Northland Pastoral Extension Research Stocktake

Winter Growth Research in Northland

Contents

1.0 Intensive Wintering of Beef Steers

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Introduction

Northlands mild winters mean relatively good winter growth rates compared to other parts of the country. This represents an opportunity for farmers to treat the winter as a productive growth period, rather than a maintenance period. In Northland nitrogen is often a limiting factor to pasture growth over the winter-spring period. The objective of the trial was to grow weaner steers to a liveweight of 250 kg/head for sale as stores by the end of October using nitrogen fertiliser and stocking rate to increase per hectare performance.

Design

The trial was run on the Punakitere Trial Area (10km west of Kaikohe). The soils are free draining basaltic (Ruatangata friable clay). The trial site consisted of 32 paddocks, each 0.4 ha. Eight farmlets of four paddocks were randomly assigned to a treatment. Each farmlet remained under the same treatment for 3 years.

96 Angus steers, with an average start weight of 186kg were randomly assigned to eight treatment groups in late April – early May each year:

Stocking Rate		Steers per Group	
Steers/ha	LWT*/ha	No Nitrogen	Nitrogen
6.2	1153	10	
6.8	1265	11	11
7.4	1376	12	12
8.0	1488	13	13
8.6	1600		14

* LWT/ha is starting liveweight/ha (kg LWT/ha)

The steers were drenched prior to the trial commencing and repeat doses administered as required (external parasites were also controlled). Steers were weighed at the end of each rotation.

The initial rotation length was 40 days, paddocks receiving N treatment had 58 kgN/ha (as urea) applied immediately after the animals left the paddock. The 40 day rotation was thought to give the most efficient use of applied nitrogen. Nitrogen was applied for three rotations, giving a total of 174 kgN/ha for the nitrogen treatments. The rotation length was maintained at 40 days following the final application of N and then reduced to 24 – 32 days to prevent the sward deteriorating in the spring. Hay was fed whenever the pasture dry-matter on offer fell below 1.5% of LWT/day. Paddocks were break-fed in two-day shifts with no back fence being used.

Results

Trial results were assessed in October-early November each year, looking at liveweight gain per head and liveweight gain per hectare:

Year 1 (1976) 183 days grazing

		No Nitrogen			175 kg Nitrogen/ha		
Stocking Rate		Liveweight Gain - No Nitrogen			Liveweight Gain - With Nitrogen		
Steers/ha	LWT/ha	per Head	Per ha	per ha per day	per Head	Per ha	per ha per day
6.2	1159	95	590	3.2			
6.8	1272	105	730	4.0	115	770	4.2
7.4	1384	90	660	3.6	120	900	4.9
8.0	1496	80	610	3.3	110	860	4.7
8.6	1608				90	780	4.3

Year 2 (1977) 172 days grazing

		No Nitrogen			175 kg Nitrogen/ha		
Stocking Rate		Liveweight Gain - No Nitrogen			Liveweight Gain - With Nitrogen		
Steers/ha	LWT/ha	per Head	Per ha	per ha per day	per Head	Per ha	per ha per day
6.2	1135	150	920	5.3			
6.8	1244	135	919	5.3	155	1040	6.0
7.4	1354	130	963	5.6	145	1074	6.2
8.0	1464	120	931	5.4	145	1150	6.7
8.6	1574				120	1061	6.2

