Project Catalyst Trial Report

18-month Extended Fallow vs Traditional 6 month Legume Fallow

Grower Information	
Grower Name:	Gerry, Sam and Joe Deguara
Entity Name:	Gerard Deguara Holdings
Trial Farm No/Name:	Joe's hills
Mill Area:	Mackay Sugar
Total Farm Area ha:	43 ha
No. Years Farming:	45 – 2nd generation
Trial Subdistrict:	North Eton
Area under Cane ha:	Approx 1000ha (combined total of operation)

Trial Status

Completed

Background Information

Aim: To show that a diversified cropping system is an advantageous management system because it has the potential to be the most economical and environmentally sustainable long-term management approach.

Background: (Rationale for why this might work)

Long-term pauses from sugar cane monoculture were required to maximise soil health and sugar cane productivity, according to the findings of the sugar industry's "Yield Decline Joint Venture" (1999-2006). In 2020, a trial was formed at Gerry Deguara's farm in the North Eton district to investigate the impact of an extended fallow season on soil health and the subsequent sugar cane crop rotation.

There were two options for treatment. The first was a conventional fallow treatment, whereas the second was an extended fallow treatment.

Treatment 1 (Grower standard practice): Plough out→ soybean→plant cane
Treatment 2 (Extended fallow option): Plough out→soybean→safflower→soybean→plant cane

Between 2012 to 2019, a pilot project was done on another of Gerry Deguara's farms. The block started as a normal fallow of soybean. The next season, a second treatment was added, this time in randomised strips, to which a further 12-month break from sugarcane was taken in this part section of block.

As a result, the plant cane for the two treatments was planted in different years, allowing for a comparison of sugarcane yield at different crop ages in the same year. The extended fallow treatment did achieve between 1.5 to 2.2 tonnes of sugar per hectare (tS/ha) each season higher than the standard fallow.

Since the original trial, Gerry has been confident in the extended fallow farm management approach and has put 22 hectares (ha) into an extended fallow. Because the two blocks are adjacently positioned and were planted at the same time, the 2022 season allowed an opportunity to make better comparisons. Prior to planting cane, one had a typical soybean fallow and the other had an 18-month grain crop phase, soil sampling and analysis to determine Pachymetra spore levels, chemical, nutrient, and textural information.

The economics of the treatments will be assessed at the trial's conclusion in 2022 to examine if extending fallow time by 12 months enhances soil health and sugar yields, and if income gained from fallow crops provides a business risk mitigation advantage.

Potential Water Quality Benefit: A reduction in potential nutrient and sediment runoff due to enhanced production from improved soil health and increased fertiliser usage efficiency. In a straight sugarcane system, planting winter crops allows for the use of novel herbicide chemistry, which can assist control weeds that often require PSII herbicides. There is a lower danger of these high ecotoxicity compounds entering local aquatic systems by limiting the usage of PSII herbicides.

Expected Outcome of Trial:

Diversified cropping systems have enhanced soil health, nutrient cycling, and yield outcomes, resulting in larger gross margins and, presumably, increased profitability and income risk mitigation.

Service provider contact: Zoe Eagger, Farmacist (0436 004 437)

Where did this idea come from: Gerry, Joe and Sam Deguara

Plan - Project Activities		
	Date:	**Activities:**
Stage 1	**November 2019**	Sugarcane crop harvested T2- 2 year fallow.
Stage 2	**December 2019**	Soybean crop planted T2- 2 year fallow.
Stage 3	**May 2020**	Harvest soybean crop T2- 2 year fallow.
Stage 4	**June 2020**	Plant safflower T2- 2 year fallow.
Stage 5	**August 2020**	Collect base line soil nutrient levels
Stage 6	**November 2020**	Harvest sugarcane off T1- standard practice
Stage 7	**November 2020**	Harvest Safflower T2- 2 year fallow.
Stage 8	**December 2020**	Plant soybean both treatments
Stage 9	**May 2021**	Harvest Soybean both treatments
Stage 10	**August 2021**	Plant Sugarcane both treatments

