

Project Catalyst Trial Report

Mixed Biodiversity Legume Cover Crop

Grower Information

| | |
|----------------------------|-----------------------------------------|
| Grower Name: | Lawrence Di Bella |
| Entity Name: | RGS Farming Co. |
| Trial Farm No/Name: | Farm # 0135A, B#1-2 |
| Mill Area: | Victoria |
| Total Farm Area ha: | 100 |
| No. Years Farming: | 4 th generation Cane Farmers |
| Trial Subdistrict: | Forest Home |
| Area under Cane ha: | 96 |

Background Information

Aim: Trial hypothesis:

Does a mixed fallow crop increase soil biodiversity leading to improvements in soil health and a reduction in the use of inorganic nutrient inputs.

Background: (Rationale for why this might work)

- It is known that legume fallow crops can reduce soil and nutrient loss from fallow blocks when compared to a bare fallow.
- It is well documented that monoculture farming systems create unhealthy soil conditions by removing specific nutrients from the soil and there becomes an increase in the number of pathogenic organisms that have a negative impact on cane yield.
- It is also well documented that legumes have the potential to fix atmospheric nitrogen in their root systems and provide nitrogen for the subsequent crop.

Potential Water Quality Benefit:

- Less soil and nutrient runoff by having a cover crop instead of a bare fallow
- Improvements to soil health to enable the soil to better hold onto nutrients instead of being lost into the environment
- Improvements in soil structure which will reduce soil erosion during heavy rain events.

Less reliance on unstable inorganic sources of nitrogen (like urea) through the introduction of organic forms of nitrogen inputs into the farming system

Expected Outcome of Trial:

- Improved soil health
- Reduced sediment and nutrient loads being exported from the field, especially in the fallow and plant cane phase
- Reduction of inorganic forms of nitrogen
- Improvement in farm economics
- Improvements in cane yield

Service provider contact: Megan Zahmel 0447 317 102

Where did this idea come from: Lawrence DiBella

| Plan - Project Activities | Date: (mth/year to be undertaken) | Activities :(breakdown of each activity for each stage) |
|------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stage 1 | Trial Established 2018-19 | Baseline soil nutrition test taken – 20 th of Dec 2018 Baseline <i>Pachymetra</i> sample taken - 2 nd of Nov 2018 Baseline nematode sampling taken – 2 nd of Nov 2018 Trial planted on the 21st of Dec 2018 – by hand |
| Stage 2 | Monitoring, 2019 bio massing and sampling on legume crop 2019 | <ul style="list-style-type: none"> - 2nd Nematode testing – 15th April 2019 - Legume biomass – total nutrient analysis for each legume treatment. Nutrient analysis will be done by volume kg/Ha – 6-8th March 2019 - Soil samples for incubation and mineralised N content. 15th April 2019 |
| Stage 3 | Establish plant cane crop. Sampling activities proposed for 2019/2020 | <ul style="list-style-type: none"> - Planted Cane Q253 – 27th July 2019 - Stalk counts - germination counts – 5th of Sep 2019. 28 days – 2nd Oct 2019. 56 days – 30th Oct 2019. - AMF and soil sampling – 13-15th Nov 2019 |
| Stage 4 | Sampling Cane 2020 | <ul style="list-style-type: none"> - Nematode sampling - Jan 2020 - CCS and cane yield harvest in August 2020 - Nematode sampling – Oct 2020 |
| Stage 5 | Sampling Cane 2021 | Economic analysis – 2020 <ul style="list-style-type: none"> - Nematode sampling – April 2021 - Harvest data 2021 - Nematode sampling – Oct 2021 |
| Stage 6 | | |

Project Trial site details

| | |
|----------------------------------------|----------------------------------------------------|
| Trial Crop: | Mixed fallow crop |
| Variety: | Mixed legumes Dec 21 st , 2018 |
| Rat/Plt: | Plant to sugarcane 27 th July 2019 Q253 |
| Trial Block No/Name: | Biodiversity in Fallow |
| Trial Block Size Ha: | 1.3ha |
| Trial Block Position (GPS): | Refer to google map |
| Soil Type: | Alluvial |

Block History, Trial Design:

Block History:

1.83m row spacing since 2010

Previous crop was Q237

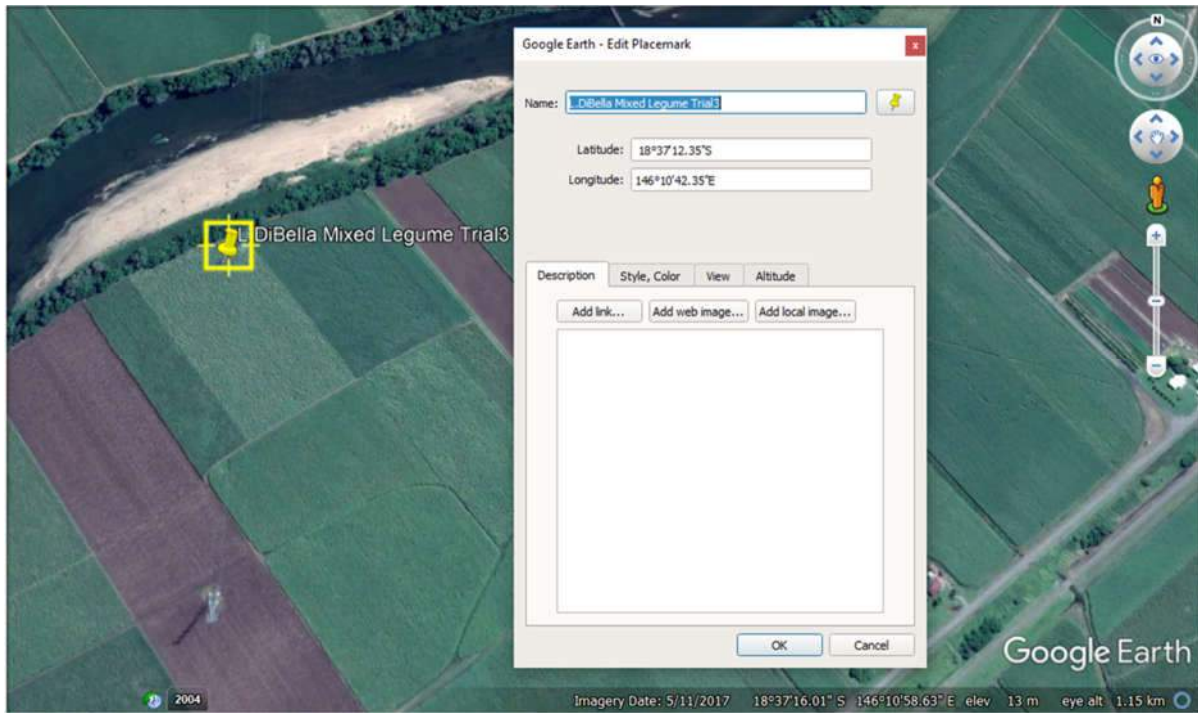
| | | | | | | | | | | |
|--------------------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|-----------------------|--------------|-------------------|
| heading towards Cordelia | | | | Town | | | | | | Blue house & shed |
| Headland | | | | | | | | | | |
| 4 rows | 4 rows | 4 rows | 4 rows | 4 rows | 4 rows | 4 rows | 4 rows | 4 rows | 4 rows | |
| Soy Zambia | Soy Kuranda | Soy Mossman | Soy Stuart | Soy A6780 | Large Cowpea | Ebony Cowpea | Meringa Cowpea | Black Stallion Cowpea | | |
| Rep 1 | | | Rep 2 | | | Rep 3 | | | Pumkin Patch | |
| trt 2 P1 | trt 17 P14 | trt 9 P15 | trt 18 P25 | trt 4 P27 | trt 2 P40 | trt 17 P41 | trt 10 P54 | trt 19 P55 | 25m | |
| trt 5 P2 | trt 11 P13 | trt 18 P17 | trt 6 P26 | trt 17 P28 | trt 5 P39 | trt 14 P42 | trt 18 P53 | trt 8 P56 | | |
| trt 14 P3 | trt 12 P12 | trt 6 P16 | trt 20 P24 | trt 12 P29 | trt 14 P38 | trt 5 P43 | trt 13 P52 | trt 4 P57 | | |
| trt 13 P4 | trt 7 P11 | trt 20 P18 | trt 1 P23 | trt 15 P30 | trt 8 P37 | trt 1 P44 | trt 11 P51 | trt 12 P58 | | |
| trt 15 P5 | trt 8 P10 | trt 4 P19 | trt 3 P22 | trt 7 P31 | trt 13 P36 | trt 9 P46 | trt 7 P50 | trt 20 P59 | | |
| trt 16 P6 | trt 10 P9 | trt 19 P20 | trt 10 P21 | trt 16 P32 | trt 11 P35 | trt 15 P45 | trt 16 P48 | trt 3 P60 | | |
| trt 1 P7 | trt 3 P8 | trt 21 | trt 21 | trt 9 P33 | trt 19 P34 | trt 2 P47 | trt 6 P49 | trt 21 | | |
| Mix legumes | | | | | | | | | | |
| Powerpole | | | | | | | | | | |
| Herbert River | | | | | | | | | | |