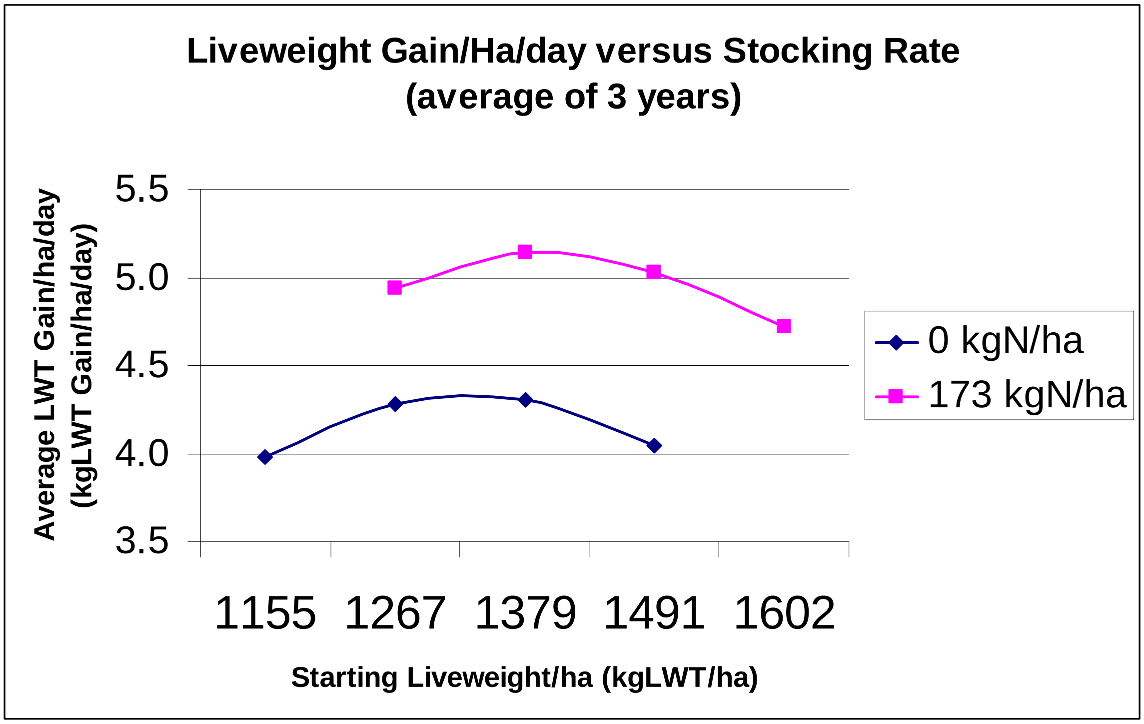
Year 3 (1978) 183 days grazing

		No Nitrogen			175 kg Nitrogen/ha		
Stocking Rate		Liveweight Gain - No Nitrogen			Liveweight Gain - With Nitrogen		
Steers/ha	LWT/ha	per Head	Per ha	per ha per day	per Head	Per ha	per ha per day
6.2	1172	110	673	3.7			
6.8	1285	105	700	3.8	130	900	4.9
7.4	1399	100	740	4.0	115	850	4.6
8.0	1512	85	680	3.7	95	750	4.1
8.6	1625				85	750	4.1

Average of 3 years results:

		No Nitrogen			175 kg Nitrogen/ha		
Stocking Rate:		Liveweight Gain - No Nitrogen			Liveweight Gain - With Nitrogen		
Steers/ha	LWT/ha	per Head	Per ha	per ha per day	per Head	Per ha	per ha per day
6.2	1155	118	728	4.0			
6.8	1267	115	783	4.3	133	903	4.9
7.4	1379	107	788	4.3	127	941	5.1
8.0	1491	95	740	4.0	117	920	5.0
8.6	1602				98	864	4.7

In all three years there were highly significant increases in Liveweight gain per head and per hectare from using nitrogen and significant reductions in liveweight gain per head by increasing stocking rate. Within years there was a general trend for liveweight gain per hectare to increase with stocking rate to a maximum, then decline with any further increases in stocking rate. The stocking rate at which maximum liveweight gain occurred was generally higher in the Nitrogen treatment group than in the treatment without nitrogen:



The use of nitrogen also reduced requirement for supplementary feed by 25 – 55%, hay was fed at an average of 185 kg/head/ for the no N treatment, compared with 115 kg/head/ for the treatment receiving nitrogen.

Discussion

The stocking policy was targeted at producing steers with a liveweight of 250 kg/head for sale to farmers on winter wet country. In all years the target mean liveweight of 250 kg/head in October was achieved.

Nitrogen fertiliser was more effective than stocking rate in increasing liveweight gain per hectare. Nitrogen was noted to have two major effects; at a constant stocking rate, N fertiliser increased LWT gain (both per head and per hectare) and liveweight gain per head could be achieved at higher stocking rates (thus giving greater liveweight gains per hectare).

Some of the variation between years was due to variable nitrogen responses. This variation makes it difficult to predict optimum stocking rates. However, the pattern of responses showed greater relative responses to nitrogen occurring in the years of lower production (Table1) and decreasing individual performance with increasing stocking rate:

Table 1: Liveweight Gain response from Nitrogen

Stocking Rate		Increased LWT gain from N			
Steers/ha	**kgLWT/ha**	**1976**	**1977**	**1978**	**Average**
6.8	1267	5%	13%	29%	15.4%
7.4	1379	36%	12%	15%	19.5%
8.0	1491	41%	24%	10%	24.3%

Table 2: Increase in Liveweight Gain due to Nitrogen and Corresponding Economics Benefit

Stocking Rate		1976		1977		1978		3 Year Average	
Steers/ha	**kgLWT/ha**	**LWT/ha***	**$/ha****	**LWT/ha***	**$/ha****	**LWT/ha***	**$/ha****	**LWT/ha***	**$/ha****
6.8	1267	40	-$162	121	$1	200	$159	120.3	-$1
7.4	1379	240	$239	111	-$20	110	-$22	153.7	$66
8.0	1491	250	$259	219	$197	70	-$102	179.7	$118

* Additional liveweight production resulting from nitrogen use

**Assuming $2/kgLWT and $1.40/kgN. No benefit has been made for the fact less supplement was used

Based on this trial, use of Nitrogen per hectare contributes more to overall increases in LWG/ha than any accompanying increase in stocking rate. To maximise the benefit of using nitrogen stocking rates should therefore be increased only slightly.

This trial suggests that without nitrogen the optimum stocking rate for maximising liveweight gain per hectare lies between 6.2 and 7.4 steers per hectare. With nitrogen the optimum stocking rate is higher, between 6.8 and 8.0 steers/ha given a starting live weight of 186kg per head.

2.0 Cool-Season Growth Responses of Kikuyu Grass and Ryegrass to Gibberellic Acid

N.S. Percival, 1980, N Z Journal of Agricultural Research 12 (19980): 97 – 102

Research suggests that gibberellins (plant hormones) increase the temperature range where active growth occurs with some plants. This study investigated whether kikuyu and ryegrass pastures produce a growth response to gibberellic acid (GA).

The study involved two trials over the winters of 1975 & 1976. Pastures were located close to Kaikohe on podzolised soils. The trial was designed to highlight the effect on ryegrass and kikuyu individually. On the 8th of July gibberellic acid was applied at 100g active ingredient/ha in water, Nitrogen was applied at 75 kgN/ha in water. Pasture was harvested at 3, 6 & 9 weeks after application, with cuts to ground level and cuts from a height of 3 cm.

