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EVALUATION OF ALTERNATIVE DRYLAND PASTURE PLANTS AND BROWSE SHRUBS FOR SOIL CONSERVATION IN DROUGHT-PRONE OTAGO GRASSIANDS

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Abstract

Alternative dryland pasture plants drilled into Wairau lucerne may provide improved groundcover for conservation of the soil resource and possible productivity increases. The results of such trials in the Hakataramea Valley are presented. Emphasis is on the use of low fertility demanding, frost and drought tolerant grasses, legumes and herbs which, when properly managed, will persist in semi-arid or drought-prone areas. Preliminary results show 'Grasslands Marry' behaviored to the soil and the semi-arid or drought-prone areas.

Maru phalaris and 'Luna' wheatgrass to be promising companion plants, in dryland lucerne.

The use of browse shrubs on low producing sunny aspects and their integration with dryland pasture plants is briefly discussed. Benefits include conservation of the soil resource, drought insurance, microclimates and shelter, plus diversification of stock nutrition and forage supply.

INTRODUCTION

In dry South Island hill country, there is presently considerable interest in plants adapted to drought-prone, low to moderate fertility soils that will grow with minimal fertiliser input. As a result of recent droughts in the eastern South Island and continued land development in semi-arid Central Otago, evaluation of such plants is extremely important, both for long term soil conservation and erosion control, and for improved productivity at low cost.

Data from New Zealand Land Resource Inventory (NWASCO, 1975-79) indicates that of the total area of land use classes 5-7, tussock grassland in Otago receiving less than 800 mm annual rainfall (281,566 ha), 82% is seriously affected by erosion. Wind erosion in the Hakataramea Valley in August 1985 accounted for an estimated 400,000 tonnes of topsoil lost over an area of approximately 5,000 ha; much of which was in lucerne pasture.

This paper describes a trial to determine if it was possible to re-establish lucerne without cultivation and to evaluate likely companion plants for **dryland** lucerne. The ideal companion plant was perceived to be summer dormant, autumn/winter active and would combine with lucerne to provide year round groundcover thus preventing the soil losses associated with establishment and maintenance of lucerne stands.

METHODS

A 10 ha paddock (soil type = Wetherburn BGE/Otiake YGE intergrade) of 18 year old Wairau lucerne was selected at Riverside Station, Hakataramea. The area was sprayed with Roundup against couch, then disc drilled with the trial species in October 1983 (Table 1). The Waitaki Catchment Commission was responsible for establishment and MWD undertook monitoring of the trial.

As several plant species were difficult to obtain, seed quantities varied and plot sizes therefore ranged from 0.1 to 0.5 ha. At sowing, 126 kg/ha of reverted super lime was applied and in 1984 a maintenance dressing of 100 kg/ha Sulphur Super 400 was carried out. Standard MAF soil 'Quick tests', carried out 12 months after sowing, recorded the following fertility levels:

рΗ	C a	K	P(Olsen)	M g	Na	S	ΑI
8.0	12	31	5 4	22	2	10	1.7

Table 1: Alternative dryland pasture plants sown at Riverside Station, October 1963.

Species	Cultivar	Sowing Rate kg/ha
Agropyron trichophorum (pubescent wheatgrass)	Luna	6
Arrhenatherum elatius (tall oat grass)		NR
Bromus wildenowii (prairie grass)	Matua	6
Dactylis glomerata (cocksfoot)	Apanui	6
Dactylis glomerata (cocksfoot)	Wana	6
Festuca arundinacea (tall fescue)	Roa	6
Lotus corniculatus (birdsfoot trefoil)	Granger	3.5
Lotus corniculatus (birdsfoot trefoil)	Cascade	3.5
Lotus tenuis (narrow leaved birdsfoot trefoil)	_	3.5
Melilotus officinalis (sweet clover)	Israel	3
Medicago sativa (lucerne)	Rere	3
Phalaris aquatica (phalaris)	Maru	6
Sanguisorba minor (sheep's burnett)	_	10
Trisetum flavescens	PGG	N R
Trifolium pratense (red clover)	Pawera	3

NR = Not recorded

Plant numbers and dry matter yields of Wairau lucerne and drilled species were determined by randomly placing five 1 m² quadrats within each plot. Groundcover % for the introduced plants was determined visually within these quadrats once the lucerne had been cut. On two occasions, merino sheep were placed in the trial paddock for 3 days at 100 su/ha and their grazing preferences were ranked on a 0 (low preference) to 10 (high preference) scale. The trial area was grazed briefly during March 1984 and again more closely in October 1984.

RESULTS AND DISCUSSION

In December 1984, poor establishment was recorded for Lotus tenuis, PGG *Trisetum flavescens*, Apanui cocksfoot, Israel sweet clover, Cascade *Lotus corniculatus* and **Pawera** red clover.

In most cases, plant numbers were low in January 1985 during the 1984185 drought (Table 2). This was particularly noticeable with slow establishing Granger birdsfoot trefoil and sheep's burnet. Those that survived best in terms of plant numbers were Luna wheatgrass, tall oat grass, Matua prairie grass and Maru phalaris. Rere lucerne appeared to be surviving well until it was accidentally sprayed out. It was resown in Autumn 1986. Plant numbers of Luna wheatgras and Matua prairie grass showed some recovery from the drought by 4188 (Table 2).

