STUDIES OF DIRECT-DRILLED BRASSICAS IN THE WAIKATO AND CENTRAL PLATEAU REGION

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Summary

Direct-drilled crops of soft turnips and swedes equalled yields of traditionally cultivated crops at Arapuni. In crops of rape and choumoellier at Arapuni and swedes and choumoellier at Reporoa, highest yields came from traditional cultivation. There are strong indications that the reduced yields from direct-drilled choumoellier and rape resulted from a dry season and limitations in the root development of direct-drilled plants.

INTRODUCTION

THE TRIALS compared direct drilling and minimal cultivation techniques, with traditional cultivation in the establishment and production of brassica crops.

Much of the ground work for these trials was done under South Island conditions by Taylor (1967b).

Evaluation of chemical treatments for direct drilling, carried out at Arapuni and Rotorua during the 1966-7 season, confirmed the need for lasting control of grasses and legumes and for rapid establishment of the crop. This work also showed advantages from application of bag nitrogen.

EXPERIMENTAL

Two trials were laid down in 1967-8, at Arapuni on Tirau sandy loam and at Reporoa on Taupo sandy silt. At the former site, parallel experiments were conducted on soft turnips, rape, swedes and choumoellier. At Reporoa, experiments were carried out with swedes and choumoellier only.

A minimal cultivation technique includes the application of paraquat to pasture 5 to 6 days prior to rotary-hoeing to give control of pasture species and rapid breakdown of turf. This treatment was included because cultivation techniques used in this part of the North Island often use the rotary-hoe or disc plough as a means of cultivating pasture, sometimes with much regrowth.

DESIGN AND TREATMENTS

Main treatments were of randomized block design with four replicates. Nitrogen treatments were applied in sub-plots in randomized positions on main plots.

Traditional Cultivation

Every attempt was made to provide an ideal seedbed. Ploughing took place 2 to 3 weeks prior to the date of drilling. Surface cultivations to give consolidation, tilth and weed control were made during the 24 hours preceding drilling.

Minimal Cultivation

Application of paraquat at 8 oz (all rates in active ingredient per acre) was made 5 to 6 days prior to rotary-hoeing. Further seedbed preparation followed, using light harrows and a Cambridge roller. Drilling took place within 48 hours of rotary-hoeing.

Direct Drilling

Pastures were prepared by grazing until four days prior to spraying when stock was removed to allow regrowth. Chemical treatments were paraquat 12 oz and paraquat 12 oz plus dicamba 4 oz.

Drilling took place on the day of spraying. All treatments were drilled on the same day.

A Duncan 700 Seedliner, with modified V-tips described by Taylor (1967a) preceded by an upright skeeth, was used to drill seed and fertilizer. Seed was mixed with 3 cwt of reverted superphosphate for drilling.

Nitrogen at 112 lb of ammonium sulphate was broadcast over sub-plots after drilling.

RESULTS

Direct-drilled crops of soft turnips and swedes established at Arapuni using 12 oz paraquat plus 4 oz of dicamba, as a clover suppressant, produced yields equal to those obtained by traditional methods of cultivation. Rape and choumoellier crops using traditional cultivation exceeded yields from direct-seeded crops by 25%. The proportion of bulb to total yield in soft turnips and swedes was higher on direct-drilled plots than on either cultivation.

TABLE 1: ARAPUNI—CROP YIELDS

(tons per acre, green weight)

Treatment	Soft Turnips		Swedes		Rape	Choumoellier
	Bulb		Bulb			
Traditional cultivation	42.0 aA	28.7 abA	39.7 abA	27.8 abA	17.8 aA	40.1 aA
Minimal cultivation	35.4 abA	24.3 bA	31.6 bA	24.2 bA	15.1 AB	29.0 bB
paraquat 12 oz direct drilled	33.0 bA	25.4 bA	36.5 abA	27.7 abA	12.9 bB	32.3 bB
paraquat 12 oz/dicamba 4 oz, direct drilled	41.9 aA	31.3 aA	41.7 aA	33.8 aA	12.7 bB	30.3 bB
CV		12.7%		19.1%	13.9%	15.3%

The addition of 4 oz dicamba to 12 oz of paraquat gave control of legumes, mainly white clover (*Trifolium repens*), and resulted in a higher yield of swedes and soft turnips.

