THE EFFECTS OF EARLY AND LATE PLOUGHING AND NITROGEN APPLICATION ON SWEDE AND KALE PRODUCTION

R.C. Stephen and A. Kelson
Invermay Agricultural Research Centre
Ministry of Agriculture and Fisheries
Private Bag
Mosgiel

ABSTRACT

The effects on swede and kale production of early and late ploughing, with and without nitrogen application, were examined in two successive years.

For similar times of sowing, the total dry matter yields of the crops were lower for November ploughing than for ploughing in July/August. However, addition of the early Spring to date of ploughing pasture production to the crop yields obtained from November ploughing gave higher total yields compared with the crop yields obtained from early ploughing.

Nitrogen application had no significant effect on crop yields but these were consistently higher in the presence of applied nitrogen.

In the case of late ploughing, rotary-hoeing and mouldboard ploughing gave similar crop yields with one exception.

INTRODUCTION

Marrow-stem kale and swedes are important winter-feed crops in Otago and Southland. Both crops are usually sown in November/December (Keenan 1971, Claridge 1972). Recommendations on time of ploughing for kale do not appear to have been reported but Sewell (1956) recommended autumn or early winter ploughing for swedes, the early ploughing allowing ample time for breakdown of the turf (Claridge 1972). Late ploughing in November just prior to sowing has become a common practice; this has allowed use of the pasture for grazing during the late winter and early spring months.

In New Zealand there are few reports of the effects of time of ploughing on crop production. Ivey (1896) reported higher yields of turnips with early ploughing in September compared with ploughing in November. However ploughing in May or in September had no effect on mangel yields (McConnell 1913). No work appears to have been done on swedes and kale and the trials reported here were intended to remedy this deficiency.

MATERIALS AND METHODS

Similar trials were carried out in 2 consecutive years on a Wingatui silt loam ploughed out of pasture in each year. The trial design was a 3 x 2 split-plot randomised block with 4 replicates for each crop. The ploughing treatments, allocated to main plots 10m x 2.44m in size, compared mouldboard ploughing (20 cm) in July/August, with ploughing in November using either a mouldboard plough or a rotary hoe. The nitrogen subplot treatments included a nil-N control and 22 kg N/ha in 1971/72 and 35 kg N/ha in 1972/73 as Urea, broadcast on the soil surface immediately after sowing.

Some of the experimental details are given in Table 1.

TABLE 1: Experimental details

Year	Crop	Ploughing Date	Sowing Date	Seed rate kg/ha	Harvest Total	Dates Residue
1971/72	Swedes	Jul. 29	Dec. 12	0.65	Jul. 13	Jul. 24
		Nov. 4				
	Kale	Jul. 29	Nov. 24	3.1	Jul. 14	Jul. 26
		Nov. 4				
1972/73	Swedes	Aug. 12	Nov. 29	0.56	Jul. 10	Aug. 1
		Nov. 24				
	Kale	Aug. 14	Nov. 29	2.8	Jul. 11	Aug. 1
		Nov. 24				

Sensation swedes were sown using a 4-row ridger (61 cm spacing) together with a mixture of 9 kg P/ha as reverted superphosphate and 10.5 kg P/ha as reverted boarted superphosphate. Medium-stemmed marrow-stem kale was sown at 15 cm spacings using a Duncan drill along with 22 kg P/ha as reverted superphosphate. At crop harvest time an area of 1.83m was randomly selected for harvesting within each plot, the outside guard rows being excluded. Fresh weights were recorded and samples taken for dry matter determination.

In the case of the late-ploughing treatments pasture production was determined at intervals from the July ploughing to the time of ploughing in November. Two strips 3.32 m x 0.61 m were cut, a different area being

sampled on each occasion. After each sampling the whole plot was trimmed to the same level. Additional of this pasture production to the late-ploughing crop yields enabled a comparison of the ploughing treatments on an annual production basis.

At Invermay, the 30 year average rainfall for the period November to July is 556 mm. In 1971/72 for the same period the rainfall amounted to 807 mm but in 1972/73 there was only 353 mm and the months of January (23 mm) and February (14 mm) were particularly dry.

RESULTS

Effects of ploughing treatments

At the time of harvest, there were no significant differences in the numbers of either swede or kale plants/plot from the various ploughing or nitrogen treatments. The number of swede plants/plot was lower in 1972/73 partly due to a slightly lower seeding rate and partly perhaps to the failure of some seedlings to survive the very low rainfall conditions prevalent after sowing in that year. In the case of kale, there was considerable variability in plant population from plot to plot, a feature presumably due to the lack of precision sowing using the Duncan drill.

The effects of ploughing treatment on dry matter yields are shown in Table 2.

