Project Catalyst Trial Report

Mixed biodiversity legume cover crop Trial 2

Grower Information	
Grower Name:	Lawrence Di Bella
Entity Name:	RGS Farming Co.
Trial Farm No/Name:	Farm# 0136A B# 2-1
Mill Area:	Victoria
Total Farm Area ha:	100ha
No. Years Farming:	4th generation Cane Farmers
Trial Subdistrict:	Forest Home
Area under Cane ha:	96 hectares under cane

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 there 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
- 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

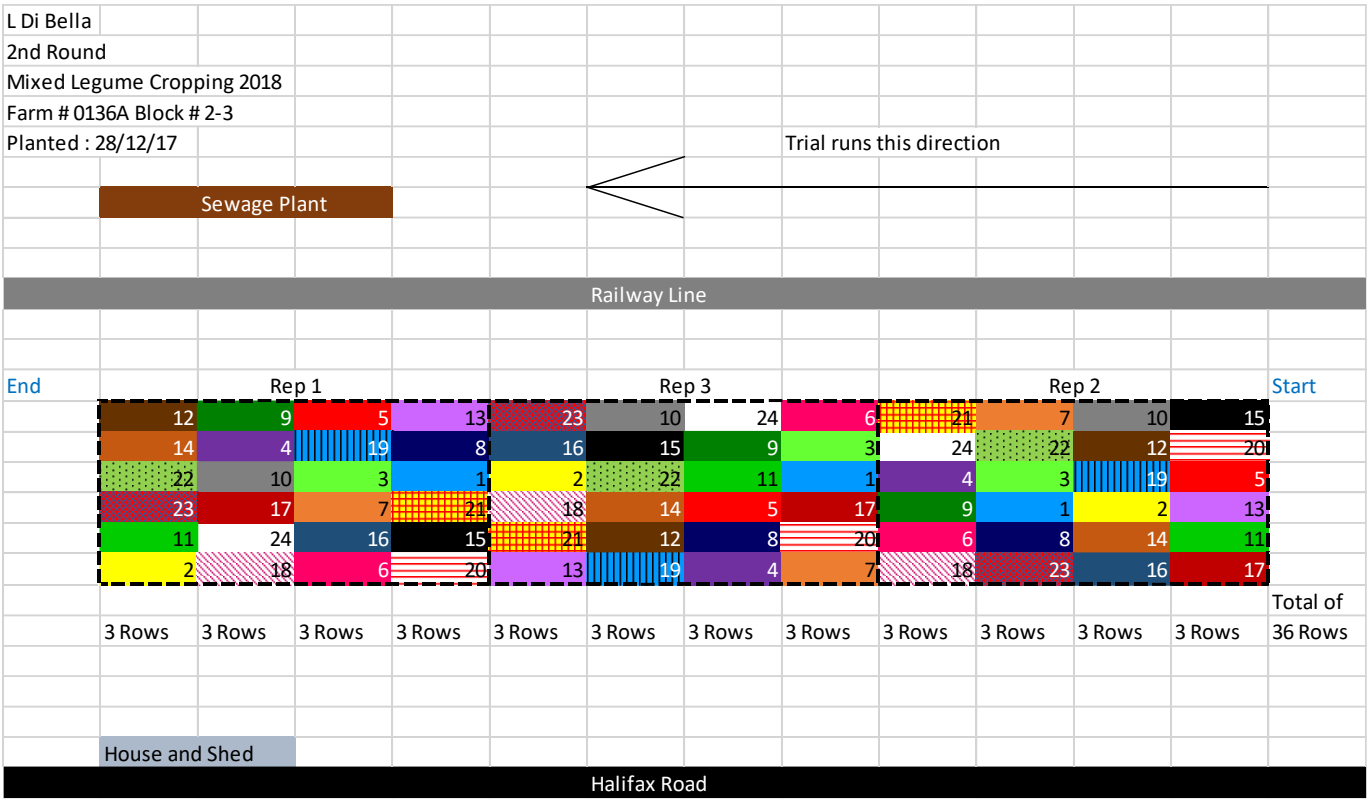
Plan - Project Activities	Date : (mth/year to be undertaken)	Activities :(breakdown of each activity for each stage)
Stage 1	Trial Established 2017-18	Baseline soil nutrition test taken – 4th of Dec 2017 Baseline Pachymetra sample taken - 4th of Dec 2017 Baseline Nematode sampling taken – 30th Jan 2018 Trial Planted on the 27th of Dec 2017 – by Hand
Stage 2	Monitoring, 2018 biomassing and sampling on legume crop 2018	- 2nd Nematode testing – 16th of April 2018 - Legume biomass – Total nutrient analysis for each legume treatment. Nutrient analysis will be done by Volume kg/Ha – 17th of April 2018 - Soil incubation samples – 17th April 2018 - Soil bulk density – 16th April 2018 - Worm populaton test in legumes – 18th 19th &20th April 2018
Stage 3	Establish Plant Cane Crop. Sampling, biomass and CCS. 2018/2019	- Cane planted on the 15th of May 2018. Q253 variety - Stalk counts at 14 days – 19th of June, 28 days – 3rd of July 2018, 122 days – 14th of August 2018 - 3rd leaf nutrient analysis - 29th of Nov 2018 - 7mth biomass of cane crop – 29th Nov 2018 - Biomass at harvest 2019 – if crop isn't too lodged - CCS sampling – At Harvest. 2019
Stage 4	Economics analysis 2019	DAF.
Stage 5		
Stage 6		

Project Trial site details

Trial Crop:	Mixed fallow crop
Variety: **Rat/Plt:**	Planted to sugarcane on the 15th May 2018 Plant Q253 2018
Trial Block No/Name:	Biodiversity in Fallow
Trial Block Size Ha:	0.395ha
Trial Block Position (GPS):	Refer to google earth map
Soil Type:	Alluvial

Block History, Trial Design:

Mill Mud was applied end of 2017 instead of lime.
1.83m row spacing since 2010
Previous crop was Q183 variety



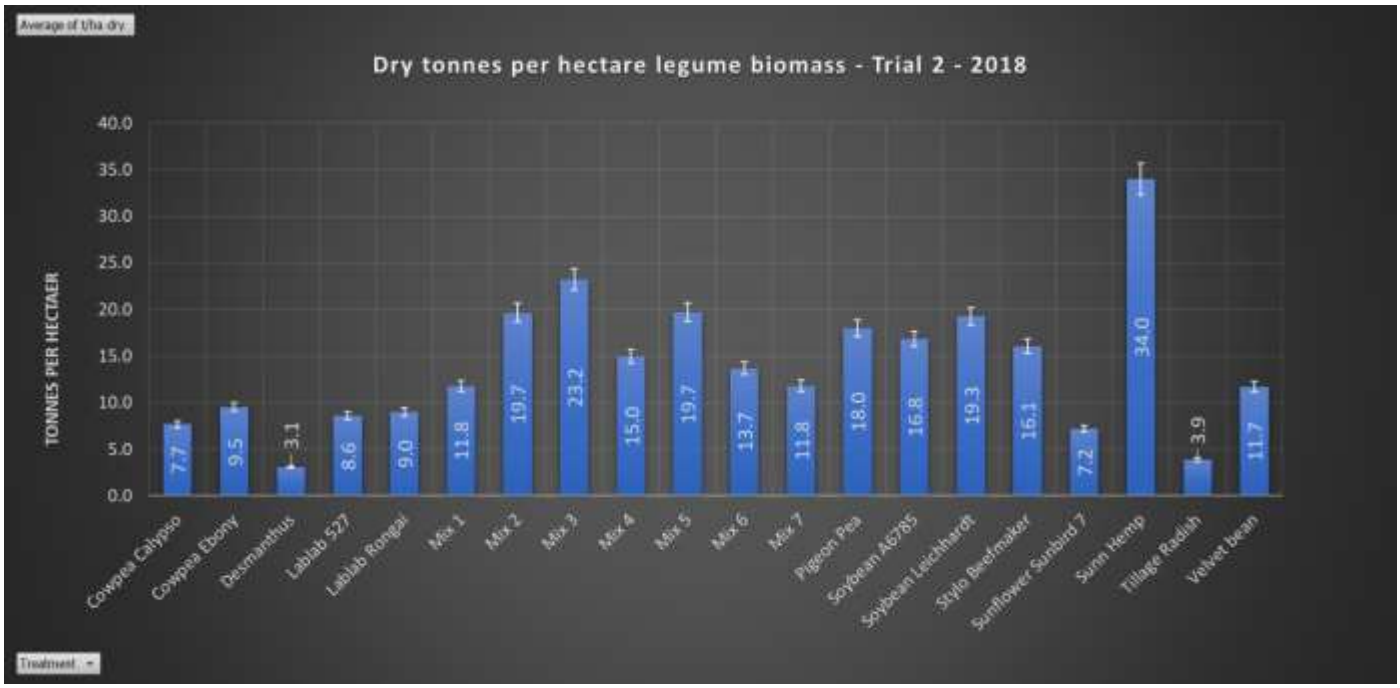
Treatments:

Trt 1	Bare Fallow	
Trt 2	Soybean A6785	
Trt 3	Soybean Leichhardt	
Trt 4	Sunflower Sunbird 7	
Trt 5	Sunn Hemp	
Trt 6	Rongai Lab Lab	
Trt 7	Rongai 527	
Trt 8	Cowpea Ebony	
Trt 9	Cappacino Mustard	
Trt 10	Cowpea Calypso	
Trt 11	Desmanthus Sugarbush	
Trt 12	Pigeon Pea	
Trt 13	Sweet Potato	
Trt 14	Velvet Bean Mix (Rep 2 Painted, Rep 3 Dominator, Rep 1 Cotton)	
Trt 15	Stylo Siran	
Trt 16	Stylo Beefmaker	
Trt 17	Tillage Radish	
Trt 18	Mix 1	Sunflower, Cowpea Mix, Soybean Leichhardt
Trt 19	Mix 2	Sunn Hemp, Cowpea mix, Soybean Leichhardt
Trt 20	Mix 3	Sunn Hemp, Soybean Leichhardt, Cowpea Mix, Rongai Lab Lab
Trt 21	Mix 4	Cowpea Mix, Soybean Leichhardt, Stylo Beefmaker, Tillage Radish
Trt 22	Mix 5	Sunn Hemp, Cowpea Mix, Desmanthus, Soybean Leichhardt
Trt 23	Mix 6	Pigeon Pea, Cowpea Mix, Soybean Leichhardt, Sunflower
Trt 24	Mix 7	Stylo Mix, Cowpea Mix, Lab Lab Mix, Soybean Leichhardt, Sunflower, Tillage Radish, Pigeon Pea and Desmanthus

