Project Catalyst Trial Report

Sowing Multi-species Crops Immediately After Harvest

Grower Information	
Grower Name:	Robert Sluggett
Entity Name:	
Trial Farm No/Name:	PCK-00798A
Mill Area:	PCK
Total Farm Area ha:	85
No. Years Farming: (Grower Experience)	20+
Trial Subdistrict:	Koumala
Area under Cane ha:	70

Trial Status

Completed Stage 1: Novel method for establishing cover crop trial

Subject to ongoing funding, continuing Stage 2: Multispecies grazing trial

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Background Information

Aim (Stage 1): To evaluate a novel method for establishing cover crops using a spreader mounted on the rear of a cane harvester.

Aim (Stage 2): To evaluate the economical and soil health benefits of grazing a multispecies cover crop.

Background:

The movement into regenerative agriculture involves the incorporation of livestock and multispecies cover crops into cropping systems. Robert Sluggett has taken inspiration from Gabe Brown, a United States of America (USA) based farmer, who has changed his cropping approach from a single cash crop grown each year to multiple cash crops, rotated with multispecies cover mixes as a 'fallow' crop. Livestock such as cattle, chickens and pigs are incorporated into the system to graze on the cover crops. This brings diversity to the farm cash flow as well as increased soil health and fertility.

In the Australian cane industry, the Sluggett's believe there is opportunity for cover crop establishment through the fallow period, typically left bare or as sprayed out cane. Combined with the fact that many cane growers also produce small numbers of beef cattle on land unsuitable for cane production, they were motivated to investigate whether this practice may increase in soil health, productivity and income. Finding ways to establish cover crops more efficiently and effectively will improve broader adoption of this practice.

In a preliminary trial conducted in 2019, an area of 25m x 13m was hand broadcast with mixed seed following the harvester. Species in the trial included cow pea, mung bean, sunflower, linseed, mustard radish and soybean. As the next row was cut, trash was spread over the previous row where seed had been broadcast. Upon the following rain event, the seed germinated and established well.

In 2020, this project aimed to determine if this process could be more efficiently implemented by mounting a spreader on the harvester that switches on and off according to the elevator position. To mimic the aspirational spreader set-up within the constraints of the project timeframes, the spreader in the trial was mounted onto an old tool bar and placed behind a tractor that followed behind the harvester and sued the method outlined.

Potential Water Quality Benefit:

Multispecies cover crops may have benefits for soil health, reduce the nitrogen (N) requirement in the following cane crop and, most importantly, following a cane crop. Cover crops limit potential erosion by providing cover over the wet season. Using a mounted spreader eliminates the need for tillage to establish the cover crop and provides an easy way for growers to incorporate the practice into their farming system.

Expected Outcome of Trial:

This trial aims to provide guidance for growers regarding whether this is an affordable and effective option for establishing cover crops and economics of grazing cattle.

Service provider contact: Farmacist Pty Ltd

Where did this idea come from: Robert Sluggett

Plan - Project Activities		
	Date:	**Activities:**
Stage 1	June – Sept 2020	Identify and evaluate spreader options. Including the size, cost, achievable planting rate, effectiveness for a range of seed sizes.
Stage 2	Oct 2020	Identify seed mixtures. Secure seed to plant
Stage 3	Nov-Dec 2020	Plant fallow block Initial soil health sampling undertaken
Stage 4	Feb 2021	Evaluate effectiveness of species established. Initiate grazing
Stage 5	March 2021	Finish grazing and undertake final soil health sampling Terminate multispecies

Project Trial site details	
Trial Crop:	Mixed species cover crop
Variety:	The multispecies mix included: • Cowpea • Fodder Radish • Mungbean • Soybean • Chicory • Buckwheat • Tillage Radish • Lucerne - L56 • Pigeon Pea • Clover • Sunflower • Sunn Hemp • Japp Millet
Trial Block No/Name:	PCK-00798A-03-05
Trial Block Size Ha:	2.37ha
Trial Block Position (GPS):	-21.63°, 149.23°
Soil Type:	Bell/Samourgassi

Block History, Trial Design

The trial block had a history of being a monoculture sugarcane paddock. The trial was designed to compare the economics and soil health benefits of a grazed multispecies mix to the standard grower practice of a sprayed-out cane fallow (Figure 1).

Treatments:
T1 – Grazed multispecies
T2 – Sprayed out cane (Grower Standard)

