FarmFLOW
growth through good practice

Pre-plant nitrate efficiency for pineapples

Fertiliser application rate recommendations in pineapples are based on research undertaken 17 years ago. Currently, pre-plant application rates of between 1000–1500 kg/ha of standard N, P, K fertiliser blends are common and generally based on soil test results. Research shows that high rates of conversion (ammonium to nitrate) promotes leaching, making standard granular fertilisers extremely inefficient at maintaining adequate nitrate nitrogen levels in the soil.

The aim of this trial was to assess plant response and leaching effects of various rates and types of pre-plant fertilisers.

What did we do?

The trial site was at Elimbah on a sandy loam with a pH 4.8. Initial soil test results reported 5 kg/ha of *nitrate* nitrogen prior to pre-plant fertiliser application. A NATA accredited laboratory analysis from the same plot reported 7 kg/ha *nitrate* nitrogen and 26 kg/ha *ammonium* nitrogen with 500 kg/ha of *total* nitrogen (TN) reported. Industry suggests the optimum level of nitrogen in the soil at planting is 120 kg/ha of *nitrate* (NO_3). (Note: the level of *nitrate* nitrogen is a measure of the amount of nitrogen directly available to the plant from the total nitrogen present.)

We applied different rates of pre-plant nitrogen to the soil then measured:

- nitrate levels in the soil for the first 10 weeks after pre-plant fertilisers were applied
- root and leaf growth at three and nine months after planting (following the procedure outlined in Chapter 14 of the *Pineapple Best Practice Manual*).

Nitrogen rates applied during bed preparation on 4 Feb 2009 were:

- 115 kgN/ha (full traditional N rate derived from the soil test result)
- 60 kgN/ha of controlled release fertiliser (half recommended rate)
- 0 kgN/ha (zero N).

Pineapple tops were planted two weeks after the fertiliser application (18 Feb) and nitrate availability was measured by sampling and analysing the soil solution at 15 cm and 30 cm depths in each of the three treatments.

A side-dressing was applied to all treatments during week 10 at which time sampling ceased.

What did we find?

Nitrogen levels

No fertiliser: The results for zero N inputs in this trial were encouraging, indicating that pineapples are able to establish and grow with no pre-plant nitrogen applied, instead utilising the soil nutrient reserves and crop residues after fallow. Energy reserves contained in the planting material would also assist in the early establishment phase. This observation is emphasised through the soil nitrate levels (0–30 cm) where we see during the first seven weeks all levels were similar (Figure 1).

50% Slow release fertiliser: The half rate application of controlled release fertiliser (CRF) provided a greater consistency of availability when compared to the full application rate across both 15 cm and 30 cm depths, highlighting the inefficiencies of traditional fertiliser types (Figures 1–3).

The most interesting result is the nitrate availability for the zero nitrogen treatment. How can there be nitrate levels similar to the full and half treatments if nothing was applied? The answer lies in the results obtained from the pre-plant soil test which recorded 500 kg/ha of total nitrogen (TN). Whilst the soil *nitrate* levels were very low (7 kg/ha) when measured prior to planting there must have been a steady conversion of mineral and organic forms of nitrogen (TN) to the plant available nitrate form which was adequate for the needs of the growing plants during the sampling period.

Root and leaf growth

Root and leaf growth were measured at three and nine months after planting. There were no large differences, either visual or measured between treatments at these sampling times. Interestingly, root length after three months in all treatments was only 10–15 cm (Figures 4–5). Photographic evidence at three months growth reinforces this (Figure 6).

FF10-001

Healthy Country
managing the land for healthy waterways
CARING FOR OUR COUNTRY

Healthy Country partners:
SEQ Catchments
Healthy Waterways
Because we're all in the same boat
Queensland Government
SEQTOA

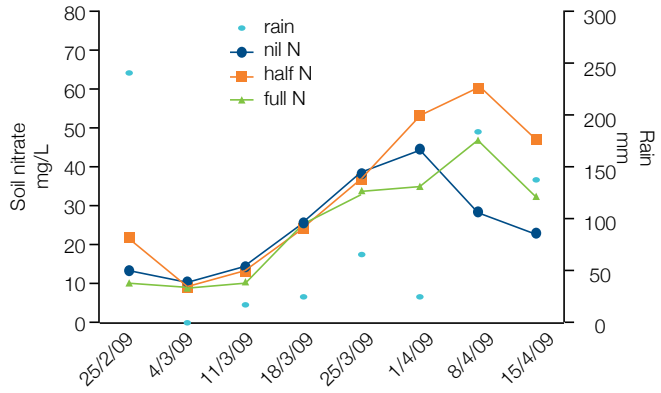

Figure 1. Mean soil nitrate 0–30 cm. The left Y axis indicates mean soil nitrate availability. The right Y axis is the total weekly rainfall. Each mean calculated from six soil solution samples collected each week.

