AUTUMN OVERDRILLED TAMA RYEGRASS AND CEREALS TO SUPPLEMENT LUCERNE IN THE CENTRAL NORTH ISLAND

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Abstract

Two experiments were conducted in which cereals and 'Grasslands Tama' ryegrass were overdrilled into lucerne in autumn, in one experiment following a prior light cultivation. The highest production was obtained from barley and oats when left uncut from sowing until early spring. Barley was distinctly superior to oats, ryecorn and Tama ryegrass when two cuts were taken in late winter and early spring. Tama ryegrass and to a lesser extent oats depressed lucerne growth, when they were growing and after their disappearance. Nitrogen doubled the weed content, where there was inadequate competition from overdrilled species.

INTRODUCTION

OVERDRILLING LUCERNE with annual species to increase winter/early spring and annual herbage yield has shown some promise in the South Island (Vartha, 1967, 1971).

In the Waikato where barley was overdrilled into lucerne, Elliott (1967) recorded an average increase over three years of 950 kg dry matter (DM)/ha from two cuts in late May and August, In two further years no increase in production was recorded. Croy and Weeda (1974) reported a much larger increase of 2400 kg DM/ha from overdrilling oats when grazed twice over winter.

For the pumice country, Taylor (1953) described the practice of overdrilling *Lolium (multiflorum × perenne)* 'Grasslands Manawa' ryegrass in autumn for augmenting silage yields in spring. However, in this region lucerne is increasingly being used for grazing and both pasture and lucerne have low early spring production (Baars *et al.*, 1975) . Consequently, any way of improving this production would be of distinct advantage to stock management.

There is a general lack of reported experimental work in the North Island on overdrilling winter-active species into lucerne. This paper describes two experiments, one in the pumice country

and one in the Waikato, in which *L. multiflorum* Lam. 'Grasslands Tama' Westerwolds ryegrass and three cereals were overdrilled into lucerne in late autumn to assess the effects of these treatments on winter and spring production.

EXPERIMENTAL

EXPERIMENT 1

This experiment was sod-seeded on April 29, 1974, into a recently grazed 2-year-old lucerne stand on Horotiu sandy loam at Ruakura Agricultural Research Centre. Plots were 0.13 ha in randomized blocks with three replicates. The treatments were Amuri oats (100 kg/ha), Tama ryegrass (30 kg/ha), Amuri oats and Tama ryegrass (80 kg/ha and 30 kg/ha), each sown with 250 kg/ha of superphosphate, and lucerne alone. In mid-August half of each plot received 50 kg N/ha as urea. Before each grazing by dairy cows an area of 8 m^2 was cut with a "Gravely" mower, to assess total dry matter and species composition.

EXPERIMENT 2

This experiment was sod-seeded after pitch pole harrowing on March 28, 1973, into a closely grazed 13-year-old lucerne stand on Atiamuri sand at Wairakei Research Station. Plots were drill strips (10 X 1 m) in randomized blocks with three replicates. The treatments were Tama ryegrass (30 kg/ha), CRD ryecorn (100 kg/ha), Carlsberg barley (100 kg/ha) and Onward oats (100 kg/ha) sown with 250 kg/ha of a 50:50 superphosphate/nitrolime mixture, and lucerne alone. The accumulated production from sowing as well as regrowths from cuts in early and midwinter were measured as in Experiment 1 with a "Gravely" mower. This experiment was sod-seeded after 6 weeks of drought and after seeding the rainfall from April until July was 129 mm below the average of 387 mm.