Treatments:

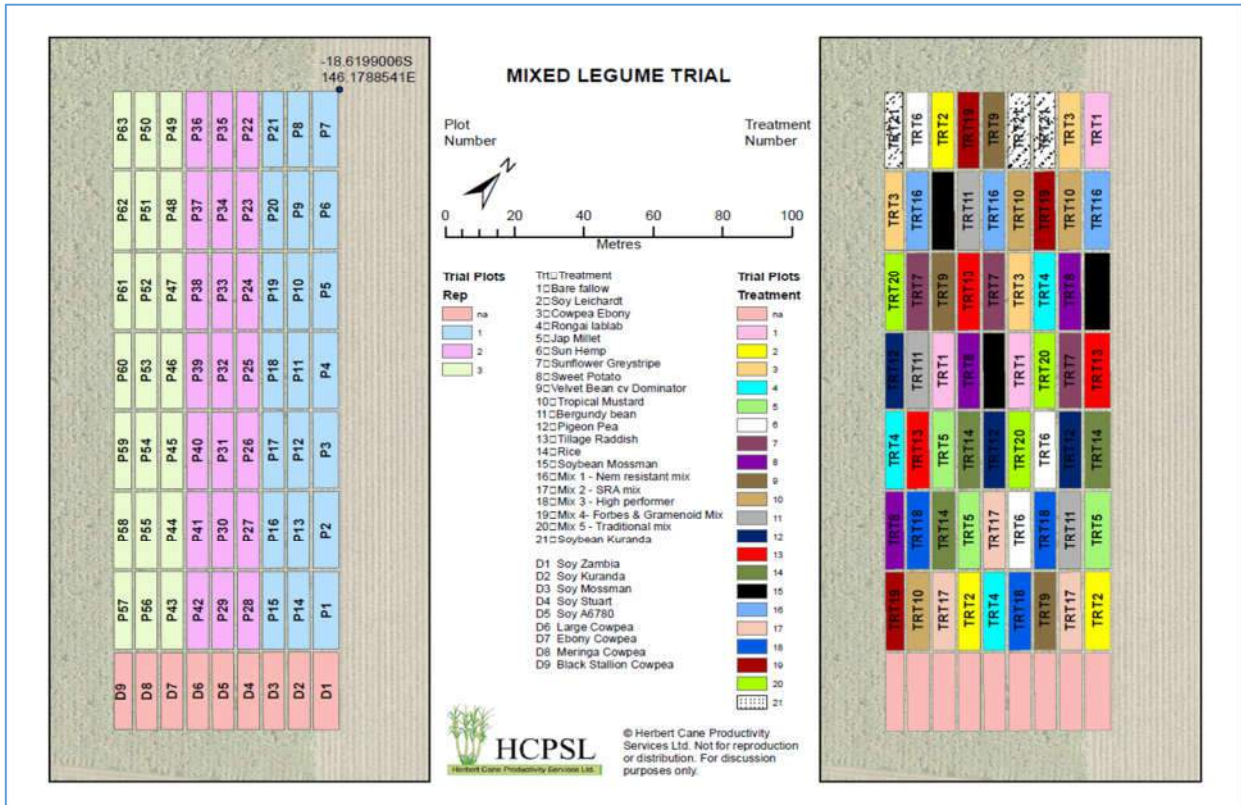
| Treatment | Trt # | | | | | | | | | | | | | | | | | | | |
|-------------------------------|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Bare fallow | 1 | | | | | | | | | | | | | | | | | | | |
| Soy Leichardt | 2 | | | | | | | | | | | | | | | | | | | |
| Cowpea Ebony | 3 | | | | | | | | | | | | | | | | | | | |
| Rongai lablab | 4 | | | | | | | | | | | | | | | | | | | |
| Jap Millet | 5 | | | | | | | | | | | | | | | | | | | |
| Sun Hemp | 6 | | | | | | | | | | | | | | | | | | | |
| Sunflower Greystripe | 7 | | | | | | | | | | | | | | | | | | | |
| Sweet Potato | 8 | | | | | | | | | | | | | | | | | | | |
| Velvet Bean cv Dominator | 9 | | | | | | | | | | | | | | | | | | | |
| Tropical Mustard | 10 | | | | | | | | | | | | | | | | | | | |
| Bergundy bean | 11 | | | | | | | | | | | | | | | | | | | |
| Pigeon Pea | 12 | | | | | | | | | | | | | | | | | | | |
| Tillage Raddish | 13 | | | | | | | | | | | | | | | | | | | |
| Rice | 14 | | | | | | | | | | | | | | | | | | | |
| Soybean Mossman | 15 | | | | | | | | | | | | | | | | | | | |
| Mix 1 - Nem resistant mix | 16 | | | | | | | | | | | | | | | | | | | |
| Mix 2 - SRA mix | 17 | | | | | | | | | | | | | | | | | | | |
| Mix 3 - High performer | 18 | | | | | | | | | | | | | | | | | | | |
| Mix 4- Forbes & Gramenoid Mix | 19 | | | | | | | | | | | | | | | | | | | |
| Mix 5 - Traditional mix | 20 | | | | | | | | | | | | | | | | | | | |
| Soybean Kuranda | 21 | | | | | | | | | | | | | | | | | | | |

Results:

