Northland Pastoral Extension:

Research Stocktake

NORTHLAND NATURALLY
FIRST REGION OF NEW ZEALAND

Sustainable Farming Fund

Temperate Pasture Species

Contents

1.0 Using chicory, plantain and facial eczema safe grasses to combat facial eczema

Reference:

Facial eczema control: on-farm assessment of promising alternative pasture species and their management. Meat New Zealand – Final Report 96 PR 34/1.4

Author:

RG Keogh, AgResearch, dated approximately 2000.

Overview – Summary:

- A series of on-farm grazing trials were conducted in Northland and the Waikato from 1997 to 2000 to assess the efficacy of using pastures comprising chicory and clovers or tall fescue and clovers for facial eczema control. With the exception of some tall fescue based pastures, in which there was considerable ingress of resident ryegrass, the use of so-called FE-control pastures was an unqualified success. Not only was control of facial eczema achieved, but also stock performance on these pastures was superior to that on resident ryegrass based pastures. Substantial losses due to facial eczema were experienced with sheep and cattle grazing ryegrass-dominant pastures in Northland in 1997 and 1998.

- A faecal monitoring method was routinely used as a measure of facial eczema in the grazing trials along with serum GGTs and liver damage recorded at slaughter. The results obtained show that this monitoring method can give a good indication of current risk of facial eczema and be successfully used to indicate when additional precautions need to be undertaken, and equally when they are able to be relaxed.

- For facial eczema causing spores (P Chartarum), the spore loads were generally higher at urine patch sites, and as herbage at these sites was preferred by stock they were the main source of most of the ingested toxins. Management to minimize toxin intake from these pastures needed to ensure that close grazing at urine patch sites did not occur. Results of grazing studies showed that this was only possible with rapid rotational grazing.

- Epicuticular wax levels were determined for pasture species that supported high or low levels of *P.chartarum*. Wax levels were lower for species supporting low levels of *P.chartarum* development, a result which indicates that the faster decomposition of these species --- chicory, red and white clovers --- may be due to easier colonization by yeasts and bacteria.

- Insertion studies showed that leaves of chicory, red and white clovers, tall fescue, and lotus had very low *P.chartarum* spore loads.

  Previously identified high risk grasses including ryegrass, cocksfoot, browntop, and Yorkshire fog all had high spore loads. However, it was also concluded that the environments prevailing beneath a Yorkshire fog canopy were not favourable for *P.chartarum* development and conversely that environments beneath white clover and lotus canopies were favourable (for *P.chartarum* development).

- Earthworm populations increased markedly under chicory/red clover pastures in Northland. The ability to support high earthworm populations has considerable benefits in the long term, including better soil aeration, drainage, and increased water-holding capacity, higher rates of nutrient cycling and pasture growth, and growth extending further into dry periods.

Background and Industry Context:

Facial eczema (FE) continues to be one of the major animal health problems affecting livestock, despite research efforts extending over 60 years. Research through the 1980's and early 1990's identified a group of species that contribute to a high level of facial exzema risk, and a second group that have considerable potential for control of FE.

The high risk group include ryegrass, browntop, cocksfoot, Yorkshire fog, and dogstail. The low risk group include chicory, red and white clovers, and tall fescue. These also have the added advantage that they are "summer species" and are likely to provide better quality feed at a time when the high risk group are of lower quality.

Method:

FE-control pastures were established in Northland and in the Waikato during spring of 1997. Most of these pastures were chicory-based and included white and/or red clovers and generally did not include any sown grasses. Other FE-control pastures were based on tall fescue and included red and white clovers in the seeds mixtures.

The methods employed for assessing the success of these FE-control pastures and of grazing management strategies for FE control were based on a technique developed to assess facial eczema risk. This technique is based on the *Pithomyces* spore load in dung and gives a measure of spore (and toxin) intake.

Results:

- Frith Farms 1998

  Facial eczema damage was assessed in lambs grazing ryegrass (high risk) pasture versus facial eczema control pastures.

  Faecal spore loads were lower in the control pastures for the whole period being end January to end May. GGT levels in blood samples, followed the same pattern.

  The faecal spore load results: all lambs grazing control pasture had normal GGT levels, whereas only 31% of lambs grazing ryegrass had normal GGT – the other lambs had high to very high levels.

  Liver damage: 60% of lambs grazing ryegrass had liver damage compared to **no** lambs in the control pastures showing liver damage.

