Crops for winter feed in an extreme high country environment

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Abstract

A 4-year trial on marginal Pukaki high country soil showed adequate (5 t DM/ha) pre-winter yields were obtained only following several years of a development legume phase, N fertilizer, early sowing, some irrigation or favourable autumn growing conditions. The highest yields were from swedes, rape, annual lupin and some cereals.

Keywords: brassicas, cereals, high country, winter feed

Introduction

Winter feed for stock is one of the main limitations to pastoral agriculture in the South Island high country. Forage crops of green-feed cereals or brassicas are one option for supplying winter feed in many areas of New Zealand. These are already being used to a limited extent in the high country (McLeod 1969; Scott & Barry 1972). However, there is a continual need to reassess this option; both to define its environmental limitations, and the suitability of species, as new material and cultivars become available.

The northern end of the Mackenzie Basin is close to the highest altitude and' hence lowest temperatures of land capable of cropping and there is no winter growth. Much of the area has weathered soils of low natural fertility, and is predominately hieracium-infested fescue tussock. The trial described investigated the potentials and limitations for establishing winter feed crops from tussock land on such marginal sites.

Methods

The 0.25 ha trial was conducted over 4 years at the Mt John trial site, Lake Tekapo, on level ground of a Pukaki like soil with a shallow 12 cm top soil over a deep 100+ cm till of sandy loam. The vegetation before cultivation was hieracium-infested fescue tussock. Soil pH was 5.01-5.1; Olsen P=5; S test=l. The low soil pH indicated high soil aluminium. Two tonne/ha lime was applied prior to the trial period which raised the pH to 5.6-5.8. Basal fertiliser of 200 kg/ha/yr boron and molybdenum lime reverted superphosphate was used.

The green feed cereals, brassicas and other species tested are listed in Table 1. Fifteen lines were tested each year and 5 were common to all years. Lines were precision drill sown into cultivated ground in 1.5 x 11 m plots.

The level of inputs in the form of times of sowing, nitrogen (N) fertiliser, pre-cropping managements and irrigation were successively increased over the trial period in the attempt to get adequate pre-winter yields. The four stages were:

I Area cultivated from tussock a year previously; re-cultivated in September; swedes and rape drilled late October; turnips end of November; and cereals, annual lupin and annual ryegrass in mid December. The two N levels were 26 kg N/ha and 65 kg N/ha as nitrolime and trial was grown under dryland conditions.

II Autumn cultivation from tussock; earlier drillings with swedes and rape mid October, and turnips, cereals and annual ryegrass mid December; N 21 and 86 kg N/ha as urea; and also grown under dryland conditions.

III Autumn cultivated land which for the previous 4 years had been in red clover; drilling mid October and mid December; 100 kg N/ha as urea; and under dryland conditions.

IV Same area as III. Late November drilling for swedes and rape; and early February drilling for turnips, cereals and annual ryegrass; 100 and 200 kg N/ha as urea; insecticide for aphid control on brassicas; and periodic irrigation from sowing.

The design was a split block of 4 replication blocks, N blocks and lines randomised within each N block. Plots were subsampled for pre-winter yields in late May, and in the first and second year on some other occasions during the winter.

Results and discussion

Adequate mean yields exceeding 5 tonne DM/ha by winter were achieved only in the later years of the trial with higher inputs (Table 1). The mean yields in the first year with the soil cultivated directly from hieracium/ tussock, low N fertiliser and sowing times used in the lowlands were unacceptable for practical farming.

Table 1 Mean pre-winter yields (May tonne DM/ha) of green-feed crops on a marginal high country site under progressively increasing inputs in successive years.