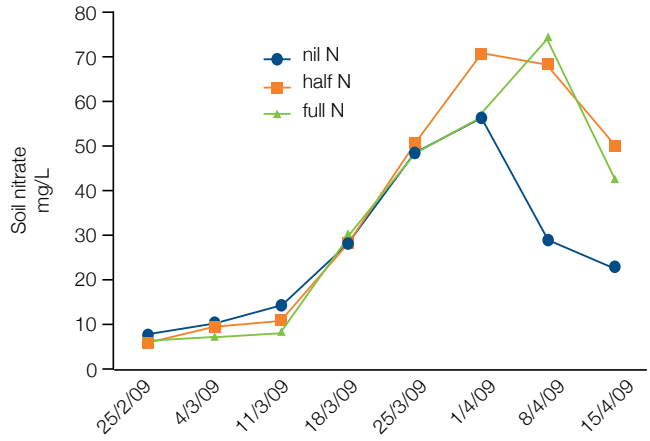

Figure 2. Mean soil nitrate available at 15 cm. Each mean calculated from three soil solution samples collected weekly during 2009. (Note: mg/L = ppm =kg/ha)

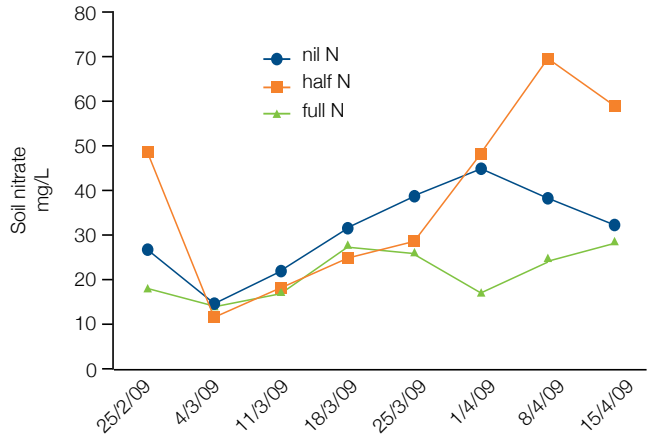

Figure 3. Mean soil nitrate available at 30 cm. Each mean calculated from three soil solution samples collected weekly during 2009.

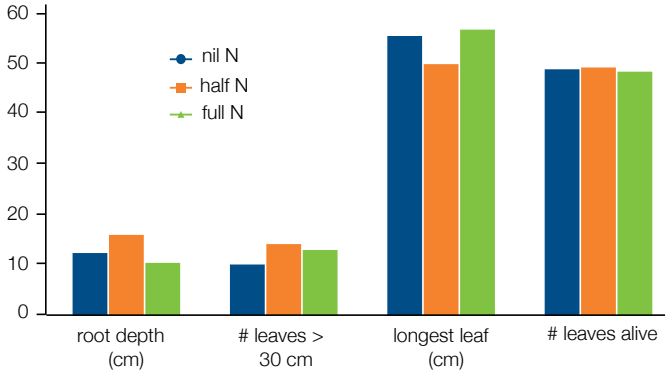

Figure 4. Root and leaf growth characteristics for each treatment at 3 months.

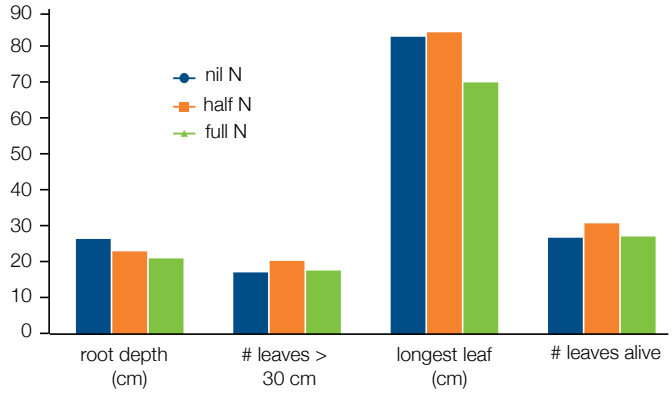

Figure 5. Root and leaf growth characteristics for each treatment after 9 months of plant growth. Side dressing was applied after 10 weeks.

Field testing soil nitrogen levels using Mottes tubes.

What have we learned?

- There may be potential savings of up to $1200 per hectare on pre-plant fertiliser.
- During the first nine months after planting, root and plant growth have not been affected by reducing the pre-plant N rates to zero or half.
- The benefits of applying pre-plant N at industry recommended rates of 120 kg/ha should be questioned by the industry.
- There is great potential to improve fertiliser efficiency by either reducing or removing nitrogen as a pre-plant requirement and better utilising crop residues and existing soil nutrient reserves.
- As the roots only reached a maximum depth of 15 cm after three months it is likely that traditional inorganic sources of nitrogen could be leached beyond the root zone, and therefore ineffective and potentially causing soil acidification and downstream water quality issues.
- Growers should question the methods and reporting used by soil testing laboratories to make pre-plant nitrogen recommendations.
- The total nitrogen (TN) pool in the soil needs to be measured before recommendations are given.
- Research needs to refocus on nitrogen fertilising practices for pineapples.

Future directions

Growers are encouraged to undertake their own trials using reduced rates of pre-plant nitrogen and/or controlled release fertilisers to see how nitrogen applications can be reduced without affecting plant growth.

Acknowledgments:
Fullerton Farms Pty Ltd, Beerwah
Jim Pulsford, PRCCA
Simon Newett, DEEDI

For more information

Zane Nicholls—Sustainable Agriculture Advisor
Department of Employment, Economic Development and Innovation
PO Box 5083 SCMC Nambour Queensland 4560

Ph: 07 5453 5816 Mobile: 0412 032 965

zane.nicholls@deedi.qld.gov.au

Figure 6. Plants randomly sampled for root and leaf measures at three months.