

## Northland Pastoral Extension: Popular Summary

# Nitrogen

– Temperate Grasses and Clovers



## Summary of Key Findings

Research work on Nitrogen in Northland during the 1970s and 1980s looked at:

- The timing and rates of autumn applications.
- The timing and rates of spring applications.
- The use of Nitrogen in pasture establishment and/or renovation.
- The extended use of Nitrogen throughout the year.

## Autumn Applications of Nitrogen

Autumn Nitrogen (N) responses can vary markedly.

Pasture growth responses to autumn applications of fertiliser N in Northland are highest around the natural peak of autumn growth, especially if the soil has re-wetted after summer.

Responses were reduced when Nitrogen applications were delayed for another month.

### Trial Design 1979–1982

Urea was applied at 50 kg N/ha in April and May.

The response was measured in two cuts over 10 weeks as follows:

| Temperate Grasses and Clover           | kg DM per kg N applied |            |
|--|------------------------|------------|
|  | 9 April                | 17 May     |
| Konoti clay (sheep pasture)            | 10.0                   | 8.0        |
| Waiotira clay (sheep pasture)          | 9.5                    | 4.0        |
| Basalt volcanic (dairy pasture)        | 21.0                   | 22.5       |
| Andesite semi-volcanic (sheep pasture) | 1.5                    | 6.0        |
| Peaty sand (with pan) (sheep pasture)  | 11.0                   | 3.5        |
| <b>Average Response All Trials</b>     | <b>12.0</b>            | <b>8.0</b> |

The response on the Andesitic site was unusual, illustrating that strange results can occur with any one fertilizer trial hence, there is a need to base recommendations on results from a number of trials over several years.

## Spring Applications of Nitrogen – Dairy Farms

The response to Nitrogen improved during the winter into the spring. The most efficient response was to 25 kg N per ha.

Responses to Nitrogen applications appeared greater with grazing trials than mowing trials. Most published data is from mowing trials, thus given response rates may well be lower than occurs in practice.

The response to Nitrogen in most cases lasted for two to three grazings, indicating that in spring when cows are on an 18–20 day rotation, Nitrogen can be applied behind the cows and a response expected beyond the first grazing.

### Trial Design 1967–1976: Mowing Trials

There were 25 trials on 10 trial sites. Production cuts were taken when pastures were 15 cm high (which was 4–6 weeks after Nitrogen was applied).

In half the trials, subsequent production cuts were done.

Nitrogen was applied at 25 and 50 Kg N per ha.

| N Response Under Mowing           | kg DM per kg N applied |      |        |           |
|-----------------------------------|------------------------|------|--------|-----------|
|                                   | June                   | July | August | September |
| Month                             |                        |      |        |           |
| Number of trials                  | 4                      | 8    | 9      | 4         |
| <b>Kg pasture dry matter/kg N</b> |                        |      |        |           |
| 25 kg N/ha                        | 10.0                   | 11.0 | 17.0   | 15.0      |
| 50 kg N/ha                        | 8.0                    | 9.0  | 13.0   | 11.0      |

Where cuts were continued beyond 4–6 weeks, 80% of trials responded significantly to N at the second cut, but in only one trial did the response persist to the third cut.

### Trial Design 1980–1981: Grazing Trials, Dargaville Research Farm

N was applied at 40–50 kg N/ha to paddocks in both July and August.

Plastic sheets (to exclude N) 12 metres square were placed to form six control plots in a single paddock receiving Nitrogen.

Dry matter production from control plots was paired with adjacent plots and measurements made with a plate meter before and after each subsequent grazing until the response disappeared.



| N Responses Under Grazing     | Date of Application |               |              |                |
|-------------------------------|---------------------|---------------|--------------|----------------|
|                               | 18 July 1980        | 4 August 1980 | 14 July 1981 | 25 August 1981 |
| Period of response (days)     | 70                  | 110           | 100          | 60             |
| Number of grazings            | 3                   | 5             | 3            | 3              |
| Pasture growth (kg DM/ha/day) | 37                  | 33            | 18           | 18             |
| Kg pasture dry matter/kg N    | 18                  | 58            | 28           | 7              |

Pasture growth estimates were from the control plots.

The response in August 1980 was exceptional and well above what could usually be expected.

For August and September, total rainfall of 185 mm was normal but rain occurred on 25 and 26 days of those respective months, providing the situation where in practice a response was lower than a cutting trial would have indicated.

