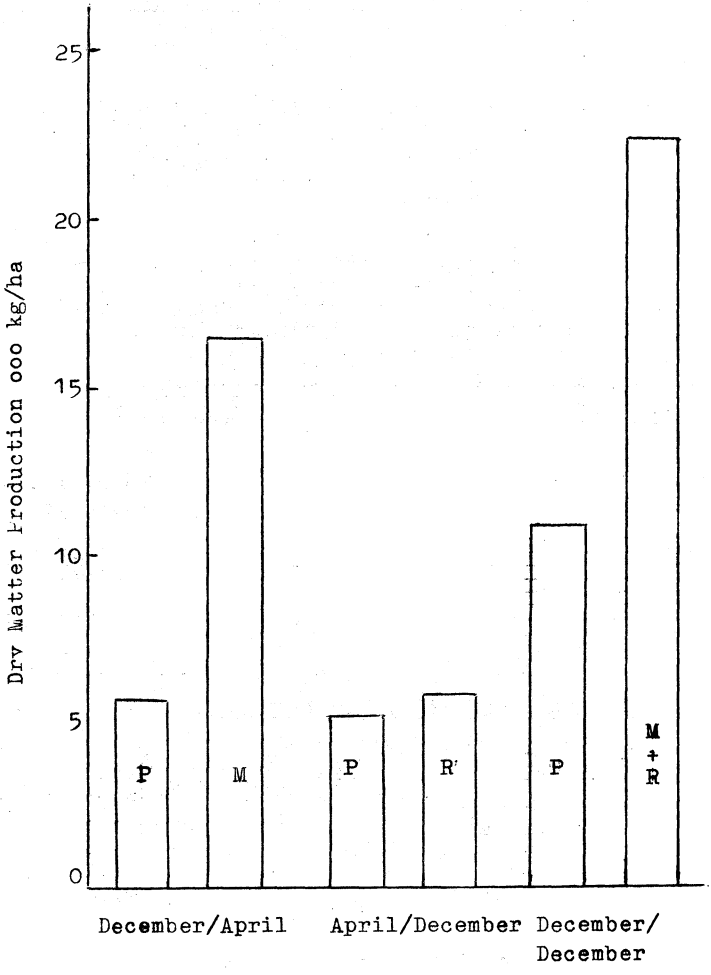

Fig. 2. Herbage dry matter yields ooo kg/ha from pasture (P), maize (M) and ryegrass (R) drilled into maize stubble.

COST PER ADDITIONAL POUND OF OF DRY MATTER	0.90 cent (9/10 cent) (0.41 cent 2/5 cent)
COMPARE PURCHASE OF HAY (50cents/bale)	2.2 cent/kg DM (1 cent/lb DM)
MEAL ($65/ton)	6.6 cents/kg/DM (3 cents/lb DM)

Utilisation:

As with the agronomist, there is scope for work by the nutritionist to investigate the use of maize for silage or green feed. American advice is that the crop should be used when dry matter content is about 35%. At this stage the crop will be still marginal in protein, and it will be reasonably fibrous.

In New Zealand pasture is a very satisfactory and economic feedstuff to sustain high levels of animal production. Maize is unlikely to replace pasture as a productive diet for reasons of both economy and available protein. It is suggested therefore, that it would be realistic to use maize as a provider of maintenance requirements during periods of pasture shortage. In this context it will be necessary to determine the optimum growth stage for feeding, as other greenfeed and silage, and the proportion of total diet it should represent for various classes of stock.

Potential:

Flexibility of decision making is a feature of direct drilling and this is a desirable feature for most animal farming enterprises. By November, dairy farmers know whether or not they are going to be able to conserve their estimated winter supplement requirements from pasture. Furthermore, they know at this stage whether, if they will be faced with a pasture shortage later in the season and whether they will have sufficient feed in reserve to cope. If at this stage they feel their reserves are inadequate they can decide to direct drill maize, and the crop could be sown within two or three days of having made that decision.

Following are two cases, one each of dairy and beef production, of the extent to which direct drilled maize might be utilised.

Maize on the Dairy Farm

Example - Maize silage to be used as winter supplement on 40 hectare (100 acre) farm milking 120 cows and carrying replacement stock. Basic assumption - Winter supplementary feeding, to approximately one

half of total intake, requires 615 kg (550 lb) of dry matter per hectare per cow (per acre per cow) of conserved feed (e.g. 10 bales of hay per cow).

120 cows + replacements (20%)

= 144 cow equivalents.

Storage losses for silage = 15%

Thus total winter requirements as green material for ensiling = 42,200 kg. DM (93,000 lb DM)

TABLE 2: Maize and pasture silages on dairy case farm

	Pasture Silage	Maize Silage
Dry Matter Yield/acre	3,360 kg (3,000 lb)	17,920 kg (16,000 lb)
Area required for 42,200 kg DM (93,000 lb DM)	12.5 hectares (31 acres)	2.4 hectares (6 acres)
Time Closed	2 months	3 months

Net Area of pasture available for grazing 9 hectares (22 acres) for 2 months.

In Table 2 the areas required to provide the winter supplements for this farm are calculated for maize and pasture silage. Making an allowance for the different periods over which each would be closed, it is calculated that a nett saving of 9 hectares (22 acres) for two months is achieved.

Having rescued 9 hectares (22 acres) for the farm we must consider ways by which this can benefit the enterprise.

In a season of pasture shortage the extra area available for late spring/summer grazing (22% of farm) may increase production by a similar amount.

In other seasons, this area may be surplus to herd requirements. In which case it may be used for some secondary enterprise, such as the rearing of beef weaners for sale in the autumn at 180/225 kg (400/500 lb) liveweight rather than 90 kg (200 lb) at weaning. The additional cash return represents the nett benefit of using maize for winter supplement.

In the 1969/70 and 1970/71 seasons two thirds of the Waikato crops, referred to earlier were grazed as greenfeed. In both years the decision to graze was made due to drought conditions prevailing in the late summer to autumn period. It was observed

that during the feeding period milk yields on the farms concerned continued to fall. Turnips, on the other hand, held milk production during the drought. However the benefit of maize was seen after the drought had finished, in so far maize-fed herds had maintained body weight and production continued for a longer season that was the case for both the turnip fed herds and those fed no crop supplement.

Maize on the Beef Farm

Intensive beef rearing is an enterprise which is gaining popularity throughout the country. The place for maize on these farms is expected to be greater than on the dairy farm. The reason for this prediction is that beef rearing is the most profitable beef enterprise, a maintenance plus level of feeding must be sustained throughout the year. The use of direct drilled maize on intensive beef farms would be the injection of additional feed into the system at any time of the year.

DISCUSSION

High production per unit at time of per unit of land is an important feature of the direct drilling method of growing crops. It enables flexibility of decision making by the farmer, and allows a bulk of feed from crop to be injected into a production of the pasture at either end of the crop's life.

Maize is a crop capable of producing a large bulk of feed in a short period of time.

Programmes incorporating direct drilled maize offer the opportunity to further lift the productive ceiling of any one farm.

There are deficiencies in our knowledge of agronomic and nutritional factors associated with maize growing and utilisation. It is suggested that if effort were applied to overcome these deficiencies, direct drilled maize could be profitably used in intensive grass farming enterprises.

ACKNOWLEDGEMENTS

The authors wish to thank farmers, farm consultants and research scientists who have contributed to the material presented in this paper.

REFERENCE

Williams, P.P. 1970 I.C.I. (N.Z.) Ltd publication TMZN 1129.