Department of Agriculture, Fisheries and Forestry

Monitoring N_2O emissions in south-east Queensland pineapple and ginger farming systems

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Australian Pineapples

Australian Ginger Pure Local Flavour

Great state. Great opportunity.

Queensland Government

Action on the ground program

Dec 2012 to June 2015

Project 143 : Improved fertiliser, soil and irrigation management in SEQ ginger production; controlled release nitrogen fertiliser trials monitor nitrous oxide emissions, fallow rotations for carbon and disease management

Project 218 : Improved fertiliser management in south east Queensland intensive horticulture- pineapple and strawberry; controlled release nitrogen fertiliser trials to test for nitrous oxide emission reduction

Why N_2O?

- 296 times more potent than CO_2
- Soils contribute 65% of global emissions
- 80% of Australia's reported emissions from Agriculture soils
- 32% linked to nitrogen fertiliser
- AotG – Opportunity to determine N_2O production levels for horticulture

IPCC 2006, AGO 2007

Controlled release nitrogen fertiliser

- 20 year old technology
  - Moisture, temperature controlled
  - expensive
  - alternatives for lower value crops
- Pineapples - basal four month 50% CR N based on a popular blend
- Ginger and strawberry – 8 and 10 month 100% CR N blends compared against fertigation (farm practice)

Fertiliser application rates

- Application rates – Farm Practice followed industry recommendations CRN at ~70% industry standard; cost equivalent to FP.
- Ginger (1000kg ha) and strawberries (20g plant) higher value crops with different nutrient application methods, one-off application vs. fertigation program. CRN application is around 5 -10% more expensive than Farm Practice in fertiliser cost
- Study area 4000m^2 per treatment

N_2O monitoring

- Static PVC chambers
- 16 chambers per farm
- Monitor plant bed and wheel tracks
- 3 samples / hour / chamber (10am-2pm)
- 1-2 day per week + >15mm rain
- Soil moisture, temperature, NO_3-N and NH_4-N
- Time series analysis

Saggar *et al*, 2004; Mosier and Mack, 1980

Cumulative emissions - pineapples

	GH^1	GH^2	EL^1	EL^2
N_2O emissions kg/ha	**3.22**	**6.09**	**2.92**	**2.36**
Mineral N inputs kg/ha	**54**	**82**	**96.5**	**133**

- Cumulative N_2O emissions (g ha^{-1}) for each treatment.
- The mineral N fertiliser inputs (kg ha^{-1}) applied at the planting stage.

