Project Catalyst Trial Report

The Impact of Intercropping Soybeans on Sugarcane Yield and Nitrogen Availability

Grower Information	
Grower Name:	Dario Germanotta
Entity Name:	
Trial Farm No/Name:	MKY-04258A
Mill Area:	Mackay Sugar
Total Farm Area ha:	527ha
No. Years Farming:	3rd generation
Trial Subdistrict:	Dawlish
Area under Cane ha:	461ha

Trial Status

Completed

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Background Information

Aim: To investigate the impact of intercropping soybeans on sugar cane yield and nitrogen availability.

Background:
The practice of using legume crops, planted during the fallow, is now commonly used in the sugarcane industry as they have proven their value in producing significant quantities of N. Healthy legume roots will produce nodules that form a symbiotic relationship with rhizobia. These good bacteria "fix" N, transferring it into a form that is easily taken-up by the plant. When legume crops are terminated, they break-down rapidly leaving behind concentrated N residues in the soil for use by the following plant cane crop.

With increasing pressure on the agricultural community to reduce impact on water quality, alternative sources of N for ratoon crops are being considered.

This trial investigates whether the recommended Six-Easy-Steps (6ES) rate of N can be reduced if a soybean is grown alongside sugarcane (intercropped) to contribute N to the system, without compromise to yield. In addition, the benefits of improving plant diversity to increase longer-term soil health, and therefore future cane ratoon crops, are also considered.

Potential Water Quality Benefit:
Reducing inorganic N fertiliser rates lowers the risk of off-farm water quality impacts to local catchments.

Expected Outcome of Trial:
There is no impact to yield where synthetic N fertiliser inputs are reduced in favour of N inputs being made available from rhizobia “fixed” sources.

Service provider contact: Farmacist Pty Ltd

Where did this idea come from: Grower/Farmacist

Plan - Project Activities		
	Date:	**Activities:**
Stage 1	**October 2018**	Plant soybean into cane crop
Stage 2	**November 2018**	Apply fertiliser
Stage 3	**January 2019**	Solvita tests to compare biological activity
Stage 4	**March 2019**	• Spray-out soybean • Leaf sample sugar cane
Stage 5	**September 2019**	Harvest Cane crop
Stage 6	**November 2019**	• Apply fertiliser • Plant soy into cane crop
	August 2020	*Property sold and new farmer, Dario Germanotta, willing to continue trial.*
Stage 7	**September 2020**	Harvest sugarcane crop
Stage 8	**November 2020**	Apply fertiliser and plant soy crop
Stage 9	**February 2021**	Solvita tests to compare biological activity
Stage 10	**September 2021**	Harvest sugarcane crop

Project Trial site details	
Trial Crop:	Sugarcane
Variety: **Rat/Plt:**	Q240 1R
Trial Block No/Name:	2-2
Trial Block Size Ha:	15ha
Trial Block Position (GPS):	149.125808, -21.375786
Soil Type:	Sunnyside, a grey-olive duplex soil

Block History, Trial Design

The block chosen for the trial has a typical history of N use. The trial design and treatments were (Figure 1.):

T1. Intercropped soybean with 75% of 6ES fertiliser applied.
T2. Intercropped soybean with 60% of 6ES fertiliser applied.
T3. No soybean with 100% 6ES fertiliser applied.