Google Earth Reference Map

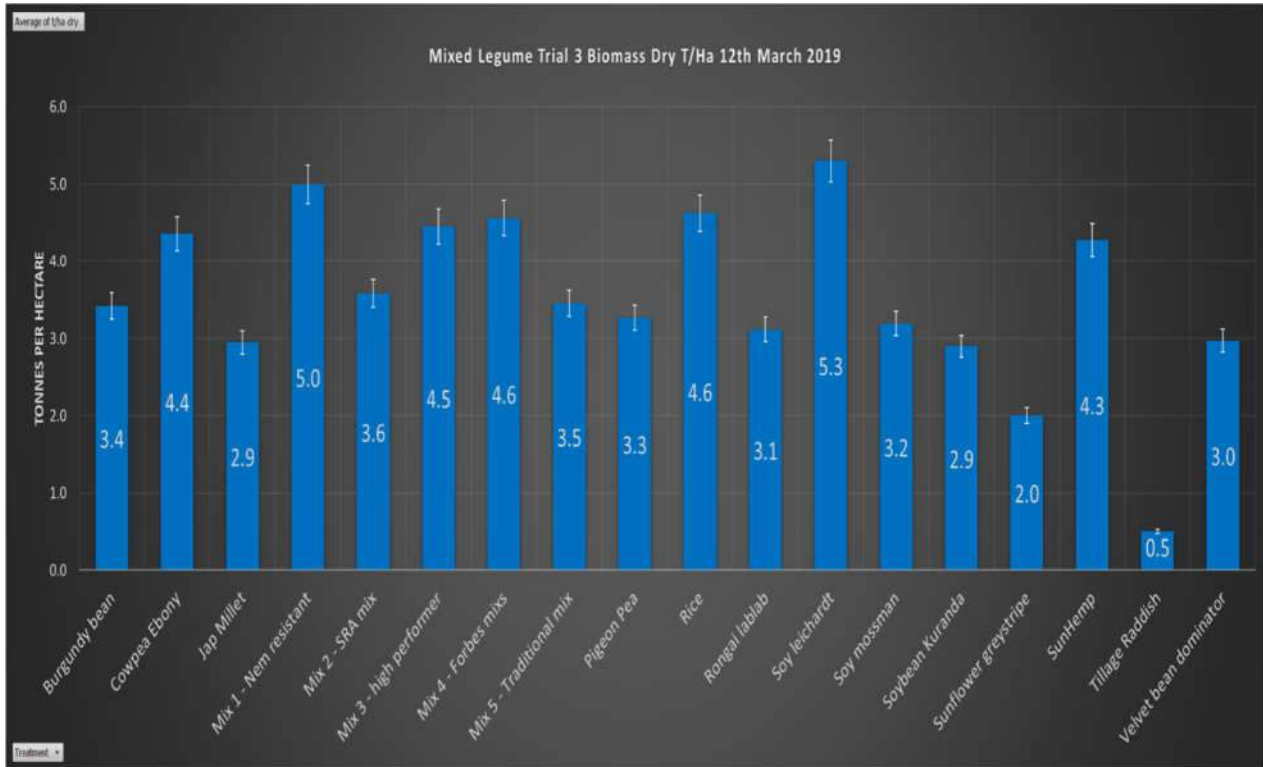


Plot areas map for Mixed Fallow trial 3

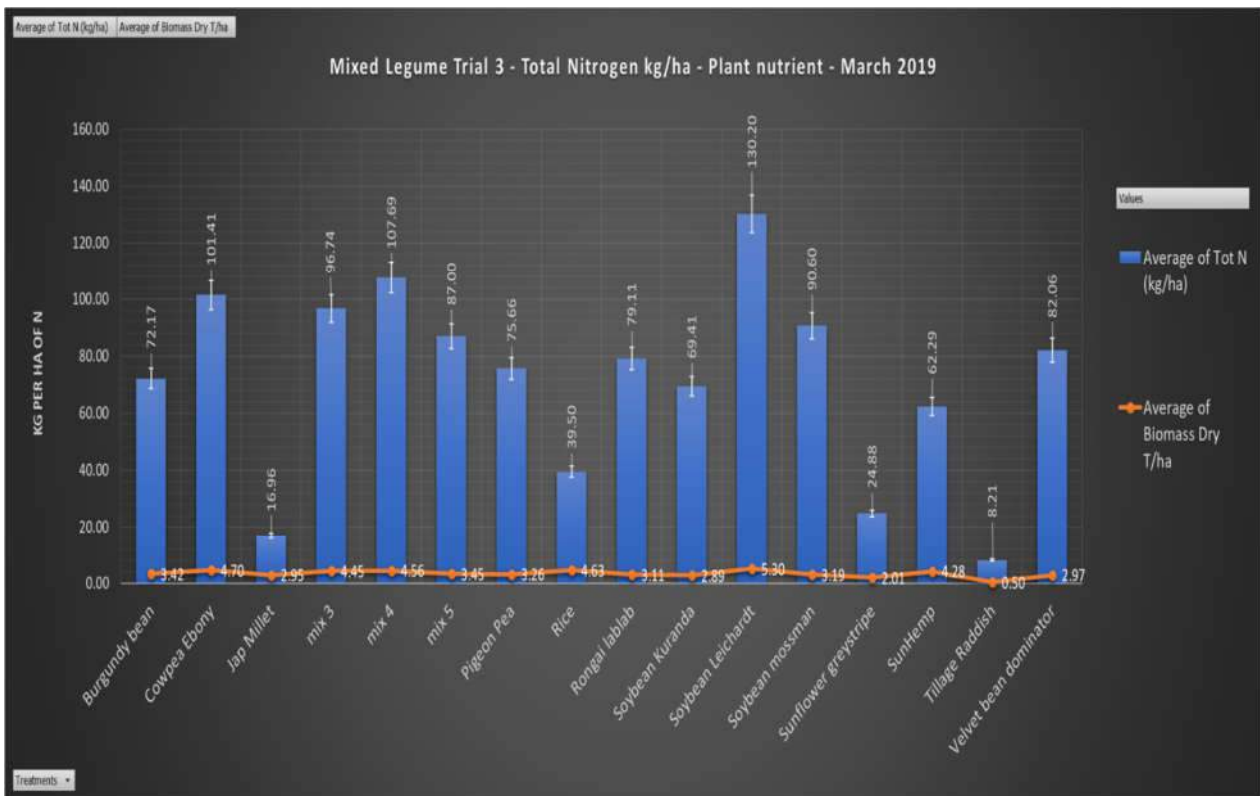


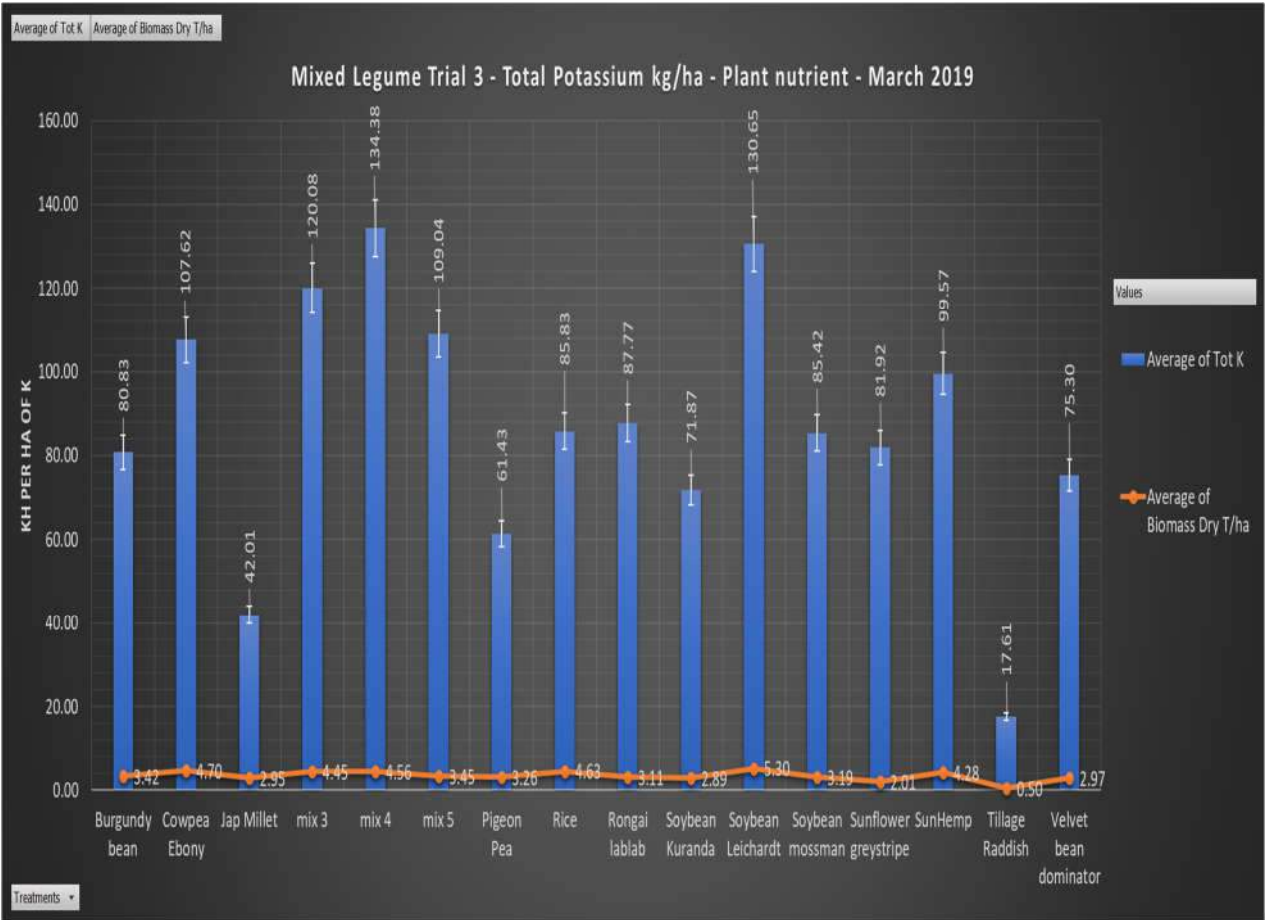
