Optimising nutrient management for improved productivity and fruit quality in mangoes

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Significant, expanding industry in NT
- 40,000 tons/year
- ~50% of total AU mango crop
- $112 million annual production

Climate and soil differences compared with QLD
- Not all management practices are transferrable

Extreme variations in NT orchard management
MPfN-mangoes

Questions?

✍ What is the local N budget for mangoes?
  • N taken up?
  • N recycled?
  • N lost to environment?

✍ How much N is too much?
  • Impacts on fruit?

✍ Are there regional differences on commercial farms?
  • Katherine region
  • Darwin region
MPfN - mangoes

How much N is too much?

- Soil applied: 0, 12.5, 25, 50 kg N/ha
  0, 50, 100, 200 g N/tree

Nitrogen in disguise
- Bio-amendments
- KNO₃ at flowering
  = ~6 kg /ha/year or 24 g/tree

No yield difference related to N
~100% yield difference between years
- Typical of biennial bearing Kensington Pride
2018-no N impact on
- Fruit % dry matter at harvest
  - Juice ° Brix
  - Flesh texture
  - Flesh colour
  - Fruit N content
  - More N ↑ trend in ‘soft nose’

2018-N skin response
- Stay green skin when ripe at 50 kg N/ha or 200 g N/tree
MPfn - mangoes-post harvest

2019
- Repeated post harvest measurements
- Ripened +/- ethylene @ 15 ppm for 3 days

Findings
- No ‘stay green’ skin during ripening
  - Probably due to double yield in 2019
- Fruit N content
  - Data pending
- Control fruit
  - Ripe/softened in 14 days at 22 °C +/- 2
- Ethylene treated fruit
  - Ripe/softened in 9 days
  - Developed ~ 2° less Brix
  - Flesh colour was lighter, less red, and less yellow

Conclusion
- Ethylene treatment reduces fruit quality-colour and sweetness
Is nitrogen taken up into leaves when trees sprayed with KNO₃ at flowering & fruit set?

- Leaves dipped into 2% KNO₃ solution (¹⁵N labelled)
- 2 x over 24 hours
- Sampled @ 48 h after dipping
- Pot based work

- 25-40 % of solution N taken into leaf
- K uptake-data pending

<table>
<thead>
<tr>
<th>Mango variety</th>
<th>Leaf NUE (%)</th>
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<tbody>
<tr>
<td>KP</td>
<td>bc</td>
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<tr>
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<td>B74</td>
<td>ab</td>
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**MPfN - uptake**
MPfN - N cycling

- Litter collected in traps over a year
  - Commercial orchards
  - Katherine & Darwin regions
  - KP & B74
- Prunings collected

Litter (kg DW ha\(^{-1}\))

- Leaves
- Flowers
- Panicles
- Fruit
- Branches
MPfN - N cycling

Litter (kg DW ha\(^{-1}\))
- Leaves
- Flowers
- Panicles
- Fruit
- Branches

Litter & prunings (tons DW ha\(^{-1}\))
- Leaves
- Panicles
- Flowers
- Fruit
- Branches
- Total

Nitrogen (kg ha\(^{-1}\))
- Litter
- Prunings

4.2 tons/ha
22.2 kg N/ha

MPfN: MPfN - N cycling

NORTHERN TERRITORY GOVERNMENT

28-Jun 9-Aug 20-Sep 1-Nov 13-Dec 24-Jan 18-Apr 30-May 11-Jul
MPfN - N cycling

2019 fruit N content? Data pending ~30 kg/ha?

NUE in yield terms? Data pending

Note that 25-40% of total yield usually stays on the trees.
Tindal 2018-2019

Tindal RAAF (014932) 2018 Rainfall (millimetres)

- **2018**: 836 mm

Tindal RAAF (014932) 2019 Rainfall (millimetres)

- **2019**: 602 mm

Tindal RAAF (014932) 2018 maximum temperature

- **Mean max**: 34.9°C

Tindal RAAF (014932) 2019 maximum temperature

- **Mean max**: 35.6°C
Young trees take up 25% of soil applied $^{15}$N labelled fertiliser.

- Mature trees - data pending

60% of annual $N_2O$ emissions occur within 2 weeks of applying $N$ to soil (Raj Pandeya).

- ~200 g $N$/year lost as $N_2O$
- Leachates-soil core work - data pending

~25-40% uptake of leaf applied $KNO_3$ in laboratory conditions - varietal variation

Harvested fruit takes ~15-30 kg $N$/ha out of the cycle

~22 kg $N$/ha cycled in litter and prunings.
Completing quantification of mango tree N demand and cycling in the soil-plant continuum

Better understanding of post-harvest impacts of N application on mango fruit and ethylene assisted ripening

Writing evidence based nitrogen ‘best practice’ recommendations for the Northern Territory mango industry
  • Will offer cost benefits to commercial growers
  • Reduced losses of N into the environment

Load data into APSIM Next Generation to start modelling
  • Agricultural production system modelling and simulation
  • Established by UQ, CSIRO, AgResearch Ltd., NZ & Qld Government
  • Broad acre crop modelling
  • Expanding into forestry and tree crops
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