Research Topic 2: Ground Prep, Fallow Management, Bed Formation

Research Topic 3: Pre-plant and Post Plant Nutrition

Research Site/Demonstration Number: SA02WB-01 and SA03WB-03

Grower Collaborator: Littabella Pines

Location 1: South Littabella Road, Yandaran

Start Date: December 2018

Outline: To evaluate the potential of crop mulching and fallow cropping to reduce or eliminate the need for pre-plant nutrition and post-plant side dressing practices, and reduce fertiliser losses into the environment.

Phase 1: To evaluate the benefits of mulching (application and timing) against traditional crop destruction practices. Targeting improved soil and plant health.

Phase 2: To evaluate the benefits of breaking the pineapple monoculture with inter-fallow cropping to improve soil health and crop nutrition.

Phase 3: To evaluate the potential of reducing or eliminating pre-plant fertiliser and post-plant side dressing, through supplementing nutritional requirements through post plant foliar fertiliser programs.

Definition – Mulching is the maceration of the previous crop.

Objectives:

Phase 1:

1) To improve the methodology, application and timing of crop destruction practices.

2) To better utilise the nutrition from previous crop residue and reduce pre-plant fertiliser requirements and costs for the next cropping cycle.

3) To improve soil biology and measure the impact on soil borne disease.

4) To compare costs of mulching against traditional crop destruction practices.

Phase 2:

1) To successfully incorporate fallow cropping methodology, application and timing for better pineapple production systems.

2) To evaluate the nutritional benefits from inter-fallow cropping to reduce fertiliser cost for the next cropping cycle.

3) To compare cost effectiveness of inter-fallow cropping in pineapple production practices.

Phase 3:

1) To undertake a cropping cycle with reduced or no pre-plant fertiliser.

2) To undertake a cropping cycle with no side dressing.

3) To undertake a cropping cycle with the primary source of nutrition being foliar fertiliser applications.

Methodology:

The trial site followed a previous crop of Smooth Cayenne that was taken to ratoon, and was harvested in February 2019. There were major issues of *Phytophthora* root rot and extremely high levels of nematode.

Trial location with previous standing ratoon crop.

Trial Map of standing ratoon crop

Demonstration Practice:

Treatment Number	Treatment
Treatment 1 (new approach) Fields 1A, 1B and 1C	Phase 1: - 1 pass with mulcher - Immediate 1 pass with rotary hoe - 20 tonnes / ha chicken manure - 1 pass with rotary hoe Phase 2: - 3 different inter-fallow crops planted: (1A) rye grass, (1B) oats (1C) barley. - Fallow crops were destroyed 4 months into the fallow period Phase 3: - standard pre-plant and post plant pesticide practices - minimal pre-plant fertiliser and no side dressing - foliar fertiliser fortnightly from 2 months of age
Treatment 2 (standard treatment) Field 2	Phase 1: - 4 - 6 passes with rotary hoe Phase 2: - fallow ground with no ground cover Phase 3: - standard pre-plant and post plant pesticide and fertiliser practices: nutritional requirements as per soil analysis.

Assessment/Evaluation Method and Delivery Schedule:

Assessment and Evaluation Method	Assessment and Evaluation Delivery Schedule
Nematode counts	Standing ratoon, pre-plant and 12 months
Soil analysis – nutrition, soil health characteristics	At crop destruction and at pre-plant
Crop residue and breakdown of leaf, butts, trash.	Period from 0 – 6 months prior to planting
Cost analysis ($/ha)	24 months

Progress Report:

Current Progress:

January 2019
Treatments planned and site selected

March 2019
Soil nematode assessment

April 2019
Treatment applied – crop destroyed
Nutritional soil assessment

July 2019
Crop residue assessments

November 2019
Nutritional soil assessment

April 2020
Site planted

July 2020
Incorporated fallow crops
Prepared ground and planted

October 2020
Crop, pest and nutrient assessments

Issues Encountered:
Awaiting good weather conditions for breakdown of crop. The Bundaberg area is currently experiencing an extremely dry period.

Results:

The initial nematode counts taken in March 2019 in the previous crop, indicated significant levels of nematode. These levels are equivalent to the highest populations found in the industry.