RESULTS AND DISCUSSION

EXPERIMENT 1

The standing production at July 30 and the total and component species yields at each cut from the initial grazing on September 11 are shown in Table 1. The accumulated production by the end of July indicates the slow winter growth of the overdrilled species. In addition there was no overall gain in total yield because of depressions in lucerne growth. By the first cut and

TABLE 1: PRODUCTION OF LUCERNE AND OVERDRILLED ANNUALS IN EXPERIMENT 1.
(kg DM/ha)

	Lucerne	*Sown Species*	*Weeds*	*Total*	
Standing DM, cut 30.7.74:					
Lucerne	930	*0*	230	1160	a
+ Oats (0)	620	460	170	1250	a
+ Tama (T)	680	270	180	1130	a
+ O + T	380	530 *0* + 260 T	120	1290	a
Min. Sig. Diff. (5%)				300	
cut 1, 11.9.74:					
Lucerne	970	*0*	450	1420	bA
+ Oats (O)	810	1140	580	2530	aA
+ Tama (T)	610	480	330	1420	bA
+ O + T	590	830 *0* + 480 T	120	2020	abA
Min. Sig. Diff. (1%)				1300	
cut 2, 30.10.74:					
Lucerne	2630	0	790	3420	a
+ Oats (O)	2470	300	570	3340	a
+ Tama (T)	1680	1560	380	3620	a
+ O + T	1790	170 0 + 1180 T	330	3470	a
Min. Sig. Diff. (5%)				600	
cut 3, 9.12.74:					
Lucerne	3830	0	240	4070	abA
+ Oats (O)	3690	0	110	3800	bA
+ Tama (T)	2870	1860	50	4780	aA
+ O + T	2630	1300 T	110	4040	abA
Min. Sig. Diff. (1%)				1340	
cut 4, 15.1.75:					
Lucerne	2800	0	30	2830	aA
+ Oats (0)	2520	0	80	2600	abA
+ Tama (T)	2320	0	50	2370	bA
+ O + T	2740	0	70	2810	aA
Min. Sig. Diff. (1%)				520	

In tables 1, 2 and 3, Duncan's Multiple Range Test: means without a common letter differ significantly (lower case, $P<0.05$; capitals, $P<0.01$).

grazing on September 11 the oats in particular had shown rapid late winter growth and they almost doubled total production. Tama produced about half the yield of oats, but there was no addition in total yield because both the lucerne and weeds fractions were depressed. Oats and Tama were intermediate in production but the lucerne was again suppressed.

In subsequent cuts there was little or no regrowth from the oats but Tama production continued into summer. Its bulk came

TABLE 2: EFFECT OF LATE WINTER N APPLICATION ON EARLY SPRING CUT (11.9.74), Experiment 1.
(kg DM/ha)

	Lucerne	**Sown** *Species*	*Weeds*	*Total*
Lucerne:				
No N	970	0	450	1420 a
N	830	0	980	1810 a
Lucerne + Oats:				
No N	810	1140	330	2530 a
N	690	1330	640	2660 a
Lucerne + Tama:				
No N	610	480	240	1420 bA
N	820	840	440	2110 aA
Lucerne + Oats + Tama:				
No N	590	990 O + 380 T	60	2020 a
N	430	730 O + 660 T	450	2270 a
Min. Sig. Diff. 5% with pairs				590

in December, similar to the pattern of production from *L. multiflorum* Lam. 'Grasslands Paroa' ryegrass in the Waikato (Elliott, 1967). The cut in January showed the lucerne was still depressed by Tama, even after the latter had disappeared. Similar depressions from annual ryegrasses have been reported by Hoglund (1972) and Elliott (1967).

The effect of the nitrogen application applied in mid-August is shown in Table 2. Tama and the weed components were markedly increased by the nitrogen, but there was little effect on the oats. The response of 13 kg DM/kg N for the Tama treatment was within the range of values recorded by Vartha (1971) in Canterbury. There were no residual N effects after the first grazing.

EXPERIMENT 2

The accumulated production from sowing, at three measurement times, is shown in Fig. 1. Appreciable yield increases did not take place until late winter/early spring at which time the cereals, apart from ryecorn, significantly outyielded Tama. Barley gave better production than oats during the winter but by the final cut in early October there was little difference. The lucerne growth over the winter period was minimal and when it began to grow in the spring it was suppressed by the overdrilled species, particularly barley and oats.