Project Trial site details	
Trial Crop:	Sugar cane, soybean and safflower.
Variety: **Rat/Plt:**	T1 - Standard practice 2019 Class = KQ228 4R T2 – 2-year fallow 2019 Class = Q232 5R
Trial Block No/Name:	17-02 and 17-03

Block History, Trial Design

A Kuranda soybean crop was sown in December 2019, and the crop was desiccated in preparation for harvest in May 2020. Across the 5ha block, the Kuranda variety averaged 4t/ha. In the trial, this block was to be used as Treatment 2 (extended fallow). In June 2020, a Safflower crop was planted in the block, and it was harvested on November 5th, 2020. The average yield of safflower was 1.1 t/ha, which was below expectation. The adjacent block had its final sugarcane crop harvested in November 2020, and it was designated as the Treatment 1 block (standard fallow). After applying 50t/ha of mill mud to both treatments, the final Kuranda soybean was planted in the first week of December 2020.

The final soybean crop was harvested in May 2021, yielding 3t/ha on average. The growing circumstances were not as favourable as they had been the previous season. The sugarcane variety Q240 was planted into the blocks in mid-July 2021. The trial is scheduled to harvested in August 2022.

Figure 1 - 2020 Soybean crop ready for harvest.

Figure 2 - Safflower sample direct from the header bin

Figure 3-2020-2021 Kuranda soybean crop. T1 on the right and T2 on the left.

Trial Layout → **North**

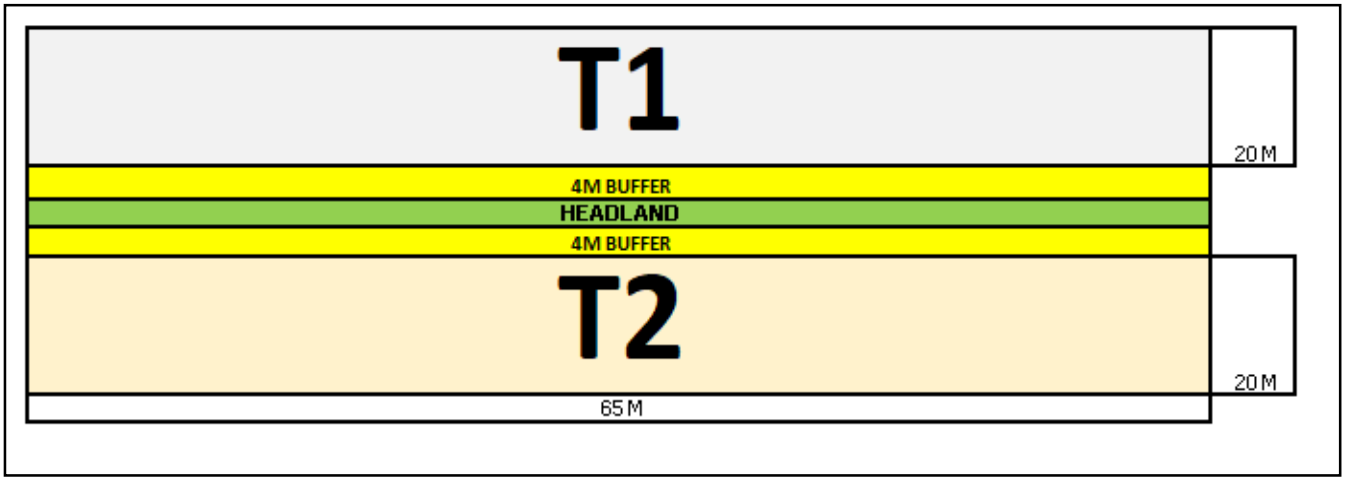

Figure 4 Trial layout

Treatment 1 (Grower standard practice) – Plough out → soybean→plant cane (Q240)

Treatment 2 (Extended fallow option) – Plough out→soybean→safflower→soybean→plant cane (Q240)

Figure 5 - Aerial view of trial layout

At the commencement of the trial in November 2019, soil tests and pachymetra tests were taken in each treatment. The sample locations and trial area were chosen based on the electromagnetic map to reduce the impact of soil variability on yield. The soil texture categorisation in both treatment plots was the same, however the test in treatment 1 revealed that it was a slightly heavy soil type, based on the higher organic carbon content and pH level. This is frequent since heterogeneity still exists even amongst the same classifications.