Animal Production:

Liveweight of 21.1 kg at the start of the trial, on 10th January. After 82 days.

Pasture Type	Ryegrass	FE Control pasture gain
Liveweight gain	7.15	9.04
Approximate gain/day	87 gms	110 gms
Carcase weight	12.3	15.4

A 25% increase in carcase weight when slaughtered on 14th May from the lambs grazing FE control feed. On another 6 farms in Northland, blood samples showed that lambs grazing ryegrass, 16% had elevated GGT levels compared to 3% of lambs grazing FE control pastures.

- DDM Farms

Different mobs of cattle grazed blocks of different types of pastures, ranging from unimproved resident grass (old ryegrass and browntop) to improved pastures based on ryegrass, clovers, chicory and tall fescue.

Incidence of elevated GGT levels in blood sample, bulls grazing different pasture types.

Pasture	% bulls with high GGT levels
Rye dominant	88%
Old resident pasture (rye, browntop)	38%
Tall fescue, ryegrass, chicory and red clover	23%

The risk of facial eczema is highest in the most dominant ryegrass pastures and also in unimproved pastures in which ryegrass and browntop were prominent.

This trial also showed a good positive relationship between faecal spore loads of cattle and subsequent measures of facial eczema.

In the above table the 23% of bulls having elevated GGT levels on “safe” pastures was attributed to ryegrass coming back into that pasture very quickly.

- Pasture based control of facial eczema

Pasture establishment in Northland. Majority of pastures were direct drilled after spraying out the existing pastures. Early results were variable. Seed was often sown too deep giving an uneven germination of chicory and clover. In 1998 one of the ten grazing trials was abandoned because of a failed pasture establishment.

Direct drilling, or a combination of drilling the grass and broadcasting clover or chicory, can give good results if done properly.

Chicory and chicory red clover based pastures have a specific requirement in management: they should be regarded as crops in their own right. As ryegrass is a high risk FE species, it needs to be sprayed out of areas where FE control specieis are going to be established. Failure to do so will compromise the FE control species such as chicory e.g. ryegrass will out-compete chicory for nitrogen. Both chicory and clovers need adequate spelling from grazing to maximise growth rates. These species are able to maintain high feed values during summer and autumn even with standing crops being over 5 tonnes of dry matter per hectare.

Management Options

- Chicory sown on its own at 5 kg/ha. Gives very dense stands, easy to manage as there is no ryegrass to force changes to grazing.

  Nitrogen used to boost growth in winter and spring. Poa annual is the most likely grass species to invade. It is short lived and within the trial, no control/eradication was used.

- Chicory and red clover, each sown at 4 kg/ha. Under very dry conditions regrowth after a severe grazing is mostly from chicory. Need to maintain good ground cover as long into a dry period as possible. Through better soil moisture and lower temperatures this will give better growth plus some re-seeding of chicory.

- Need to combat ryegrass invasion in FE control pastures. If not, there is a loss of integrity of control pastures and eventually the run-out of pasture though death of these control plants, e.g. chicory.

  Treatment to eliminate ryegrass for a chicory – clover crop is to spray in early – mid spring with glyphosate at rates upto 2.5 l/ha after grazing but getting some regrowth in ryegrass. This early spraying is important because ryegrass will reseed very easily.

Earthworm Population Changes:

Earthworms are important in the ecology of the facial eczema fungus because they are major agents in removal of plant litter from the soil surface. They remove both the potential and actual substrate and associated toxins. Plus the fungus is killed as it passes through the digestive tract of the surface feeding worm, lumbricus rubellus.

Earthworm population from 1997 to 1999: the average was approximately:

- 6.5 gm / 0.4m2 under chicory pastures
- 1.3 gm / 0.4m2 under ryegrass pastures

Summary

- A high level of facial eczema control is able to be achieved with the use of pasture species identified as low risk e.g. chicory, red or white clover, tall fescue and also plantain in pastures grazed by cattle.

- Where breakdown in control has occurred it has been attributed to a failure to eliminate ryegrass initially or to subsequent ingress of ryegrass.

- To maintain control it is essential to prevent ingress of high risk grasses such as ryegrass, cocksfoot, browntop, danthonia. These can and should be eliminated from chicory based pastures by mid-spring using glyphosate.

- Monitoring faecal spore loads will provide a good indication of current facial eczema.