The treatments summary is outlined below:

Treatment	GA (grams a.i./ha)	Nitrogen (kgN/ha)
GA_0N_0-Control	0	0
$GA_{100}N_o$	100	0
GA_oN_{75}	0	75
$GA_{100}N_{75}$	100	75

Results - Year 1

Table: Growth difference from G.A. & Nitrogen (kgDM/ha/day)

	Weeks Post Application	Control	GA	Nitrogen
Ryegrass component	3	0	3	4
	6	0	0.7	5.1
	9	0	0.9	2.1
Kikuyu Component	3	0	1	3
	6	0	6.1	-4.6
	9	0	10.6	3.4

Ryegrass

- There was a significant response to GA, but no response to nitrogen
- Ryegrass responded quickly to the gibberellic acid, with the greatest difference 3 weeks after application
- Much of the dry-matter growth occurred above 3cm height, showing elongation of leaves
- Although differences were not significant, re-growth tended to be lower in the GA treated plots

- GA treated plots tended to have lower crude protein levels, while nitrogen treated plots had higher crude protein levels

Kikuyu

- There was a significant response to GA, but not to nitrogen
- Kikuyu responded more slowly than ryegrass, the greatest increase in kikuyu growth occurred 9 weeks after application
- Once again pasture growth tended to increase above the 3cm height, suggesting elongation of existing leaves
- There appeared to be an increase in the proportion of kikuyu leaf in the GA treated plots
- Gibberellins tend to have a better response at warmer temperatures

Results - Year 2

No significant dry matter yield effects were recorded from the GA or Nitrogen treatments in the second year, although there continued to be an increase in the yield of leaf above 3 cm.

Conclusions

- Gibberellins do increase winter and spring production in both ryegrass and kikuyu
- Pasture growth responses relate to the application rate of both GA and nitrogen
- Ryegrass pasture in the winter will respond to both nitrogen and GA.
- Nitrogen is cheaper, so should be the preferred option
- Kikuyu pasture is less responsive to nitrogen applied during the winter, so GA's represent an opportunity to increase winter production from kikuyu dominant pastures during the winter

3.0 Altering the Growth Pattern of Kikuyu Pastures with Temperate Grasses

Keith Betteridge and BA Haynes, 1986, Proceedings of the New Zealand Grasslands Association, 47: 149-156

Overview

Three trials were carried out on dairy farms in the Kaikohe area to investigate whether introducing temperate grasses into kikuyu pasture increased winter and spring pasture growth rates.

Each trial used slightly different techniques for introducing the temperate grasses:

Trial 1 – Pre Sowing Management

This trial looked at different treatments prior to sowing the seed and different establishment methds.

Trial 1 Design Summary:

Trial		Treatment
Trial 1 (16 Treatments in total)	Pre-sowing Management	Hard Graze
		Forage Harvest
	Spraying	Nil-Contol
		Paraquat (2.2 litres/ha)
	Sowing	Nil-Control
		Nitrogen
		Direct Drilled Tama (+N)
		Oversown Tama (+N)

Results

Pre-grazing treatment

- No difference between hard grazing and forage harvesting before sowing

Spraying (Table 1)

- 7 times greater density of Tama tillers in the spray-drill treatment than in the unsprayed-oversown treatment after 7 weeks. Similar trends after 18 weeks
- Paraquat reduced growth of resident pasture by 30% in autumn and winter
- Where Tama was drilled into sprayed pasture, growth was 40% higher than unsprayed resident pasture
- Spring growth is higher in sprayed resident pasture than in unsprayed due to less competition from kikuyu

Table 1: Seven month pasture production (kgDM/ha) from pasture sown with Tama

	Resident	Resident +N	Drilled	Oversown
Sprayed	6165	5980	7870	6670
Unsprayed	5365	6550	7165	5870
Mean	5765[b]	6265[b]	7525[a]	6270[b]

[a] *Means with different letters are significantly different (P 0.05)*

Sowing

- Total 7 month production was higher in direct drilled than in oversown or resident treatments
- Nitrogen grew more grass in the unsprayed resident pasture in the spring and summer

Trial 1 – Summary

- Successfully established Tama does increase winter and spring production relative to resident pasture
- Paraquat spraying increases density and production from Tama, but only during the spring
- During winter the gains from Tama only offset the loss of production from resident pasture suppressed by herbicide

Trial 2 – Annual versus Perennial Grasses (2 Years)

This trial investigated the differences in pasture production from annual grasses compared with perennial grasses.