At Reporoa, interim harvest data showed that traditionally cultivated crops had also out-yielded other treatments.

Assessments of crop vigour made at Reporoa 4 weeks after drilling showed a marked increase in germination and seedling vigour of direct-

TABLE 2: ARAPUNI—WEED AND CLOVER INFESTATION AT HARVEST—SWEDES

(Weights in grams from 16 sq. yd of plot)

<i>Treatment</i>	<i>Annual Weeds</i>	<i>Legume</i>
Traditional cultivation	768	0
Minimal cultivation	1,364	0
paraquat 12 oz, direct drilled	119	581
paraquat 12 oz/dicamba 4 oz, direct drilled	227	46

drilled and minimal cultivation plots over traditional cultivation. Seven weeks from drilling, traditional cultivation had increased in vigour and at nine weeks was the most vigorous treatment.

Soil nitrogen tests made four weeks after sowing show the availability of soil nitrogen in the top 3 in. of soil to be greatest in direct-drilled treatments.

Plant root measurements, made at a time when traditional cultivation was the most vigorous treatment, showed differences in root structure, depth and weight between the various cultivation treatments.

No response to 1 cwt of ammonium sulphate was evident in yield data from any crop.

TABLE 3: REPOROA—CHOUMOELLIER OBSERVATION

(Estimations of vigour based on 0 to 10 scale with 10 maximum vigour)

<i>Treatment</i>	<i>Vigour</i>				<i>Nitrogen Avail-</i>	<i>Root</i>	<i>Interim</i>
	<i>Weeks from Plant</i>				<i>ability (ppm)</i>	<i>Weight</i>	<i>Yields</i>
	<i>from</i>	<i>drilling</i>	<i>Count</i>				
	4	7	9	4	4	9	24
Traditional cultivation	4	10	10	8	161	43	22.5 aA
Minimal cultivation	9	10	9	15	228	39	17 abAB
Direct drilled CV	9	9	6	14	330	23	12 bAB
							26.1%

TABLE 4: RAINFALL FIGURES—ARAPUNI AND REPOROA

	<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>
ARAPUNI					
Ave. of 5 yr			4.88	4.26	6.35
1967-8			4.26	1.88	2.45
				4.55	2.83
				1.42	7.21
REPOROA					
Aver. of 5 yr			5.15	5.71	6.58
1967-8			7.88	1.75	1.06
				5.14	3.79
				1.48	6.71

DISCUSSION

At Arapuni, yield differences between leaf and bulb brassicas grown in parallel experiments by direct drilling methods suggest that limitations in the availability of nitrogen or moisture may have affected yields of choumoellier and rape.

Appilcation of 1 cwt of ammonium sulphate produced no consistent advantage in yield in any crop. However, application of 3 cwt of ammonium sulphate to direct-drilled turnips during the 1966-7 season produced increases in yield and vigour.

Poor germination and low seedling vigour appearing in traditionally cultivated plots at Reporoa were almost certainly due to lack of available nitrogen during the early stages of plant development. In these treatments, the thin topsoil inverted by ploughing would be placed beyond the root range of small seedlings. As root systems developed, penetration of the top soil layer would account for the rapid increase in crop vigour. Organic matter at the furrow bottom would also have a better retention of moisture than it would at the surface.

Consideration of the requirements and availability of nitrogen and moisture stemming from a decline in vigour of direct-drilled crops at Reporoa led to the inspection and measurement of root structure in choumoellier. The results of this observation were that plants from direct-drilled plots exhibited a shallow horizontal root structure while plants from traditional cultivation had a deep-spreading root system. Stoker (1965) reported similar findings of root structure in kale. The cumulative effects of root structure and poor moisture retention of the soils studied in this unusually dry season, for these districts, would explain the inability of the direct-drilled leaf brassicas to produce yields comparable to those shown by Taylor on Canterbury soils.

Yields from minimal cultivation treatments were suppressed by weed competition, although the problem was not severe. Direct drilling gave a high degree of weed control but some competition due to clover regrowth resulted where no clover suppressant was included. Whilst the 1968 dry summer caused moisture stress in direct-drilled choumoellier and rape, it also had the effect of reducing weed growth on cultivated plots. Only in the rotary-hoed plots did weed competition affect yield, but experience in this district would indicate that weed growth is generally greater with cultivation than shown in this experiment.

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