

Fertiliser Requirements & Responses for Kikuyu Grass

Northland Kikuyu
Action Group

Early work

Kikuyu grass can be very responsive to fertiliser inputs. Bay of Islands dairy farmers Harold and Raewyn Robinson told the Massey University Dairy Farmers Conference in 1999 they began farming on their own property in the mid 1970s when phosphate levels ranged from 9 to 15 and pH was 5.3 (1975). The farm was 80% kikuyu-dominant pasture. Applications of 400-500kg/ha of superphosphate were applied but soil fertility progress was slow during the first decade. During a period as Northland Dairy Company focal farm project from 1989 to 1993, 300kg/ha of superphosphate was applied in three dressings over 18 months, raising the soil fertility to phosphate 32 and pH 6.2 (1993) and thereafter to phosphate 53 and pH 6.3 (1998).

"Increased fertility has changed the kikuyu from yellow leaves and long, stringy runners to dark green, leafy, more palatable growth similar in appearance to ryegrass. It has better performance and complements other species in periods of stress," they said. "We often see the cows racing into a paddock to get first pickings of leafy kikuyu in preference to ryegrass or clover."

The Robinsons said that controlled kikuyu with clover and ryegrass has removed the pressure of short production seasons in Northland's hot, dry summer conditions. The excellent pasture response to controlled grazing, solid fertiliser and nitrogen applications has resulted in 80-100kg DM/ha/day growth rates with summer rains. Kikuyu pasture also reduces the need for high conserved feed inputs and cropping. Dominant and prolonged

clover growth (hard to obtain in Northland) is evident in well-controlled kikuyu pasture, with few animal health problems. Annual dairy production has improved from 400kg MS/ha to 1000kg MS/ha.

At the same conference Livestock Improvement field officer S.F. Lavery reported on a summer nitrogen application trial on a farm near Ruawai which had about 35% kikuyu-dominance. The Kaipara clay soils

were of average fertility, with Olsen P tests ranging from 17 to 31, pH from 5.5 to 6.0 and low sulphur status. There was no cropping programme and kikuyu grass was viewed as a valuable summer feed. Stocking rate was three cows per hectare and production 800-900kg/ha MS.

The 50ha farm was split into two equal farmlets in October, the herd split into two herds of 76 cows each and an extra vat installed to monitor milk production.

One half of the farm received 30kg/ha N in two dressings during November

and a further 30kg N on one dressing in late January. Rotation lengths remained the same for both herds, 21 days. Pasture monitoring using a rising plate meter was carried out on fortnightly farm walks and cage cuts made every 30 days. Pasture compositions were done three times and the herds regularly condition scored by independent farm consultants. The late spring and early summer period was drier than normal and a total of 178mm of rainfall was recorded between November 1998 and March 1999. Cage cuts measured an advantage to the treated farmlet of 960kg/ha DM. The effect of the nitrogen on pasture production was greatest



Kikuyu pastures are not true low-fertility pastures, as they are responsive to fertility.



following rain in mid-January. Kikuyu grass was a major factor in the grass growth during January/February. The response rate from kikuyu was 33kg/ha per kilogram of nitrogen used, which was a major part of the overall pasture response rate of 16kg/ha. The treatment had no effect on botanical or chemical pasture composition. The average crude protein on both farmlets was 23.4%. Metabolisable energy averaged 10.5 MJME/kg DM recorded in early January. Total production gain to the treatment farmlet was 31kg/ha MS, of which 65% was due to an increase in lactation days and 35% to increased per cow production. Lavery commented: "Unfortunately due to the physical nature of kikuyu the total (extra) drymatter accumulated cannot be converted into milk solids, resulting in the lower than expected conversion efficiency, 24kg DM: 1kg MS. Although not measured, the kikuyu on the treatment farm seemed to have a better leaf to stem ratio. The kikuyu base on both farms had to be topped once during summer to retain control. Nitrogen applied to kikuyu in late summer would not be recommended, as losing control of the pasture can cause detrimental effects into the winter and spring. Once you have paid for the (extra) feed, utilisation is critical. The utilisation was estimated at 50%, and this was caused by the majority of the extra feed coming from kikuyu. Kikuyu is difficult to convert into milk solids due to its physical characteristics and with the topping, decreased the utilisation and conversion efficiency of the extra feed grown into milksolids." The cost of the feed grown was 5.6c/kg DM and cost of feed consumed 11c/kg DM, which was considered cheap, by Lavery. He recommended matching the amount of nitrogen used with the stocking rate because it becomes more and more difficult to convert extra feed into milk solids if a surplus occurs. The first application of nitrogen had broken even before the rainfall in January. The second application would not have occurred unless rain had fallen in January. Lavery concluded that the results of year one of the trial would give Northland farmers confidence to carry a higher stocking rate further into summer.