Trial 2 Design Summary:

Trial		**Treatment**
Trial 2 (8 treatments)	Pre-sowing Management	Forage Harvest
	Establishment Method	Direct drilled into unsprayed pasture
		Oversown into paraquat sprayed pasture
	Species	Nil-Control
		Tama (April sown @ 22 kg/ha)
		Nui Ryegrass (April sown @ 15 kg/ha)
		Matua Prairie (April Sown @ 40kg/ha)

Spraying

- Grasses oversown onto sprayed pasture produced 6% more dry-matter than those established by direct drilling
- Greater rates of paraquat (2.2 litres/ha) resulted in better kikuyu suppression

Species (Table 2)

- Tama, Nui and Matua pastures grew faster than the resident pasture during winter
- Nui and Tama grew more pasture in the spring
- Only Matua grew more pasture than the resident in the summer and autumn
- Tama treatments had to be sown each year making them less attractive
- This was a mowing trial, which would have helped the sown grasses by reducing the kikuyu mat

Table 2: Seasonal daily growth rate averaged over 2 years (kgDM/ha/day)

	Pasture Type			
Season	Resident	Tama	Nui	Matua
Winter	9^{c}	15^{a}	19^{a}	16^{ab}
Spring	49^{c}	56^{ab}	60^{a}	53^{bc}
Summer	62^{b}	63^{ab}`	63^{ab}	65^{a}
Autumn	44^{b}	38^{c}	35^{c}	50^{a}
Mean	40.8^{c}	42.8^{bc}	44.4^{b}	46^{a}

[a] Means with different letters are statistically significant (p 0.05)

Trial 3 – Time of Sowing

This trial compared a range of sowing dates.

Trial 3 Design Summary:

Trial		Treatment
Trial 3 (4 treatments)	Pre-sowing Management	Forage Harvest (March)
	Time of Sowing	Nil-Control
		Tama drilled in March
		Tama drilled in April
		Tama drilled in May

Time of sowing

- Ideal pasture growth conditions in March and April promoted vigorous kikuyu growth
- April Sown Tama had highest tiller densities in June and September
- Tama sown in March struggled to compete with kikuyu
- Tama sown in May was too late to allow dense tillering
- April sown Tama pastures yielded 23% more than resident pastures in the 6 months to August

Conclusion

These trials showed that successfully established temperate grass species do improve seasonal and annual production from kikuyu pastures. Keys to successful establishment include:

- Removing the dense kikuyu mat before sowing
- Kikuyu should be suppressed using herbicide (2.2 litres paraquat/ha), especially when oversowing seed or drilling in early autumn
- Perennial temperate grasses are more cost effective than annual grasses by reducing annual establishment costs
- The kikuyu mat needs to be removed each autumn by intensive grazing or mechanical means if the temperate species are to express their winter potential

4.0 Effects of Winter Application of Phenoxy Herbicides on White Clover and Pasture Production in Lower Northland

E.N. Honore, A. Rahman & C.B. Dyson, 1980
Proceedings from the 33rd Weed and Pest Control Conference: 55 – 58

Clover production is a major contributor to overall pasture production. In southern regions, herbicides are applied during the winter when clover is dormant, while in Northland high soil temperatures mean clover dormancy does not occur. This trial evaluated the impact of three phenoxy herbicides on pasture production.

Three trials were carried out in three locations comparing early and late application of ethyl ester 2,4 D (1 kg/ha), MCPA (1 kg/ha) and MCPB (2 kg/ha). Pasture production was measured by regular pasture cuts and dissection. The trial sites were outlined below:

Trial	Location	Pasture Type	Clover %	Application Date	
				Early	Late
1	Silverdale	Cattle	25 – 30	24 June	Not applied
2	Waimauku	Cattle	20 – 25	31 May	1 August
3	Otakanini	Sheep	8 – 10	23 June	7 August

Results

Pasture production from application to January:

	Early Sprayed				Late Sprayed		
	1	*2*	*3*	*Mean*	*2*	*3*	*Mean*
Control	7700	6340	5240	6490	5840	4590	5210
2 4 D	7070	5470	4890	5810*	4230	3840	4030**
MCPA	7070	5530	5070	5890*	5090	3720	4400*
MCPB	7520	5760	5510	6260	5120	3970	4540*

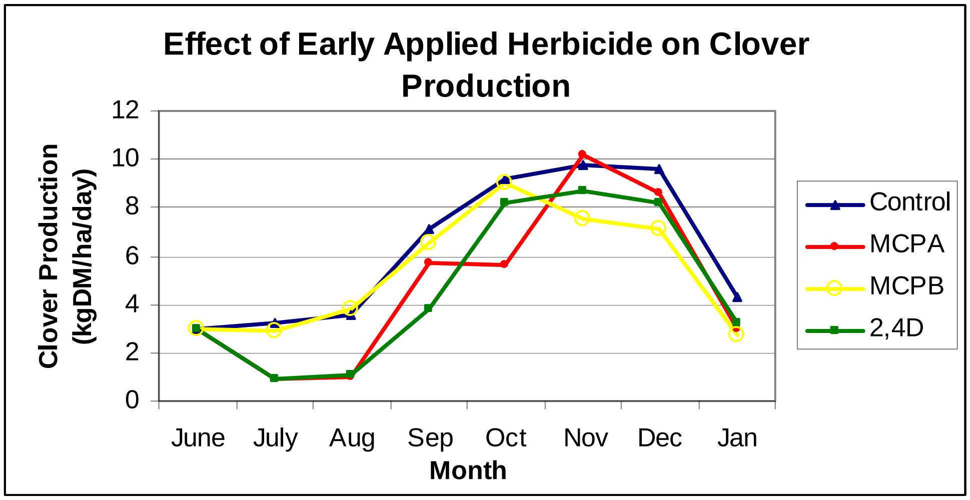
** ** Significantly lower than the control at 5% and 1% respectively*

Early Results

- MCPB has little effect on clover production until late spring, when some residual effects in the trials with higher clover content
- 2,4 D and MCPA showed pronounced effect from the early application, reducing clover content by around 70%
- The impact of 2,4 D and MCPA carried through until the spring

Late Results

- The impact of 2,4 D and MCPA was greater in the later application, not only restricting clover growth, but also killing some clover foliage
- The late application of MCPB depressed clover



Impact of weed reduction on grass production.