Date	Root Knot	Root Lesion	Spiral	Free Living
01-March-2019	2,180	40	20	2,060

There were variations in the level of crop residue breakdown in both treatments after crop destruction. The mulching treatment pulverised the crop residue and immediate rotary hoe buried it into the profile. Standard practice with multiple passes of the rotary hoe chopped up the crop and partially buried the residue.

Treatment 1 (Mulching)

Mulching

Trash after mulching

Immediate rotary hoe

Treatment 2 (Standard practice)

Initial crop destruction - two passes with rotary hoe

Observations 3 months after crop destruction are as follows:

Mulching		
Standard practices		

After 3 months, there was less visible crop residue in the mulched treatment in comparison to the standard practice. The latter had visible residue on the surface and was therefore more prone to nutrient losses to the environment.

After the areas were free of crop residue, individual plots of rye grass, oats and barley were planted on treatment area 1 (mulched). Treatment area 2 (standard practices) was left as a bare fallow.

	Rye Grass	Oats	Barley
1 month			
3 months			

Variations in the establishment of the fallow crops were the result of dry conditions experienced at planting and throughout the fallow crop cycle. Three months after planting the dry conditions and heat affected establishment and plant growth. The rye grass performed better than the oats or barley.

Treatment 2 (standard practices): bare fallow soil

Phase 3

Soil analysis were taken prior to planting and results compared to the initial soil analysis results at crop destruction. The soil nutritional levels and soil characteristics were compared between both standard and treatment (pre-plant mulch). The impact of crop mulching the previous crop, addition of organic compost and fallow cropping can be seen in this initial evaluation. The comparative results of the soil analysis are as follows:

Soil pH – at crop destruction the soil pH was 4.5. The treatment soil pH was 5.0. This can be attribute to the additional organic compost applied. Standard practices increase slightly to 4.7.

Soil Organic Matter – improves soil structure, capacity to store and supply essential nutrients. This results in better plant growth and health allowing more movement of mobile nutrients to the root. At crop destruction the soil organic matter was 1.27%. Soil levels within the treatment dropped minimally to 1.25%. This can be attributed to crop residue incorporated and broken down into the soil profile. Standard practice declined significantly to 1.12%. This would suggest significant losses in vegetative mass breaking down on the surface of the soil.

Solvita Respiration Levels – is a measurement for determining soil health by the release of carbon dioxide from the soil. Carbon dioxide emissions from the soil are primarily due to microbial respiration. The level of microbial activity is indicative of the amount of active organic matter that has been broken down and nutrients being released. Results from the trial indicate the Solvita Respiration levels at crop destruction did not change in the standard practises and remained at 1%. The Solvita Respiration level within the treatment were 2%. This level indicates twice the amount of microbial activity in the treatment and can be

attributed to higher levels of soil organic matter from additional composting products and breakdown of crop residue into the soil.

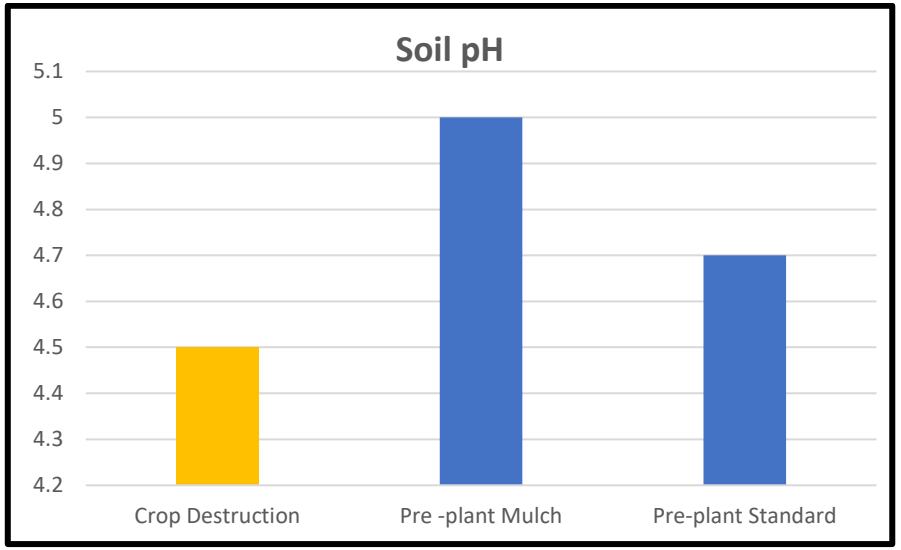
Major Elements – at crop destruction the levels of nitrogen, phosphorus, potassium, calcium and magnesium were very minimal in the soil. Within the treatment the levels of major elements were substantially higher across all major elements prior to planting. This can be attributed to better nutritional levels utilised from within the previous crop residue and additional organic compost. Results within the standard practices indicated nitrogen and potassium were higher, but phosphorus, magnesium and calcium were significantly lower when compare to levels at crop destruction.