TABLE 2: The effect of ploughing treatment on total dry matter production

Ploughing Treatment					
Month	Implement	Swedes	Swedes + Grass *	Kale	Kale + Grass*
1971-72					
Jul.	mouldboard	7 916 aA	7 916 cB	13 543	13 543 a
Nov.	mouldboard	7 173 aAB	10 057 aA	11 090 a	13 968 a
Nov.	rotary hoe	6 224 bB	9 108 bAB	11 207 a	14 084 a
C.V. %		9.4	7.4	40.8	35.5
1972-73					
Aug.	mouldboard	7 852 aA	7 852 bB	9 119 aA	9 119 a
Nov.	mouldboard	6 748 bA	10 021 aA	7 031 bA	10 111 a
Nov.	rotary hoe	6 718 bA	9 991 aA	7 298 bA	10 378 a
C.V. %		13.7	10.7	16.3	12.9

* Pasture production (kg DM/ha) from spring to date of ploughing added to November — ploughed crop yields

With one exception the trends were similar for both crops over the two years. Total dry matter yields were higher from the early ploughing treatment with the November mouldboard ploughing treatment though the differences were not significant in 1971/72. Using either a mouldboard plough or rotary hoe in November had no significant effect on total yields except for swedes in 1971/72 where the yields from rotary-hoeing were lower.

When, however, the pasture production from early Spring to the date of ploughing in November was added to the crop yields in the late-ploughed treatments the position was quite different. The total dry matter production from late-ploughing was greater than that from the early-ploughing crop yields though the differences were not significant in the case of kale. Rotary-hoeing or using a mouldboard plough in November had no apparent effect on crop yields except in the case of swedes in 1971/72 when the yields from rotary-hoeing were lower.

Effect of nitrogen application

The interactions between ploughing and nitrogen treatments were not significant and hence only the main effect means for nitrogen application are given in Table 3.

TABLE 3: Effect of nitrogen application on total dry matter yields (kg/ha)

	1971-72		1972-73	
Crop	No N	22 kg N/ha	No N	35 kg N/ha
Swedes	6 875 a	7 334 a	7 008 a	7 203 a
C.V.%	10.2		12.4	
Kale	11 151 a	12 742 a	7 598 a	
C.V.%	17.2		13.1	

Nitrogen application, even at the higher rate in 1972/73, had no significant effect on the total crop yields. It may be of some significance, however, that the crop yields with applied nitrogen were consistently higher than those without added nitrogen.

Crop utilisation

The crops were grazed off and a residue sampling was undertaken to determine percentage utilization. Neither ploughing treatment nor nitrogen application had any significant effect on the percentage utilization. Crop utilization was high for swedes in both years varying from 87 to 93% and also for kale in 1972/73 where utilization averaged 91%. Utilization of kale in 1971/72 was lower (79%) but this was due probably to the fact that the sheep were not kept on the crop sufficiently long for fuller utilization.

DISCUSSION

Though the differences were not always significant in the present trials, there was a similar trend in both years for the total crop yields to be lower following late ploughing in November compared with early ploughing in July-August. This result is similar to that reported by Ivey (1896) for turnips. McConnell's (1913) report of no difference in mangel yields is not inconsistent since the ploughing treatments (May and September) could both be termed "early" in respect of a December sowing.

On the other hand, late ploughing in November just prior to sowing allows the use of the pasture for grazing during the late winter and early spring months. Addition of the pasture production for this period to the crop yields obtained from November ploughing tended to give greater total production on an annual basis compared with the crop yields obtained from early ploughing. It was unprofitable therefore on an annual production basis to leave the land fallow and unproductive from the date of early ploughing to sowing in late November/December.

Nitrogen application was included as a treatment because of the possibility that a nitrogen-deficiency situation might result in the case of the late-ploughing treatments. With early ploughing it was expected that considerable decomposition of the turf would have occured before sowing and hence it was less likely that the crop would suffer from lack of available soil nitrogen. A lack of response to nitrogen would be likely if the soil nitrogen status was satisfactory as was possible in this study since the crops followed immediately after pasture. However, nitrogen application had no significant effect on the crop yields and there was no evidence of any interaction between the ploughing and nitrogen treatments.

However, although the differences were not significant, there was a consistent trend towards increased yield in the presence of applied nitrogen which suggests that the soil nitrogen status was not sufficiently high to support maximum yields. The trend towards higher yields with applied nitrogen occured also in the early-ploughed plots and implies that some nitrogen immobilization, from turf decomposition, may have continued during the early stages of crop growth and hence there was a possibility of at least a partial nitrogen deficiency at that time. There is no evidence in the present trials to substantiate this hypothesis but further experimental work should be designed to examine it.

CONCLUSION

If land for winter-feed crop production is limited it would seem advisable to plough as early as possible as this treatment would tend to lead to higher crop yields. On the other hand, if land for winter-feed production is not limited, late-ploughing of a larger acreage would give sufficient feed (of lower average yield). The latter system would be more profitable in terms of a higher total annual yield and has an advantage in the fact that the pasture is available for grazing in late winter and early spring instead of the land being unproductive.

REFERENCES

Claridge, J.H. 1972. Arable farm crops of New Zealand Department of Scientific and Industrial Research, 345 pp.

Ivey, W.E. 1896. Report on Agricultural Experiments at Lincoln College. Supplement to New Zealand Country Journal **20:** 6-16.

Kennan, B.R. 1971. Crops Section, Technical Handbook, Research Division, New Zealand Department of Agriculture, C3 and C4.

McConnell, P. 1913. Root crops at Ruakura. New Zealand Journal of Agriculture **7:** 479-481.

Sewell, T.G. 1956. Land preparation for spring-sown fodder crops in South Island. New Zealand Journal of Agriculture **93:** 137.