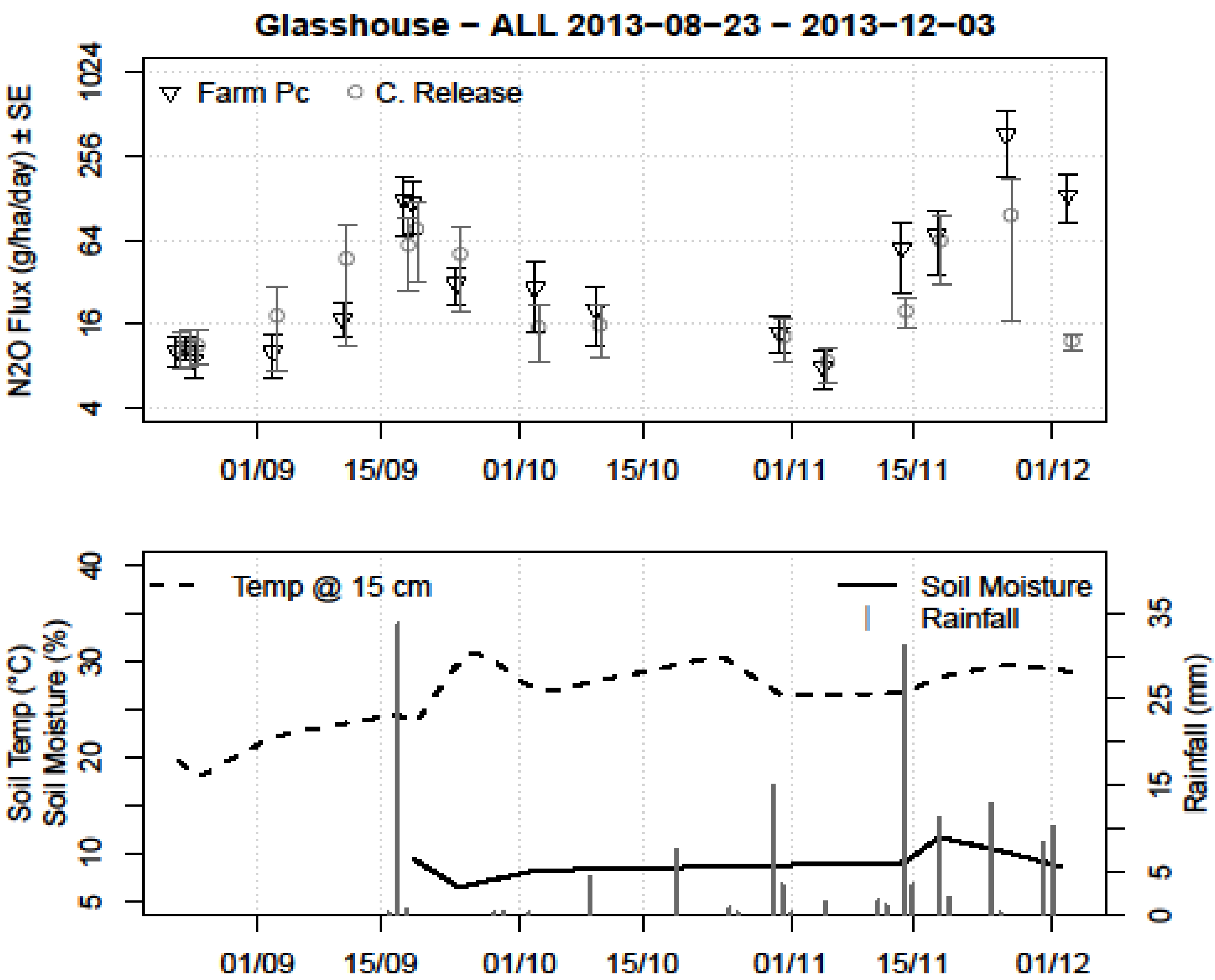
- Huang *et al* 2012 1.16kg/ha N_2O
- CR Nitrogen[1] Farm practice [2].

Mean daily N_2O flux (g ha day^{-1}) pineapple

Site	Block	Bed	Wheel track	Total
Glasshouse	Farm Prac	41.69	18.18	59.87
	CR nitrogen	22.30	10.16	32.46
Elimbah	Farm Prac	13.66	9.06	22.71
	CR nitrogen	15.00	17.13	32.13

Means relative to spatial representation; 74% bed and 26% wheel track over three months.

Combined raw daily means g ha day^{-1}



Start-up fertiliser applied to sub-surface at Glasshouse Mountains for both treatments.