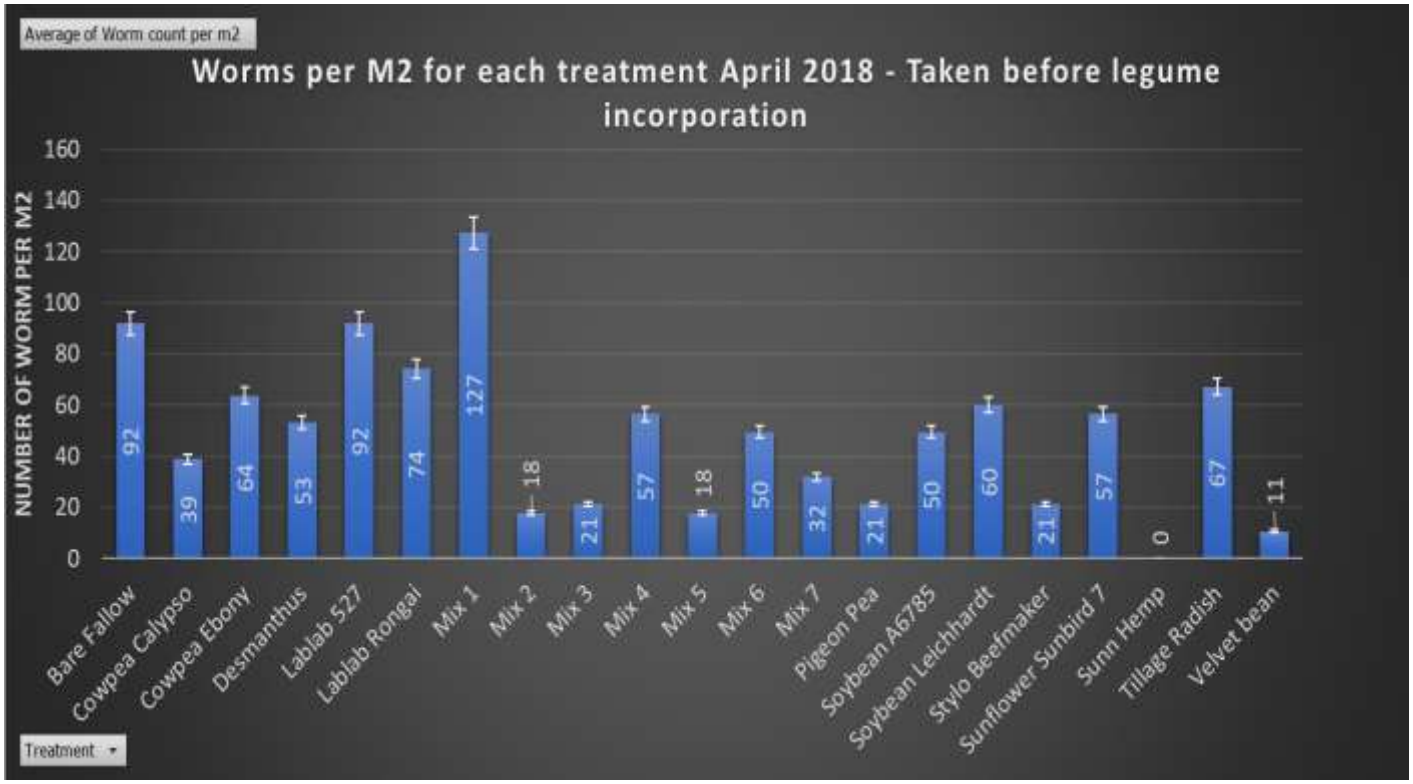
Results:

(Please note that data is still being processed for Trial #2 and will be added to the report soon)

Legume Biomass Dry tonnes per Ha April 2018

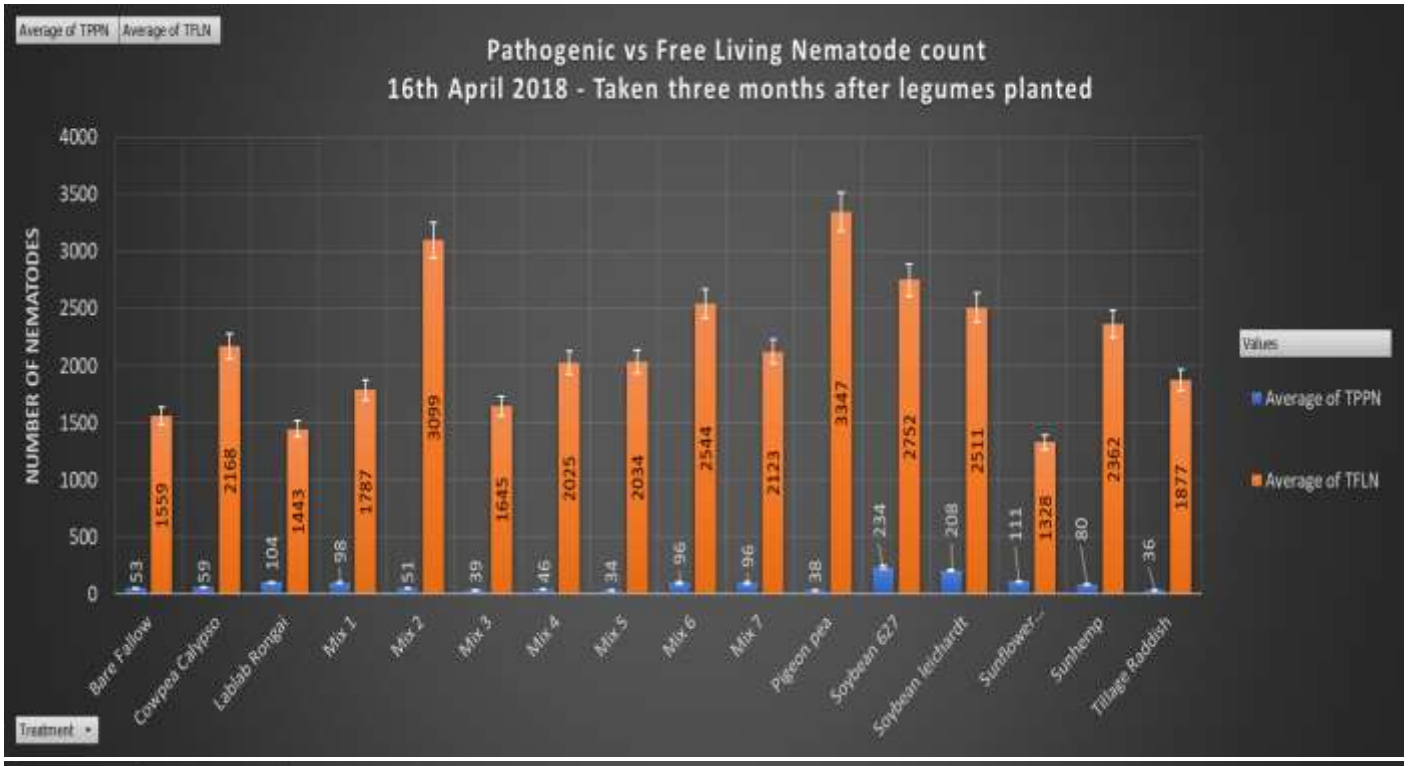


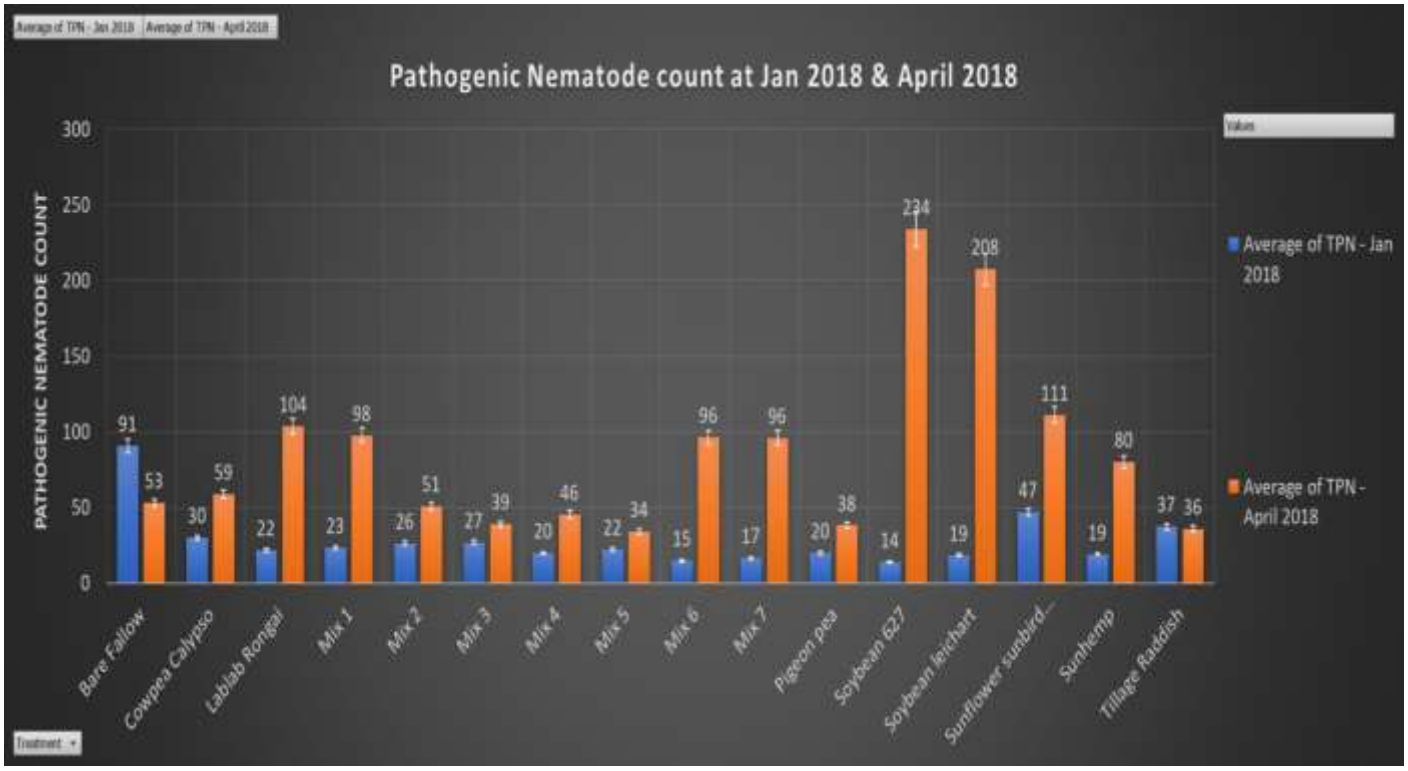
Worm counts per M2 taken in Legume crop – April 2018