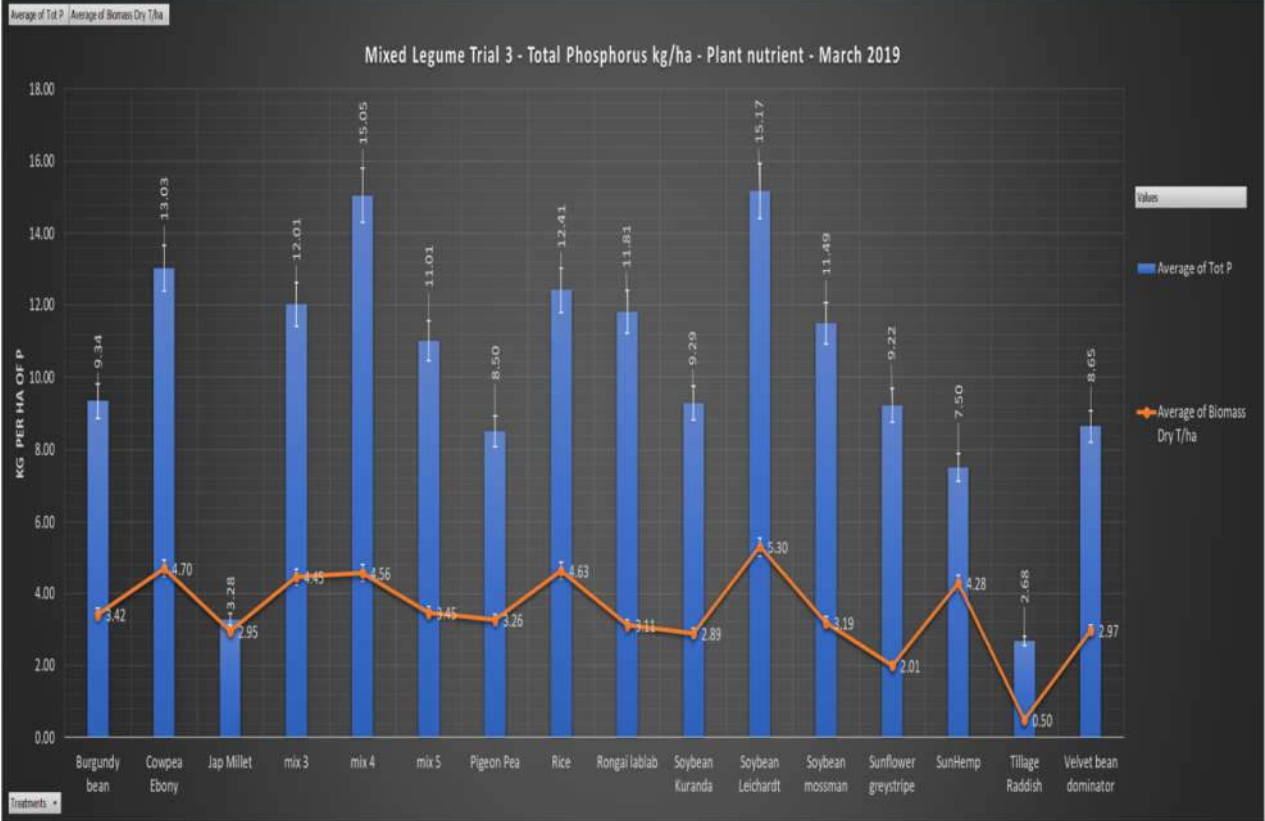
This trial was planted on the 21st of December 2018.

Legume Biomass results 12th March 2019



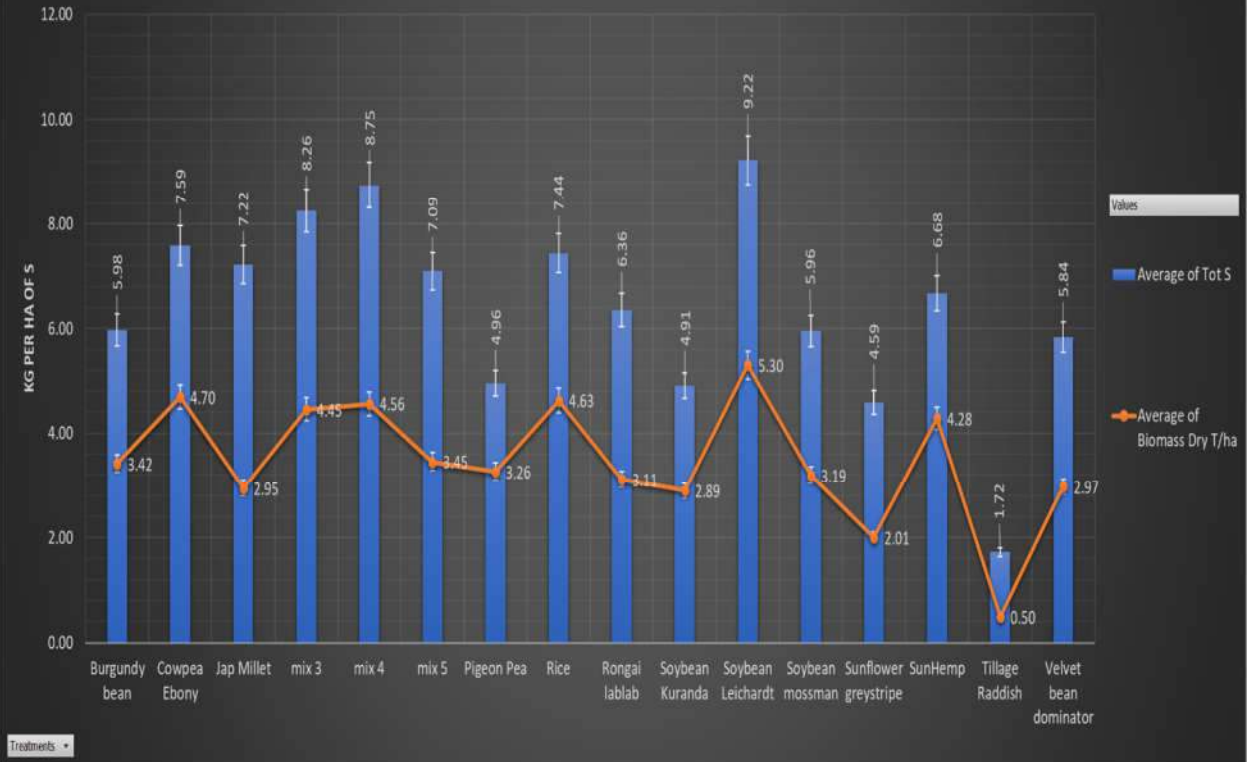
Nutrient analysis of legume plant uptake – March 2019