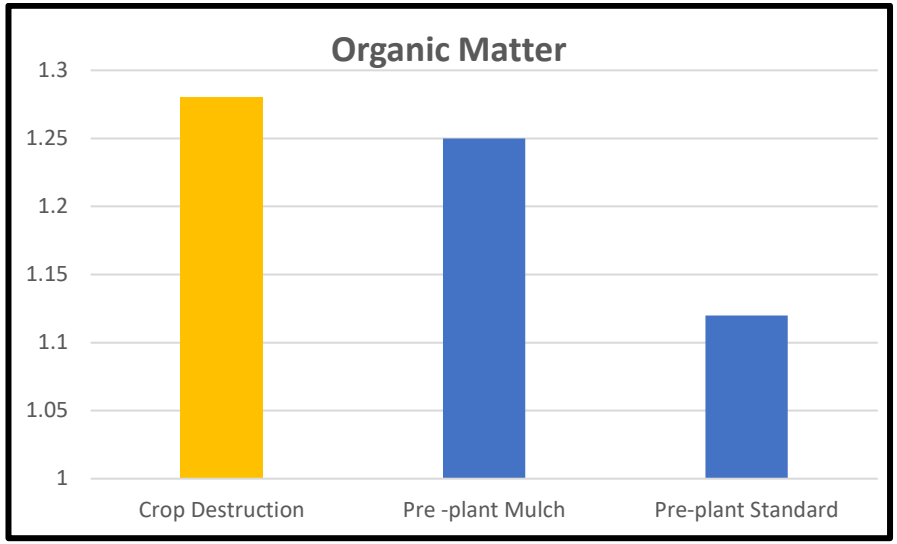
Minor Elements – at cropped destruction the levels of iron and copper were very good but zinc extremely low. Within the treatment the levels of zinc and iron were substantially higher and copper very low when compared to results at crop destruction. Standard practices had substantially higher levels of zinc but both iron and copper were below levels at crop destruction.

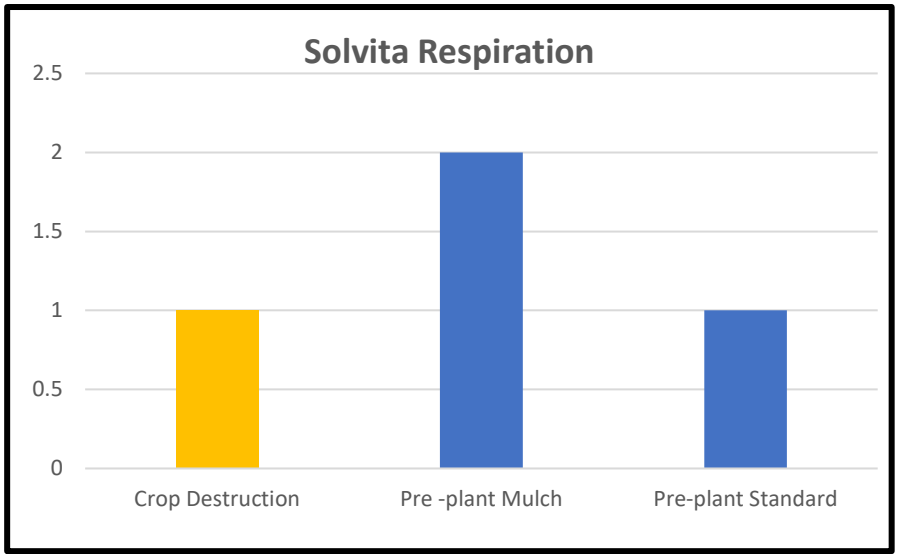
In summary, when benchmarking against industry standard nutritional levels prior to planting, the treatment consisted minimal requirements for pre-plant fertiliser. The pre-plant fertiliser within the treatment consisted a moderate rate of calcium but no other fertiliser was applied. Although levels of some major elements were below industry standard requirements, they would be made up in the post plant foliar applications.