Trial	Initial Weed (% pasture)	Impact on Grass Production	
		Early Application	Late Application
1	8%	+12%	-
2	30%	+30%	+20%
3	3%	-2%	-10%

- In weedy pasture the effect is to reduce weed content, reduce clover growth and increase grass growth by reducing competition
- However, the net effect is to reduce total drymatter yields by 250 – 400 kgDM/ha

Conclusion

- In Northland there is no safe time for applying phenoxy herbicides, but early or mid winter applications caused less damage to clovers than the late winter sprays
- Total pasture drymatter losses from early application of MCPA and 2,4D ranged from 400 – 900 kgDM/ha in the 7 months following application
- Total pasture losses from early application of MCPB were insignificant
- Pasture losses from late application of MCPB were more significant (600 – 1,600 kgDM/ha)
- Phenoxy herbicide application should be restricted to early winter
- Practices which encourage smothering of annual weeds and reduce the need for herbicide application should be encouraged

5.0 Effect of Nitrogen and Cutting Interval on Production of Grass Species Swards

1: Kikuyu Swards

G J Goold, 1979, NZ Journal of Experimental Agriculture 7 353-359

This project examined the effect of 2, 4 & 6 weekly cutting intervals at 4 rates of nitrogen (0, 120, 240, 480 kg N/ha/year) on kikuyu swards at three sites in Northland (Peria, Dargaville and Matakohe).

The sites were monitored for 96 weeks, the site information is outlined in the Table 1. Each cutting or nitrogen treatment had 4 replicates, with nitrogen being applied after each pasture cut. Pasture species was assessed using point analysis in late winter of the second year, at all other periods the sward was dominated by kikuyu.

Table 1: Soil summary at each site (75mm depth)

Site	Soil Type	Fertility	pH	%N
Peria	Mangakahia silt loan	High	5.4	0.67
Dargaville	Te Kopuru sand podzol	Low	5.6	0.53
Matakohe	Matakohe clay	Medium	5.9	0.63

Results

Annual yield of each treatment are outlined in Table 2, pasture composition results are presented in Table 3.

Key Highlights - Nitrogen

- Growth rates were highest in the autumn when kikuyu was the dominant pasture species
- Growth rates were lowest in the spring when swards were a mixture of Poa annua and kikuyu
- At Peria nitrogen responses were linear and consistent through the project
- At Dargaville and Matakohe N responses were consistent and linear through the winter and spring, but inconsistent during periods of water stress or low temperature
- Increasing nitrogen applications resulted in a marked decrease in clover content
- Increasing nitrogen applications increased the proportion of Poa annua

Key Highlights – Cutting Interval

- Longer regrowth intervals resulted in greater herbage yields of kikuyu
- Longer regrowth intervals gave the greatest response in spring and autumn and the least in winter and summer.

- The effect of cutting interval was greater than the effect of N at the Dargaville and Matakohe sites
- Nitrogen content in the mixed herbage decreased with extended cutting interval
- Extending the cutting interval increased clover content and decreased kikuyu content

Table 2: Effect of N application & cutting interval on mean annual herbage yield (kgDM/ha)

Site	**Cutting Interval (weeks)**	**Rate of Applied Nitrogen (KgN/ha/year)**			
		0	**120**	**240**	**480**
Peria	2	5060	5970	7490	8930
	4	7420	8800	10740	12800
	6	9020	10760	12360	14650
Av N Response (kgDM/kgN)		**-**	**11**	**13**	**10**
Dargaville	2	4760	4850	5430	6880
	4	6500	6840	7320	8470
	6	7460	8090	8480	9360
Av N Response (kgDM/kgN)		**-**	**3**	**4**	**4**
Matakohe	2	6590	6830	7300	9460
	4	9480	9270	9390	11520
	6	10800	11860	12250	12960
Av N Response (kgDM/kgN)		**-**	**3**	**3**	**5**

Table 3: Effect of N and cutting interval on the botanical composition of swards at Dargaville and Matakohe (% of cover)

Cutting Interval	**Kikuyu (%)**	**Clover (%)**	**Other Grasses (%)**
2 weeks	36	6	50
4 weeks	29	7	50
6 weeks	20	13	49
N Applied	**Kikuyu**	**Clover**	**Other Grasses**
0	29	17	39
120 kg/ha	29	10	48
240 kg/ha	27	6	54
480 kg/ha	27	3	58

Summary & Conclusions

- From April – July decreases in sward growth rates were significantly correlated with temperature:
- Growth rates declined by 3.4 kgDM/ha/day per 1^{o}C reduction in temperature
- Yields of kikuyu were clearly influenced by rate of nitrogen application, cutting interval and climatic conditions at each site.
- Peak growth rates in spring (when Poa annua made a large contribution to pasture yield) were low in comparison to ryegrass – white clover swards

- Frequent cuttings reduced the yield at all sites:
- Impact of frequent cutting was lowest during winter
- Frequency of cutting generally had a greater effect than nitrogen application
- Except during the winter
- Pastures are less responsive to cutting frequency as the rate of nitrogen increases
- The optimum period to use nitrogen to increase pasture yield is in the late winter
- At other times, rotation length will probably have more impact on herbage yield of the kikuyu component than small dressing of nitrogen
- Longer re-growth periods tended to decrease kikuyu content and increase clover content, potentially resulting in higher nutritive value

This trial indicates grazing management (rotation length) can be as effective as nitrogen to increase pasture growth. Farmers looking to match feed supply and demand should be looking to utilise rotation length to maximise pasture growth. Nitrogen application in the late winter period is an effective tool to increase pasture growth rates.