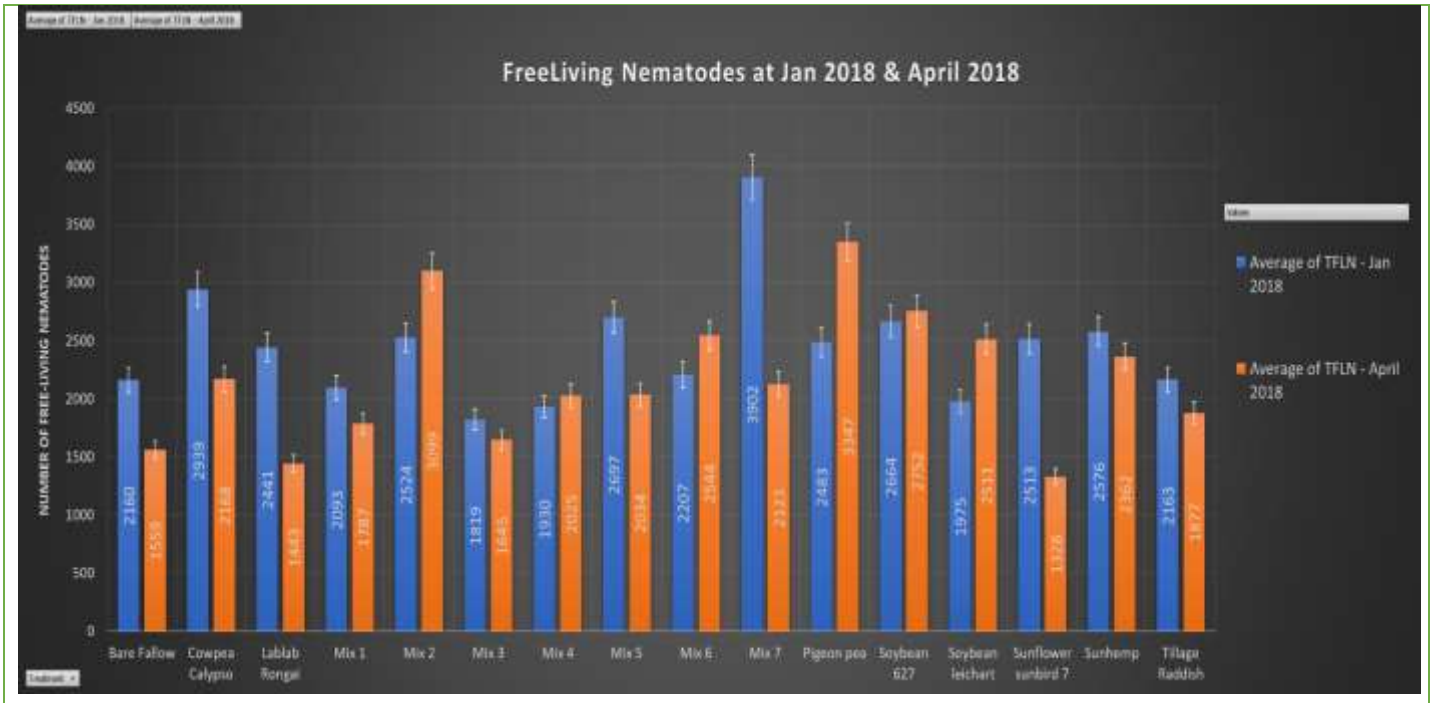


Nematode populations in full grown legume crop

Pathogen vs Freeliving – April 2018

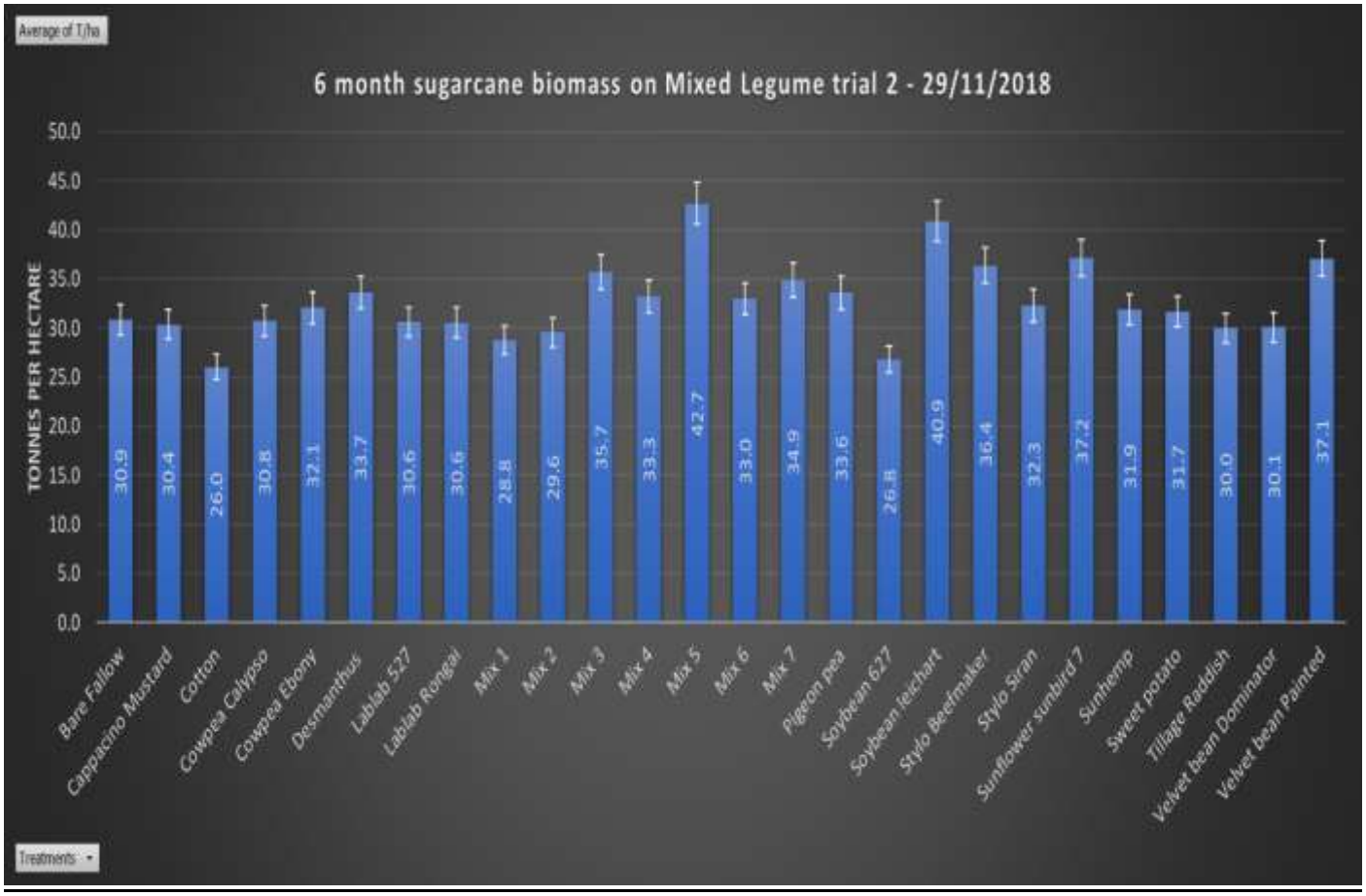




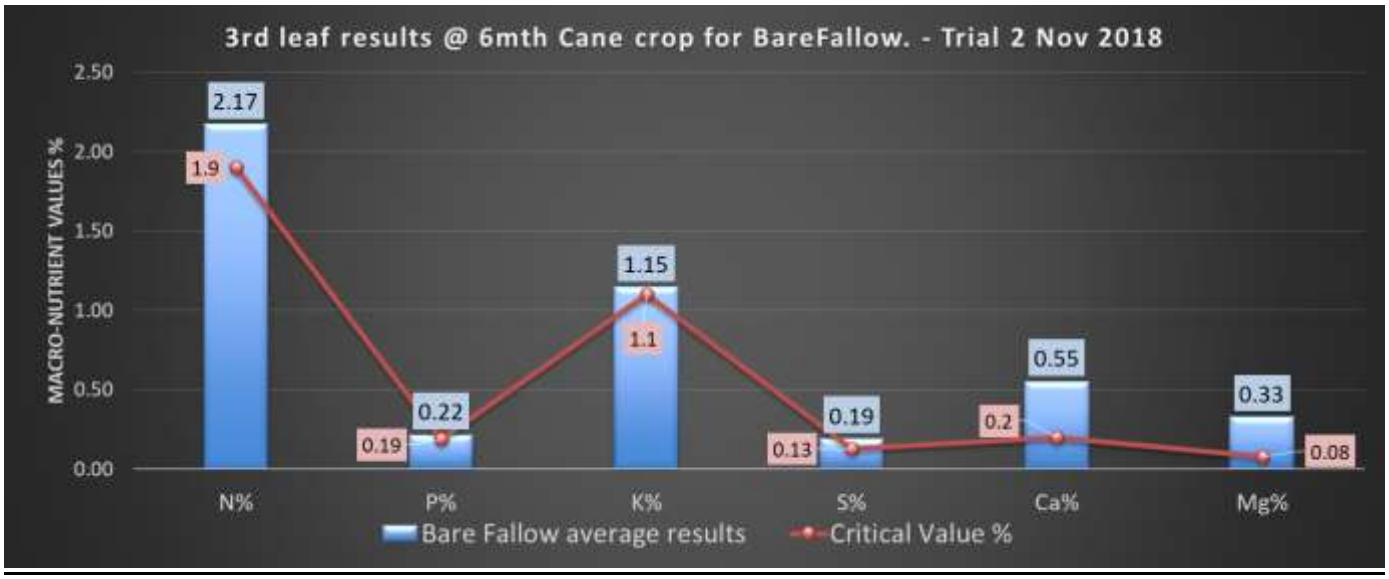


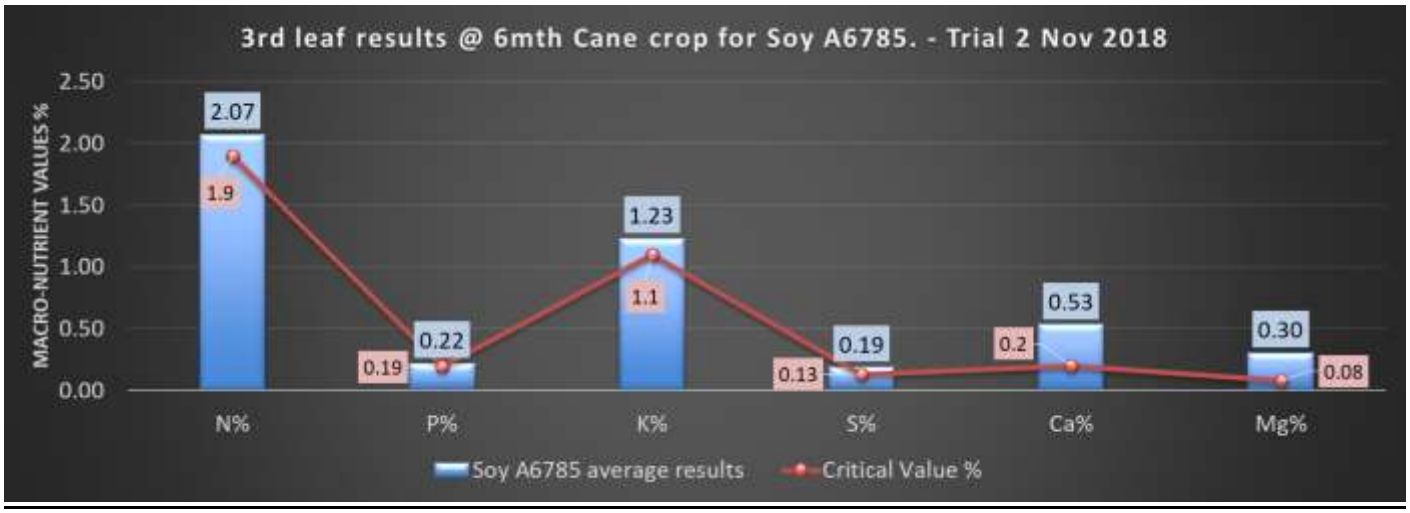
SugarCane results from Mixed Legume Trial 2