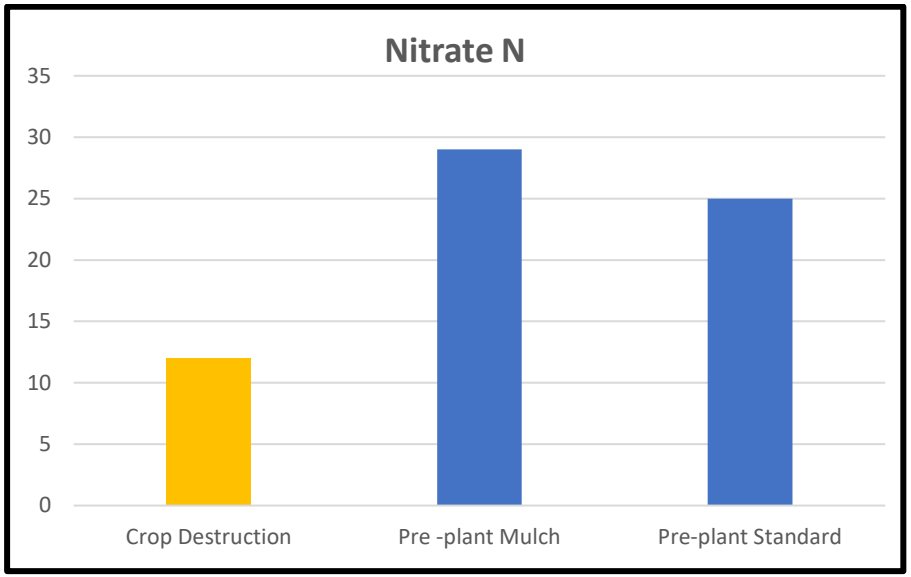
3 months after planting

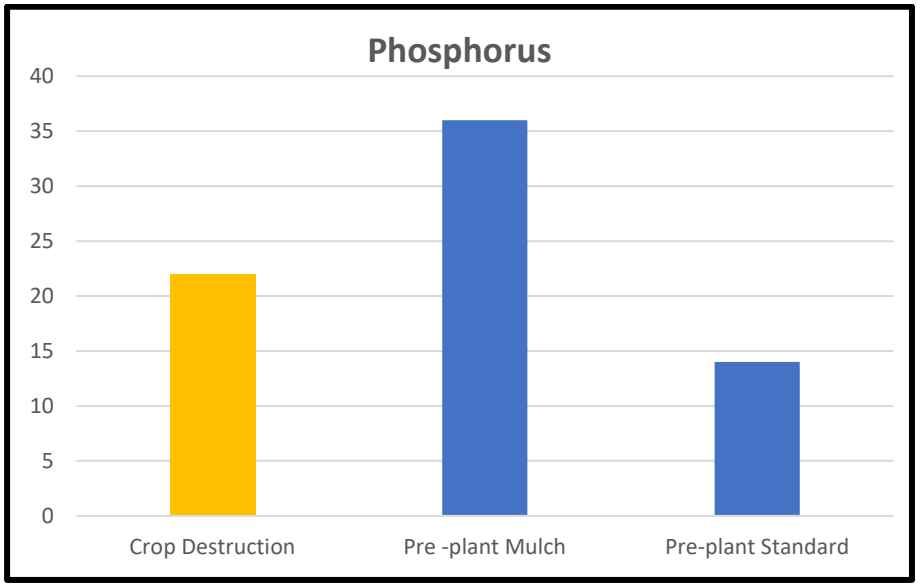
Note: no pre-plant side dressing will be applied within this trial. Foliar fertiliser applications will be applied fortnightly with precision application equipment.

