

An integrated approach to soil health and fertility

Healthy Crops, Healthy Soils



Bactivate Bactivate Liquid

BactivatePlus[®]Liquid

Bactivate
BioBoost⁺

Bactivate SeaweedSolution[®]



Werrington Station Airstrip Layout

Improved pasture growth with Bactivate products

Untreated

Treated



- Sparse roots
- Impenetrable clay soil

- Increased root density
 - More friable soil

Improved pasture growth with Bactivate products

Untreated



Treated

- - Increased height and vigour

Improved nutrition with Bactivate products

Nutritional Values of Different Treatments



| Cation Balance | | | | | |
|---|-------------|-----------------|------------|-----------------|--|
| ITEM | RESULT | DESIRABL | E | | |
| pH(1:5 Water) pH(1:5 0.01M CaClz) | 5.8 5.23 | 5.5-7.5 | | | |
| Electrical Conductivity EC µS/cm | 67.3 | < 300 | | | |
| TOTAL SOLUBLE SALT TSS ppm | 222.09 | < 990 | | | |
| TOTAL ORGANIC MATTER 70 TOTAL ORGANIC CARBON % | 6.55 | 3 - 5 | | | |
| EXCHANGEABLE CATIONS | | | RESULTS | DESIRABLE LEVEL | |
| CALCIUM | Ca | mea/100 of soil | 3.97 | 10.89 | |
| MAGNESIUM | Ma | mea/100 of soil | 2.06 | 2.51 | |
| SODIUM | Na | meg/100 of soil | 0.06 | < 0.84 | |
| POTASSIUM | К | meq/100 of soil | 0.62 | 0.84 | |
| HYDROGEN | Н | meq/100 of soil | 16.6 | | |
| ADJ. EXCH. HYDROGEN | Н | meq/100 of soil | 10.05 | < 2.51 | |
| CATION EXCHANGE CAPACITY | CEC | meq/100 of soil | 23.31 | | |
| ADJUSTED CEC | Adj.CEC | meq/100 of soil | 16.76 | | |
| SATURATION BASE PERCENTAGE | BSP | | 30 | | |
| EXCHANGEABLE CATION BALANCE | | % OF AD | JUSTED CEC | DESIRABLE | |
| CALCIUM PERCENTAGE | | | 23.7 | 65-70% | |
| MAGNESIUM PERCENTAGE | | | 12.3 | 12-15% | |
| SODIUM PERCENTAGE | ESP | | 0.4 | 0.5-5% | |
| POTASSIUM PERCENTAGE | | | 3.7 | 3-5% | |
| ADJ. HYDROGEN PERCENTAGE | | , | 60.0 | <20% | |
| CALCIUM / MAGNESIUM RATIO | Ca/Mg | | 1.92 | 2 - 4 | |
| Actual Cation Br | alance | | Desirable | Cation Balance | |
| | | | | Sodium | |
| 0% | Sodium | 5' | % 10% 5% | Calcium | |

CATION BALANCE CORRECTIONS

(To optimise the soil structure & condition)

15%

2076 kg of Calcium is needed to raise the Available Calcium to 68% and/or Exchangeable Calcium to 65% 81 kg of Magnesium is needed to raise the Available Magnesium and Exchangeable Magnesium to 15%

■Calcium ■Magnesium

Potassium

Hydrogen

12% 4%

| GYPSUM REQUIREMENT | 0 | t/ha | | | |
|----------------------|------|-------|----|-----------------|--|
| LIME REQUIREMENT | 4.73 | t/ha | | | |
| DOLOMITE REQUIREMENT | 0.74 | t/ha | | | |
| MAGNESIUM SULPHATE | 0 | kg/ha | or | MAGNESIUM OXIDE | |