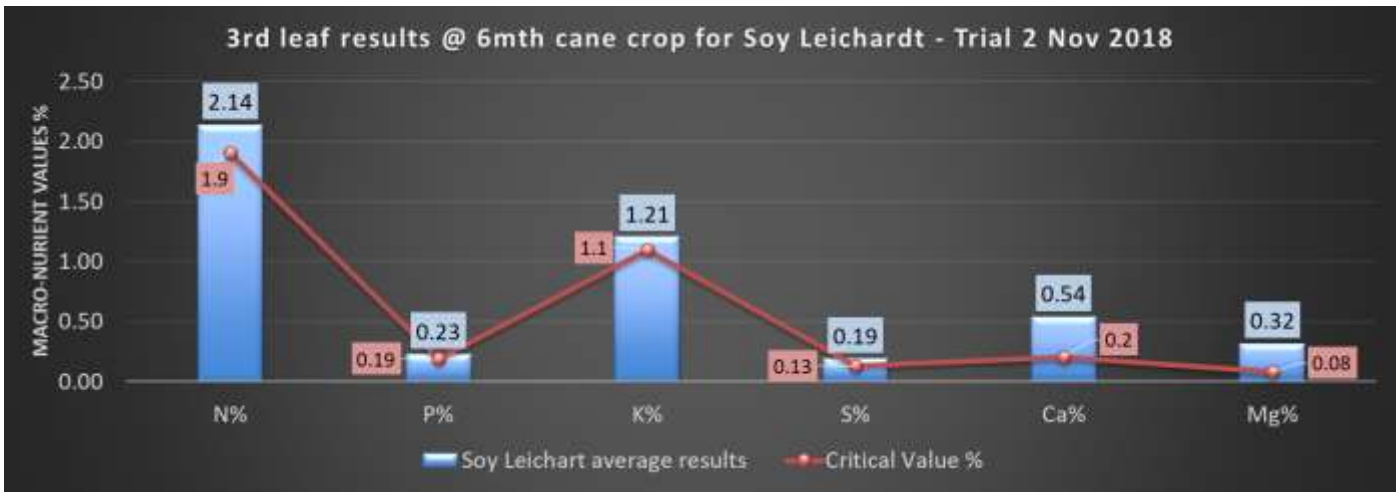
6mth old cane biomass results Nov 2018

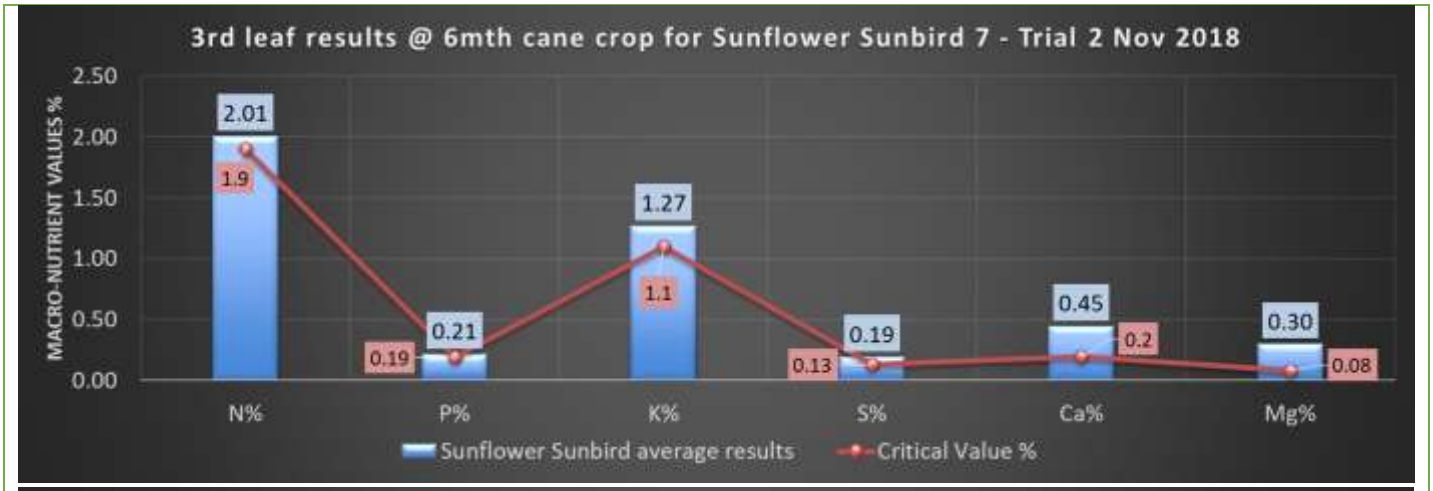


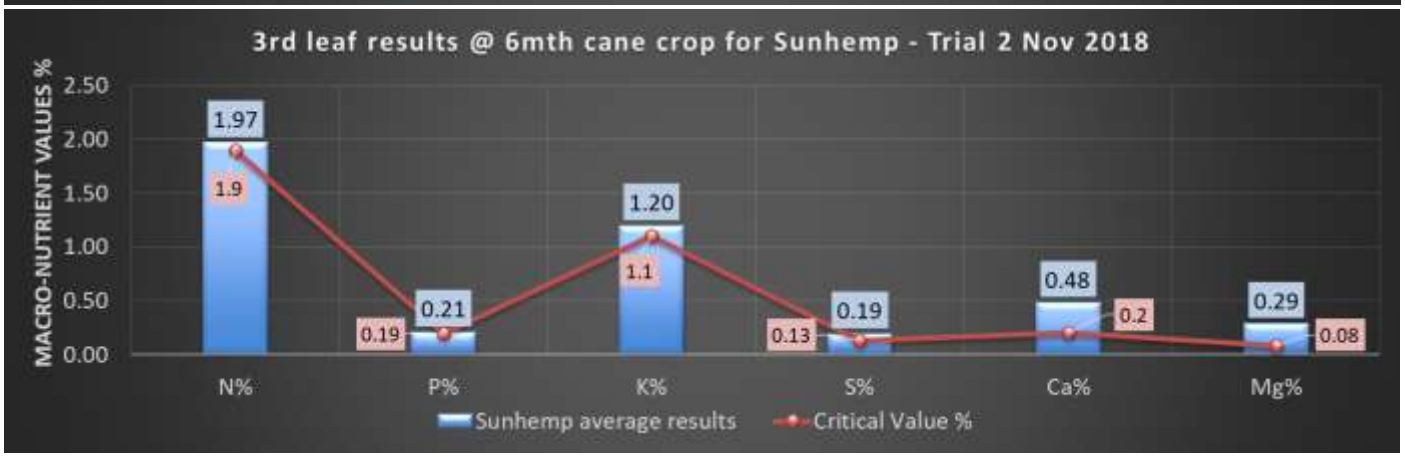
3rd leaf results from cane crop Nov 2018