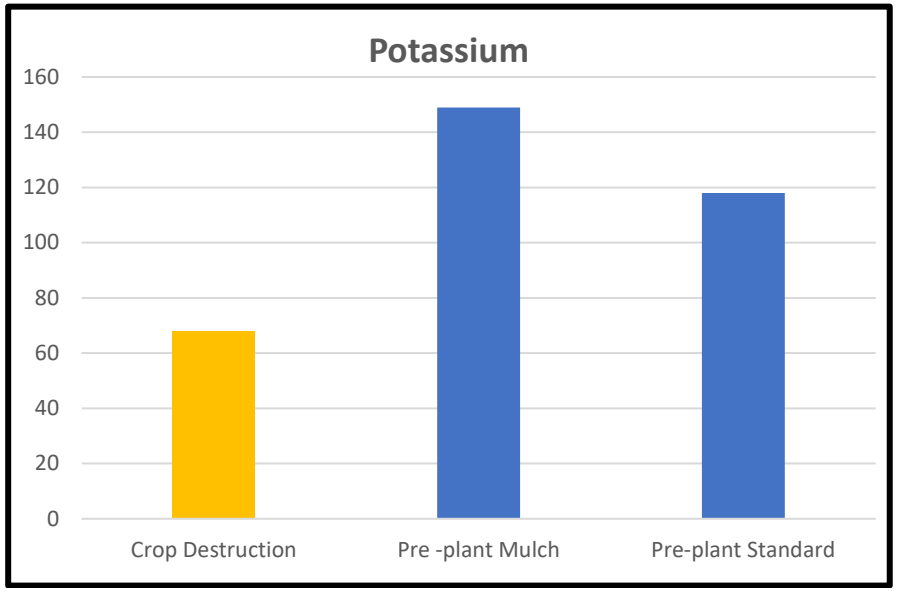

Soil pH
5.1
5
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
Crop Destruction
Pre -plant Mulch
Pre-plant Standard

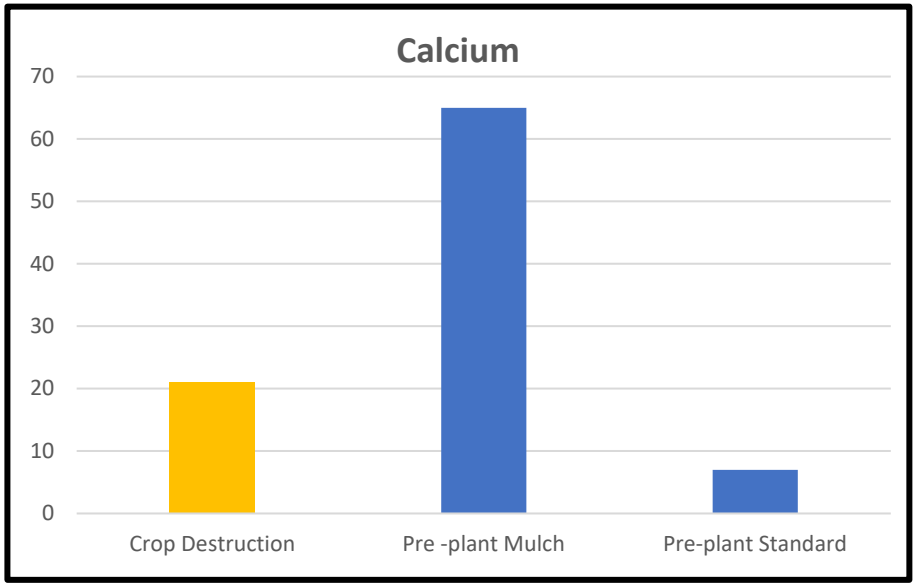

Organic Matter
1.3
1.25
1.2
1.15
1.1
1.05
1
Crop Destruction
Pre -plant Mulch
Pre-plant Standard