Magnesium

Potassium

Hydrogen

| | | | Nutrient Balance | | |
|----------------------|----|-----|------------------|-----------------|--|
| ITEMS | | | RESULTS | DESIRABLE LEVEL | |
| | | | | | |
| AVAILABLE CALCIUM | Ca | ppm | 820 | 2309 | |
| AVAILABLE MAGNESIUM | Mg | ppm | 255.6 | 424 | |
| AVAILABLE SODIUM | Na | ppm | 13.8 | < 271 | |
| AVAILABLE NITROGEN | Ν | ppm | 3.46 | 26 | |
| AVAILABLE PHOSPHORUS | Р | ppm | 11 | 30 | |
| AVAILABLE POTASSIUM | К | ppm | 249.99 | 289 | |
| AVAILABLE SULPHUR | S | ppm | 12.2 | 11 - 15 | |
| AVAILABLE COPPER | Cu | ppm | 13.5 | 2 | |
| AVAILABLE ZINC | Zn | ppm | 3.46 | 7 | |
| AVAILABLE IRON | Fe | ppm | 147 | > 30 | |
| AVAILABLE MANGANESE | Mn | ppm | 45 | > 20 | |
| AVAILABLE COBALT | Co | ppm | 4.88 | => 1.0 | |
| AVAILABLE MOLYBDENUM | Mo | ppm | 0.15 | > 0.5 | |
| AVAILABLE BORON | В | ppm | 0.19 | 0.6-1.0 | |
| | | | | | |
| TOTAL CALCIUM | Ca | ppm | 1070 | | |
| TOTAL MAGNESIUM | Mg | ppm | 681 | | |
| TOTAL SODIUM | Na | ppm | 81.4 | | |
| TOTAL POTASSIUM | К | ppm | 498 | | |
| TOTAL NITROGEN | Ν | % | 0.501 | | |
| TOTAL PHOSPHORUS | Р | ppm | 2590 | | |
| TOTAL SULPHUR | S | ppm | 509 | | |
| TOTAL COPPER | Cu | ppm | 61.9 | | |
| TOTAL ZINC | Zn | ppm | 81 | | |
| TOTAL IRON | Fe | ppm | 32000 | | |
| TOTAL MANGANESE | Mn | ppm | 1410 | | |
| TOTAL COBALT | Co | ppm | 27.3 | | |
| TOTAL MOLYBDENUM | Mo | ppm | 0.148 | | |
| TOTAL BORON | В | ppm | 78.7 | | |



Notes:

- Phosphorus fixation effects if Iron is more than 300 ppm

- Manganese will be at toxicity level if it reaches 500 ppm

| PLANT NUTRITION REQUIREMENTS | | | | (For the spec | cified Land Use over | the period of its | growing season) | |
|--------------------------------------|------------|------|----|---------------|----------------------|-------------------|-----------------|---|
| TOTAL FERTILISER REQUIREMENT (kg/ha) | | | Ν | Р | к | S | Са | |
| | | | | 23 | 24 | 39 | 0 | 0 |
| with Trace Ele | ments: | | | | | | | |
| | COPPER | 0.5 | kg | | IRON | | 0 kg | |
| | ZINC | 3 | kg | | MANGANESE | | 0 kg | |
| | COBALT | 0 | kg | | BORON | 1.1 | 13 kg | |
| | MOLYBDENUM | 0.05 | kg | | | | | |

| Biology Balance | | | | | |
|--------------------------------|------------|---------|----------|-----------|-------------|
| ITEM | | Result | % of TAP | Desirable | % Desirable |
| ACTIVE LACTIC ACID BACTERIA | cfu/g soil | 1,000 | 0.2% | 131,555 | 17.0% |
| Active Fungi | cfu/g soil | 310,000 | | | |
| Cellulose utilisers | cfu/g soil | 80,000 | | | |
| TOTAL ACTIVE FUNGI | cfu/g soil | 390,000 | 84.6% | 255,371 | 33.0% |
| ACTIVE YEASTS | cfu/g soil | 10,000 | 2.2% | 123,816 | 16.0% |
| ACTIVE ACTINOMYCETES | cfu/g soil | 60,000 | 13.0% | 162,509 | 21.0% |
| ACTIVE PHOTOSYNTHETIC BACTERIA | cfu/g soil | 10 | 0.0% | 100,601 | 13.0% |
| Total Active Population (TAP): | cfu/g soil | 461,100 |) | 773,853 | |
| CARBON/NITROGEN RATIO | | 13.1 | l | 10-15 | |



