WINTER FORAGE CROPS IN CANTERBURY

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SUMMARY

Forage yield data were obtained in field experiments in Canterbury from two cultivars of beet, marrow-stemmed kales, rapes, turnips, cereal green-feeds and turnip/ryegrass greenfeed mixtures. Overall the beets gave highest yields of dry matter and were followed in order of declining yields by marrow-stemed kales, turnips, turnip/ryegrass greenfeed mixtures, swedes, rapes, ryegrass greenfeeds and cereal greenfeeds.

INTRODUCTION

In Canterbury, growth of irrigated and non-irrigated pastures on Lismore soils is limited in winter months by low soil temperatures and under these conditions, supply inadequate quantities of feed for sheep and cattle (Rickard 1968). Consequently in Lismore and other similar soils it is common practice to cultivate forage crops for feeding *in situ* to livestock in the late winter and early spring months. Each year some 90,000 hectares or 8% of the total area of arable soils in Canterbury are sown in winter forage crops comprising beets, swedes, marrow-stemmed kales, turnips, rapes, lupins, cereal and ryegrass greenfeeds and various mixtures of these crops (Anon 1970).

In the past, local research effort has been directed to the improvement of individual winter forage crops through selection and breeding for either resistance or tolerance to diseases and pests (Calder, 1939, 1944., Lobb 1951, van Steveninch 1956., Palmer 1960, 1965., and Lammerinck 1968). Little has been done to assess the relative values of individual crops as sources of winter forage. This paper gives details of field experiments designed to facilitate comparisons of winter forage crops and their cultivars.

MATERIALS AND METHODS

The winter forage crops were established in the early summer on areas of shallow soils near Hinds and Rokeby in 1968 and at Seafield in 1969. On each site two cultivars of swedes *Brassica napus*, L, marrow-stemmed kales *Brassica oleracea* L, turnips *Brassica rapa* L, cereal greenfeeds *Avena sativa* L, *Secale cereale* L, and ryegrass greenfeeds *Lolium spp.* were sown in cultivated seedbeds at seeding rates and at times local commercial farmer experience had shown to be satisfactory. At Rokeby and Seafield two rape cultivars *Brassica napus* L were also sown and additionally at Seafield two beets *Beta vulgaris* L.

The crops were sown in main plots each 5 m x 30 m in randomised blocks replicated four times. The cultivars of each crop were sown in sub-plots each 2.5 m x 30 m. The rapes, turnips, cereal greenfeeds, ryegrass greenfeeds and turnip/ryegrass greenfeed mixtures were drilled in 18 cm rows, the swedes and marrow-stemmed kales in 36 cm rows and the beets in 54 cm rows. Each crop was drilled with molybdic reverted superphosphate at the rate of 250 kg/ha.

Apart from the beets at Seafield, none of the crops was given additional cultural treatments after establishment and prior to harvest. At Seafield approximately 25 mm of water was applied immediately after seeding to the beets which, after establishment, were thinned and singled.

In the late winter each field experiment was sampled for yield data. At one site, Rokeby, plots were also sampled in the early winter. The crop samples were cleaned, where necessary dissected into either leaf and bulb components or leaf and stalk components, weighed and sub-samples taken for dry matter determinations as recommended by Lynch (1960). Dry matter determinations were made using standard techniques (Lynch 1960).

RESULTS

In the summers and early autumns of 1969 and 1970, high temperatures and normal drought conditions were experienced. The crops established well but made little growth before the onset of lower temperatures and damper conditions in the autumn. In both years, crop growth continued well into the winter.

At Hinds and Rokeby, the aphid *Brevicoryne brassicae* became established in swede, marrow-stemmed kale and rape crops and the ryecorn greenfeed crops became infected with leaf rust *Puccinia graminis.* At Hinds the soft turnips became infested with larvae of diamond-backed moth *Plutella maculipennis.*

At Seafield, the cereal greenfeed Amuri oats matured early and produced grain before the onset of winter. Cultivar forage yields are given in Table 1. Apart from Giant marrow-stemmed kale at Seafield, which yielded significantly ($P < 0.05$) more forage than Thousand Headed marrow-stemmed kale, none of the other members of paired crop cultivars differed significantly in their dry matter yields.

TABLE 1: Cultivar Forage Yields – dry matter kg/ha

Site	Hinds		Rokeby		Seafield	
Harvest Date	14.7.69		28.7.69		1.7.70	
Beets					Orange Globe	13360 aA
					Korsroe	13650 aA
Swedes	Calder	3039 cdeCDE	Calder	5680 abcABC	Calder	5990 cde CD
	Doon Spartan	2658 deDEF	Doon Spartan	5060 cdABC	Wilhlemsberger	6820 cd BC
Marrow-stem-med Kales	Giant	4487 aA	Giant	6470 abAB	Giant	10480 b AB
	Maris Kestrel	4106 abAB	Maris Kestrel	6150 abcAB	Thousand headed	7500 c BC
Rapes			Moana	5050 cdBCD	Moana	3710 ef CD
			Rangi	5480 bcABCD	Rangi	4650 cdef CD
Turnips	Green Globe	3040 cdBCDE	Green Globe	6640 abAB	Green Globe	5190 cdef CD
	Kapai	3911	Kapai	6600 abAB	Kapai	6160 cde CD
Cereals	Amuri oats	1323 gG	Amuri oats	3440 eE	Amuri oats	2270 f D
	CRD ryecorn	1874 fgFG	CRD ryecorn	3440 eE	CRD ryecorn	2230 f D
Ryegrasses	Paroa	2205 efEFG	Paroa	4010 deCDE	Paroa	3930 def CD
	Tama	2072 deDEF	Tama	3800 deDE	Tama	3880 def CD
Turnip/ Ryegrass mitures	Green Globe & Paroa	3542 bcABCD	Green Globe & Paroa	7000 aA	Green Globe & Paroa	5100 cdef CD
	Green Globe & Tama	3815 abABC	Green Globe & Tama	6190 abcAB	Green Globe & Tama	4850 cdef CD
CV	16%		16.3%		29.6%	