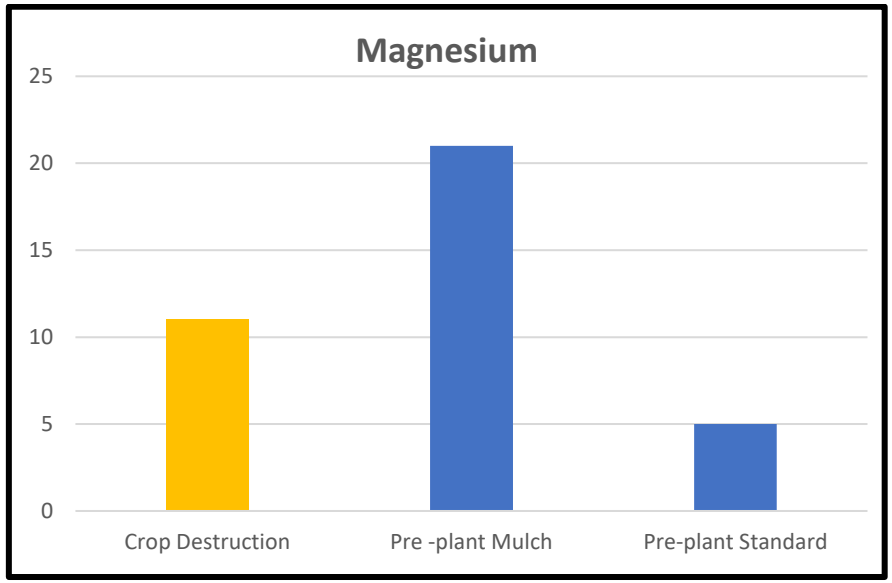

Solvita Respiration
2.5
2
1.5
1
0.5
0
Crop Destruction
Pre -plant Mulch
Pre-plant Standard

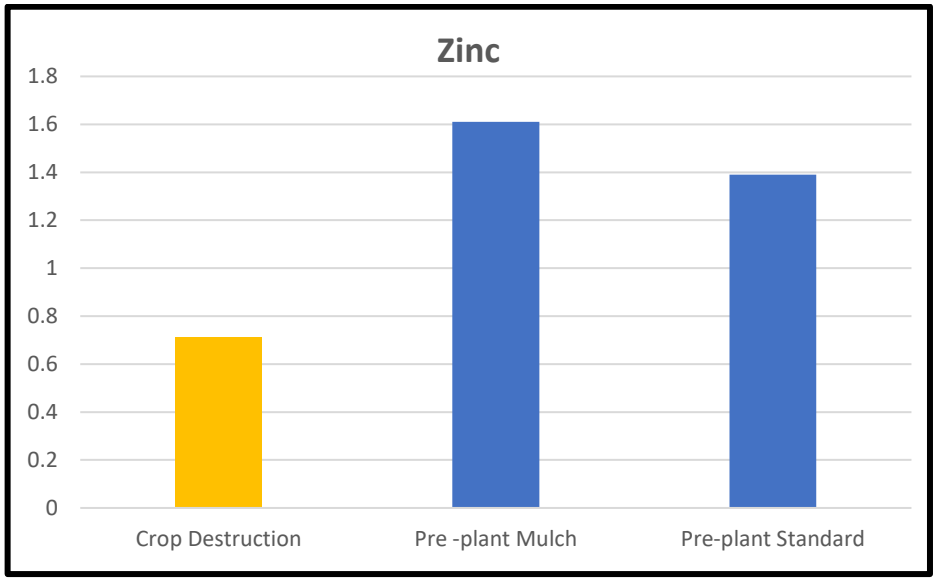

Nitrate N
35
30
25
20
15
10
5
0
Crop Destruction
Pre -plant Mulch
Pre-plant Standard