SOIL BIOLOGY MANAGEMENT

(To help accelerate changes in soil structure and nutrient availablility)

| Kelp extract | 5 litres/ha | To encourage Actinomycetes, Yeast, Photosynthetic and/or discourages Fung |
|-----------------------|--------------|---|
| Molasses or sugar | 2 litres/ha | To encourage Yeasts, Fungis & other fermenters |
| Worm leachate | 10 litres/ha | To encourage Photosynthetic bacteria, Fungis and/or Actinomycetes |
| Fish emulsion | 2 litres/ha | Helps improve the C:N ratio & discourages Lactic Acid Bacteria |
| Liquified humate | 0 litres/ha | |
| Mulch or Green Manure | Beneficial | To encourage various Fungi |
| | | |

NB. Use only good quality materials & for best results, apply twice annually.

| PREVIOUS APPLICATIO | | | DATE OF APPL | CATION | | | |
|--|----------------------|----|--------------|--------|----|----|---|
| GYPSUM APPLIED LIME APPLIED DOLOMITE APPLIED | t/ha t/ha t/ha | | | | | | |
| Trace elements kg/ha Date of application | Cu | Zn | Fe | Mn | Co | Мо | В |

Werrington Station Treatment Schedule 2016-2021

- 2016 Bactivate + Bioboost + Seaweed
- 2017 Bactivate + Bioboost + Seaweed
- 2018 Bactivate + Bioboost + Seaweed
- 2019 Stimulants + Calciprill

2020 – Bactivate + Stimulants + Calciprill + DAP

After 2 years of treatment

Untreated

Treated



Results:

- Pasture species improved
 - Weeds reduced
- Grader Grass outcompeted

After 2 years of treatment

Untreated

Treated



Results:

- Pasture species improved
 - Weeds reduced
- Grader Grass outcompeted

Major Elements Overall During Treatment (Airstrip)



Change in Cation Balance



Soil Biology During Treatment



Hay Production by Year



Increased production, more legumes in pasture.









Werrington Station - 2016-2021 Treatment Effects

- Improved soil friability no surface pan
- Increased root mass and infiltration
- Increased soil nutrients
- Increased soil biology population



Werrington Station - 2016-2021 Pasture Effects

- Increased production
- Changed pasture species fewer weeds and more legumes
- Increased pasture quality
- Adding fertiliser increased production but depleted nutrient bank



Petersen Trial (2019-2020)

In conjunction with Cape York NRM



Petersen Trial - Layout

KEY

- 1. Bactivate Liquid
- 2. Bactivate Plus Liquid
- 3. Control
- 4. Product X



∋ 2018 Google mage © 2019 DigitalGlobe Ñ

16/5/2019

4/6/2019

- Visit site Trial design
- Mark out blocks
- Soil sample each block
- Pasture sample (composite)
- Supplied product





6/6/2019

19/9/2019

- Product applied rain
- Site visit
- Frosted blocks
- Delivered product for re-treatment

| 3/10/2019 | 2nd treatment. Product out - rain |
|------------|--|
| 29/11/2019 | Visit – too dry for pasture samples |
| 19/2/2020 | Visit. Photos taken |



| 6/5/2020 | Soil and pasture samples taken |
|------------|--|
| 20/7/2020 | Re-treated |
| 16/10/2020 | Soil and pasture samples taken |



Petersen Trial - Elemental outcome

Major Element Concentrations Across Treatments (Blocks) After 16 months



Petersen Trial – Soil Biology

Soil Biology in 2020





Change in Pasture Coverage by Type



Change in Energy and Crude Protein



Conclusion

Pasture treatments with Bactivate soil biology and stimulants:

- Increase soil friability and root penetration
- Increase soil fertility
- Increase soil biology levels and balance
- Increase pasture quality and quantity
- Suppress weed and grader grass
- Support pasture diversity supports legume growth

Conclusion



Werrington Station

Petersen Trial

