Project Catalyst Trial Report

Low Risk Strategy for Growing Legume Crops and Transitioning Back to Cane

Grower Information	
Grower Name:	Frank Clayton
Entity Name:	TBC
Trial Farm No/Name:	PSM 01538A
Mill Area:	Proserpine Sugar Mill
Total Farm Area ha:	135
No. Years Farming:	12
Trial Subdistrict:	Bloomsbury
Area under Cane ha:	128

Trial Status

Completed

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Background Information

Aim: To assess the sugarcane crop impacts of fallow practices that may provide a low risk strategy for growing legume crops and transitioning back to cane.

Background:

It has been demonstrated that the practice of a minimum-tillage soybean fallow, followed by zonal bed preparation for planting cane, reduces damage to soil structure and improves a number of indicators of soil health.

Cultivation to prepare paddocks for wet season soybean crop planting can increase soil erosion risk for the period between planting and crop canopy closure. The zero till/ zonal bed integrated farming practice allows growers to maintain valuable soil and nutrient assets within the paddock boundaries. It reduces the risk of soil (sediment) loss from paddock sources whilst increasing the nutrient holding capacity of the soil.

After soybean crops are terminated for plant cane, incorporation of the soybean trash into zonal beds accelerates decomposition. The nitrogen (N) becomes available for plant cane uptake and can provide opportunity for reduced inorganic N fertiliser to be applied.

Potential Water Quality Benefit:

Reduced cultivation greatly decreases risk of soil erosion and therefore a reduction in nutrient run-off associated with sediment losses. Additionally, infiltration rates are greater in mininal cultivated soils, providing increased soil moisture to rooting depth and, consequently, improved crop yield.

Expected Outcome of Trial:

Reduced N runoff and improved crop yield in low tillage areas.

Service provider contact: Farmacist Pty Ltd

Where did this idea come from: Frank Clayton in consultation with Farmacist

Plan - Project Activities		
	Date:	**Activities:**
Stage 1	Jan 2020	Sprayout sugarcane and plant soy treatments
Stage 2	Mar/Apr 2020	Harvest soy for grain
Stage 3	August 2020	Plant sugarcane crop
Stage 4	Dec 2020	Install water quality sampling equipment
Stage 5	Sep 2021	Harvest trial to determine sugarcane yield
Stage 6	Oct 2021 /March 2022	Water quality monitoring, capture furrow runoff from both treatments

Project Trial site details	
Trial Crop:	Soy - Sugarcane
Variety: Rat/Plt:	Soy – Leichhardt, sugarcane – Q208
Trial Block No/Name:	47-1
Trial Block Size Ha:	7.06ha
Trial Block Position (GPS):	148.595655, -20.62385
Soil Type:	Wagoora

Block History, Trial Design

Trial Layout

Two treatments were established with four replicates (Figure 1). The treatments were:

T1 - No legumes, cultivated bare grassy fallow, multiple cultivations into plant cane. N @ 6ES fertiliser rates.
T2 - Zero till soy break crop, single rip cultivation plant cane, N rate determined from soil nitrate values

	Bruce Highway								
	48 Rows								
	Trial plan - Frank Clayton Farming -Farm 1538 - Block 47-1								↑ East
	5 rows	6 rows	6 rows		6 rows	6 rows	6 rows	6 rows	6 rows	
←North										
Cattle Paddock and Headland	Spray/Soybean/Min till/Cane	Spray/Grassy Fallow/Worked/Cane	Spray/Grassy Fallow/Worked/Cane	Winch row	Spray/Soybean/Min till/Cane	Spray/Grassy Fallow/Worked/Cane	Spray/Soybean/Min till/Cane	Spray/Soybean/Min till/Cane	Spray/Grassy Fallow/Worked/Cane	Remainder of Paddock
	R1T2	R1T1	R2T1		R2T2	R3T1	R3T2	R4T2	R4T1	
						KP Sampler	KP sampler			
	T1 - Bare fallow- multiple cultivations - plant cane - Full N rates as per 6ES guidelines - conventional practice									
	T2 - Legumes - single cultivation - plant cane - legume N assessment plus top-up from fertilisers - Innovative practice									

Figure 1. Trial plan for innovative practice Vs conventional practice.

Soybean planting

The paddock was sprayed with glyphosate before soybean was planted (Figure 2) into Treatment 2 and Treatment 1 fallow was only cultivated after wet season. The soybean (Treatment 2) required further haloxyfop herbicide application to treat the sugarcane volunteers. The soybean crop established well but increased weed pressure and low irrigation availability reduced crops full potential.

Figure 2. Soy planted direct into sugarcane trash.

As Frank has his own grain harvester, in late May he was able to harvest the soybean crop (Treatment 2). The fallow (Treatment 1) was cultivated in July with off-setts. Both Treatment 1 & 2 were then ripped and wavey-disced. A decision was made to also wavy-disc Treatment 2 as the sugarcane stools were brought to the surface by the rippers that had potential to effect the shute sugarcane planter. Sugarcane variety Q208 was planted (Figure 3) with a shute type planter in August. Early establishment of sugarcane for treatments was not considered different.

Figure 3. Plant cane establishment for soy min-till on right (green peg) and conventional cultivation on left (yellow peg).

Water runoff KP samplers (Figure 4) were installed in Replicate 3 in late August 2020. Low rainfall and soil absorption resulted in no run-off until December.

Figure 4. Frank Clayton with KP Sampler for collecting run-off water.

