

# Optimising poultry litter management in cotton production

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## Abstract

A field trial in Griffith NSW, examined the rate and placement strategy (banded or incorporated) of poultry litter and inorganic fertiliser at equivalent N rates on cotton plant growth, lint yield and quality, soil available N and biology.

## Results

### Crop N uptake

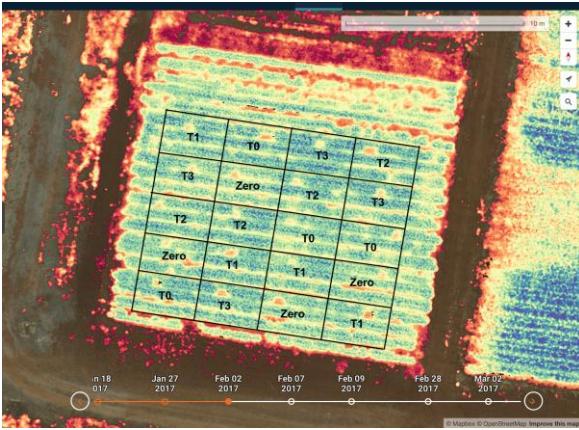


Figure 1. NDRE field map at 90 days after treatment application.

Significant difference between treatment NDRE means coincided with first flower and cut out (days after treatment application; 89\*, 97\*, 117\*\*\* and 125\*\*).

Significance: \* $p \leq 0.1$ ; \*\* $p \leq 0.05$ ; \*\*\* $p \leq 0.01$ .

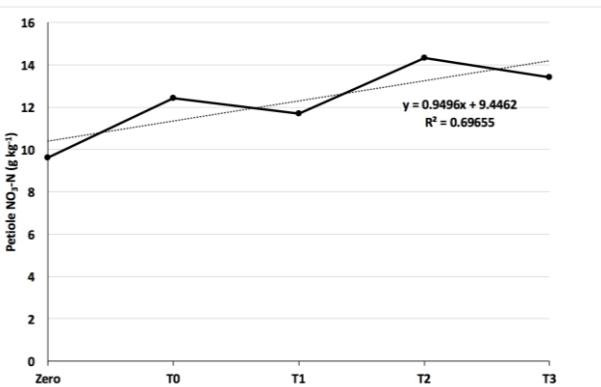


Figure 2. Relationship between petiole  $\text{NO}_3\text{-N}$  concentrations averaged over 645, 890 and 1102 degree days (DD) and applied-N.

Petiole  $\text{NO}_3\text{-N}$  concentration, ranging from 9.6 to 14.3  $\text{g kg}^{-1}$ , indicated soil N availability did not vary widely between treatments. Significant treatment difference between petiole  $\text{NO}_3\text{-N}$  means occurred at 645\*, 890\*\*\* and 1102\*\*\* DD.

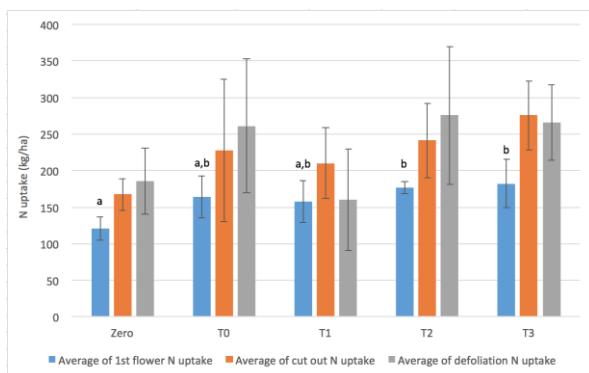


Figure 3. Differences in crop N uptake at first flower\*\*, cut out\* and defoliation\* with standard deviation bars. Letters between columns of the same colour are significant differences at  $p \leq 0.05$ .

## Methodology

The trial was conducted on a Chromosol (loam), in a complete randomized block design with 5 treatments replicated 4 times. The treatments comprised a zero N control, farmer practice at 150 kg urea-N/ha applied by machine drill, and three poultry litter treatments applied manually using local non-composted fresh broiler litter.