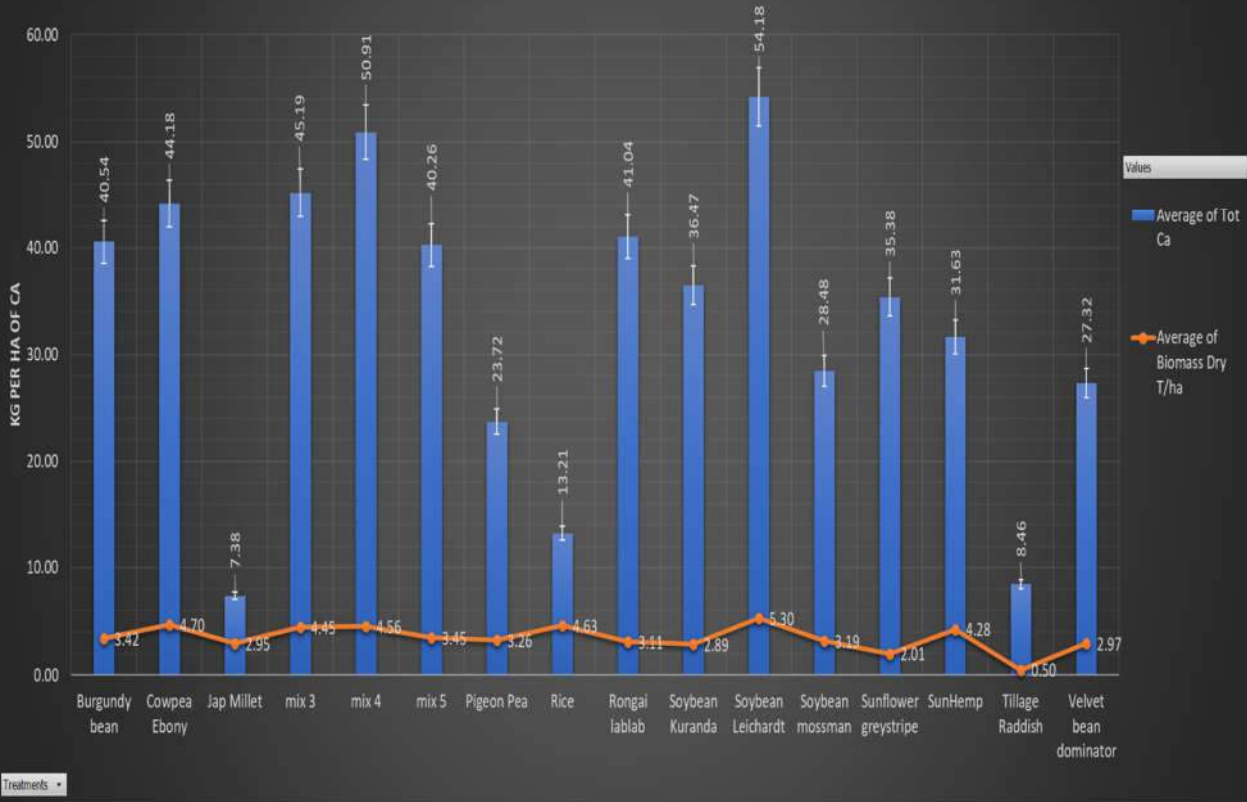
Average of Tot S | Average of Biomass Dry T/ha

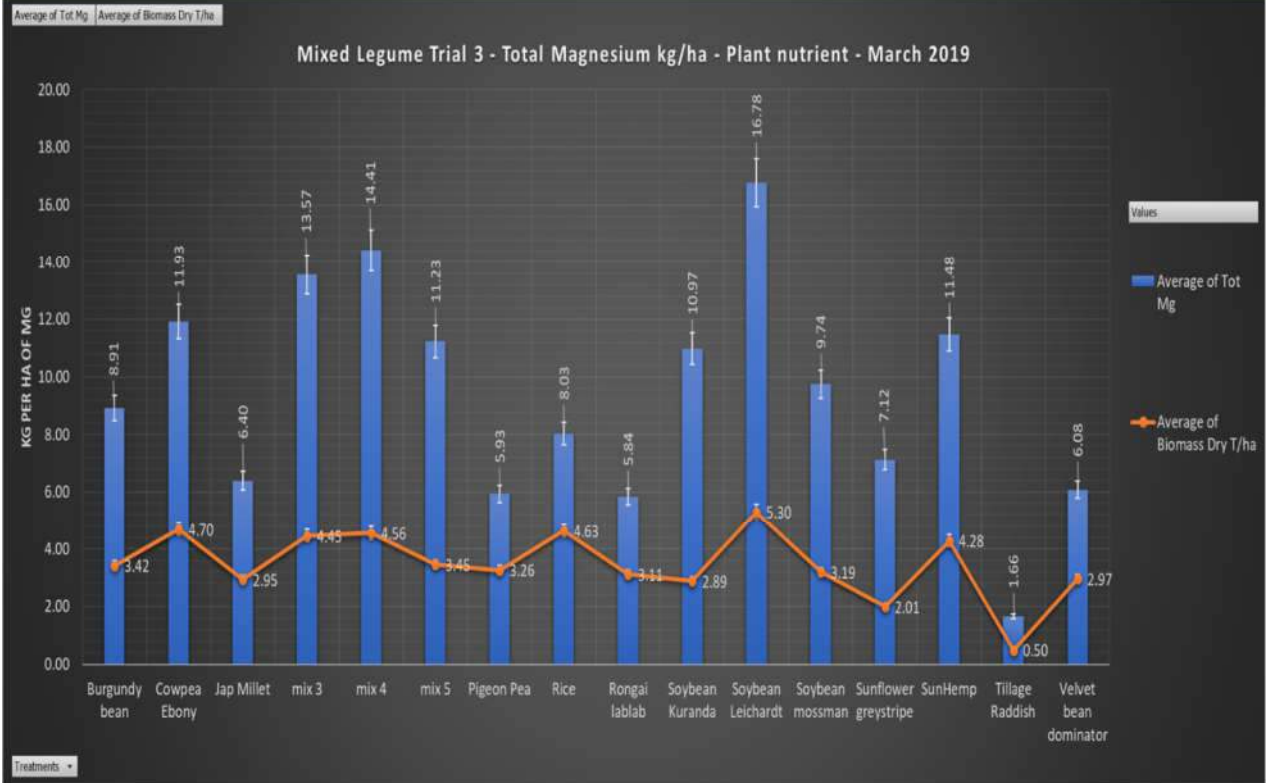
Mixed Legume Trial 3 - Total Sulfur kg/ha - Plant nutrient - March 2019