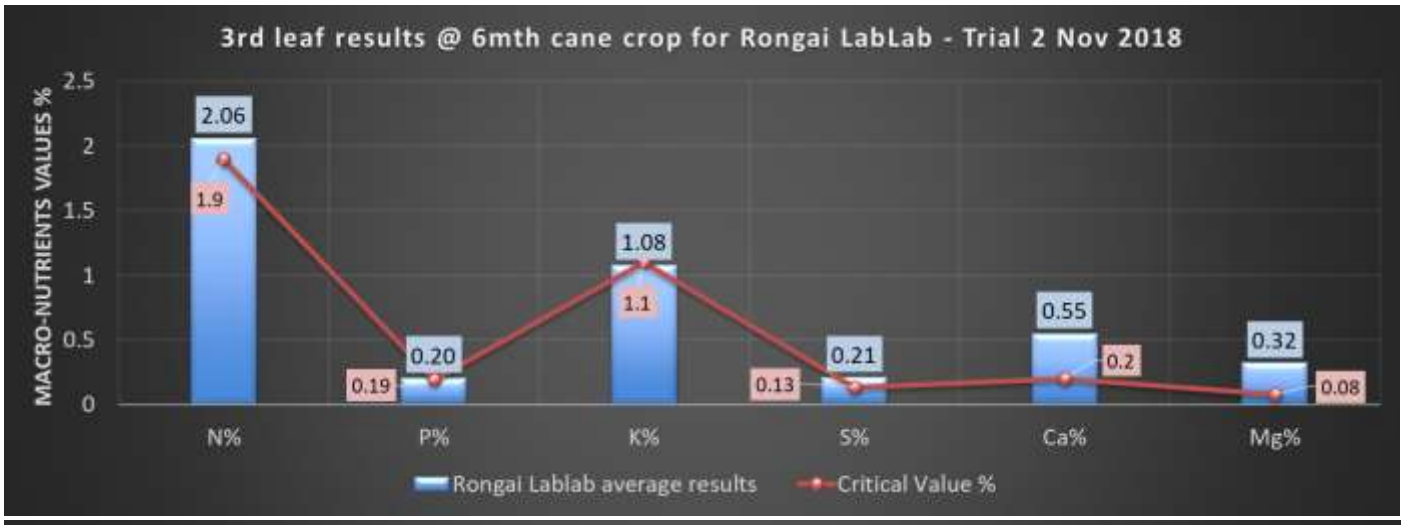


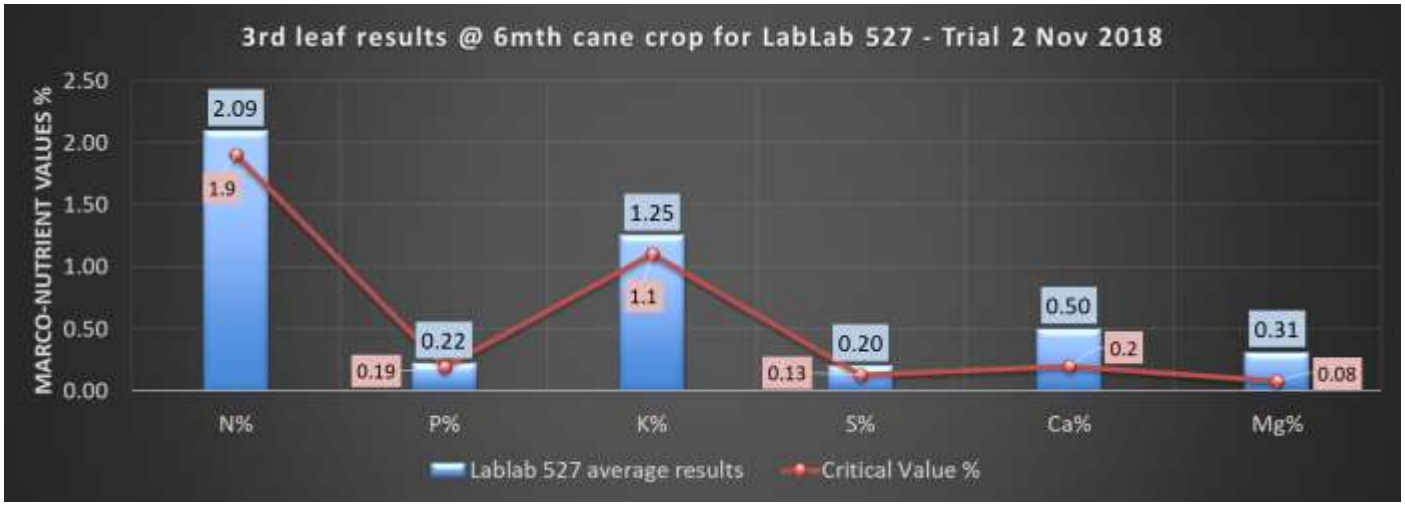


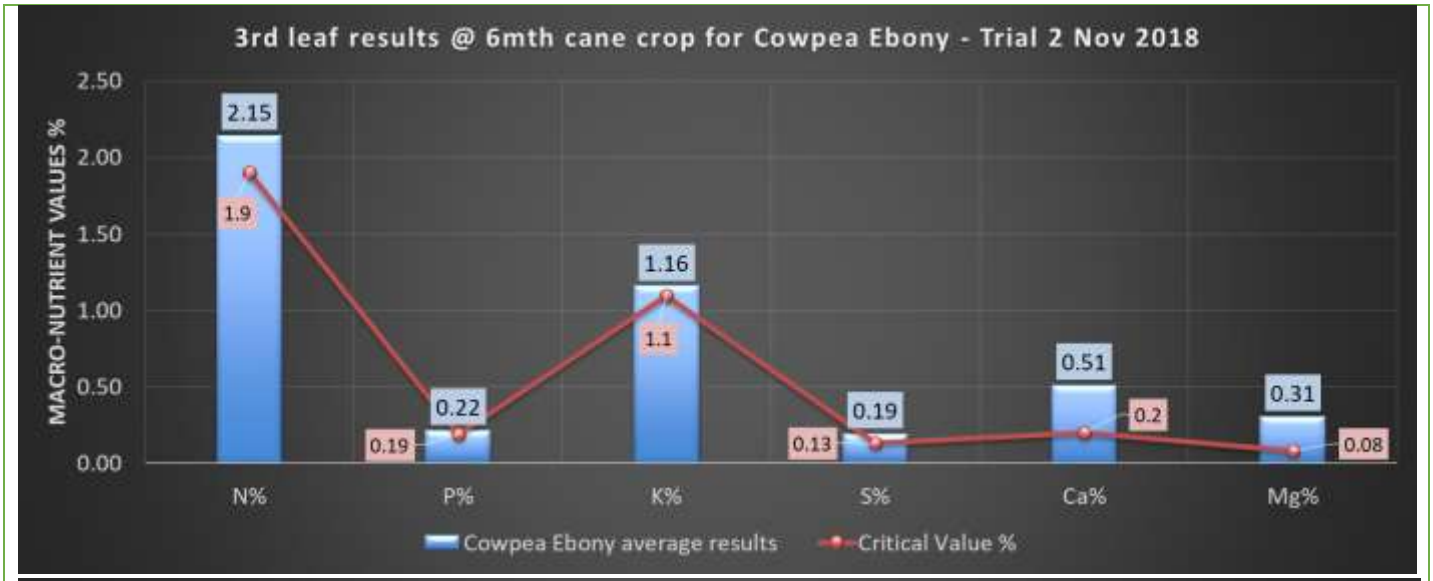


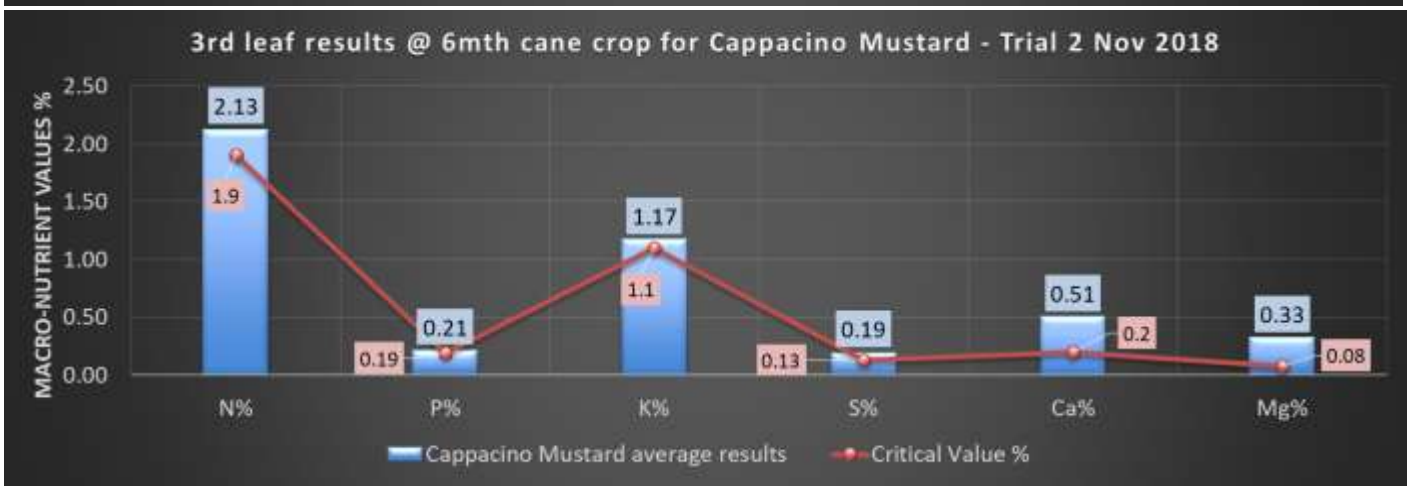

3rd leaf results @ 6mth cane crop for Sunflower Sunbird 7 - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.01
1.9
0.19
0.21
1.27
1.1
0.13
0.19
0.45
0.2
0.30
0.08
N%
P%
K%
S%
Ca%
Mg%
Sunflower Sunbird average results
Critical Value %

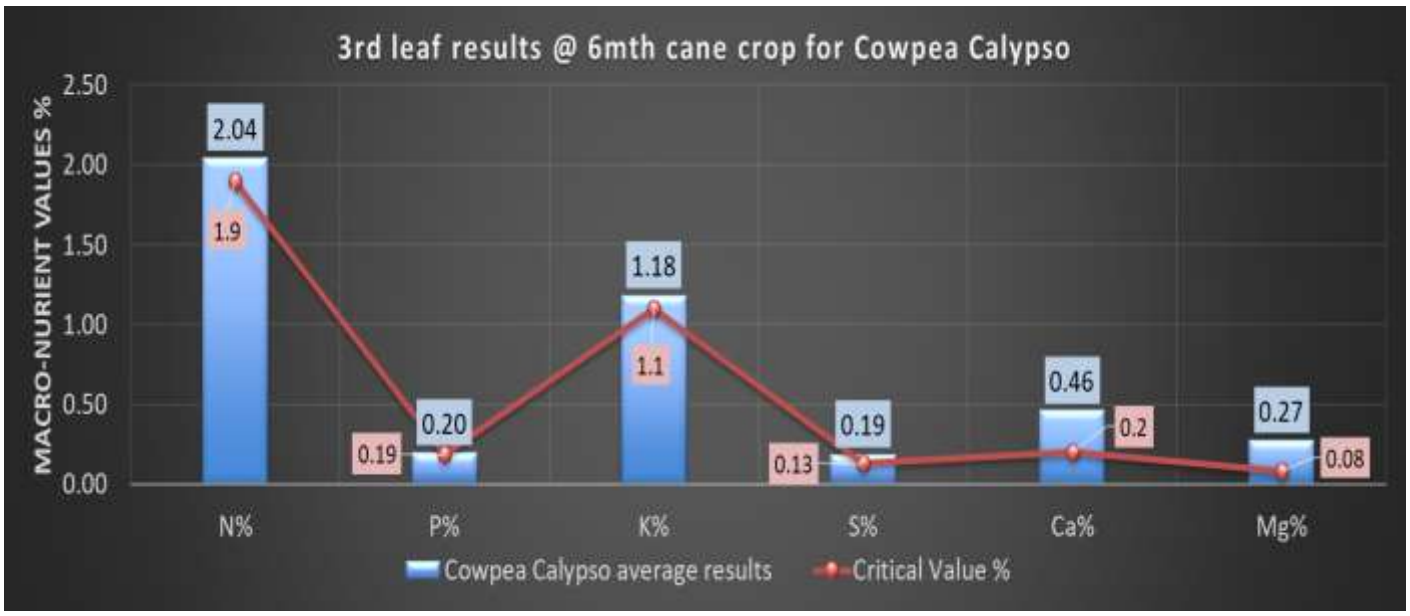

3rd leaf results @ 6mth cane crop for Sunhemp - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
1.97
1.9
0.19
0.21
1.20
1.1
0.13
0.19
0.48
0.2
0.29
0.08
N%
P%
K%
S%
Ca%
Mg%
Sunhemp average results
Critical Value %

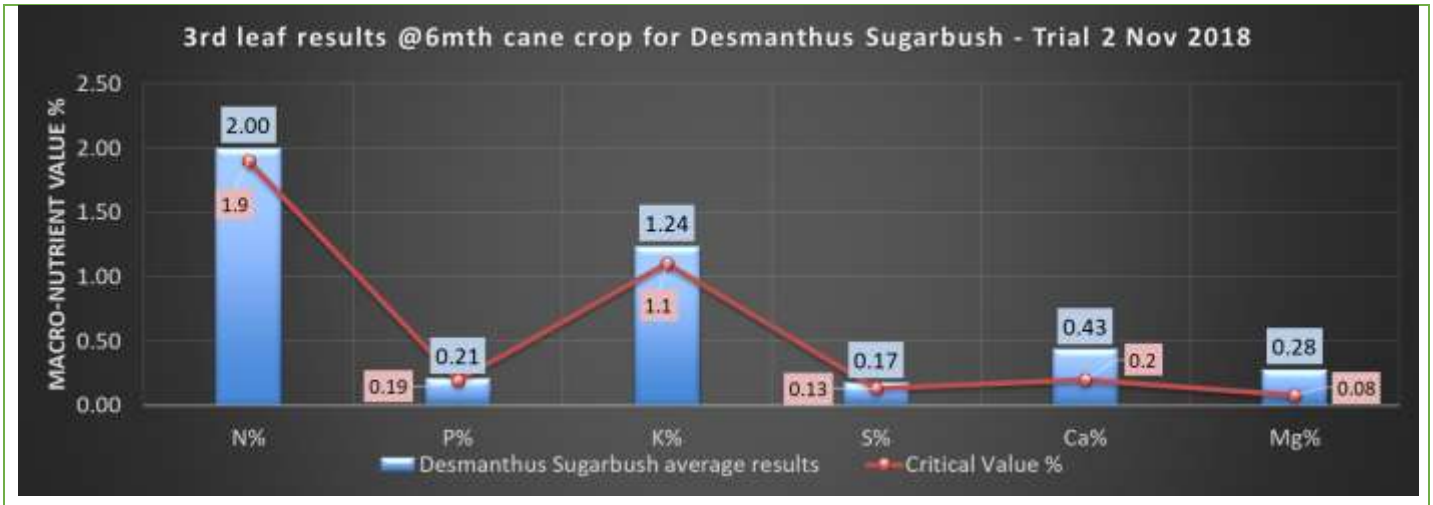

3rd leaf results @ 6mth cane crop for Rongai LabLab - Trial 2 Nov 2018
MACRO-NUTRIENTS VALUES %
2.5
2
1.5
1
0.5
0
2.06
1.9
0.19
0.20
1.08
1.1
0.13
0.21
0.55
0.2
0.32
0.08
N%
P%
K%
S%
Ca%
Mg%
Rongai Lablab average results
Critical Value %