Both treatments received 50t/ha of mill mud before the final soybean crop was sown, giving more than enough phosphorus for the cane crop cycle. Q240 was able to be planted in 2021 since both plots' Pachymetra values were below the 30,000-spore threshold.

Analyte / Assay	Units	T1	T2
Soil Colour			
Soil Texture		Sandy clay	Sandy clay
pH (1:5 Water)		5.8	5.56
pH CaCl		4.96	4.67
ECSE	dS/m	0.387	0.3784
EC (1:5)		0.045	0.044
Chloride	mg/kg	7	7
Organic Carbon (OC)	%	1.72	1.3
Nitrate Nitrogen (NO3)	mg/kg		
Phosphorus (Colwell)	mg/kg	80	25
Phosphorus (BSES)	mg/kg	74	27
PBI-Col		131	105
Potassium (Amm-acet.)	Meq/100g	0.31	0.21
Potassium	%	2.75	2.4
Potassium (Nitric K)	Meq/100g	2.171	1.598
Available Potassium	mg/kg	123	81
Sulphate Sulphur (MCP)	mg/kg	11	16
Cation Exchange Capacity	Meq/100g	11.4	8.6
Calcium (Amm-acet.)	Meq/100g	7.15	4.69
Calcium %CEC	%	62.51	54.36
Magnesium (Amm-acet.)	Meq/100g	3.7	3.19
Magnesium %CEC	%	32.32	37.02
Sodium (Amm-acet.)	Meq/100g	0.1	0.1
Sodium % of Cations (ESP)	%	0.85	1.11
Aluminium Saturation	%	0.79	3.59
Aluminium (KCl)	mg/kg	0.09	0.31
Zinc (HCl)	mg/kg	2.12	1.52
Zinc (DTPA)	mg/kg	1.4	1.1
Copper (DTPA)	mg/kg	2.1	1.7
Iron (DTPA)	mg/kg	100	96
Manganese (DTPA)	mg/kg	61	72
Silicon (BSES)	mg/kg	290	200
Silicon (CaCl2)	mg/kg		

Min Max

Figure 5 – Soil test results from both treatments

Results

Cane yield data isn't available yet because the trial isn't expected to be harvested until August 2022. The extended fallow crops were subjected to a basic gross margin analysis. In 2019-2020, the Deguara family secured a soybean contract worth $930 per tonne, with a crop yield of 4 tonnes per hectare, which equated to a gross margin of $2624/ha.

With a gross margin of $49/ha, the safflower crop was not considered a success by the grower. Input expenditures for fertiliser and herbicide applications contributed to the low gross margin, which was further exacerbated by the low yield of 1.1t/ha in 2020.

The family received a reduced soybean price of $750/tonne in the 2020-2021 season due to a strong market supply. The crop yielded 3t/ha, due to less favourable growing conditions compared to the crop planted in 2019. Herbicides, particularly roundup, and soybean insecticides had gone up in price in 2021, resulting in a smaller profit margin. The growers are still profitable, with a gross margin of $1072/ha in 2020-2021, and the Deguara family saves even more money by cutting their plant cane nitrogen top dress after soybean crops.

The family has their Farmacist agronomist do a nitrate test trip, which is inexpensive, quick test that provides an indication of organic nitrogen levels so that top-dress rates can be adjusted. In 2021, instead of 140 kg/ha, 90 kg/ha was applied to the plant cane crop, saving the business $141/ha in fertiliser expenses.