Plant cane Q208 was harvested in September 2021, fertilised and water quality monitoring KP samplers installed in October 2021 to capture wet season runoff.

Results

The 2020 harvested soybean crop yielded 2.5 t/ha first grade quality grain.
Soybean grain prices at the time of harvest (January 2021) were high at >$750/t. Taking into account inputs (cultivation, chemical, seed, irrigation, agronomical advice, harvester and transport cost), the crop returned >$550/ha.

Trial was harvested in September 2021 with yield and CCS calculated from mill bin data processed at Proserpine Mill. The innovative practice of min-till soy yielded 69 t/ha which is 8 t/ha above conventional practice at 61 t/ha (Figure 5.) The CCS was very similar as innovative practice measured 17 and conventional 17.2. Low yields are a result of reduced rain and irrigation. Data was analysied statisticaly, however there was no significant difference between treatments.

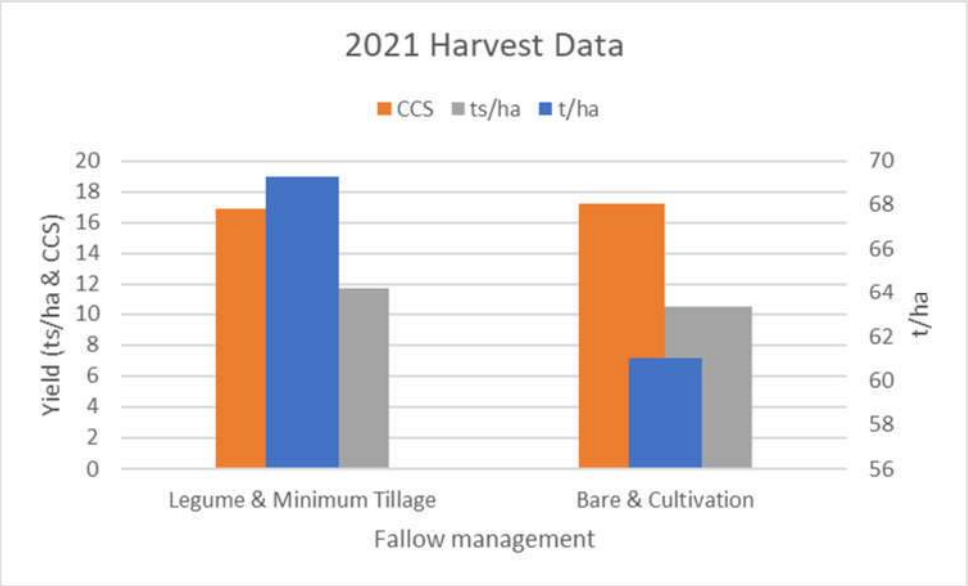

Figure 5: 2021 harvest data for yield (t/ha), CCS (Commercial Cane Sugar) and sugar (ts/ha).

The water quality data was collected four times from late September 2020 through to the 23rd March 2021. There was no clearly defined trend when comparing the levels of Nitrogen and Phosphorus for each sample date, however the average across all samples for total nitrogen and total phosphorus (mg/L) for innovative practice is 8.0 & 1.3 and conventional practice is 7.9 & 0.2 respectively. The increased P for the innovative practice could be contributed to the increased level of disturbed soil at planting due to more cane stools and soy roots present.

Conclusions and comments

Research highlights the numerous benefits of having a legume fallow in a sugarcane system for soil health and sugarcane productivity. Soil health is not the only driver for adoption of this management strategy as increased income from harvested grain provides extra incentive for growers to implement the management.

The soybean yield was comparable to district average and it was both grower and Farmacist's observation that the soybean crop easied cultiavation for sugarcane.

Planting soybean direct into cane trash works well when the planter discs can go through the existing bed. Soy germination diminishes if the seed is planted on the bed shoulder or in the wheel track, due to compacted soil and dry soil conditions.

Soybean yield may have increased with improved irrigation management as there were periods of crop stress that negatively impacted crop growth.

The soy crop had no negative impact on stored soil moisture, however this is highly season dependant. The stored soil N by the soy was consider very low (< 10 kg N/ha) prompting the same nitrogen fertiliser amount to be applied to both treatments. This can explain the similar yields between treatments. Increased irrigation would have allowed the opportunity for the treatments to be tested further, potentially increasing yield for soy if more nitrogen was stored in the soil.

The system would benefit from a double-disc cane planter allowing for reduced soil disturbance. Using a controlled traffic system also has a potential to greatly reduce or remove cultivation between crops.

This project is now complete under this round of funding, however the grower is interested in investigating suitability of this practice on the farms loam/sandy soils.

Advantages of this Practice Change:
Planting soybean into trash cover provided extra weed protection and reduced soil moisture losses. Soil erosion risks were reduced as there was no soil worked prior to the wet season.

Disadvantages of this Practice Change:
Reduced cultivation did not allow for the sugarcane stool to breakdown over the wet season and created difficulties in forming an even bed profile and having a suitable soil cover when planting the sugarcane.

As a soybean crop is generally planted at end of the sugarcane crop cycle, there is an increased risk of weed pressures and this can create control issues during the crop's development.

Will you be using this practice in the future:
The grower is set to continue this practice for future fallow as they see the value in reduced inputs. Adoption in the region will potentially driven by the increase in cost inputs.

% of farm you would be confident to use this practice:
All of suitable fallow soils - approximately 12%.