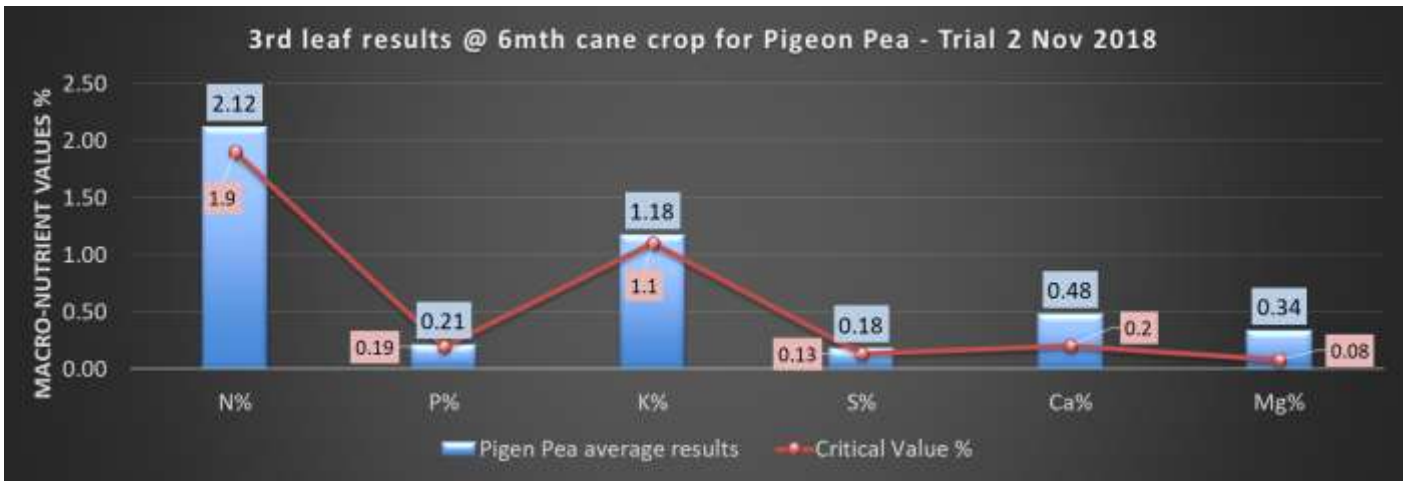

3rd leaf results @ 6mth cane crop for LabLab 527 - Trial 2 Nov 2018
MARCO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.09
1.9
0.19
0.22
1.25
1.1
0.13
0.20
0.50
0.2
0.31
0.08
N%
P%
K%
S%
Ca%
Mg%
Lablab 527 average results
Critical Value %

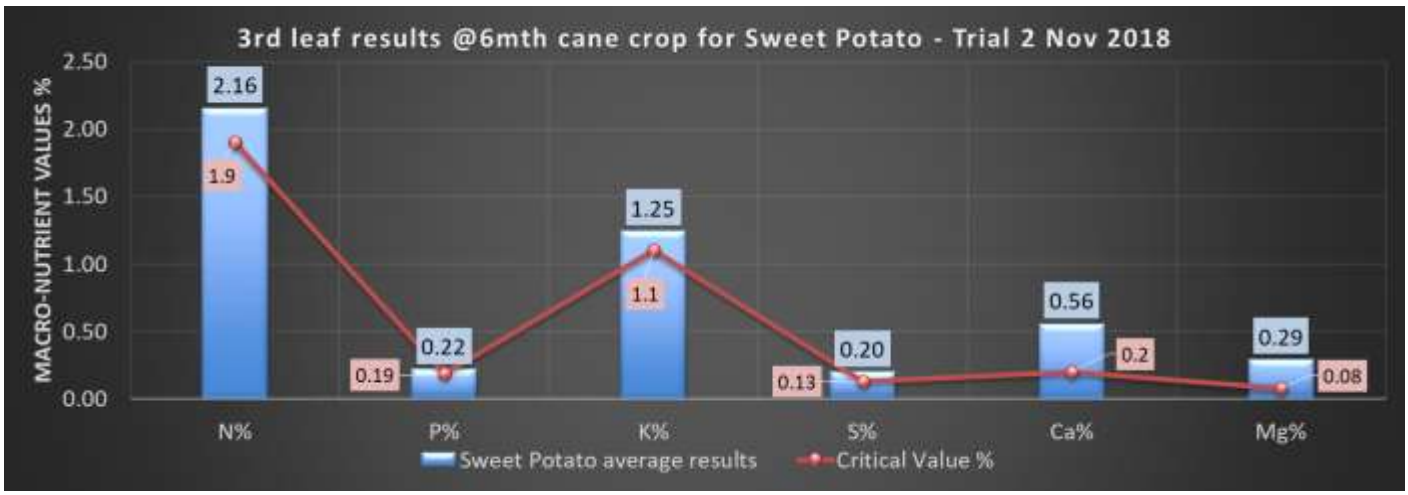

3rd leaf results @ 6mth cane crop for Cowpea Ebony - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.15
1.9
0.19
0.22
1.16
1.1
0.13
0.19
0.51
0.2
0.31
0.08
N%
P%
K%
S%
Ca%
Mg%
Cowpea Ebony average results
Critical Value %

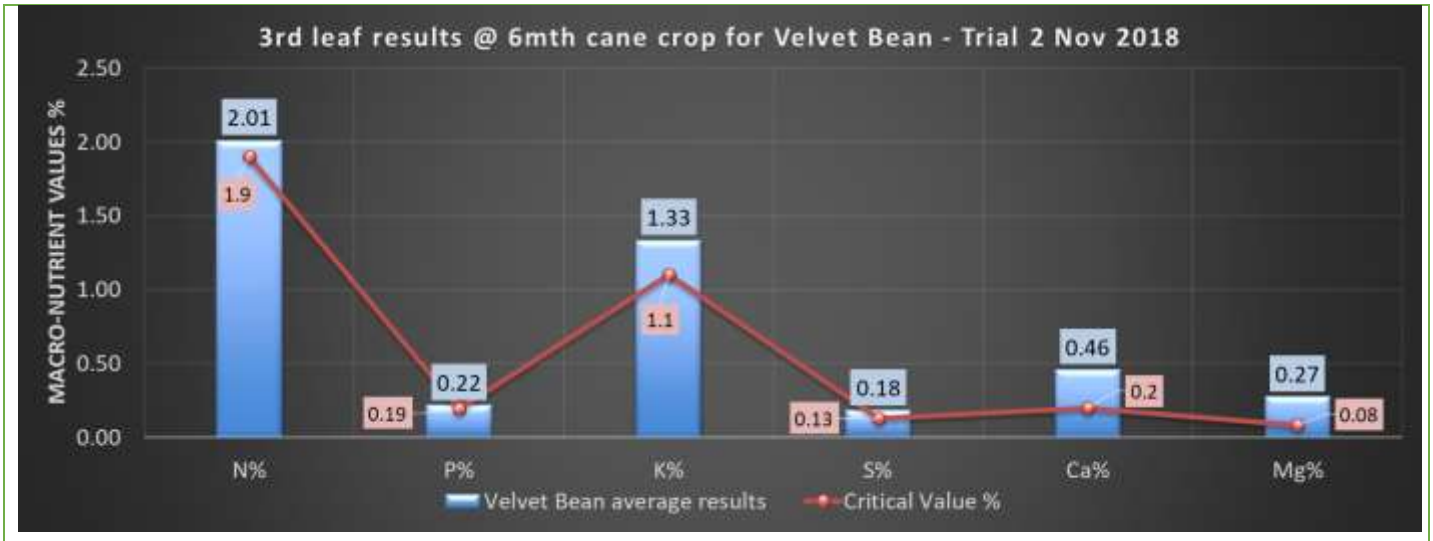

3rd leaf results @ 6mth cane crop for Cappacino Mustard - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.13
1.9
0.19
0.21
1.17
1.1
0.13
0.19
0.51
0.2
0.33
0.08
N%
P%
K%
S%
Ca%
Mg%
Cappacino Mustard average results
Critical Value %

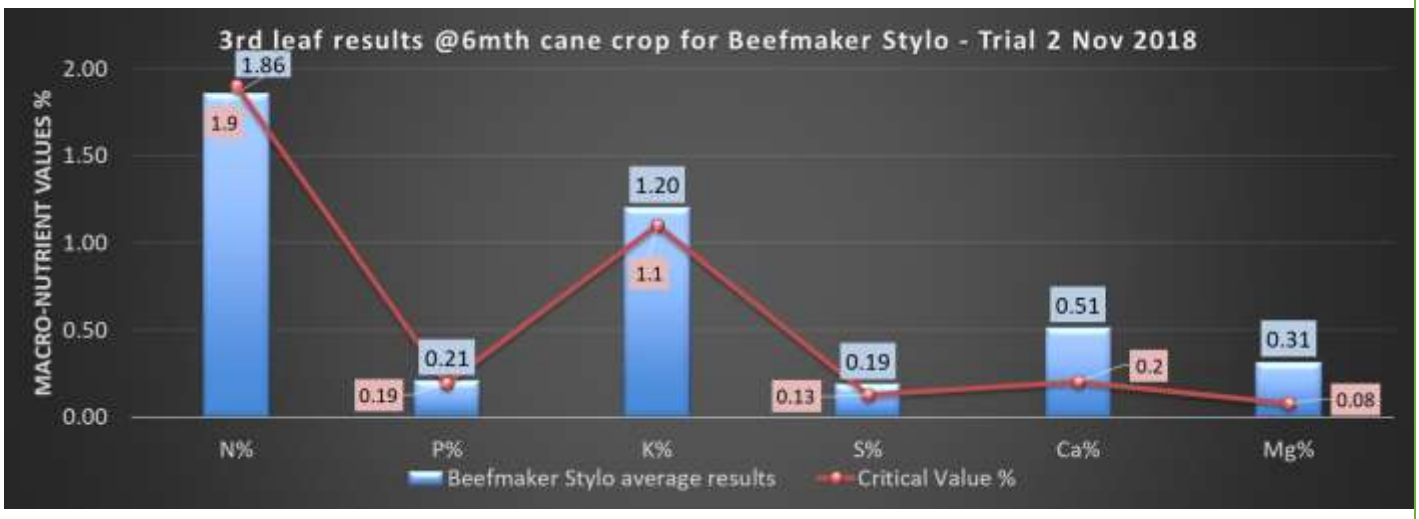

3rd leaf results @ 6mth cane crop for Cowpea Calypso
MACRO-NURIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.04
1.9
0.19
0.20
1.18
1.1
0.13
0.19
0.46
0.2
0.27
0.08
N%
P%
K%
S%
Ca%
Mg%
Cowpea Calypso average results
Critical Value %