Species and cultivar	Input I	II	III	IV
Mean all lines	0.9	2.1	1.6	5.5
Annual tyegrass				
Moata	1.4	2.2	1.1	3.0
Swede				
Doon Major	0.6	7.4	1.9	14.1
Rape				
Rangi				10.4
Winifred	0.6	3.3	2.6	
Turnip				
Green globe	1.5	2.6		6.2
Annual lupin				
Fest	1.6	7.0		
Ryecorn				
Local	0.0	0.9	1.6	2.3
Rapaki	1.3	1.3	1.3	5.1
Oats				
Ohau				4.3
Omihi	1.8	0.0	0.8	
Taiko	1.5	0.6	0.9	2.9
Barley				
Gwylan				5.7
Illia	0.7	0.7	1.0	
Koru	1.1	0.5	1.0	
PSB-69				5.2
Wheat				
Abele		0.4	2.3	
Bounty	0.4	0.7	1.7	
CR1-111				4.6
Karamu	0.2			4.3
Triticale				
Beaguelita	0.5			
CT 138/77/1		1.8		
Karere	0.4	0.6	0.7	6.2
PST-I 1				5.4
SE diff	0.4	0.6	0.4	0.6

An initial trial prior to those described had indicated that soil aluminium was likely to be a major problem and hence the inclusion of liming prior to this series of trials.

Earlier sowings were made in subsequent years in an attempt to give a longer growth period and to use the better soil moisture conditions of late spring. The annual lupin and swedes gave acceptable yields in those conditions. A consequence of the earlier sowing was that most cereals went to head in late summer and many did not return to vegetative growth when topped.

The third year used a block which had been in red clover for 4 years and even with higher rates of N fertiliser, still did not give adequate yields. Cereals still went to head and aphids attacked the brassicas. The first 3 years were under dryland conditions and were thus very dependent on summer and autumn rain for adequate yields.

Good yields were obtained in the fourth year when periodic irrigation was used together with higher N fertiliser levels, insecticide for aphid control in the bassicas, and with cereals sown later. The reasoning that earlier drillings were required under dryland conditions was to get adequate growth in these regions of variable autumn growth conditions. But with irrigation, later drillings, as used in more favourable areas, could be used without the problem of cereals going to head. The highest yields were from brassicas in the order swede, rape and turnips.

In the first, second and fourth years there were also differential N fertiliser treatments, the increase in means yields between the two levels being 9.1, 10.5 and 4.1 kg DM/kg N respectively. From a farm management perspective it would probably be justifiable to use higher N fertilizer rates if it was necessary to produce winter feed crops from this class of soil.

In the first and second years yields were also sampled on one or two occasions during the winter. With frosting there was a significant decrease in available feed over the winter, with a 47% net decrease between June and August in the first year, and 19% between May and July in the second year. However, there was a difference between species, the decrease being least for the brassicas, ryecom, barley and some other cereals. There was great variation among the cereals in relation to their growth habit and frost tolerance.

The trial indicates that winter feed crops on these weathered soils can be extremely variable. Crops are very dependent on favourable summer and autumn growing conditions, and on these free-draining structureless soils with variable rainfall, irrigation seems to be the only way to give some certainty in crop yields. Liming may be required. The soils will also probably have to go through several years of clover before going to these crops, and N fertiliser may also be required.

With adequate growing conditions the brassicas seem to give the highest yields, decrease least during the winter, but apart from turnips, require the longest growing period. However, the bulbs of turnips and swedes are totally frozen during periods of prolonged frosts, leaving only the tops to be grazed. The kales would be more useful under those conditions, or when snow lies.

The high yield of annual lupin in the second year when other species were still giving low yields with low inputs, warrants further trials. However, they are not suitable for carrying into mid winter as they were quickly burnt off by severe frost and flattened by snow.

As late autumn feed they appear to have good potential. Experience with perennial lupin is also suggesting that the lupin genus has good potential in high country agriculture.

Under irrigation cereals for green-feed can have an important role and may in some seasons be more useful than brassicas under the conditions described above. Later sowings of cereals for green-feed can alleviate the problems of them going to ear. This is their main disadvantage under dryland conditions, with their consequent requirement of earlier drillings.

This trial, and a previous trial on a more fertile high country site (Scott et al. 1984), have not determined which are the best yielding green-feed cereal species and cultivars. Ryecorn seem to be more consistent in producing adequate yields but can be surpassed by other cereal species under better conditions.

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