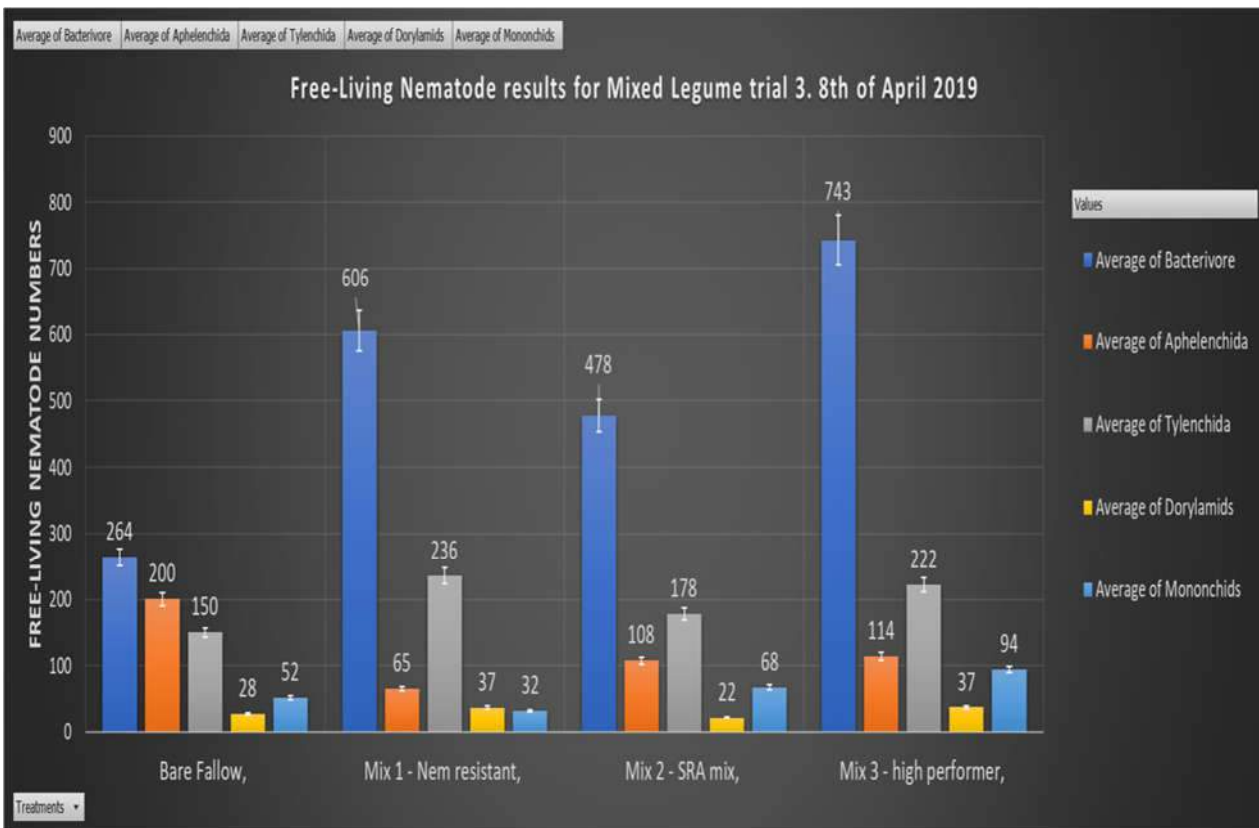
Average of Tot Ca | Average of Biomass Dry T/ha

Mixed Legume Trial 3 - Total Calcium kg/ha - Plant nutrient - March 2019

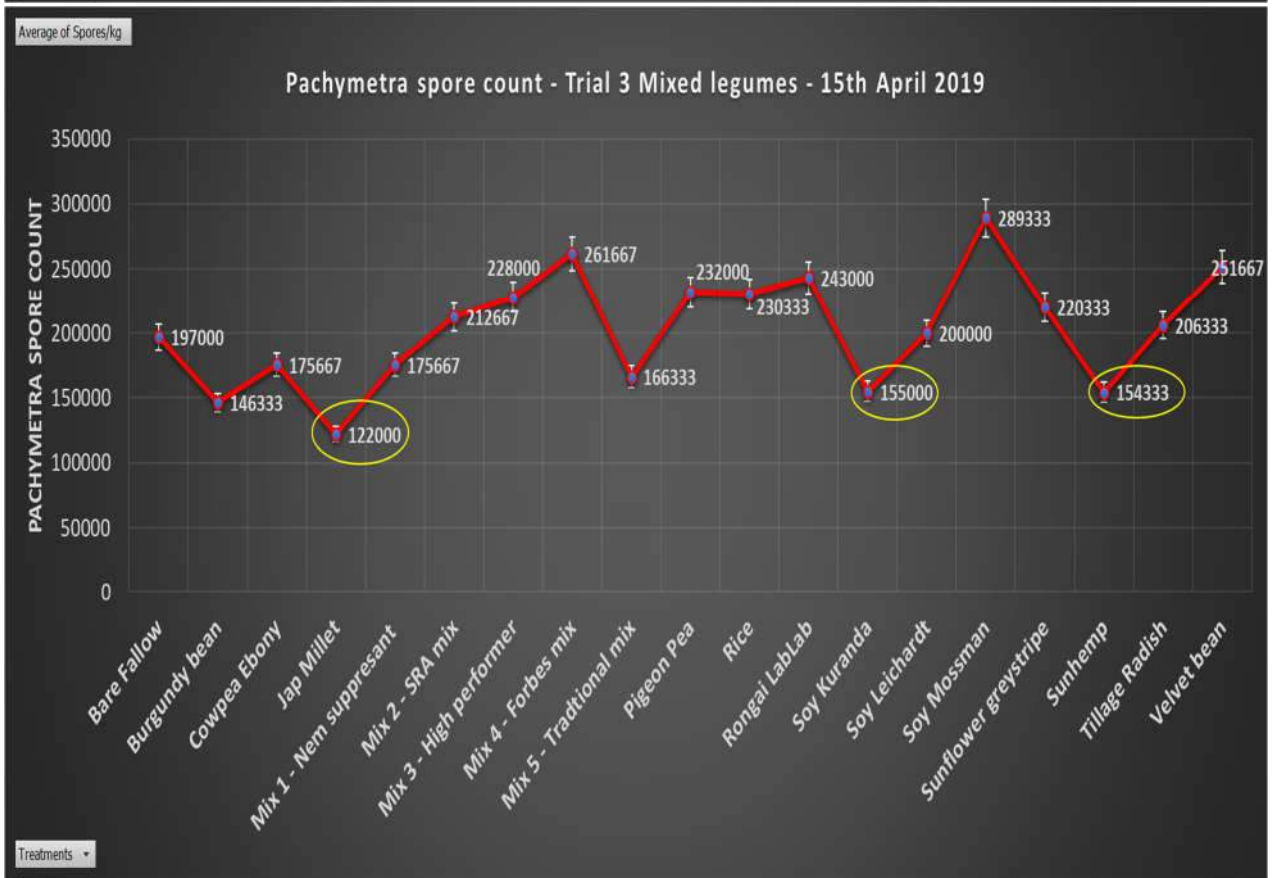
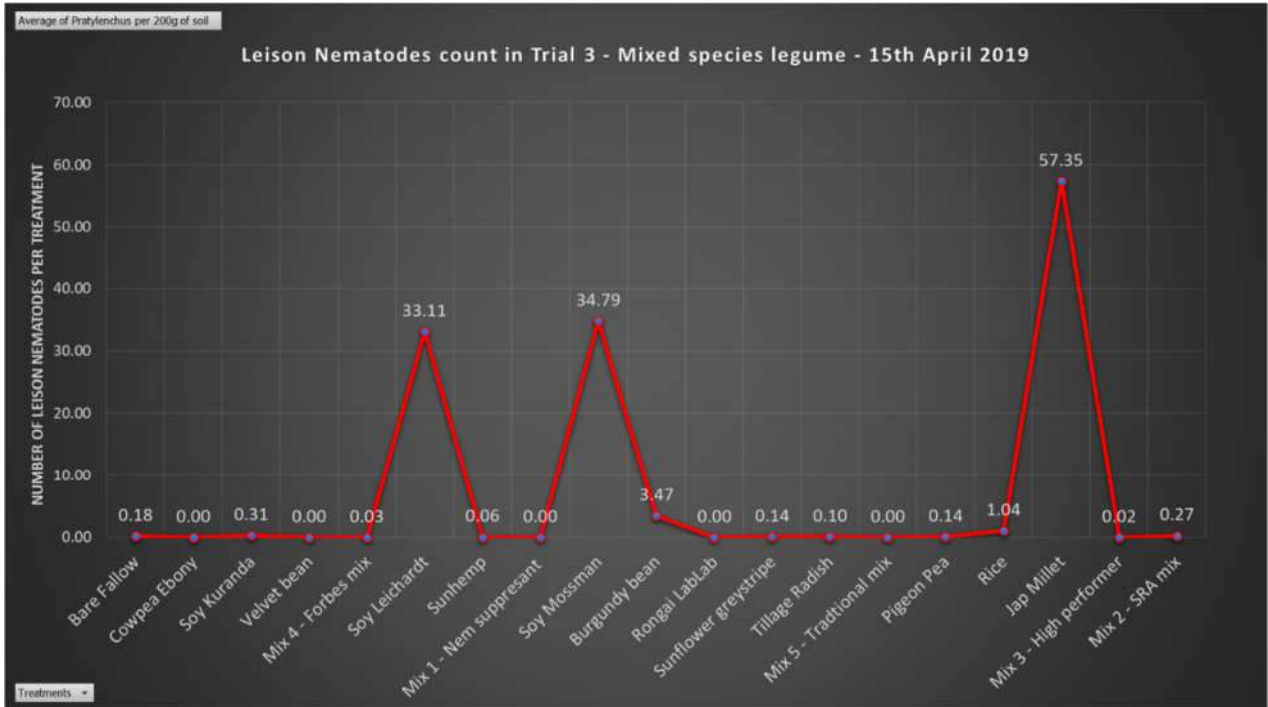