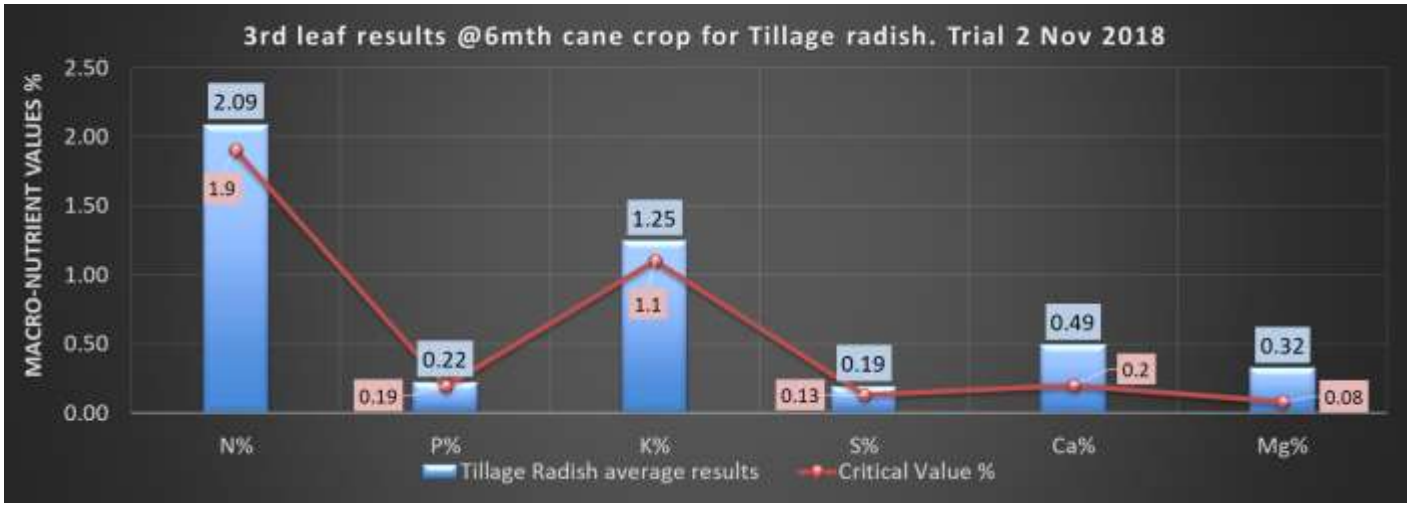

3rd leaf results @6mth cane crop for Desmanthus Sugarbush - Trial 2 Nov 2018
MACRO-NUTRIENT VALUE %
2.50
2.00
1.50
1.00
0.50
0.00
2.00
1.9
0.19
0.21
1.24
1.1
0.13
0.17
0.43
0.2
0.28
0.08
N%
P%
K%
S%
Ca%
Mg%
Desmanthus Sugarbush average results
Critical Value %

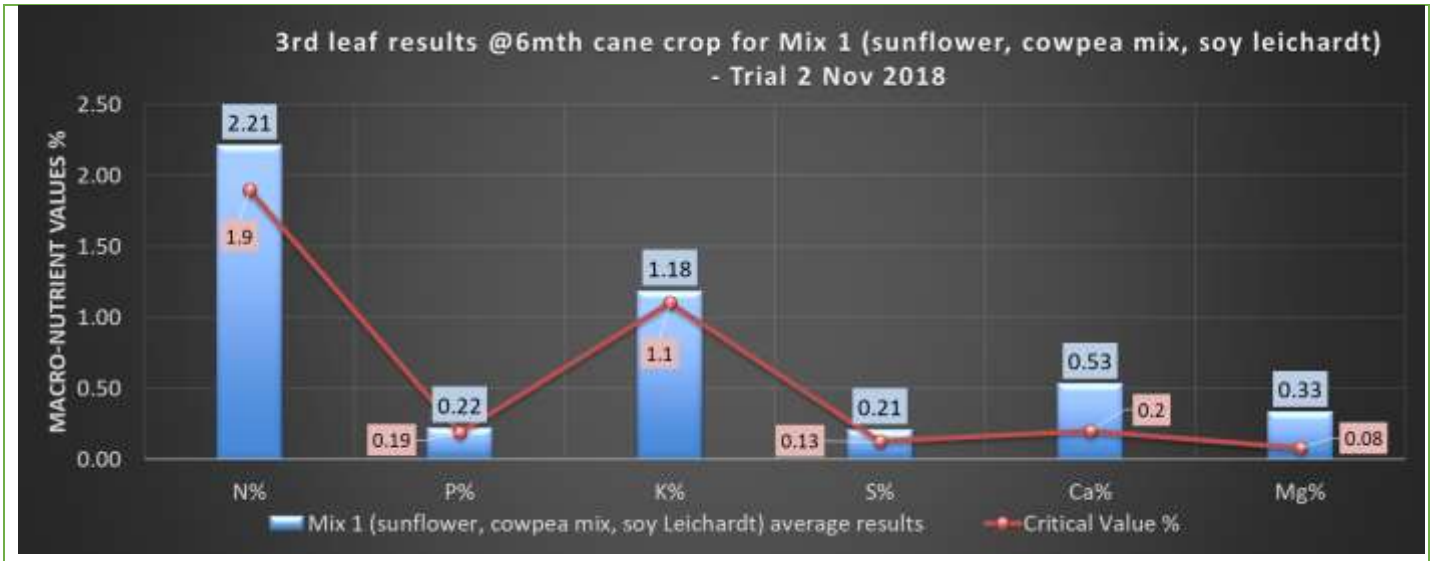

3rd leaf results @ 6mth cane crop for Pigeon Pea - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.12
1.9
0.19
0.21
1.18
1.1
0.13
0.18
0.48
0.2
0.34
0.08
N%
P%
K%
S%
Ca%
Mg%
Pigen Pea average results
Critical Value %

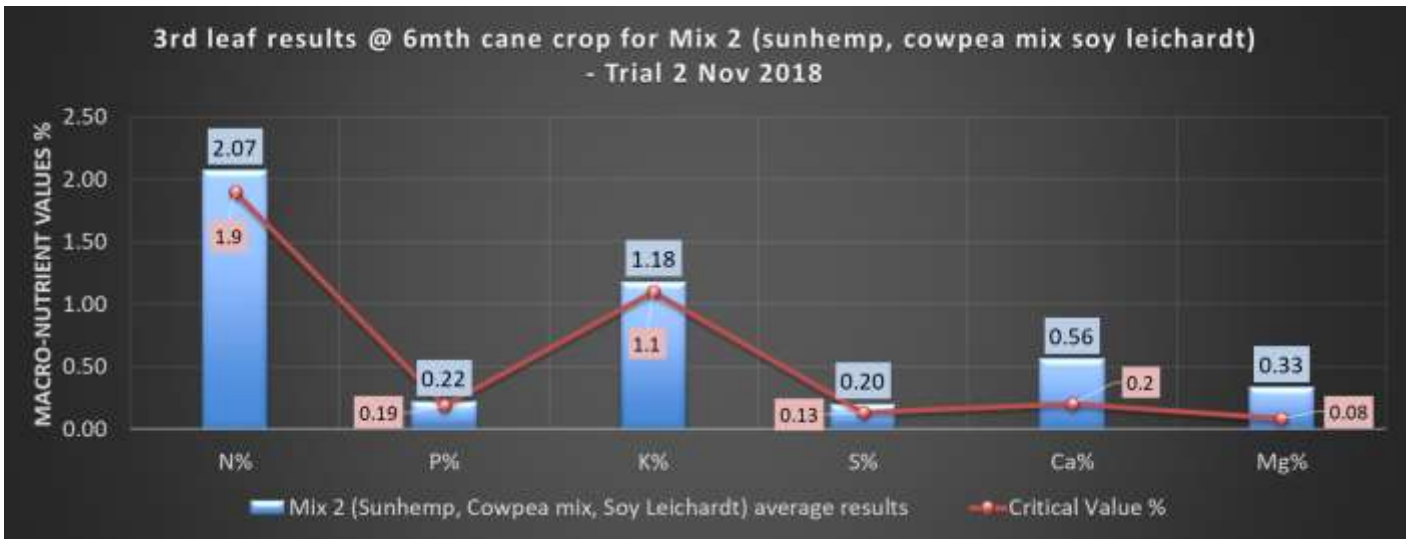

3rd leaf results @6mth cane crop for Sweet Potato - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.16
1.9
0.19
0.22
1.25
1.1
0.13
0.20
0.56
0.2
0.29
0.08
N%
P%
K%
S%
Ca%
Mg%
Sweet Potato average results
Critical Value %


3rd leaf results @ 6mth cane crop for Velvet Bean - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.01
1.9
0.19
0.22
1.33
1.1
0.13
0.18
0.46
0.2
0.27
0.08
N%
P%
K%
S%
Ca%
Mg%
Velvet Bean average results
Critical Value %


3rd leaf results @6mth cane crop for Beefmaker Stylo - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.00
1.50
1.00
0.50
0.00
1.86
1.9
0.19
0.21
1.20
1.1
0.13
0.19
0.51
0.2
0.31
0.08
N%
P%
K%
S%
Ca%
Mg%
Beefmaker Stylo average results
Critical Value %

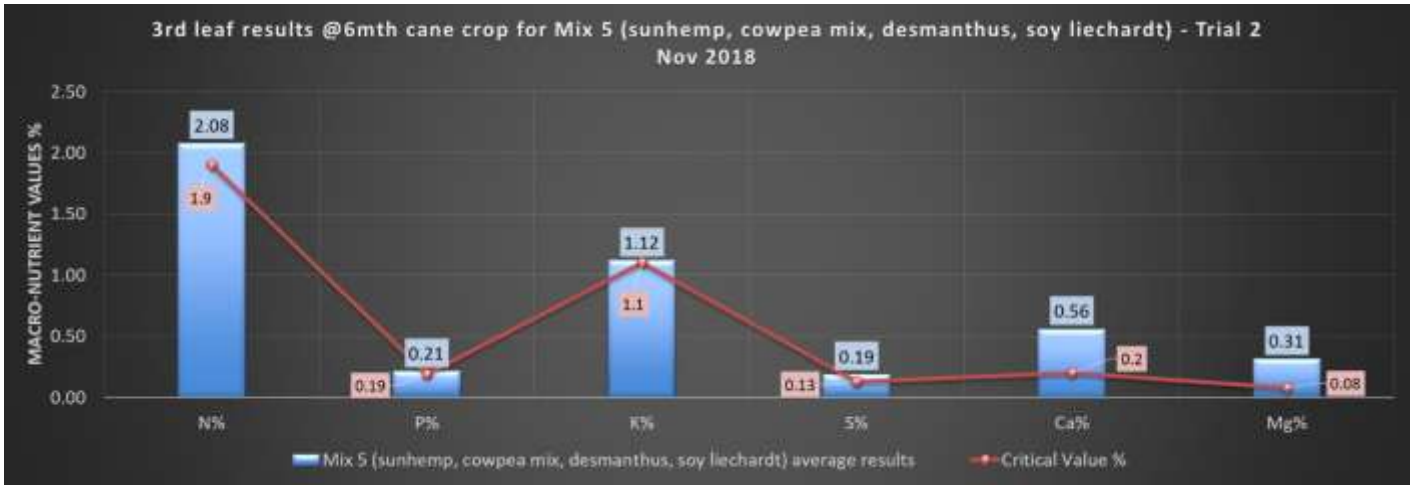

3rd leaf results @6mth cane crop for Tillage radish. Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.09
1.9
0.19
0.22
1.25
1.1
0.13
0.19
0.49
0.2
0.32
0.08
N%
P%
K%
S%
Ca%
Mg%
Tillage Radish average results
Critical Value %

