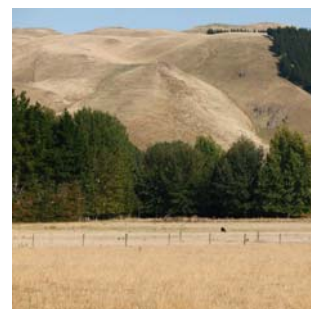
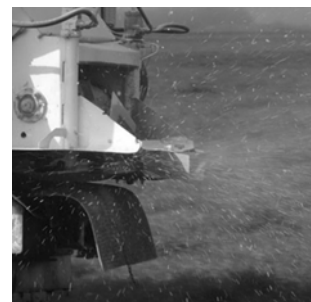


post-drought nitrogen use



Most years, drought affects farmers in some part of New Zealand, causing serious issues with feed supply, productivity and profitability. When rain finally falls, farmers want to grow as much grass as they can, as quickly as possible. To help achieve this, urea is often applied to land as soon as the first rains fall, even though this rain may not be sufficient to elevate soil moisture levels in the long term. Conventional wisdom suggests that much of the benefit of this urea will be lost, as drought-stricken pasture requires time to recover before it will respond effectively to applied nitrogen. To test this theory, Ballance commissioned research into the subject, and two experiments were undertaken in drought-affected land in the Bay of Plenty and Hawke's Bay regions.

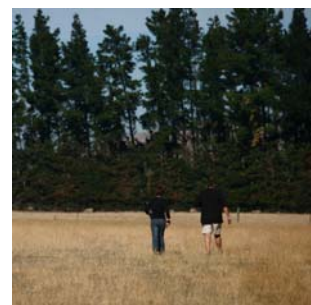


experimental approach

Randomised small-plot trials were set up on one farm in the Bay of Plenty (with a Taupo sandy silt soil) and another in the Hawke's Bay (with a Pallic soil). When the trial sites were established, both farms had experienced drought conditions and soil moisture levels had been low for some time. Within each trial there were five treatments:

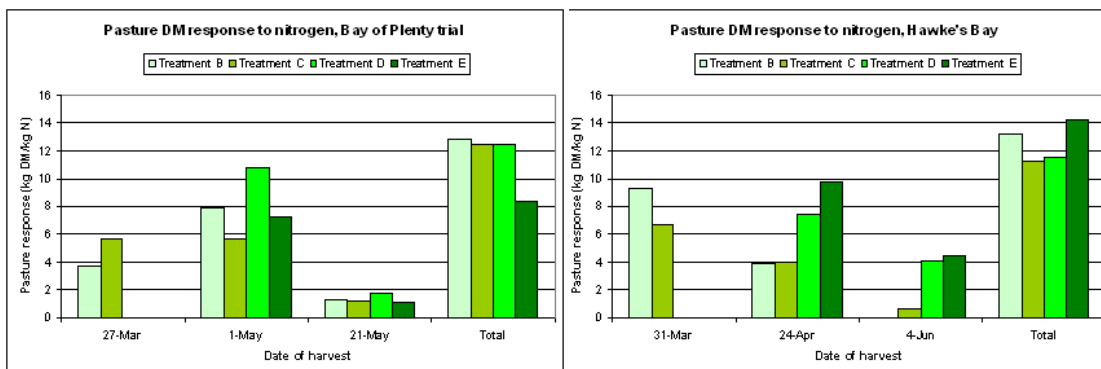
- A. Control plots, which received no fertiliser nitrogen
- B. Test plots that received 25 kg N/ha immediately after the first rain fell
- C. Test plots that received 50 kg N/ha immediately after the first rain fell
- D. Test plots that received 25 kg N/ha after subsequent rainfall or irrigation
- E. Test plots that received 50 kg N/ha after subsequent rainfall or irrigation

In the Bay of Plenty trial, the land was not irrigated and relied on rainfall for moisture supply. In the Hawke's Bay trial, the land was irrigated after the first rain fell so that soil moisture was maintained at around 33% in the top 0-8 cm. In this instance, treatments D and E were applied four weeks after the initial rainfall.

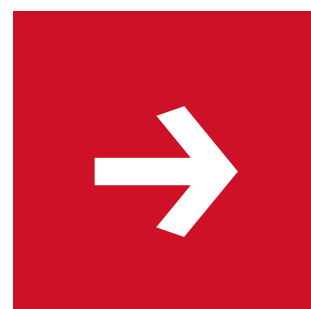


effect of fertiliser nitrogen on dry matter production

A pasture dry matter response to nitrogen was noted at both trial sites when **n-rich** urea was applied after the first rainfall. Responses varied from 3.7:1 to 9.3:1. This effect persisted over the following four weeks, with pasture responses still noted at the second harvest. Nitrogen fertiliser applied after subsequent rainfall or irrigation (treatments D and E), also produced a dry matter response. Interestingly, the total dry matter response was similar in all treatments, regardless of whether the nitrogen had been applied after the first or subsequent rainfall.