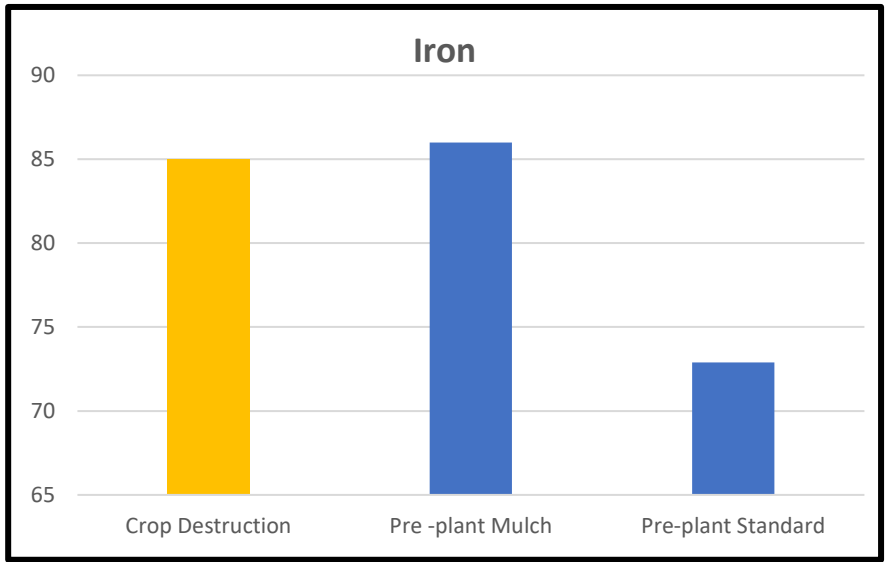

Phosphorus
40
35
30
25
20
15
10
5
0
Crop Destruction
Pre -plant Mulch
Pre-plant Standard

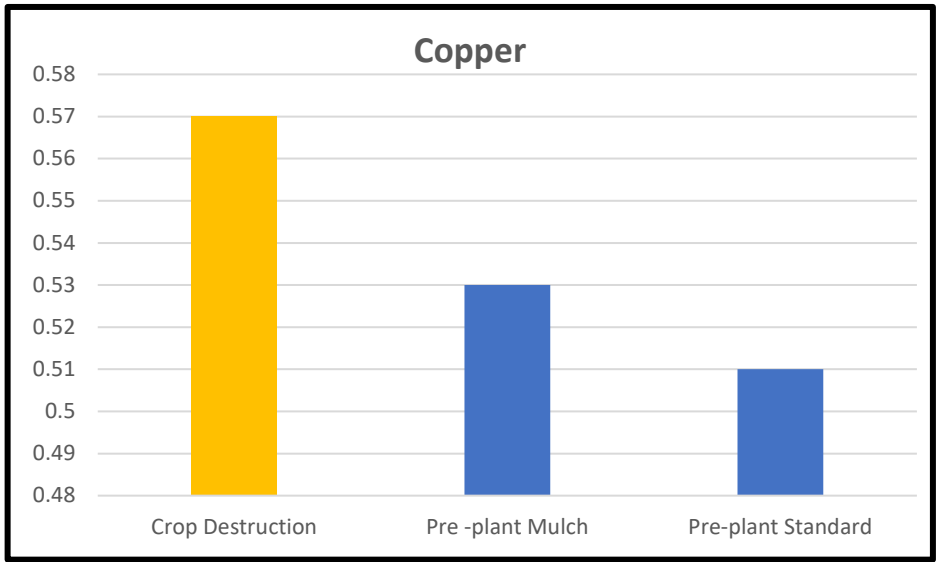

Potassium
160
140
120
100
80
60
40
20
0
Crop Destruction
Pre -plant Mulch
Pre-plant Standard


Calcium
70
60
50
40
30
20
10
0
Crop Destruction
Pre -plant Mulch
Pre-plant Standard


Magnesium
25
20
15
10
5
0
Crop Destruction
Pre -plant Mulch
Pre-plant Standard


Zinc
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Crop Destruction
Pre -plant Mulch
Pre-plant Standard


Iron
90
85
80
75
70
65
Crop Destruction
Pre -plant Mulch
Pre-plant Standard


Copper
0.58
0.57
0.56
0.55
0.54
0.53
0.52
0.51
0.5
0.49
0.48
Crop Destruction
Pre -plant Mulch
Pre-plant Standard