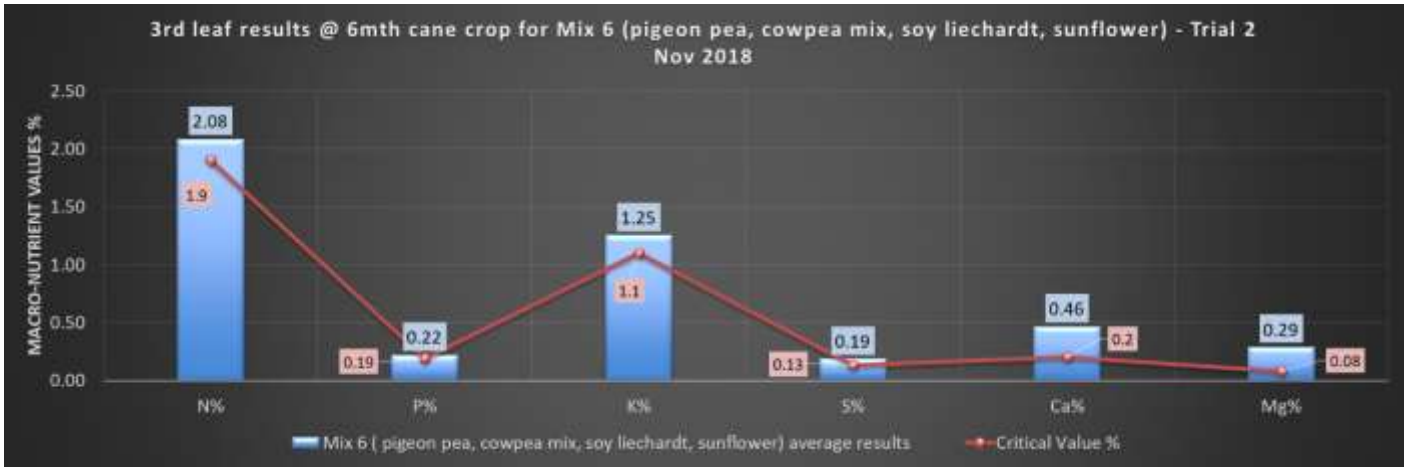

3rd leaf results @6mth cane crop for Mix 1 (sunflower, cowpea mix, soy leichardt) - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.21
1.9
0.19
0.22
1.18
1.1
0.13
0.21
0.53
0.2
0.33
0.08
N%
P%
K%
S%
Ca%
Mg%
Mix 1 (sunflower, cowpea mix, soy Leichardt) average results
Critical Value %

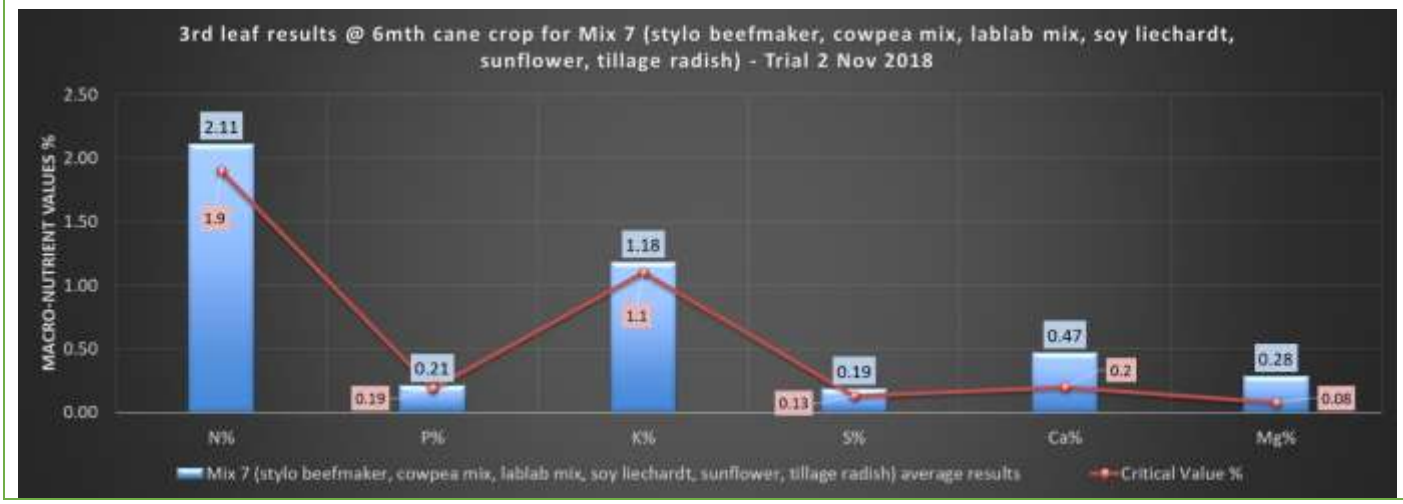

3rd leaf results @ 6mth cane crop for Mix 2 (sunhemp, cowpea mix soy leichardt) - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.07
1.9
0.19
0.22
1.18
1.1
0.13
0.20
0.56
0.2
0.33
0.08
N%
P%
K%
S%
Ca%
Mg%
Mix 2 (Sunhemp, Cowpea mix, Soy Leichardt) average results
Critical Value %


3rd leaf results @6mth cane crop for Mix 3 (sunhemp, soy leichardt, cowpea mix, rongai lablab) - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.16
1.9
0.19
0.22
1.16
1.1
0.13
0.20
0.54
0.2
0.33
0.08
N%
P%
K%
S%
Ca%
Mg%
Mix 3 (sunhemp,soy leichardt, cowpea mix, Rongai LabLab) average results
Critical Value %

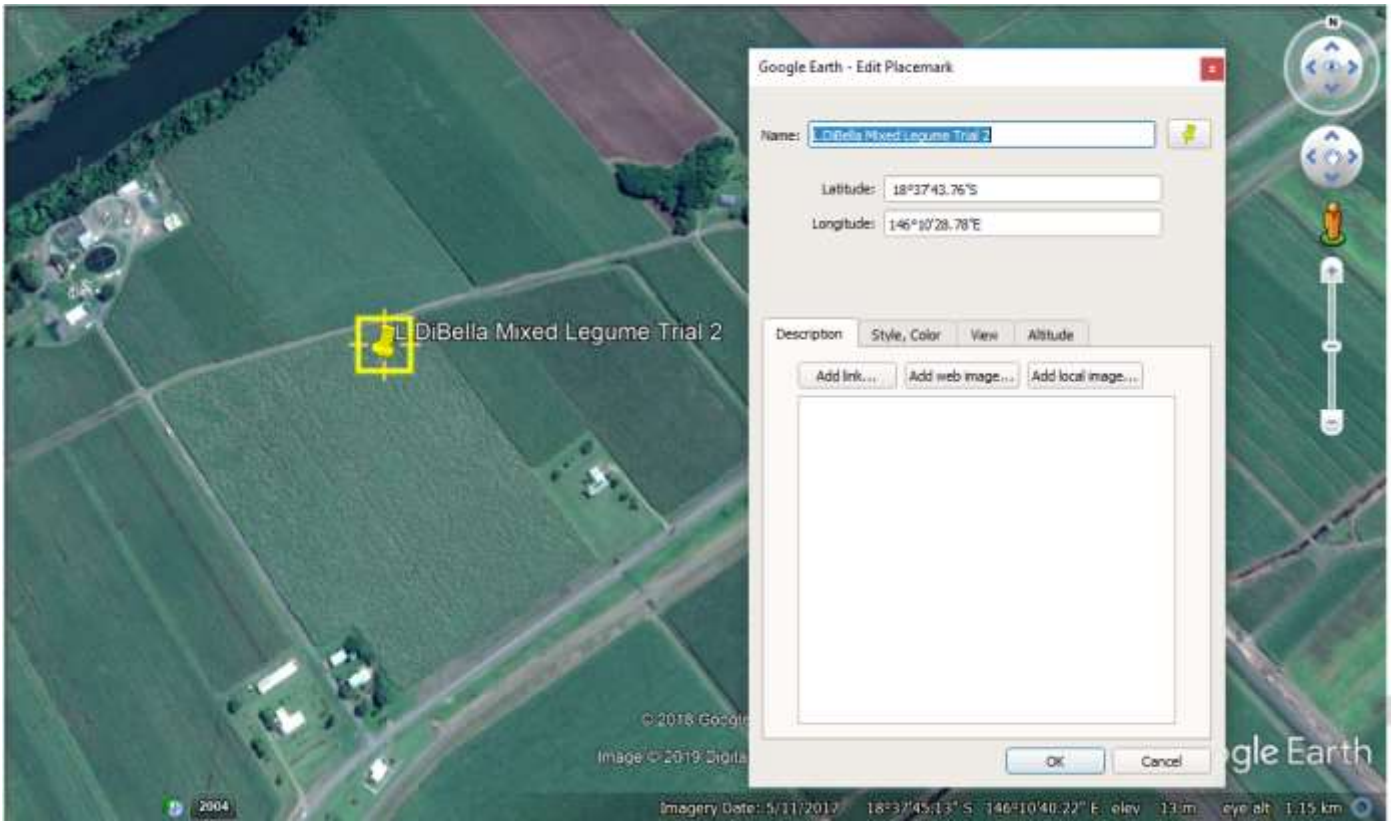

3rd leaf results @6mth cane crop for Mix 4 (cowpea mix, soy liechardt, stylo beefmaker, tillage radish) - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.20
1.9
0.19
0.21
1.15
1.1
0.13
0.19
0.59
0.2
0.32
0.08
N%
P%
K%
S%
Ca%
Mg%
Mix 4 (cowpea mix, soy liechardt, stylo beefmaker, tillage radish) average results
Critical Value %


3rd leaf results @6mth cane crop for Mix 5 (sunhemp, cowpea mix, desmanthus, soy liechardt) - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.08
1.9
0.19
0.21
1.12
1.1
0.13
0.19
0.56
0.2
0.31
0.08
N%
P%
K%
S%
Ca%
Mg%
Mix 5 (sunhemp, cowpea mix, desmanthus, soy liechardt) average results
Critical Value %


3rd leaf results @ 6mth cane crop for Mix 6 (pigeon pea, cowpea mix, soy liechardt, sunflower) - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.08
1.9
0.19
0.22
1.25
1.1
0.13
0.19
0.46
0.2
0.29
0.08
N%
P%
K%
S%
Ca%
Mg%
Mix 6 (pigeon pea, cowpea mix, soy liechardt, sunflower) average results
Critical Value %


3rd leaf results @ 6mth cane crop for Mix 7 (stylo beefmaker, cowpea mix, lablab mix, soy liechardt, sunflower, tillage radish) - Trial 2 Nov 2018
MACRO-NUTRIENT VALUES %
2.50
2.00
1.50
1.00
0.50
0.00
2.11
1.9
0.19
0.21
1.18
1.1
0.13
0.19
0.47
0.2
0.28
0.08
N%
P%
K%
S%
Ca%
Mg%
Mix 7 (stylo beefmaker, cowpea mix, lablab mix, soy liechardt, sunflower, tillage radish) average results
Critical Value %

Google Earth Reference Map



Conclusions and comments

The trial has produced some interesting data that is showing positive effects from having such a mixed crop. The trial will continue into 2019 plant harvest. The next block has been chosen for 2019 to put another mixed legume crop to further assess the effects in fallow systems.
Legume crops that have been unsuccessfully grown this year were the Stylo Siran. This variety of stylo didn't germinate due to weather conditions. Cappocino Mustard has also been unsuccessful as a cover crop so far. This crop is more suited to cooler climates and didn't grow well with the hot summer season. Perhaps it would have been more successful as a winter cover crop and not a summer cover crop. Tillage radish seems to grow better within the mixed species crops. Once again suited more to the cooler climates of winter, though mixed with a variety of legumes and other plants the tillage radish takes advantage of the shade and coolness provided and grew well enough to see the benefits in the fallow system.
Harvest biomass and CCS results are still to come with the harvest season which starts in late June 2019.

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 was able to reduce the rate of inorganic fertiliser inputs. Only 35kg of N/ha from an inorganic source was used to grow the crop to harvest.

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 advantages 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.