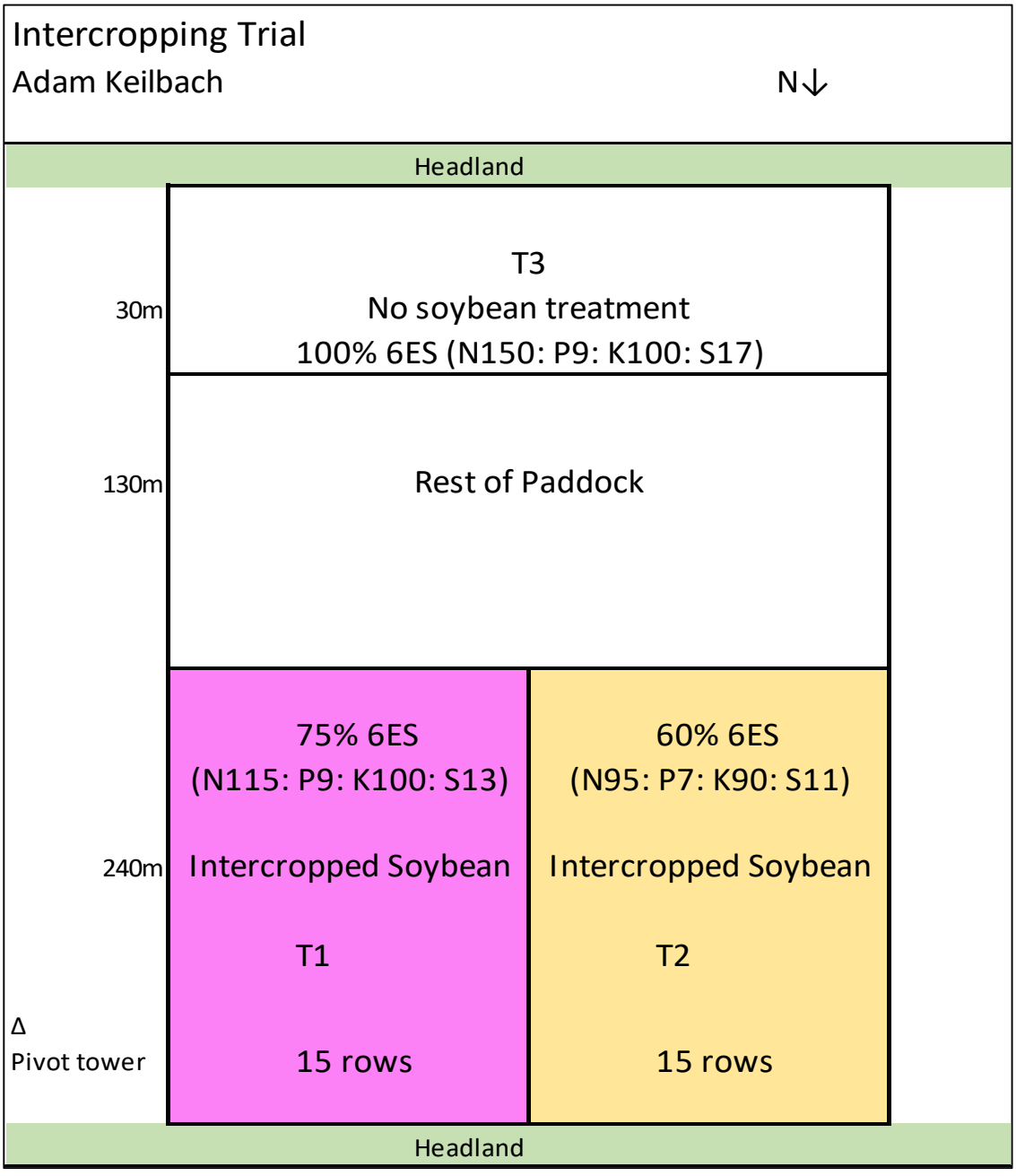