6.0 Effects of Subsoiling on a Northern Podzol Soil

MA Richardson & CR Edwards, 1993
Proceedings of the XVII International Grassland Congress 1993

Poor drainage is considered to be a major limitation to pasture production and pasture utilisation in Northland. Traditional moling is difficult in Northland soils due to buried timber, hard pans and unstable clays can lead to moles collapsing or scouring. This trial investigated whether sub-soiling is an effective option for Northland soils.

Two 0.5 ha paddocks were drained using 65mm Novaflo 27-34 metres apart at 800mm depth, backfilled with scoria. The paddocks were “sub soiled” (Shakaerator) to a depth of 500mm and at 1 m spacings above and perpendicular to the subsurface drain. The gradients of the channels ranged between 3 – 6% due to changes in slope. The sub soiling was repeated each autumn. Pasture production, pasture composition, root growth/distribution and water table depth were all monitored and compared with control paddocks. Two adjacent undrained paddocks were used as the control. Trial paddocks were grazed with sheep.

Results

Effects of sub-soiling on pasture production and water table depth:

Year	Treatment	Pasture Production (kgDM/ha)	Soil Moisture (%)	Water Table Depth (mm below surface)
1989[^]	Control	4902	79	240
	Sub-soiled	5885[+]	62[+]	480*
1990	Control	7127	77	240
	Sub-soiled	8449	56[*]	500*
1991	Control	5942+	54	260
	Sub-soiled	6752	44[+]	480*
Average	**Control**	**5990**	**70**	**247**
	Sub-soiled	**7029**	**54**	**287***

[^] Average of 8 months data
[+] Significant difference at 10%
** Significant difference at 5%*

- Pasture production was increased by 20% in year 1, 18% in year 2 and 14% in year 3
- Soil moisture was much lower in the sub-soiled areas
- There was a significant reduction in the water table on the subsoiled treatments in all three years
- Subsoiling reduced pasture growth in the summer

Pasture Composition: Effect of sub-soiling on pasture composition

		Percentage Dry Weight			
Year		Rye	Other Grass	White Clover	Other
1989	Control	22	54	8	14
	Sub-soiled	40*	44	8	8
1990	Control	44	34	14	9
	Sub-soiled	59	26	13	2
1991	Control	23	43	11	23
	Sub-soiled	47*	33*	10	10
Average	**Control**	**30**	**44**	**11**	**15**
	Sub-soiled	**49**	**34**	**10**	**7**

** Significant difference at 5%*

- Sub-soil drainage significantly increased the ryegrass component of the pasture in two of the years
- Sub soil drainage reduced the amount of ‘other grasses’, lotus and rushes in the pasture
- There was no effect on the proportion of white clover or other weeds

Root Depth

		Root Weight (mg root/cm^3 soil)			
Season		***0–100mm***	***100–200mm***	***200-300mm***	***>300 mm***
Winter	Control	33.2	4.5	1.9	2.8
	Sub-soiled	28.2	16*	7.6*	3.1
Summer	Control	35.4	8.2	5.0	3.0
	Sub-Soiled	53.8	6.1	3.2	2.0

** Significant difference at 5%*

- Sub-soiling resulted in 30% more roots being present in the winter
- Most additional roots were present in the upper soil profile 100 – 300mm
- Sub-soiling had no effect on root distribution in the summer

Conclusions

- Sub-Soil drainage on podzolised soils does increase pasture production
- Root depth changes were less than expected
- Sub-soiling must be repeated each autumn (1 – 2 hours tractor time/ha) to offset damage from pugging during winter grazing
- Gradients should be less than 8% to reduce the risk of scouring
- Drier soils create more cracking, but also require more tractor power. Autumn is generally considered a good time for subsoiling, but subsoiling will damage roots initially and may cause water stress
- Drainage does increase winter pasture growth rates, but may depress pasture growth during dry summers, drainage decisions should reflect these seasonal effects

8.0 Winter-Spring Nutrition and Management Effects on Ewe and Lamb Performance

D C Smeaton & PV Rattray, 1984
Proceddings of the New Zealand Grasslands Association 45; 190-198

Matching feed demand and supply can be challenging due to variability in spring pasture growth, this may result in underfeeding during late winter or early spring. This project investigates the impact of winter management on animal production. The project involved 5 trials manipulating winter management and evaluating the impact on sheep production systems. Although sheep were the species used in the trials, many of the principles can be extrapolated to other farm systems. All trials were conducted at the Whatawhata Research Station using Romney and Coopworth ewes with a lambing percentage of 125%.

Trial 1: Effects of nutrition on ewes during pregnancy and lactation

Ewes were assigned to one of 8 different feeding levels (low or high) during mid pregnancy, late pregnancy and lactation. Feeding level was manipulated by post grazing residuals, with low level feeding having much lower replacements.