Nitrogen response trials

In the late 1970s and early 1980s on a typical seasonal supply dairy farm near Kaikohe, Wayne Andrewes, then at DSIR Kaikohe, conducted repeated trials monitoring the responses of kikuyu pastures to nitrogen applied in spring or summer. He reported on these trials to the Whangarei kikuyu grass forum in 1985. Each trial started with nitrogen as urea being applied at 0, 50, or 100kg N/ha to kikuyu pasture, one day after a grazing with the dairy herd. The trials were arranged in 2.5 by 10m plots in a randomised block design with four or five replicates. Pasture growth was measured after four weeks the plots were then grazed and growth was measured after a further four weeks, in 1978 the pasture had been saved from May to July,

so that kikuyu dominated, so spring growth was low and responses to nitrogen poor (1 to 6kg DM/kgN at 4 weeks and 3 to 8kg at 8 weeks). In 1979 the farmer had made autumn silage, introduced more stock and attempted to reduce the dominance of the kikuyu grass in autumn. The pasture was not autumn-saved and the kikuyu content fell to 30%, so that the higher component of temperate grasses meant more response to nitrogen in spring (6 to 8kg DM/kgN at 4 weeks and 4 to 13kg at 8 weeks).

Kikuyu grass was the main contributor to pasture yield from December to March and responses to nitrogen were variable and related to conditions favourable for pasture growth. There was one period when the growth was high but no response occurred. Conversely, an application in dry weather gave a carryover effect when rain fell four weeks later. Nitrogen appeared to have no influence on the ratio of leaf to stem, Andrewes reported. Response efficiencies of 15 to 20kg DM/kgN were observed with mid-November to early February applications and 20 to 28kg DM/kg N for two December/January applications in 1980/81. "Nitrogen could have a place in boosting early summer pasture yield," Andrewes said. "Nitrogen application in December had a carryover effect into the period of slow growth in January. Extra pasture at this time may be efficiently converted into milk and assist in maintaining pasture cover into a dry spell. While pastures responded well to late summer nitrogen application, it is difficult to see how nitrogen could be used to advantage in dairying at this time. Pasture growth rates are already too high and control of kikuyu grass is the prime aim of pasture management, not further stimulation of growth," he said.



Kikuyu can be very responsive when given moisture and perhaps nitrogen in the summer, as shown by the bright green in the low-lying areas.

Garry Goold, MAF Ruakura, conducted plot trials on the effects of three different cutting intervals and four rates of nitrogen application on kikuyu grass pastures in three locations (Peria, Dargaville and Matakoho) in Northland from January 1971 to December 1972. He observed the normal high autumn dry matter production, while low temperatures and moisture stress limited production at other times during the year. From April to August monthly pasture production was strongly correlated with temperature variables and for every one degree decline in daily grass minimum temperature, pasture production decreased by 3.4 ± 0.4 kg DM/ha/day. Nitrogen increased DM yield at each site, the response being generally linear. At each site the effect of nitrogen was greatest during the winter and spring, when *Poa* species made a large contribution, and in autumn, when swards were kikuyu dominant. The longer cutting intervals (six weeks) and highest rate of nitrogen (480kg/ha) resulted in annual yields over 12 tonnes DM/ha. Yields on plots without nitrogen ranged from 1t to 3t less than those from the highest fertiliser rates. Peak growth rates were 110kg DM/ha/day at Peria and 80kg at Matakoho, both after rain in autumn. Goold reported that Taylor et al (1976) had recorded a peak rate of 245 kg DM/ha/day at Kaitaia under irrigation.

At the highest rate of nitrogen (480 kg/ha/year) the increase in mean annual pasture yield was 69% at Peria, 32% and Dargaville and 26% at Matakoho. The

response to nitrogen varied, expressed at response rates calculated by Gavin Ussher, farm consultant.