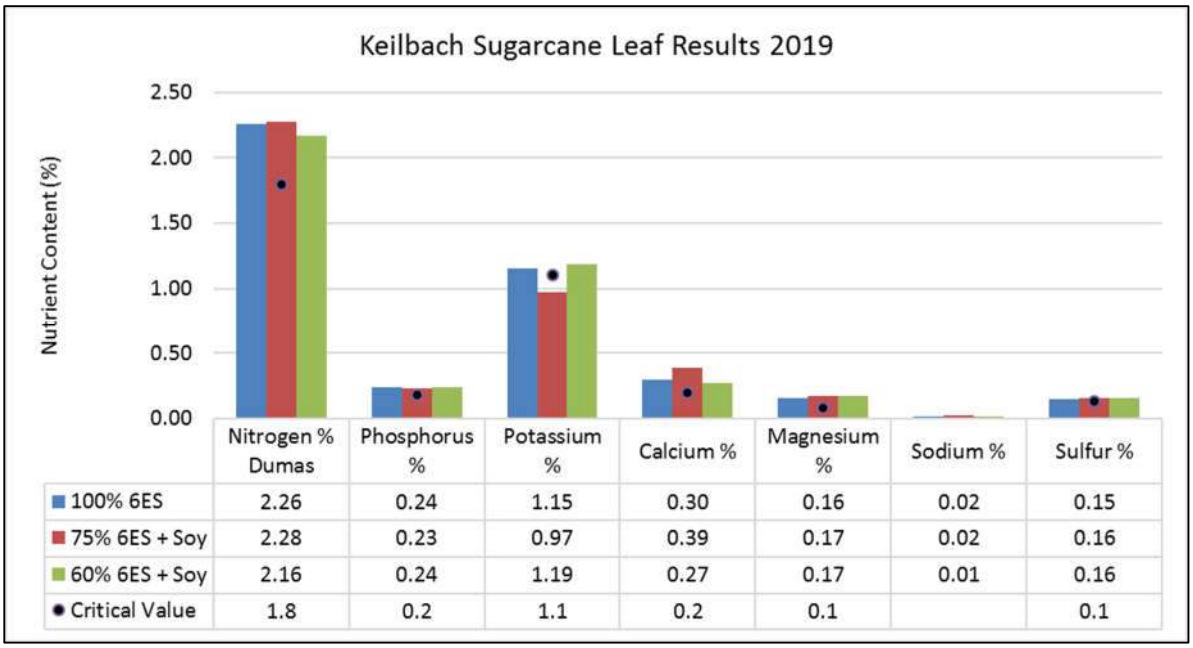