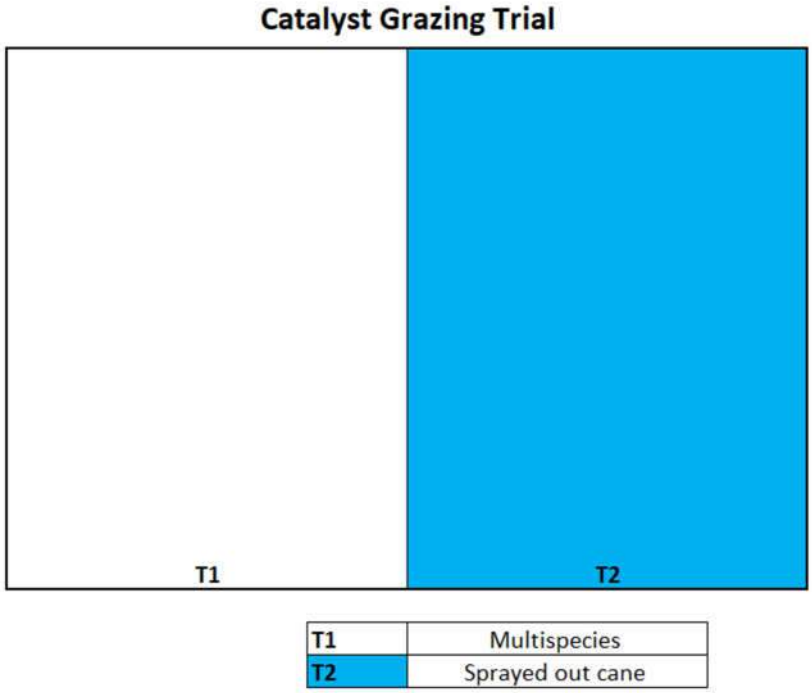

Figure 1- Trial Plan

Sampling was undertaken over 2 different EC zones of the paddock as shown in Figure 2. The blue proportion of the EC map has a low EC value, whilst the red has a high EC value soil. The results from each sample location were combined and the mean was found.

Figure 2: Trial block indicating varied EC zones of the paddock

Results

2020 Results

The multispecies mix was planted in November, using an air-seeder behind a tractor following the harvester.

Figure 3- Planting of the multispecies crop

Following planting (Figure 3), baseline soil health sampling was undertaken. Soil health tests undertaken included water infiltration, worm counts, penetrometer readings, biology samples (pachymetra and nematode community), CO_2 burst test, Hanney soil test and a standard Six Easy Steps (6ES) industry compliant soil test.

Compaction

Compaction was measured using a penetrometer, the depth to 300Psi was recorded. It is known that at a 300 psi resistance, roots are unable to penetrate the soil to develop. The mean results for each treatment is provided in Table 1.

Table 1- Compaction results

Treatment	Mean depth to 300 psi (cm)
Treatment 1	22.45
Treatment 2	23.2

At the termination of the multispecies crop. The compaction of each treatment will be re-measured and the change in compaction will be communicated in the next report update.

Worm counts

Worm counts were undertaken using a worm ring. At sampling, the soil moisture was low and air temperature was approximately 31^{0}C. These conditions were not ideal for earthworm sampling, however, earthworms were still observed in both treatments (Table 2). The earthworms found in this sampling event display a low to moderate level of biological activity in the soil.

Table 2- Earthworm Counts

Treatment	Mean worm count	Mean earthworms/cm3	Mean earthworms/cm2
Treatment 1	8	0.004	0.009
Treatment 2	9	0.004	0.009

Figure 4- Earthworm sampling process undertaken

Infiltration

Water infiltration was conducted on both treatments with the results shown in Table 3. For both treatments, the mean infiltration was 180mm/hour.

Table 3- Water Infiltration results

Treatment	Mean infiltration (mm/min)	Mean (mm/hour)
Treatment 1	3	180
Treatment 2	3	180

Nematode

Samples were taken and analysed under laboratory conditions for nematode community. It was found that plant parasitic nematodes dominated the nematode community (more than 70%), with the most common being the root lesion nematode. Free living nematode numbers were low, with most of the nematode community being bacterivores. Omnivorous and predatory nematodes were identified however numbers were also low. The combined results of high plant parasitic nematodes and fewer predatory or omnivorous nematodes displays that the biological health of this soil is quite poor.

Pachymetra

Pachymetra samples were also taken from both treatments. The mean results are shown in Table 4.

Table 4- Pachymetra results

Treatment	Mean Pachymetra count
Treatment 1	9074
Treatment 2	46,345

The Pachymetra counts are low for T1 and moderate for T2 2. This is to be expected as the previous sugarcane variety grown on the site was a Pachymetra resistant variety.

Haney Soil Test

The Haney soil test was undertaken as a measure of soil health and plant available nutrients. The key soil health parameters are shown in Table 5.

Table 5- Key Haney soil test results

	Treatment 1- High EC	Treatment 1 – Low EC	Treatment 2 – High EC	Treatment 2 - Low EC	Mean of 120 random Lab samples
Haney Soil Health Score	2.7	5.2	3.4	4.2	8.2
Solvita	11	26	15	21	44

From the initial sampling, the Haney health score is well below the mean of 8.2 across treatments. The same pattern is shown for the Solvita results, all results were below the mean of 44.

Figure 4- Growth of the multispecies – (L) 27th November 2020 (R) 4th January 2021

Conclusions and comments

The baseline data is suggesting that the soil health of both treatment sites of the trial site is quite poor.

After grazing and termination of the multispecies site, the same analysis will be completed again, and a comparison will be undertaken to finalise and provide conclusions.

This is an early stage trial, supplementary to the main innovation program and will be completed subject to the programs future funding.

Advantages of this Practice Change:

The expected advantages of this practice change are:

- Increase soil health and fertility
- Reduction of applied N on following plant crop
- Reduced sediment loss from increased ground cover
- Reduced cost to plant due to no tillage requirements
- Diversifying income streams through the addition of livestock
- Generating income from an area that would otherwise not be productive through the fallow period through livestock weight gains

Disadvantages of this Practice Change:

The expected disadvantages of this practice change are:

- Expense of seed purchases for cover crops.
- A 6 month fallow every 5 years, may not be enough for a change in soil health to occur. May need longer periods of 12-18 months.
- Possible pugging of paddocks by cattle during the wet season making cane planting more onerous.

Will you be using this practice in the future: TBC

% of farm you would be confident to use this practice: TBC