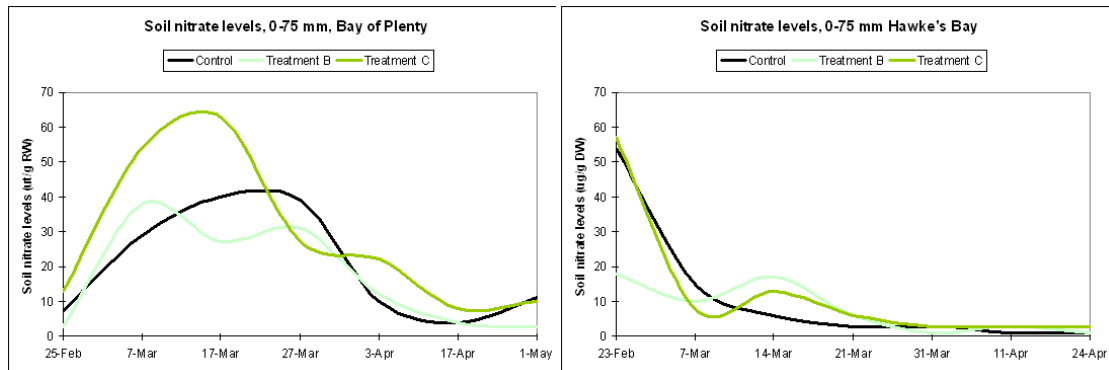


Figures 1 and 2: Pasture dry matter response to **n-rich** urea applied to drought-affected land. Fertiliser nitrogen was applied after the first rainfall (treatments B (25 kg N/ha) and C (50 kg N/ha) or following subsequent rainfall or irrigation (treatments D (25 kg N/ha) and E (50 kg N/ha).



soil nitrate and ammonium

Soil nitrate and ammonium levels were measured at intervals throughout the experiment. Figures 3 and 4 show soil nitrate levels for the control, treatment B and treatment C plots, at 0-75 mm depth. In the Bay of Plenty trial, there was a flush of soil nitrate after the first rain (1 March), then levels gradually declined throughout the trial. In Hawke's Bay, soil nitrate levels were initially high, then declined rapidly following rain on 3 March. There was a slight flush following irrigation and nitrogen application on 7 March.



Figures 3 and 4: Soil nitrate levels (0-75 mm depth) at test sites in Bay of Plenty and Hawke's Bay. In Bay of Plenty, treatments B (25 kg N/ha) and C (50 kg N/ha) were applied 5 March. In Hawke's Bay, treatments B (25 kg N/ha) and C (50 kg N/ha) were applied 7 March.

Soil ammonium levels were generally low at both sites during drought conditions. At the Bay of Plenty site, ammonium levels rose after the first rain and application of nitrogen, but declined within a matter of weeks. This effect was also seen at the Hawke's Bay site, along with a smaller increase after the later application of nitrogen.

herbage quality

One major risk during a post-drought period is nitrate poisoning, especially on cloudy days. Analysis of herbage samples taken during this trial showed that nitrate-N levels remained below the critical level of 0.22% for the duration of the trial. In the Bay of Plenty trial, the highest nitrate level recorded was 0.12%, while in the Hawke's Bay trial the highest level recorded was 0.19%.

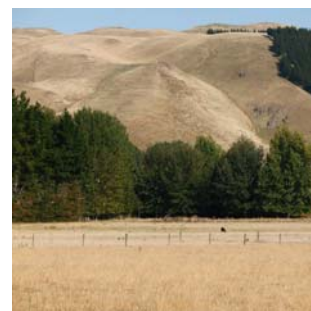
Plant total nitrogen levels tended to be slightly on the low side of normal (4.5-5.5%) at both sites. At the Bay of Plenty site, herbage total nitrogen content ranged from 3.54% to 5.41%, while at the Hawke's Bay site the range was 3.02% to 5.20%.

discussion

While farmers have traditionally been advised to wait until pasture begins to recover from a drought before applying fertiliser nitrogen, this research indicates that nitrogen can safely be applied to pasture after the first significant rains have fallen. In these trials, a dry matter response to fertiliser nitrogen was noted after the first post-drought rainfall and even if the soil subsequently dried again, as in the Bay of Plenty trial, the growth-promoting effect of the nitrogen was not lost. At the end of the experiment, total dry matter responses were similar, regardless of whether nitrogen had been applied after the first rains or following subsequent rain or irrigation.

As a rule, pasture responses tended to be higher in the Hawke's Bay trial, which may reflect the fact that soil moisture contents were kept relatively even through irrigation, whereas the Bay of Plenty site received only natural moisture, so dried out after the initial rain.

Importantly, herbage nitrate levels did not increase to the critical threshold at which nitrate poisoning becomes a risk. Applying fertiliser nitrogen once post-drought rain has fallen will help farmers grow as much grass as possible, as quickly as possible, and so help in returning the farm to better productivity.



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