2.0 Yields of pure clover and grass plots: red clover silage

Reference:

Ley pasture Trials – Ruawai, Internal, preliminary report for DSIR, May 1982.

Author:

Tony Taylor

Overview:

Various clover and grass species and cultivars were sown as pure plots. Dry matter production is given for a 7 month period during the second year of production.

Comments are given regarding the use of red clover for an ongoing silage cropping system.

Trial Method:

Two sites were planted on the Ruawai Flats, Dargavile on 17th November 1980. Plot sizes were 3 metres by 3 metres, with 3 replicates per site. Grasses were resown in autumn 1981.

Results:

Seeds germinated well.

At one site, 50-80% of the grass seedlings were killed by inadvertent herbicide spraying. Legume seedlings were unharmed by this spray.

At the other site, a massive infestation of summer weeds rapidly developed. While control of these weeds was attempted by mowing, they still severely depressed the sown species.

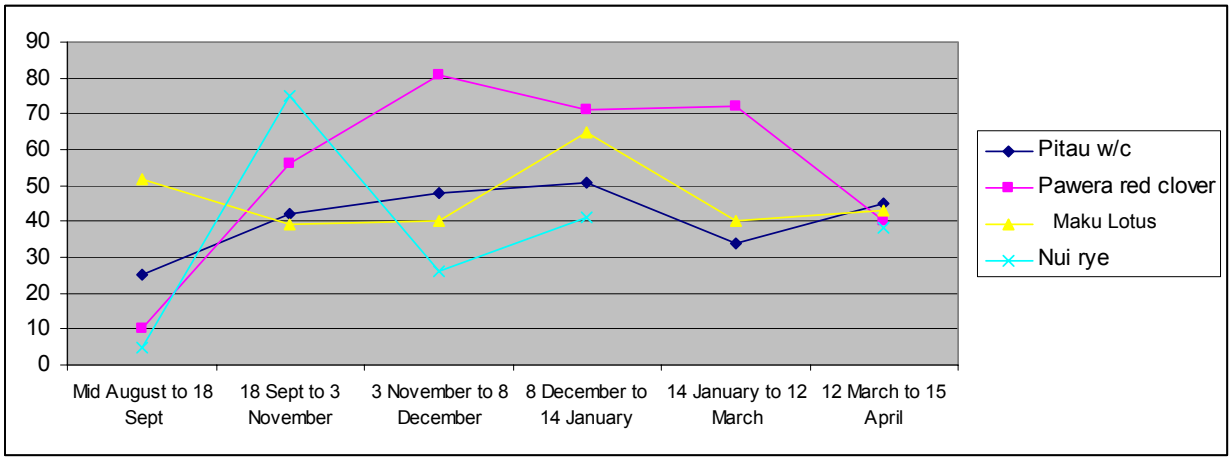
The grasses re-sown in autumn 1981 established moderately well, but the very wet site had major competition with sedge and other aquatic weeds. By mid winter all grasses were extremely nitrogen deficient – nitrogen was then applied.

Yields:

Data covering the establishing 6-12 months is not shown; because grass establishment was so poor. Forage yields recorded from mid spring.