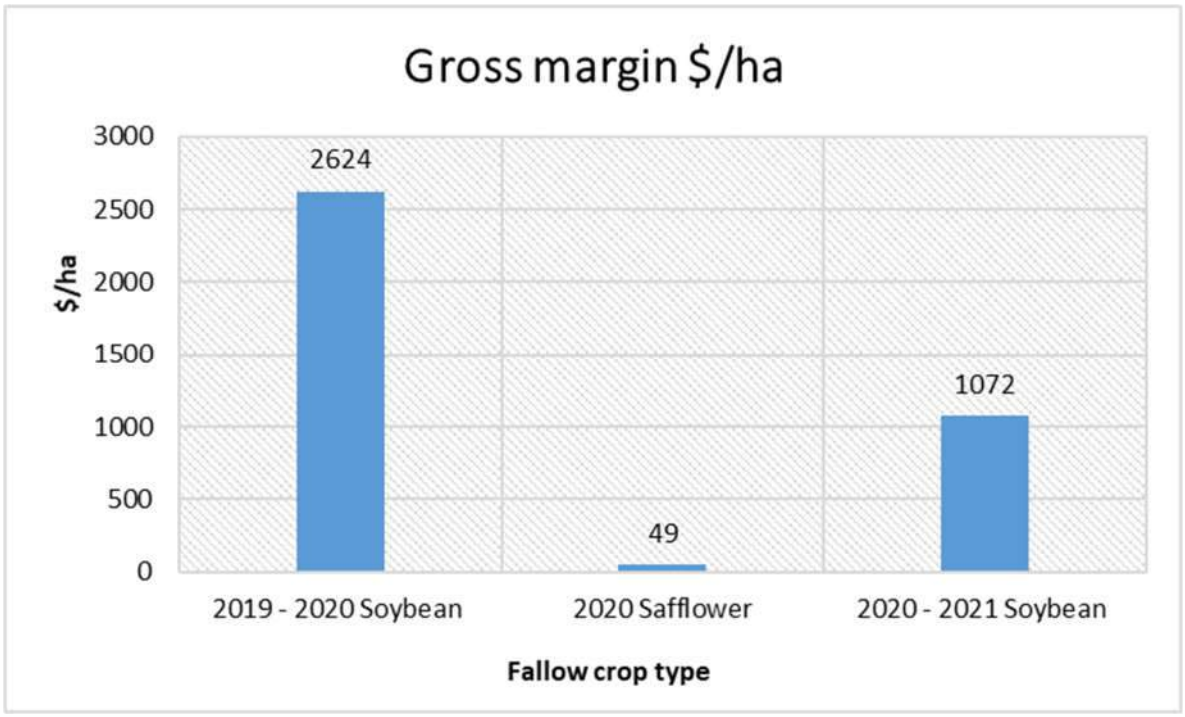

Figure 6 – Gross margin return/ha of the three different crops in the extended fallow treatment

Conclusions and comments

The family will continue to grow a soybean crop throughout the traditional fallow time. The extended fallow option is still conceivable, but the winter crop option is the greatest restricting factor, and crop varieties and options currently lack the ability of summer soybean crops gross margin capability.

In 2022, cane yield data will be obtained, and it is hoped that a favourable impact on cane and sugar yield will be observed. Once yield has been obtained a further economic analysis can be conducted. When the opportunity arises, the family will continue to experiment with alternative winter crop options.

Advantages of this Practice Change:
Quote from Sam Deguara "With the break crops sold, it's a great cash injection into the business and if sugar prices are low, a two-year fallow could be more profitable than the standard fallow break"

Disadvantages of this Practice Change:
Quote from Sam Deguara "The disadvantages are that we have yet to discover a winter crop that is consistently profitable in our climate and isn't a legume. Corn and sorghum fit well in that time but are unattractive options because to the Fall army worm problem in the area. There is also the added challenge of harvesting winter crops in November and December is risky owing to wet weather"

Will you be using this practice in the future:
Quote from Sam Deguara "We'll keep looking for winter crops that fit into our rotation, have a decent gross margin, and are compatible with our management system and machinery"

% of farm you would be confident to use this practice:
Quote from Sam Deguara "We are confident in our ability to continue testing an extended fallow on 5% of the farm until an appropriate rotation options are established"