Figure 1 Trial design and treatments applied

Results

Leaf Samples 2019

Leaf samples taken in March 2019 showed minimal differences between treatments. All treatments were well above the critical value for N content as shown in Figure 2.



	Nitrogen % Dumas	Phosphorus %	Potassium %	Calcium %	Magnesium %	Sodium %	Sulfur %
100% 6ES	2.26	0.24	1.15	0.30	0.16	0.02	0.15
75% 6ES + Soy	2.28	0.23	0.97	0.39	0.17	0.02	0.16
60% 6ES + Soy	2.16	0.24	1.19	0.27	0.17	0.01	0.16
Critical Value	1.8	0.2	1.1	0.2	0.1		0.1

Figure 2 Leaf results 2019

Solvita Results

The Solvita Burst test is an indicator of soils microbiological potential by measuring CO_2 respiration of a unit of soil in a confined chamber. The nil soybean crop was lower than the soybean reduced 6ES treatments (Figure 3).

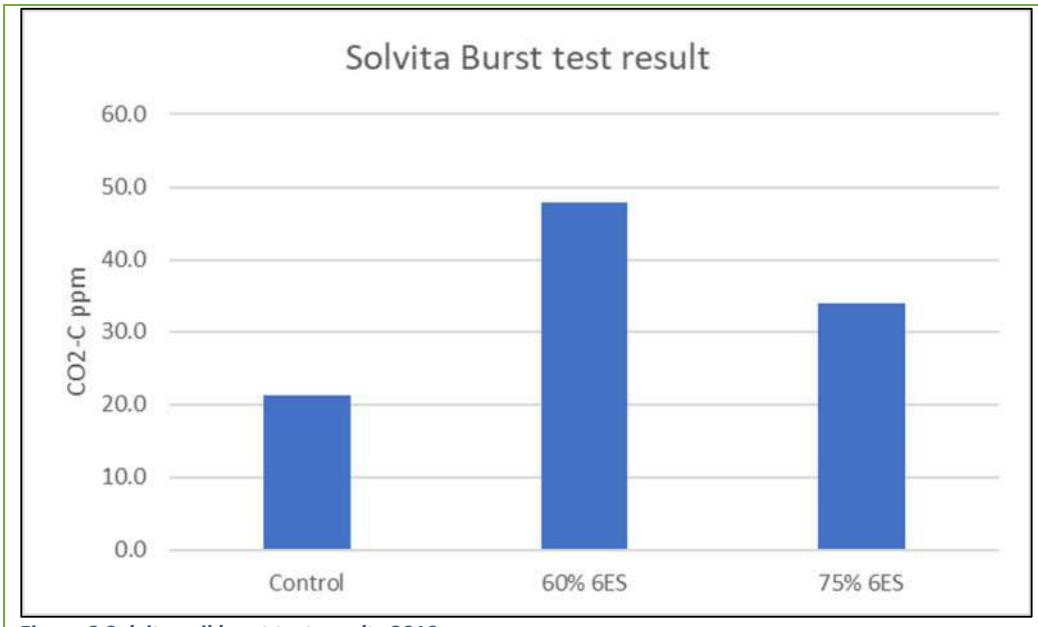


Figure 3 Solvita soil burst test results 2019

Harvest Results 2019

The trial was harvested late September using weight truck and stick samples to determine CCS. The control (zero soybean) performed better than both soybean treatments (Figure 4), though the 75% 6ES treatment yielded a similar CCS.

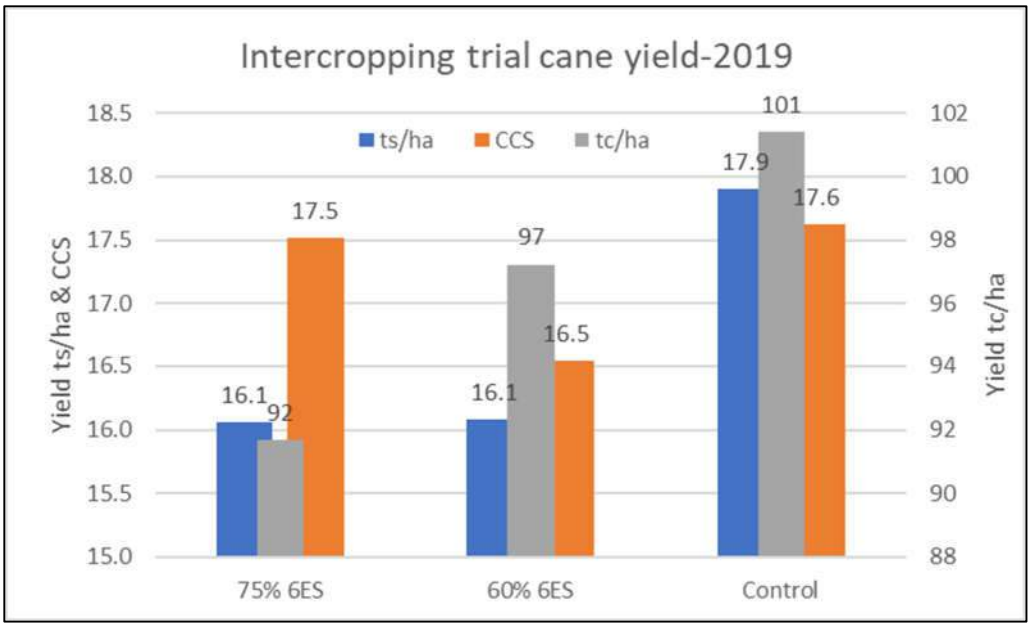


Figure 4 Sugarcane yield results 2019

Harvest Results 2020

Trial harvested early September and yield determined by weight truck and six sticks for CCS (Figure 5). The lower nutrient application (60% 6ES) was 13 tS/ha and 15 tS/ha lower than the 75% 6ES and control respectively. The CCS for both reduced nutrient rates had significantly lower CCS compared to the control, this combined with reduced tonnage had the control performing best with a yield of 17.1 tS/ha.