Table: Yield Data – Daily Growth Rates (kgDM/ha/day)
Site 1: Wallace Road

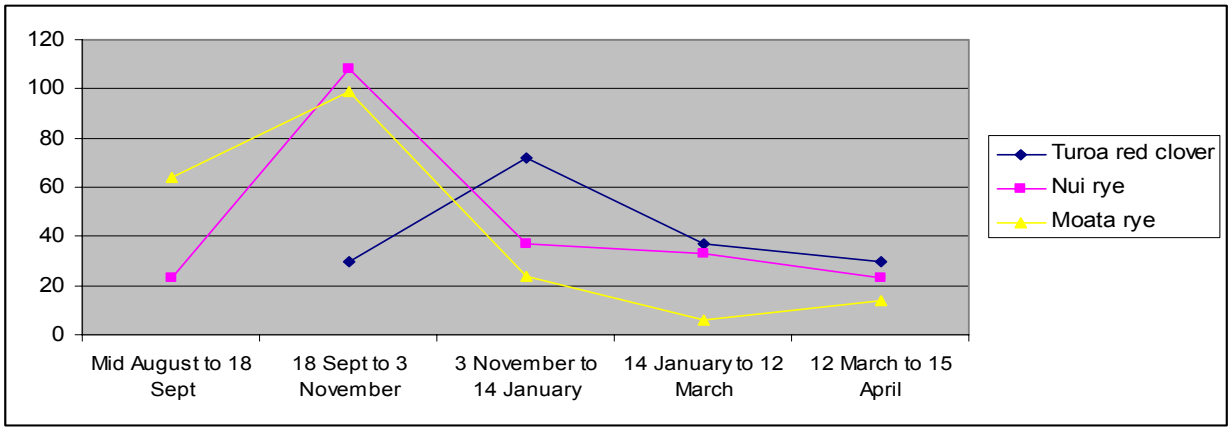
Plant species / cultivars	Mid August to 18 Sept	18 Sept to 3 November	3 November to 8 December	8 December to 14 January	14 January to 12 March	12 March to 15 April	Total yield from August to April kgDM/ha
Pitau w/c	25	42	48	51	34	45	9925
G18 w/c	36	36	48	56	32	40	9992
Turoa red clover	8	41	69	72	56	35	11580
Pawera red clover	10	56	81	71	72	40	13953
Maku lotus	52	39	40	65	40	43	11333
Nui rye	5	75	26	41		38	7396
Moata rye	43	85	32	41		7	8402
Tall fescue	3	53	32	61		84	8833



This Wallace site was better drained compared to the House site (data shown below). The legumes out performed the grasses.

Table 2: Yield Data – Daily Growth Rates (kgDM/ha/day)
Site 2: House: 1981/82 Data

Plant Species/Cultivar	Mid August to 18 Sept	18 Sept to 3 November	3 November to 14 January	14 January to 12 March	12 March to 15 April	7 month yield August to April
Pitau w/c		50	26	38	43	7820
Turoa red clover		30	72	37	30	9700
Pawera red clover		21	61	47	41	9480
Nui rye	23	108	37	33	23	10610
Manawa rye	40	105	41	14	18	10753
Moata rye	64	99	24	6	14	9542



Yield Comments:

Data shown above is for the second year after establishment of the clovers: the summer grass competition was too severe to give good data in the first year.

At the Wallace site which was better drained, the legumes out yielded the grasses. On the wetter House site the grasses and legume yields were very similar for the 7 month collection period, but the seasonal production was quite different.

- Very strong grass production in September – October.
- Very low grass production in summer, with the perennial rye Nui being moderate in autumn.
- Legumes showed very slow late winter early spring growth.
- Clover growth was considerably slower in September – October but faster in summer and autumn, than the ryegrass

Ryegrass yields increased with the 300 kg N/ha applied. Even with this input, there were still signs of nitrogen deficiency.

The grasses had slow growth during winter: they had only been sown in the previous autumn and the small plants did poorly in the very wet soil.

White clover achieved a substantial lower peak summer growth than red clover. The red clover had the best growth pattern for silage making.

Ryegrass Rust:

A requirement for a plant designed for silage harvesting over the late spring to mid autumn period will be reduced levels of rust. Within this trial:

- Tama showed high levels of rust when shut for silage in late spring,
- In mid September there was no rust present on any grass.
- Mota showed severe rust in early December; Nui had considerably less
- Roa tall fescue showed no rust or any other disease at any time.

Insects:

Crickets were baited during summer but some reinvasion occurred. The grasses at the Wallace site were damaged: because of this, no yield data shown for the February – March period. Crickets preferred the ryegrasses to clover, lotus or fescue.

Weeds:

Well established legume strands resisted weed invasion reasonably well. Small amounts of weed should not be a major problem under crops being cut for silage.

White clover was the most aggressive clover: it significantly encroached into the pure grass swards despite the high rates of N used. The white clover showed slower ingress into the lotus or red clover plots. This white clover spread would not be a problem for a 3 year crop system. The worst weed problems occurred at establishment. Poa annual was the worst after an autumn planting and barnyard grass (summer grower) after a spring planting.

Conclusions:

The sites used favoured clovers over grasses due to:

- Naturally high phosphate and potash status
- Good summer moisture
- Low mineral nitrogen after maize cropping.

Red clover cultivar Pawera is capable of persisting for around three years as a pure stand. In a full production season yielding up to 14 t DM/ha. This would allow 3 silage cuts for a harvestable yield of 8 – 10 t DM/ha. Red clover has a weed problem at establishment.