Free-Living Nematode counts – 8th April 2019

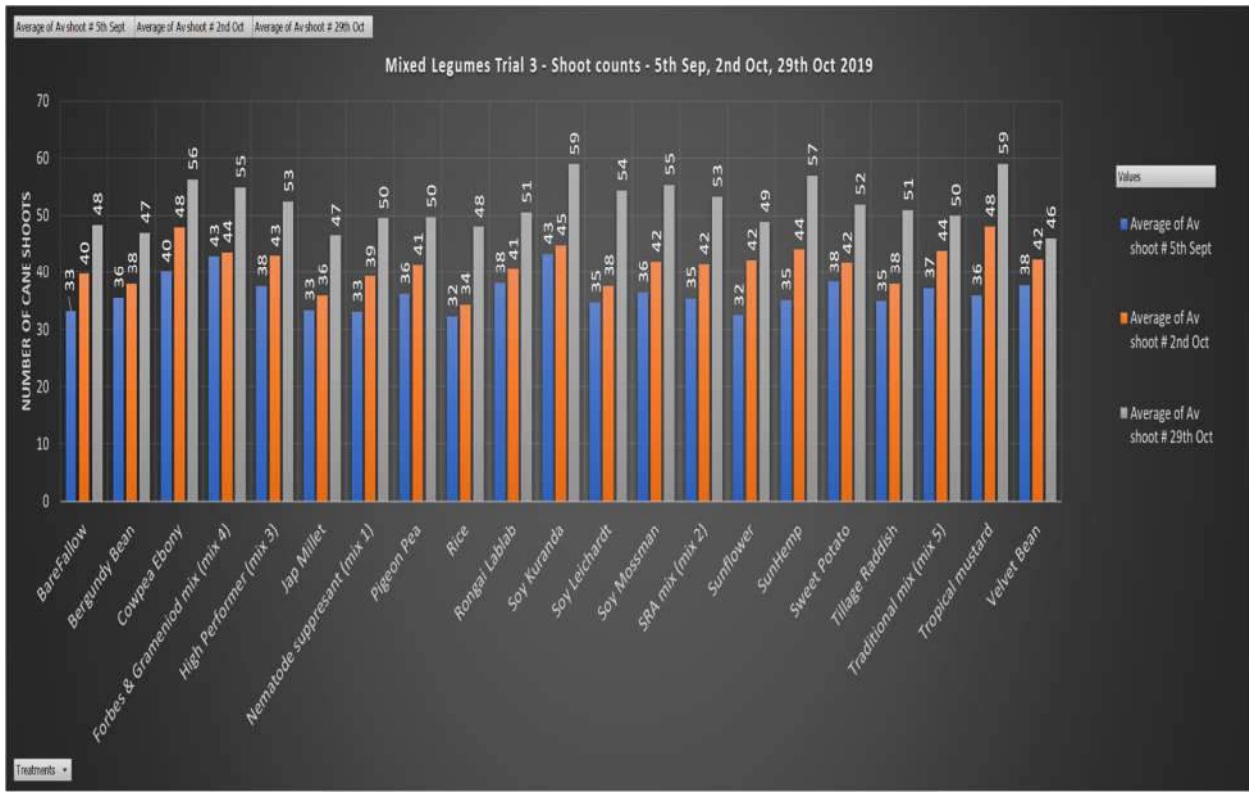


Pathogenic Nematode & Pachymetra results in mixed legume crop April 2019

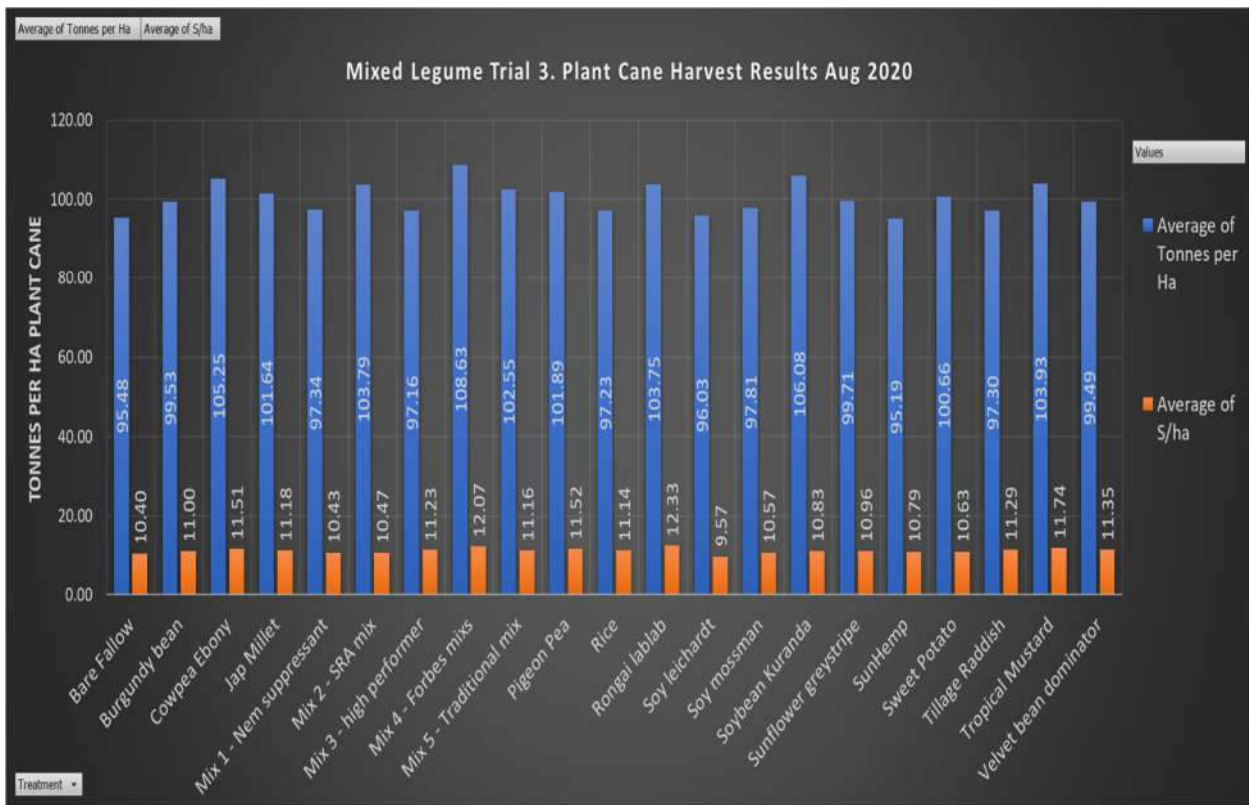


Planted to cane variety Q253 - 27th July 2019

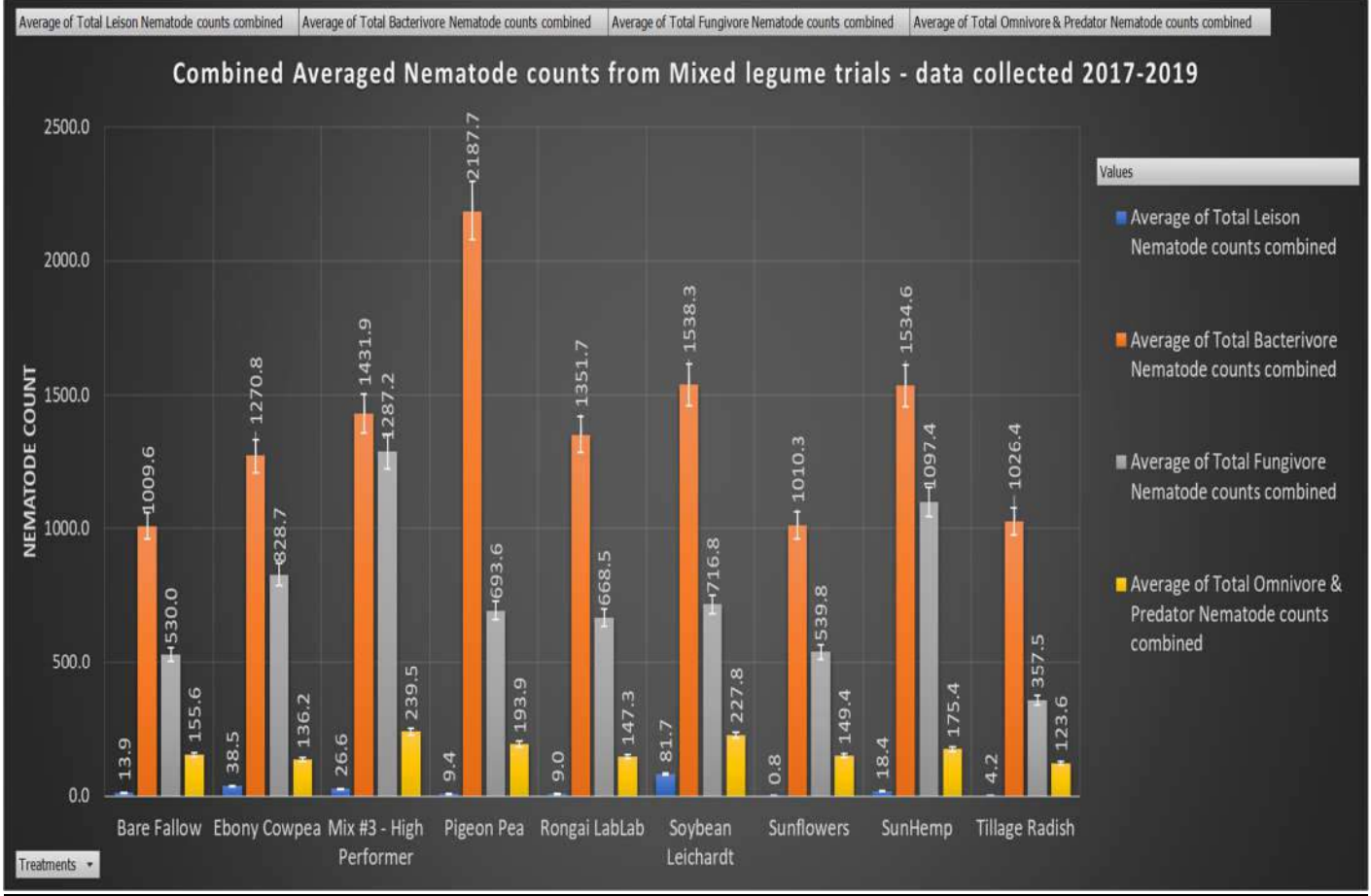
Sugarcane Shoot Counts for the 5th of Sept, 2nd Oct, 29th Oct - 2019



Plant Cane Harvest Data – August 2020



3 years of Nematode Data Combined 2017-2019



Conclusions and comments

This trial has now become one of the CRC for High Performing Soils (HPS) projects. Funding from the CRC HPS will enable root sampling of the biosphere to assess the impact of different fallow plant species.

It has been a very wet season, but the mixed species crops have done well as the different legume's types dominated in the extreme weather events. The cover crops were also successful at reducing erosions under extreme wet weather compared to the bare fallow plots. We have seen differences in pachymetra spore counts in different legume plots and are hopeful that we can use this in future farming practices. There has been consistent data with relations to nematode populations both pathogenic and free-living

Advantages of this Practice Change:

The mixed fallow plots have been very successful in shading out weed species. The crop has provided organic nutrients back to the soil and the grower should be able to reduce the rate of inorganic fertiliser inputs.

Disadvantages of this Practice Change:

- Some legume seeds can be costly.
- The smaller seeded varieties of legumes can be more difficult to spread through a bean planter. Though if weather conditions and soil health permits, seed can be spread with a spinner spreader and harrowed in, which is much easier.

The risk of crop failure would cause loss of income and advantage provided by the fallow crop will not be realised

Will you be using this practice in the future:

Yes

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

All fallow blocks will have a mixed legume crops in the future