TABLE 2: Crop Forage Yields * – dry matter kg/ha

Site	Hinds		Rokeby		Seafield		
Harvest Date	14.7.69		28.7.69		1.7.70		Mean
Beets					15,130	aA	
Swedes	3,190	cCD	6,015	bcAB	7,210	cC	5,470
Kales	4,800	aA	7,070	abAB	10,080	bB	7,320
Rapes			5,890	cB	4,680	deCD	5,290
Turnips	3,900	bBC	7,420	aA	6,360	cdC	5,890
Cereal Greenfeeds	1,790	dE	3,690	dC	2,520	eD	2,670
Ryegrass Greenfeeds	2,730	cD	4,370	dC	4,380	deCD	3,830
Turnip/ryegrass Greenfeeds	4,140	baB	7,380	aA	5,560	cdC	5,690
C.V.	16.0%		16.3%		29.6%		

* Means of cultivar yields

Crop forage yields are given in Table 2. Of the crops included in both years the marrow-stemmed kales gave the highest mean yields (overall) followed in order of declining yield by turnips, turnip/ryegrass greenfeed mixtures, swedes, rapes, ryegrass and cereal greenfeeds. In the single experiment including beets (Seafield), the yields of this crop outyielded all others.

At Rokeby, where the experimental crops were harvested on two occasions, the early-winter forage yields were lower than the late-winter yields. However, relative forage yields did not differ.

TABLE 3: Crop Forage Yields * – metabolizable energy Mcal/ha.

Sites		Hinds	Rokeby	Seafield	Mean
Crops	DM/ME Conversion factor				
Beets	3.0			45,390	
Swedes	3.1	9,570	18,045	21,630	16,420
Kales	2.9	13,920	20,503	29,232	21,220
Rapes	3.0	–	17,670	14,040	15,580
Turnips	3.0	11,700	22,260	19,080	17,680
Cereal Greenfeeds	2.7	3,938	8,118	5,544	5,870
Ryegrass Greenfeeds	2.8	7.644	12,236	12,264	10,720
Turnip/Ryegrass Greenfeed Mixtures	2.9	12.006	21,402	16,124	16,510

* Means of cultivar yields.

In the field experiments described winter forage crops yielded comparatively large quantities of a feed at a time in the year when grass/clover and lucerne pastures provide negligible quantities of feed. In both seasons there was no pasture growth on sites adjacent to the experiments. In fact the higher-yielding forage crops produced as much material as would normally be expected from a full year's non-irrigated growth of either grass/clover pasture (Rickard, 1968) or lucerne (Stephen, 1970).

Forage yields of beets are available from only one experiment, but in it they yielded 50% more than the next highest yielding crop, marrow-stemmed kale. However, it may be argued that the application of water may have had some beneficial effect on beet yield. This coupled with the fact that beet was only included in 1 experiment suggests that more experimentation on beet versus other crops is desirable.

Crop yields vary with the length of the growing period and the rate of dry matter accumulation. Turnips have a comparatively high mean rate of dry matter accumulation and in a shorter period produced as much forage as was produced by the swede crops.

The yields of the turnip/ryegrass greenfeed mixtures tended to be greater than those of the ryegrass greenfeeds drilled alone but differed little from those of the turnip crops. These yields suggested that there is little advantage in terms of winter forage yields to be derived from the common practice of drilling ryegrasses with turnips.

In his consideration of the values of feed for ruminants, Bryant (1971) urged use of the concept of metabolizable energy to assess the qualities of feeds. Jagusch and Coop (1971) using locally derived data have produced dry matter/metabolizable energy conversion factors for a wide range of common feeds. Use of their conversion factors to calculate winter forage yields in terms of metabolizable energy (Table 3) indicates that the relative productivity of crops in terms of dry matter kg/ha differs little from that expressed in terms of metabolizable energy Kcal/ha.

Apart from Giant and Thousand Headed marrow-stemmed kale, none of the other members of paired crop cultivars differed in forage yields. The failure of crop cultivars to differ in forage yields prompts the question whether plant breeders have sought improvement in those individual crop characteristics which have the greatest influence on forage yields.

Overall, the late winter forage yields of the marrow-stemmed kales were respectively almost three times and almost twice as great as the forage yields of cereal greenfeeds and ryegrass greenfeeds. With the other crops occupying an intermediate position while greenfeeds may have a place as "catch" crops, the question arises whether research effort is worthwhile on crops having low potential yields. The high yields of the kales (and possibly beet) suggest that more agronomic research would be more profitable on these crops.

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