Red clover silage used in combination with maize silage would provide a better balanced ration than maize silage above. Protein and mineral deficiencies in maize silage would be partly or fully overcome.

Overseas trial work gives good animal performance from red clover silage as a sole ration:

	Red Clover	*Perennial Rye*
Forage Yield – t DM/ha	4.7	6.0
Formic acid treated silage:		
- crude protein	21.3%	16.0%
- digestibility	67%	61%
Steer Performance		
- silage intake kgDM/ha	7.3	6.5
- liveweight gain/kg/day	1.04	0.5
- feed conversion kgDM/kgLWG	7.0	13.1

Red clover has high potential for silage crops if:

- Yields average 8 t DM/ha
- Wilt to 40% dry matter
- Fine chop
- Achieve good compaction.

Advantage of red clover for silage yield compared to maize:
Establishment cost of red clover can be spread over 3 years.

- Harvesting is less rushed compared to maize
- Needs no nitrogen fertiliser
- Needs no insecticide
- It will provide considerably soil nitrogen for succeeding maize crops

3.0 Differences in pasture yield methods

Reference:

Pasture Production of Northern Dairy Farms. Proceedings of the NZ Grassland Association vol 59, 1997 pages 103-106.

Author:

GJ Piggot

Overview

Pasture production and parameters were measured on 53 dairy farms between 1989-1996 in Northland, Waikato and Bay of Plenty.

Pasture growth was assessed from a trimmed “cage” technique and from a “whole farm” technique.

Annual yield from the cage technique averaged 14.8 tDM/ha while the whole farm yield was 11.4 tDM/ha, being just 77% of the cage yield.

Trial Method:

- Potential pasture growth is measured by the cage technique. The cage sites involved were above average for productivity for the farm, had typical species but always had ryegrass and white clover.

- The whole farm technique has 2 parts:

    - Calculation of changes in farm pasture cover between monthly visits,

    - Calculation of daily growth required to equate with the livestock pasture intake. This requires pre and post grazing paddock yields; daily grazing pressure as cows/ha.

Results:

- Averaged over the season and years, the whole farm yields were 77% of the cage yields.

- This difference is due to the whole farm growth representing the “capture” of the latest growth indicated from the cage yields and is the consequence of management.

TABLE: Annual yields (tDM/ha) for cage or whole farm pasture growth assessment

	Cage Yield	Whole – farm yield	Number of farms
Regions			
Northland	14.5	10.9	90
Bay of Plenty	15.5	12.3	34
Waikato	15.9	13.3	11
Northland Soils (non irrigated)			
Volcanic	15.7	11.2	15
Alluvial	14.4	11.2	18
Gumland/Limestone	13.2	10.3	15
Hilly/north YBE	13.1	10.0	12
Irrigated Farm			
Non-irrigated cage	13.9		
Irrigated	16.6	11.5	12
ALL DATA	14.8	11.4	135

- Whole farm yields were within 10% of the cage yields in just 10% of cases. This interfering very good pasture management occurring on those farms.

- Whole – farm yields were less than 70% of cage yields for 22% of cases, indicating much potential to improve production through adopting improved pasture management.

- Cage yields in excess of 18 tDM/ha/year occurred in 7% of season years all on different farms. No pattern showed relating to these high yield farms. Whole farm yields below 9 tDM/ha/year occurred in 5% of season years, all being on Northland rolling or hill farms.

- The differences between regions are unsurprising: Northland soils have a reputation of being poor. The best Northland soil (volcanic) compares favourably with the Waikato and Bay of Plenty cage yields, but not in whole-farm yield.

- The difference between cage and whole farm yield was greatest in September: average daily growth from all the data had whole farm yield at 38 kgDM/ha/day compared to 51 kgDM/ha/day for cage yield, being 72% of this cage result. The September effect is probably dominated by an accumulated pasture damage effect which is a consequence of grazing wet soils in early spring.

Consultants Conclusions

- There is a big difference at 22% between pasture growth measured by use of cages (gives potential yield) and what the farm actually grows (given by whole-farm yield). This needs to be taken into account when feed budgeting, or planning stocking rates, or deciding on calving dates etc.

- The very best managed farms for grazing management/feed utilisation, have whole farm yields being within 10% of their cage (potential) yields.

- In contrast to these very well managed farms, pasture wise, 22% of cases had whole farm yields being less than 70% of their cage yields. This showing the large potential there is to improve pasture management.