## Spring Applications of Nitrogen – Sheep Farms

**Pasture and hogget growth respond quickly to Nitrogen.**

**Efficient sheep production responses occur on dense, low-growing pasture in early spring with up to 50 kg N per ha.**

### Trial Design 1980: Grazing Trials, Grasslands Division Kaikohe

The trial area consisted of 6.5 ha of Wharekohe silt loam, with pasture composition consisting mainly of perennial ryegrass and white clover producing 9–12 tonnes DM per year.

Breeding ewes grazed the area up to 9 July, which was then spelled. Urea was applied two weeks later and the area stocked with hoggets at 22 per ha. There were six replications for each treatment.

After 9 weeks, fences in each block were removed and the hoggets run as one mob, hogget comparison therefore was between 23 July to 25 September; pasture monitoring continued to 5 November, week 15.

| Treatments and Results             | Control | 50 kg N per ha | 200 kg N per ha |
|------------------------------------|---------|----------------|-----------------|
| Pasture cover 23 July (kg DM/ha)   | 670     | 670            | 670             |
| Pasture cover Week 9               | 710     | 980            | 1140            |
| Hogget LW gain per head (g/day)    | 82      | 154            | 190             |
| Hogget liveweight gain (kg per ha) | 114     | 214            | 263             |
| Herbage accumulation Week 9        | 1141    | 2054           | 2594            |
| Herbage accumulation Week 15       | 2938    | 4173           | 6032            |
| Kg pasture DM per kg N applied     |         | 24.7:1         | 10.5:1          |

Measurement of growth responses of grasses was also monitored. Annual poa gave the quickest and largest yield response. Annual poa increased its yield over the first two cuts by 148% for 50 kg N and 231% for 200 kg N, compared with increases of only 66% and 76% for ryegrass.

## Nitrogen for Pasture Establishment

Three 50 kg applications of N – at 2, 10 and 18 weeks post emergence – was significantly better than all other treatments in total DM yield.

Average response to N was 15 kg DM per kg N applied.

Multiple applications of Nitrogen depressed clover in pasture, but clover percentages returned to a similar level after application ceased.



### Trial Design 1975: Grasslands Division Kaikohe

The trial was established on virgin Wharekohe silt loam at the DSIR Kaikohe Grasslands Regional Station. The area was covered with stunted manuka scrub, cut with a rotary slasher, ploughed, rotary hoed and rolled to prepare a firm seed bed.

The trial consisted of 11 treatments with 5 replications. Basal applications of potassic superphosphate plus molybdenum and lime were applied.

|   | Total kg Nitrogen | Total DM all cuts (kg) | Extra kg DM |
|---|-------------------|------------------------|-------------|
| Control sown with Pitau White clover + Rye            |                   | 11245                  |             |
| 25 kg N 2 weeks post emergence                        | 25                | 11816                  | 570         |
| 50 kg N 2 weeks post emergence                        | 50                | 12123                  | 880         |
| 25 kg N at 2,10, 18 weeks.                            | 75                | 13108                  | 1860        |
| 50 kg N at 2, 10, 18 weeks.                           | 150               | 11837                  | 590         |
| 25 kg N at 2 weeks, then 6 applications every 8 weeks | 175               | 13164                  | 1920        |
| 50 kg N at 2 weeks then 6 applications every 8 weeks  | 350               | 15900                  | 4650        |

## Nitrogen for Pasture Renovation

Multiple applications of Nitrogen substantially increased dry matter production during the initial six months after drilling, but the total response over 12 months was less than that for no application of Nitrogen.

50 kg N/ha was significantly better than 25 kg N/ha. 50 kg N/ha applied two weeks after sowing gave a better response – of 15 kg DM/kg (15:1) – than the same amount applied when the seed was drilled (11:1); however, there was no long-term increase in total production. For the first six months, dry matter response was 16 kg pasture dry matter per kg N applied two weeks after emergence.

There was no significant post response depression of pasture growth after cessation of Nitrogen applications, and the clover content returned to a level similar to that of the control.

### Trial Design 1974: Grasslands Division Kaikohe

Renovation trials were conducted on a Wharekohe silt loam at the demonstration farm at Punakitere, with two sites as follows:

- One area was sprayed with paraquat, rotary hoed, and rolled before drilling.
- The other area was direct drilled and rolled after spraying with paraquat.