Drought conditions also reduced dry matter yields in many plots. Moderate rainfall from November 1984 — January 1985 and the reduction in Wairau lucerne cover as a result of overdrilling damage promoted good yields from a number of the alternative species at the January 1985 assessment (Figure 1).

Early spring yields were best in Luna wheatgrass, tall oat grass and Rere lucerne, as were late spring yields. By late spring, however, the yield of Matua prairie grass approached that of the above plants. Reduced early spring yields recorded for Roa tall fescue, **Wana** cocksfoot and sheep's burnet were accompanied by low plant numbers (Table 1).

The most successful plants have been Luna wheatgrass, Maru phalaris and tall oat grass. Both Luna and Maru have increased by rhizomatous spread whereas tall oat grass plants increased in vegetative size. Wairau lucerne yields remain high in all three of these plots following an initial depression due to drought and drill damage.

By winter 1986, although the contribution of many of the alternative plants to total dry matter yield was not high, several provided a comprehensive groundcover without adversely affecting lucerne production. The rhizomatous varieties, Luna

Table 2: Mean numbers of alternative plants and Walrau lucerne plants in quadrats - Riverside Station

			Plant Nu	ımbers		
	Medicag	go sativa 'Wa	iirau'	Alterr	native Speci	es
Date Assessed Species	1/85	10/85	4/86	1185	10185	4/86
+ Luna	20(B-E)	14(G-U)	14(G-T)	31(m-n)	38(i-m)	100 + (a)
+ A. elatius	15(N-M)	14(G-S)	14(G-R)	44(g-i)	30(m-p)	30(m-o)
+ Matua	18(B-G)	15(0-0)	17(B-J)	24(n-s)	17(r-u)	28(n-a)
+ Wana	21(B)	14(K-V)	16(D-M)	53(e-g)	26(n-r)	22(n-t)
+ Aoa	20(BC)	17(C-J)	14(G-Q)	77(b)	42(h-1)	15(s-v)
+ Granger	12(M-Y)	10(Q-△)	t	51(e-h)	5(v)	,
+ Israel	12(M-X)	10(M-△)	#	12(uv)	0	t
+ Rere	5(4)	7(6)	#	72(b-d)	43(g-k)	#
+ Maru	6(ø)	17(B-H)	19(B-F)	75(bc)	56(ef)	60(e)
+ S. minor	17(C-L)	10(Q-Z)	12(M-Ŵ)	44(g-j)	7(uv)	8(uv)
+ PGG	20(B-D)	t	t , ,	12(uv)	ť	
Control	27(A)	16(D-N)	17(B-I)	0	0	0

† Measurement discontinued because of low plant numbers

Numbers with identical letters not significantly different at p = 0.05

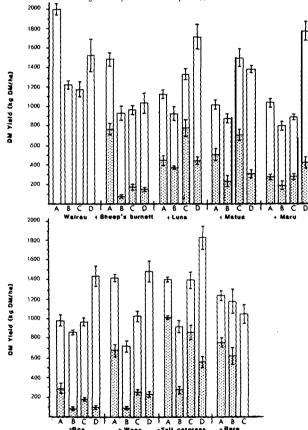


Figure 1: Dry matter yields (kg/ha) of lucerne/alternative pasture plant combinations at Riverside Station, cut on four occasions (A= Jan '85, B= Oct '85, C= Dec '85, D = Apr '86).

[#] Non-programmed spraying of trial area

Table 3: Sheep grazing preferences at Riverside Station measured three days after stock introduced and ranked 0 (low preference) to 10 (high preference).

Species	Luna	A. elatius	Matua	Wana	Roa	Granger	Sweet clover		Sheep's burnett		Control Wairau
Date											
1185	6	0	0	2	0	2	4	0	9	0	8
12185	a	8	1	7	7	t	t	2	10	t	1

tMeasurement discontinued because of low plant numbers

wheatgrass and Maru phalaris, provided the best soil protection with 65% and 64% groundcover respectively.

The acceptability of the various alternative plants to merino sheep is given in Table 3. The consistent acceptance of sheep's burnet and Luna wheatgrass by the sheep is of note. At both assessments, lucerne and several grasses were flowering affecting their palatability.

Both Maru phalaris and Luna wheatgrass are capable of providing good vegetative groundcover in existing lucerne crops during the period critical for soil conservation - autumn through spring. Once established they did not affect lucerne productivity. adversely

Persistence of perennial plants under conditions normally dominated by annuals should improve long term productivity of such land and help preserve its soil resource. Management criteria to ensure sustainable utilisation from combinations with these alternative pasture plants and to maintain groundcover now require

investigation on a larger scale.

Possibilities also exist for the integration of **dryland** browse shrubs, such as saltbush or tagasaste, with traditional pasture plants and alternative herbaceous pasture species selected for drought-prone farmland. The benefits they can provide, such as nutritious browse, shelter, nitrogen fixation in some, provisions of microclimates, bee forage and protected wildlife habitats, will be an important contribution to soil conservation and erosion control in New Zealand.

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