Table 1: Residual Herbage levels (kgDM/ha) and effects of Nutrition on ewe and lamb performance:

	Mid Pregnancy		Late Pregnancy		Lactation	
	Low	High	Low	High	Low	High
Post Graze Residual[1]	250	1000	300	800	450	600
Ewe LW (Kg)						
Day 100 of pregnancy	44.0	56.2	-	-	-	-
Lambing	53.6	59.1	52.9	59.7	-	-
Docking	43.6	46.5	44.0	46.1	42.4	47.6
Weaning	45.2	48.5	45.7	47.9	44.5	49.2
Lamb LW (kg)[3]						
Lambing	5.1	6.0	5.6	6.1	-	-
Docking	14.0	16.0	14.7	15.3	13.7	16.3
Weaning	21.5	23.7	22.3	23.0	20.6	24.6

[1] *Herbage mass under set stocking: low nutrition, 20 ewes/ha, high 16 ewes/ha*
[3] *Litter weights adjusted for 1.25 lambs/ewe*

Table 2: Effect of different treatments on ewe weight and litter weights at weaning (assuming 1.25 lambs per ewe)

Nutrition Treatment[1]	**Weaning Weight (Kg)**	
	Ewe	**Litter**
LLH	46.2	25.2
LHH	48.4	24.7
HLH	49.2	25.6
LLL	42.1	20.3
HHH	54.0	28.5
SED	1.1	1.3

[1] Nutrition treatment in mid-pregnancy, late pregnancy and lactation respectively (L = low and H = high feeding level)

Summary

- Ewe and lamb losses were not changed by any nutrition regimes
- While ewes lost weight by low feeding during the mid and late pregnancy, much of the weight had been re-gained during high feeding in lactation
- Providing ewes were fed well during lactation, underfeeding in pregnancy had little impact on lamb weaning weight
- Underfeeding ewes during lactation had significant impact on lamb weaning weight
- Use caution applying these results with twinning ewes

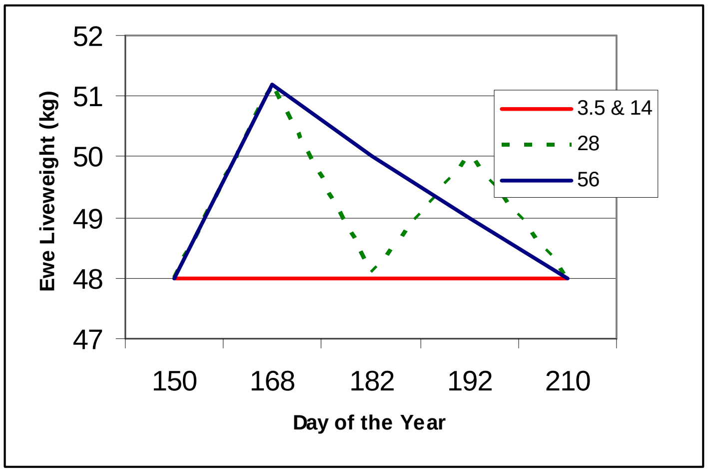
Trials 2 & 3: Effect of Grazing Duration on Ewes During Pregnancy

This trial looked at the frequency of shifting on ewes restricted during pregnancy. Shift frequency varied between 3, 9, 27 and 54 days per break.

Table 3: Effect of grazing duration (shift frequency) during mid pregnancy on ewe performance

	Trial 2				Trial 3			
Grazing Duration (days)	3	9	27	54	3.5	14	28	56
Lambs born/Ewes lambing	131	132	136	123	130	130	123	136
Lambs Weaned/Lamb Born	91	75	90	94	86	89	90	89
Ewes lambing/Ewes Present	84	92	92	94	78	75	79	84

Graph 1: Effect of grazing duration on ewe liveweight during mid pregnancy



Trials 2 & 3 Summary

- Grazing duration had no effect on final ewe liveweight or on ewe performance
- Large changes in ewe liveweight during the trial (graph 1)
- Ewes with long grazing duration tended to gain weight quickly, then loose weight later
- Shorter grazing duration (more regular shifting) can be used to help manage feed more effectively

Trials 4 & 5: Grazing Management Effects During Pregnancy and Lactation

Trial 4

This trial involved set stocking ewes at either 4 weeks pre lambing or at lambing and at two stocking rates

Ewes Per ha	Time of Set Stocking	Lambing Herbage Mass (kgDM/ha)	Ewe Liveweight (kg)		Litter LW at weaning (kg)[1]
			Lambing	weaning	
20	4 weeks pre-lamb	310	62.2	51.4	22.1
	At lambing	820	59.2	54.0	25.2
12	4 weeks pre-lamb	610	62.1	58.8	25.8
	At lambing	690	62.3	58.8	26.4

[1] 1.25 lambs per litter

Trial 4 Summary

- At high stocking rates the ewes set stocked 4 weeks prior to lambing had consumed their pasture reserves (310 kgDM/ha versus 820 kgDM/ha).
- There was no effect at the lower stocking rate
- Set stocking too early will impact on ewe and lamb liveweight at high stocking rates

Trial 5

This trial involved set stocking ewes at either 4 weeks pre lambing or at lambing and at two stocking rates following a long (70 day) or Short (35 day) rotation. One mob were rotationally grazed at lambing (RG post-L)