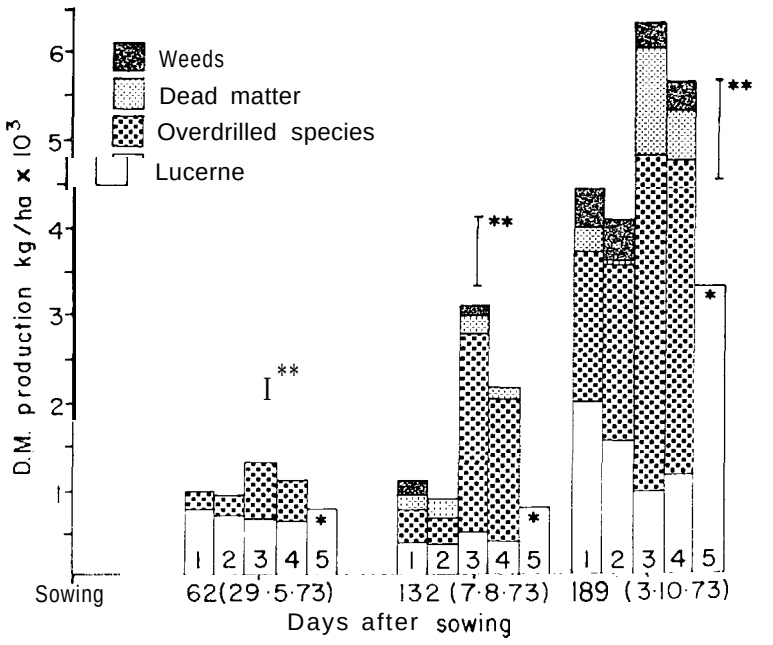

FIG. 1: Accumulated production at three dates (29.5.73, 7.8.73 and 3.10.73) after sowing in Experiment 2.
Treatments:
1. Tama + Lucerne. 2. Ryecorn + Lucerne. 3. Barley + Lucerne. 4. Oats + Lucerne. 5 Lucerne control. * No Dissection. ** Min. Sig. Diff. ($P = 0.01$)

Production from the two- and three-cut systems compared with the single cuts is shown in Table 3. In no case did the cut and recut systems outproduce that derived from the single cut at the end of the period. The three-cut system over the winter/early spring gave no production increase over that produced by lucerne alone, even though the sown species gave significant component yields.

Any reliance on regrowth of the sown species was of little benefit. This is indicated especially by oats under the three-cut system only producing 17% of the yield when left to grow until the final cut (one-cut system). Similar figures for barley were 34%, ryecorn 65%, and Tama 60%. Some of the previous failures with overdrilled cereals (e.g., McLeod and Douglas, 1976; Vartha, 1967) also indicate the inability of cereals, particularly oats, to regrow from early grazing. However, ryecorn did show an ability

TABLE 3: TOTAL PRODUCTION OF LUCERNE-ANNUAL SPECIES AND LUCERNE UNDER THREE CUTS (29.5.73, 7.8.73 AND 3.10.73), TWO CUTS (7.8.73, 3.10.73) AND ONE CUT (3.10.73) SYSTEMS. (kg DM/ha)

	Lucerne	*Sown Species*	*Weeds*	*Total**
Lucerne + Tama:				
3 cuts	1240 a	1020 edDE	290	2630 efD
2 cuts	1400 a	1270 cdDE	80	3130 deCD
1 cut	1370 a	1710 cCD	600	3960 cB
Lucerne + Ryecorn:				
3 cuts	1380 aA	1200 cdDE	210	2940 efCD
2 cuts	670 bA	1660 cCDE	470	2920 efCD
3 cuts	1270 aA	1830 cCD	450	3620 cdBC
Lucerne + Barley:				
3 cuts	1440 aA	1260 cdDE	140	2840 efCD
2 cuts	1180 abAB	3420 aAB	260	5120 bA
1 cut	610 bB	3750 aA	210	5780 aA
Lucerne + Oats:				
3 cuts	1400 a	600 dE	700	2840 efCD
2 cuts	1330 a	2600 bBC	130	4230 cB
1 cut	850 a	3520 aAB	330	5220 abA
Lucerne control:				
3 cuts	No dissection			2610 efD
1 cut				2500 fD
2 cuts				2900 eCD
Significance of interaction	5%	1%		1%

*Including dead matter.

to withstand early defoliation and if its production was similar to the other cereals this attribute would be a considerable advantage. There are some data to suggest that ryecorn is particularly sensitive to low nitrogen conditions (McLeod and Douglas, 1976; K. Cottier, unpublished data).