**Zero:** Control, no N

**T0:** 150 kg urea-N/ha

**T1:** ~ 8t/ha dry litter weight broadcast and incorporated, providing an equivalent amount of available N as the T0 urea-N

**T2:** ~ 8t/ha dry litter weight banded into a 15 cm deep central trench and covered.

**T3:** ~16 t/ha dry litter weight broadcast and incorporated providing double the amount of available N compared with the T0 urea-N

## Soil quality

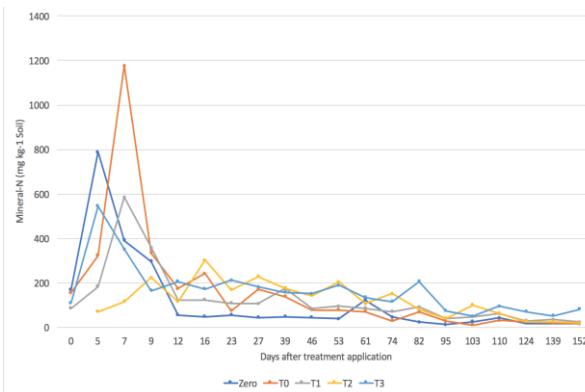


Figure 6. Net available soil mineral N over the growing season in response to treatments. NDRE analysis and significant difference in treatment means indicates treatments Zero, T0 and T1 may be drawing on soil N reserves, particularly between days 74-152 after application.

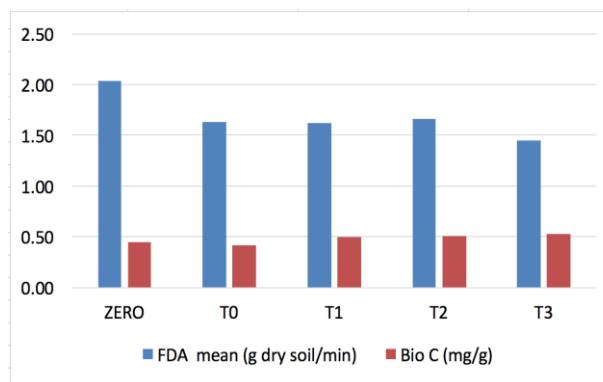


Figure 7. Fluorescein Diacetate Activity (FDA) and Biomass Carbon (Bio C) soil biology tests were conducted on 0-15cm soil at harvest. The FDA tests show whether the microbes are active or not while the Biomass Carbon test is a measure of the weight of carbon present in the soil microbes. The FDA test for microbe activity found the Zero treatment had higher levels of activity compared with urea and litter treatments, however, the Zero treatment had low Bio C.

## Lint yield and quality

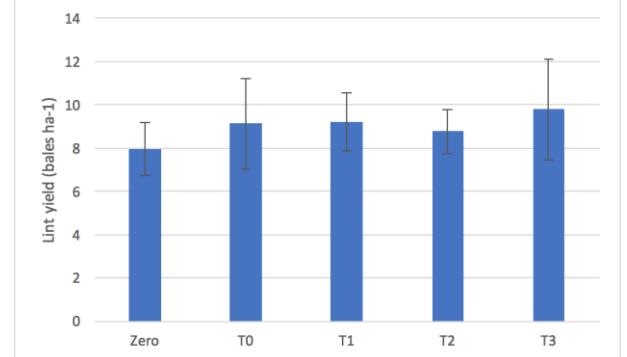


Figure 4. Average lint yield for treatments with standard deviation bars.

No significant difference between treatment means.

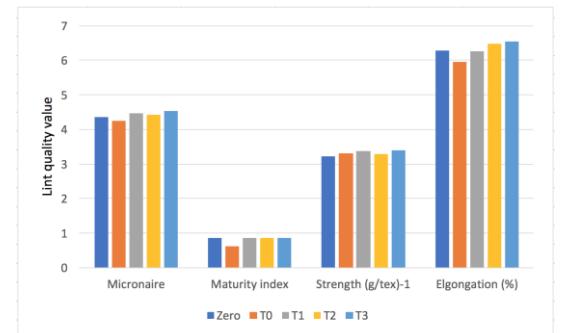


Figure 5. Lint quality of treatments for micronaire, maturity index, strength and elongation.

Analysis of lint quality parameters revealed that the Zero and T0 treatments performed poorly in micronaire, maturity, strength and elongation, while T3 generally had better quality. However, there was no significant difference between treatment means.

## Discussion and conclusion

The Zero, T0 and T1 treatments had the lowest values of petiole  $\text{NO}_3\text{-N}$ , crop N uptake (at first flower, cut out and defoliation), and NDRE from first flower until defoliation. The T2 and T3 treatments consistently remained at the upper end of each of these parameters, achieving greater plant N uptake and NDRE. Treatment effects on lint and soil biology were unclear.

In this first-year study the soil was relatively non-responsive to poultry litter due to initial high nutrient soil concentration and possibly different N leaching in treatments due to the free draining loam nature of the soil. Repeating the research in subsequent years is required to further examine treatment effects on yield, lint quality, soil biology and nutrient use efficiency.



## Acknowledgements

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