Rot[1]	Set Stocking[2]	Average herbage Mass			Ewe LW (kg)		Lamb LW[3]	
		4 weeks pre-L	Lambing	Wean	Lambing	Weaning	Lambing	Weaning
70	4 wk PL	940	490	1220	67.2	58.4	6.8	32.2
70	AL	860	1030	1930	61.3	60	6.5	34.3
35	AL	870	930	700	65.6	59.4	6.7	33.0
70	RG	840	1030	3300	62.4	57.4	6.5	30.4
	SED							

[1] *Rotation Length (pre-lambing): 70 = 70 day rotation, 35 = 35 day rotation*
[2] *4 wk PL = 4 weeks pre lambing, AL = at lambing, RG = Rotationally grazed during lambing*
[3] *average litter size 1.5 Lambs/ewe*

Trial 5 Summary

- Ewes set stocked 4 weeks before lambing were heavier at lambing (67 vs 61 Kg) compared to ewes set stocked at lambing, but the lambs were lighter
- Set stocking 4 weeks prior to lambing will decrease pasture reserves, ewes may be underfed in lactation
- Ewes on the longer rotation had higher pasture covers at lambing and were better fed during lactation
- Rotational grazing after lambing grew much more pasture, but in this trial (20 day rotation) pasture quality may have declined, reducing lamb weaning weights.

Project Summary and Implications for Northland

While the trial was carried out at Whatawhata, it was done on Hill Country similar to much of Northland and the following points would most probably apply to Northland.

- Underfeeding in lactation has a greater impact on ewe and lamb weaning weight than underfeeding in pregnancy
  - Restrict ewes during pregnancy to build feed reserves
  - Don’t underfeed ewes in lactation
- Underfeeding in pregnancy has little impact on lambing percentage
  - Restrict ewes during pregnancy to build feed reserves
  - Don’t underfeed ewes in lactation
- More regular shifting in mid pregnancy helps ration feed more efficiently but does not improve final ewe liveweight
- Set stocking ewes 4 weeks prior to lambing reduces pasture cover at lambing and negatively impacts on weaning weight at high stocking rates
- Having a long rotation during pregnancy results in better feeding during lactation and better weaning performance
- Rotationally grazing ewes and lambs after lambing helps to build covers, but the rotation must be short to maintain pasture quality (15 – 20 days)

9.0 Production from a Drought-Prone Northland Pasture Direct Drilled With 3 Grass Cultivars

K Betteridge, CJ Baker, 1983
New Zealand Journal of Experimental Agriculture Vol 11: 101-106

This project looked at the effect on production of introducing three grass species into a drought-prone Northland pasture.

The soil type was a volcanic soil on a dairy farm 20km east of Kaikohe, with a resident population of ryegrass and clover. The introduced grasses were Nui (perennial ryegrass), Matua (prairie grass) and Maru (phalaris) and were direct drilled in April. Three spray treatments were trialled; unsprayed or paraquat and glyphosate. Sowing occurred shortly after a prolonged dry period had ended.

In the first year spring and summer were dry, in the second year autumn, winter and summer were much wetter.

Results

(Results are presented in Table 1 & 2)

Production

- Pasture yield by season is shown for the two years of the trial
- Over the two years Matua prairie grass grew 13% more than Nui and 14% more than the control
- Matua grew more pasture across all seasons after the first autumn
- Both Matua and Maru had better growth in the second year
- Although not sown, Poa annua comprised up to 16% of drymatter in late winter and spring on the control, Nui and Maru plots

Table 1: Herbage drymatter yields (kgDM/ha)

	Growth (days)	**Pasture Type (total herbage)**				Average Growth (kgDM/ha/day)
		Control	Nui	Matua	Maru	
Year 1						
Autumn	90	2005	2150	2025	2050	23
Winter	81	2505	2540	2810	2540	32
Spring	73	4445	4485	4600	4315	61
Summer	109	1045	1045	1590	1070	11
Total		**10000**	**10220**	**11025**	**9975**	**29**
Year 2						
Autumn	85	1465	1435	1740	1705	19
Winter	31	650	575	730	580	20
Spring	103	5090	5255	5965	4900	51
Summer	107	3140	3110	3720	3415	31
Total		**10345**	**10375**	**12155**	**10600**	**33**
2 Year mean		10170	10295	11590	10285	

Spray Treatments

- The no-spray and glyphosate sprayed pasture produced slightly more dry-matter than the paraquat sprayed treatments in the first autumn (Table 2)
- Apart from the first autumn there were no other significant differences between spray treatments

Table 2: Herbage DM yields in the first 90 days after sowing (kgDM/ha)

Pasture type	Spray Treatment		
	No Spray	**Paraquat**	**Glyphosate**
Control	2105	1845	2065
Nui	2170	2035	2245
Matua	2025	2015	2040
Maru	2055	1935	2155

Conclusion & Discussion

- The resident ryegrass appeared to be well adapted to the environment, with little difference in either total pasture production or the season production from the sown Nui
- Matua prairie grass was the highest yielding pasture species across the two years, adding approximately 3 kgDM/ha/day to winter production. Hessian fly is a major pest associated with prairie grass and limits the widespread use of prairie grass in Northland
- Maru phalaris was slow to establish, but increased as a percentage of pasture production during the second year
- This summer dry environment may suit tolerant species such as prairie grass and phalaris
- There appears to be little benefit from band spraying herbicides immediately flowing a summer drought