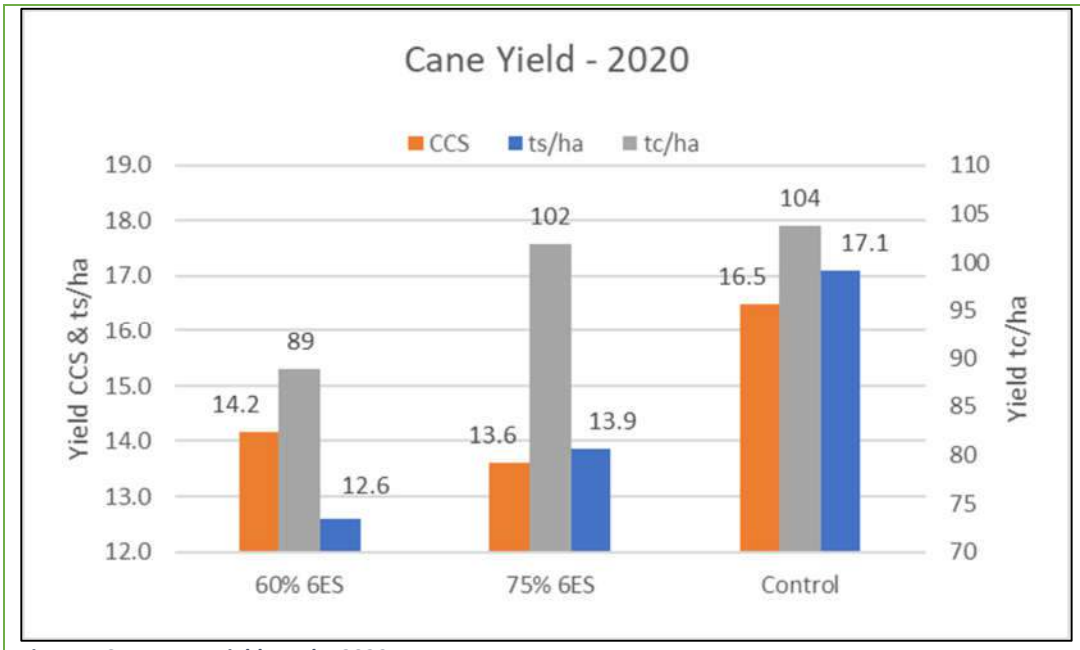


Figure 5 Sugarcane yield results 2020

Soy intercrop establishment

Figure 6 Planting soy directing into cane trash 10 days after harvest

Figure 7 Established soy in sugarcane

Conclusions and comments

The leaf analysis indicated no lack of nutrients that could attribute N being a factor impacting yield. N rates were well above critical value and K was the only element below critical value by a small margin (Figure 2).

The soil health indicator was the Solvita Burst test and this result supported increased soil biology activity in those treatments where soybean was grown (Figure 3). The improved soil health indicator, however, did not translate into increased yield, as the nil soybean treatment outperformed both soybean treatments in the 2019 and 2020 harvests (Figure 4 & 5). Soil health improvements are a long-term goal, therefore the benefits of intercropping soybean upon soil health are likely to take several years to manifest.

Planting soybean (Figure 6) so close after harvest, and generally when soil is dry, increases the difficulty of getting soybean seed sown to the correct depth as mounds can be irregular and hard soil reduces planting depth. Generally, this can be managed by irrigation directly after planting.

The increased biomass per hectare (Figure 7) will require increased soil moisture than a standalone sugarcane crop to ensure cane yields are not negatively impacted.

Advantages of this Practice Change:
Potential to improve soil health allowing a reduction in inorganic N inputs longer-term. This reduces the likelihood of N loss to local catchments.

Disadvantages of this Practice Change:
There is additional workload directly after harvest to plant the soybean crop and it restricts weed control options. The practice is easiest where weed pressure is low. In dry conditions, the cane/legume requires additional irrigations due to the additional water uptake demands.

Will you be using this practice in the future: The trialling is still continuing but the initial indicators are positive.

% of farm you would be confident to use this practice : Approximately 60% as the practice is more suited to young crop stages.