Where the early cut was not taken (two-cut system) the barley and oats in particular gave high production without causing the severe depression to the lucerne under the one-cut system.

GENERAL

In both trials Tama ryegrass showed negligible growth from the end of May to August in comparison with oats and barley. Vartha '(1967, 1971) and Janson (1975) stressed the importance of sufficient moisture in autumn for early Tama establishment to have high winter and early spring production, Under cultivated condi-

tions Tama production in winter is improved by early autumn sowing (Crouchley and Bircham, 1971). However, early sowing, especially in the pumice country, is frequently impossible because of dry autumn conditions.

Experiment 2 recorded considerably higher yields than Experiment 1 in spite of dry cold conditions after sowing. Earlier sowing, nitrogen fertilizer at drilling, and prior cultivation may all have contributed to this difference. Robinson and Cross (1957) recorded better establishment and growth of overdrilled grass species after light cultivation on clover-dominant swards on pumice country soils near Whakamaru.

Any gain from overdrilling Tama and cereals has to be weighed against the reduction in lucerne as found in both experiments. Further, one has to consider a possible lowering of subsequent lucerne spring production, following winter grazing as reported by Janson (1975) in Canterbury and/or reductions in late spring yields caused by early spring defoliation (Vartha, 1967).

CONCLUSION

Overdrilling lucerne in autumn with cereals could be of considerable value for late winter/early spring breakgrazing or to conserve large quantities of forage as silage or hay. Barley would be a better choice than oats for breakfeeding because of its better regrowth ability.

Tama has a greater ability than the cereals to withstand several grazings, but in these experiments its lack of growth and its depression of lucerne have led to no great increase in production.

Further work must be carried out on surface cultivation, time of overdrilling, and grazing management to establish the *value* of this technique in annual lucerne management.

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REFERENCES

Baars, J. A.; Radcliffe, J. E.; Brunswick, L., 1975. Seasonal distribution of pasture production in New Zealand. VI. Wairakei, pasture and lucerne production. *N.Z. Jl exp. Agric., 3: 253-9.*

Crouchley, G.; Bircham, J. S., 1971. Winter greenfeed production in the Wairarapa. *N.Z. Jl Agric., 122: 36-7.*

Croy, B. G.; Weeda, W. C., 1974. Beef production on pasture and lucerne. *Proc. N.Z. Grassld Ass., 36: 73-8.*

Elliott, I. L., 1967. Lucerne in the North Island of New Zealand. In *The Lucerne Crop* (ed. R. H. M. Langer), pp. 298303. Reed, Wellington.

Hoglund, J. H., 1972. Effect of defoliation management and 'Tama' overdrilling on weed yields of irrigated lucerne. *Proc. N.Z. Weed & Pest Control Conf.*, 25: 96-100.

Janson, C. G., 1975. Influence of autumn-winter lucerne management and overdrilled 'Grasslands Tama' on spring herbage yields under irrigated and dry conditions. *N.Z. Jl exp. Agric., 3: 229-34.*

McLeod, C. C.; Douglas, J. A., 1976. Autumn overdrilling of lucerne with cereals and annual ryegrasses to improve spring production in South Canterbury and North Otago. *Proc. N.Z. Grassld Ass., 37: 228-36.*

Robinson, G. S.; Cross, M. W., 1957. Overdrilling pumice pastures. N.Z. *Jl Agric., 91: 283-S.*

Taylor, C. R., 1953. Oversowing lucerne with short-rotation ryegrass. *Ibid., S7: 425-6.*

Vartha, E. W., 1967. Lucerne overdrilled with grasses for grazing. In The *Lucerne Crop* (ed. R. H. M. Langer), pp. 177-85. Reed, Wellington.

Vartha, E. W., 1971. Overdrilled winter-growing annual grass to supplement lucerne. *Proc. N.Z. Grassld Ass., 33:* 115-23.