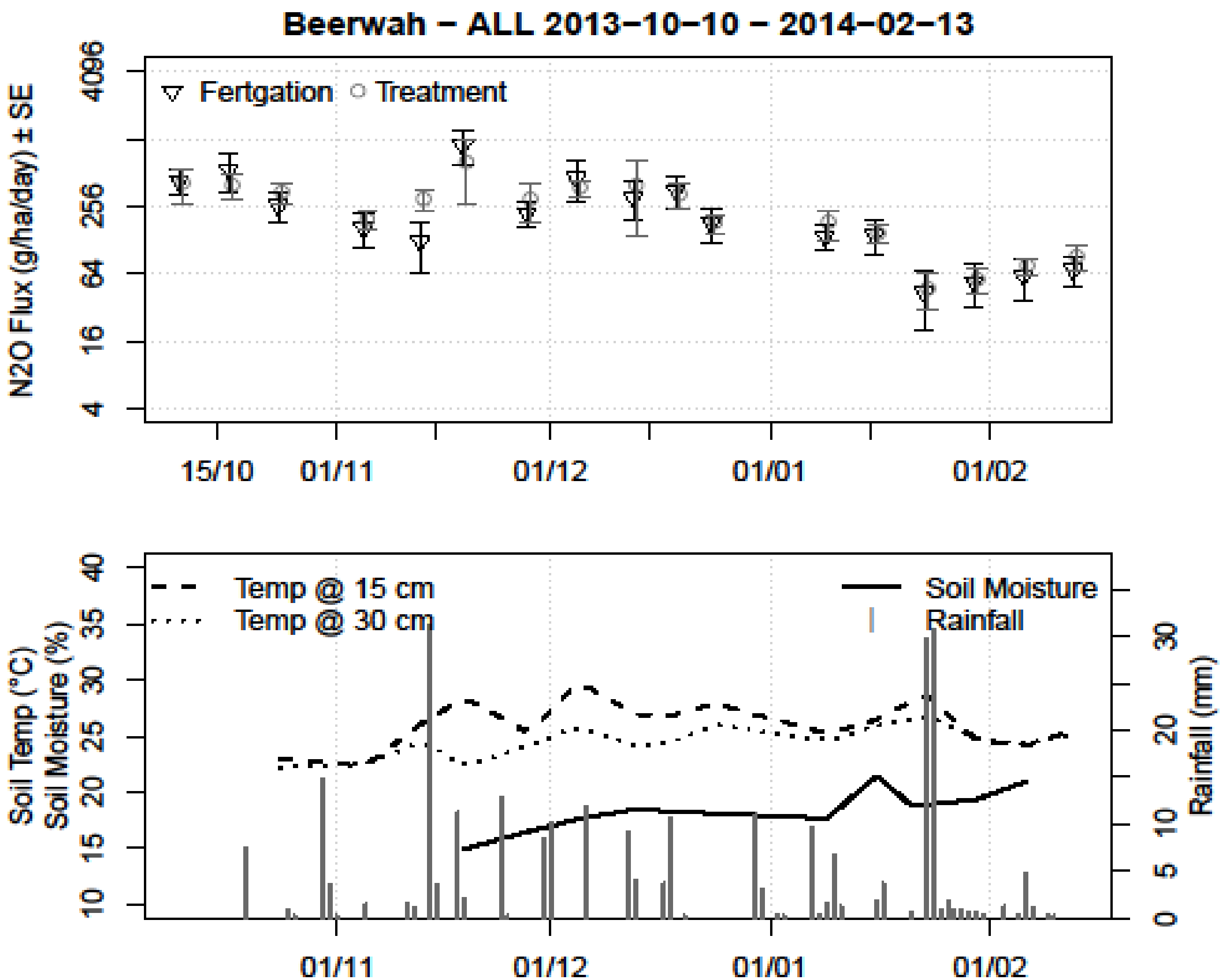
Mean daily N_2O flux (g ha day^{-1}) - Ginger

Site	Block	Bed	Wheel track	Total
Beerwah	Fertigation	140.47	75.09	215.56
	C Release	145.15	106.16	251.31

4 month cumulative emissions

- Fertigation - 26.76 kg/ha
- C Release N - 30.11 kg/ha

AUC analysis indicated a 2.04% difference in favour of farm practice



Ginger – Fertigation (standard practice) vs. 8 month controlled release nitrogen trial. Time series analysis of the 2013/14 season.

Discussion

- Important role soil moisture plays in creating conditions for N_2O production, research suggests temperature influential
- short term increase N_2O emissions >90g ha day^{-1} after >15mm rain.
- High emissions observed in the wheel tracks for all treatments; compaction + ↑ rain
  - denitrification; ↑ leaching
  - sugarcane studies reported similar

Discussion

- Plant and soil nutrient data so far suggests CRN use consistent with standard practice
- More consistent results from 100% CRN blends than 50%, soil type and management history have influence
- In-field harvests in ginger show a 15-20% ↑
- Two seasons of use in ginger and now 40% of plants under CRN
- Pineapple harvest 6 - 8% reduced harvest
- Strawberry 5% reduced harvest

Conclusions

- Preliminary findings
- More investigations are required to verify the benefits associated with controlled release fertiliser use in pineapples in low pH soils

  - placement and seasonal timing to quantify N_2O emissions in pineapples
- Information currently available comparing new fertiliser technologies is limited
- Limited CRN studies for subtropical horticulture in general

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