Basal fertiliser was applied. The seed mix included rye, clover and cocksfoot. Pasture cuts were carried out over two years.

| Pasture Cuts Direct Drill Site                  | Total kg N | Total DM Jun to Oct | Total DM all cuts |
|---|------------|---------------------|-------------------|
| Control (no Nitrogen)                           |            | 1880                | 7200              |
| 50 kg N as urea at drilling                     | 50         | 2450                | 7170              |
| 25 kg N as urea broadcast on surface at 2 weeks | 25         | 2290                | 7050              |
| 50 kg N as urea broadcast on surface at 2 weeks | 50         | 2650                | 7740              |
| 25 kg N as urea at 2, 10, 18 weeks              | 75         | 2960                | 7370              |
| 50 kg N as urea at 2, 10, 18 weeks              | 150        | 3580                | 8230              |

The three applications of 25 kg N per ha increased pasture production by 60% from June to October, but only by 2% over the first 12 months.

The three applications of 50 kg N/ha increased pasture production by 90% from June to October and by 14% over the first 12 months, a response rate of 7 kg DM/kg N applied.

## Year-round Use of Nitrogen

Total pasture production increased 34% after Nitrogen was applied; the response rate on average was 8 kg DM/kg N applied. This confirms that in Northland, pasture production throughout the year is limited by the shortage of Nitrogen.

The most consistent responses were from mid winter to early summer.

December and January applications of Nitrogen were responsive, but from February to June the response was less, depending on rainfall.

There was no decline in the clover content following Nitrogen treatment.

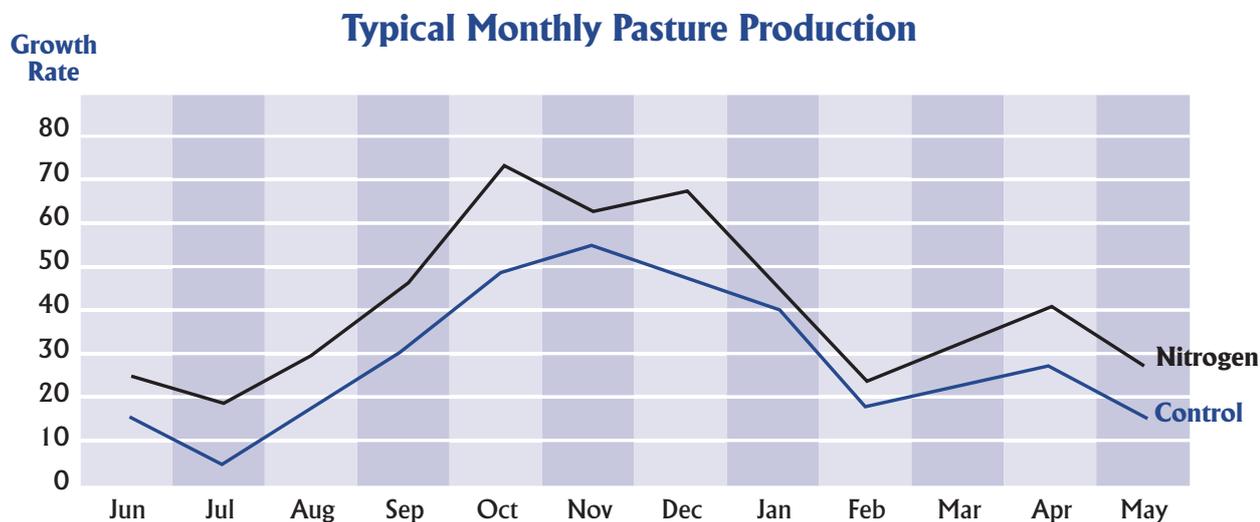
## Trial Design 1970–1973: Kara Silt Loam Warkworth

A paddock was cut in half:

- One half was the control.
- The other half received Nitrogen every two months at 70 kg N/ha (giving 420 kg N for a year).

The trial lasted three years. Each half was grazed with the same grazing policy.

Randomly placed cages were mown at three-weekly intervals.



The control produced on average over the three years 10200 kg DM/ha and the Nitrogen area 13600 kg DM/ha.



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A project coordinated by the Northland Pastoral Farming Development Group

The unabridged version of Research Stocktake – Soil Fertility is available on the Enterprise Northland website: [www.enterprisenorthland.co.nz](http://www.enterprisenorthland.co.nz)