Lack of phosphate response

Fertiliser responses on hill country were studied at two sites (Maungaturoto and Tinopai) with north-facing slopes by Graeme Piggot, MAF Whangarei, during the mid 1980s. He attempted to test speculation that kikuyu grass pastures could be maintained at lower fertiliser inputs than temperate pastures. He conducted plot trials with and without nitrogen and with or without phosphorus inputs on kikuyu pasture versus non-kikuyu temperature pasture. Phosphorus was applied as single superphosphate on June 1 for two years at 50kg P/ha. Nitrogen was applied as urea to 50kg N/ha at the start of each season except for the autumn of both years when the soil was so dry that the plant leaves would burn. Potassium at 100kg K/ha and sulphur at 25kg S/ha were also applied in June of both years.

"The responses to fertiliser hint at some clear differences between pastures with or without kikuyu grass. Responses to both N and P from the temperate pastures were largely as expected, i.e. N responses in all season except summer and P responses in autumn. Pastures with kikuyu grass responded to P only when N was applied, and responded to N alone only in winter. This N response presumably occurred with the temperate grasses rather than kikuyu grass.

"Since fertiliser recommendations for P fertiliser are based on results from trials on pastures without kikuyu grass, there is doubt on their relevance to kikuyu grass pastures. Based on these results, it could be speculated that for farmers with kikuyu grass pastures compared with those without, their fertiliser practices may be of lower priority than the other management techniques that grow more grass," Piggot concluded.

Cool-season response to gibberellic acid

N.S. Percival, DSIR Grasslands Kaikohe, applied gibberellic acid (GA) at 100g active ingredient per hectare in July over two winters of 1975 and 1976 to recently established plots of pure kikuyu and pure ryegrass Kaikohe. Gibberellins are plant hormones in actively growing tissues and one of the effects of their application is that the temperature range for active

growth is widened, promoting higher growth rates at suboptimal temperatures. Cool season growth responses had been reported from Hawaii

Nitrogen response: kgDM/kgN applied

Rate of N (kg/ha applied)	Peria	Dargaville and Matakoho avg
120	11.2	3.0
240	12.6	3.3
480	10.3	4.5

These response rates show that the additional kikuyu pasture growth from applied nitrogen can be low to very low.

and Percival wanted to see if the same responses could be obtained in Northland. He applied urea at the rate of 75kg N/ha to plots with or without GA and there was a control plot which received neither. Treatments were applied on July 8 and production cuts made three, six and nine weeks later. He concluded that the responses of kikuyu and ryegrass to GA were sufficiently large to be of use in overcoming late winter/early spring feed shortages. "As the winter growth of ryegrass can be increased reliably with nitrogenous fertilisers, GA at its current costs does not appear to provide an alternative. There appears to be more scope with GA on kikuyu swards, as kikuyu is not generally responsive to nitrogenous fertilisers during winter. The GA used was a relatively pure but costly preparation. Availability of crude preparations of the hormone could enhance the economics of its use," Percival said.

Fertiliser responsiveness of kikuyu

Ballance Agri-Nutrients trialled fertilisers on kikuyu pastures on the Jagger dairy farm at Whangarei Heads. The results confirm that kikuyu pastures are responsive to fertility and are therefore not true low-fertility pastures. However, it was found that responses to phosphate, potassium, sulphur and lime all depend on pasture composition, as clover, ryegrass and kikuyu content will all influence optimum levels. Clover competes with kikuyu for moisture, light and the available phosphate, so higher levels of nutrients are required for clover to compete. A response by kikuyu to potassium was not expected because normally K is very high in the plant. Nor was any response to sulphur expected. Australian work showed some responses to lime, but at a very low pH of 4.8. The Jagger trial site was pH 5.6, Olsen P 10, soil K 3, soil S 4, soil Na 5, soil Mg 19 and soil Ca 4. The treatments were 4 tonnes of lime per hectare, 100kg phosphorus, 150kg of potassium, 80kg of sulphur and 20kg of nitrogen, all compared with nil application controls. The increase in dry matter yields from the phosphorus applications were 23% in the first year and 33% in the second year. The phosphorus application also led to less fibrous pasture, higher crude protein, by 20%, and higher digestibility (+3%). There was no response to sulphur and a 10% increase from potassium in the second year alone. The nitrogen responses were 24% more DM in the first year and 9% in the second. Urea on its



Northland farmers are very keen to know more about kikuyu grass, especially how to manage it to maximum advantage, using renovation and fertiliser.

own, and plus phosphorus, increased soluble carbohydrate by 19% and 34%. More work is needed to find the optimum phosphorus application, Ballance reported.

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