ADVANCED NUTRIENTS®

EVERYTHING IN BLACK AND WHITE

# SCIENTIFIC COMPARATIVE DATA DOCUMENT

BLACK UREA®

BLACK DAP™


ADVANCED NUTRIENTS®

# Contents

## The Best On Earth

John Ferguson
Soil Consultant

188 Moorina Road
Moorina QLD 4506
Tel: 07 5496 7037
Mobile: 0418 989 802
Fax: 07 5497 0069

Mr G Murdoch-Brown
Advanced Nutrients

Reference: Laboratory Trials on “Black Urea®”

Dear Sir

The above product which, for identification purpose of this trial has been called “Black Urea®” because it is normal chemical urea coated with carbon biocatalysts technology with the intention of holding in the nitrogen content of the urea and releasing it slowly as per the plant requirements.

As nitrogen is the principal energy source for plant growth, chemical nitrogen has obvious appeal to farmers, but there are several downsides when considering sustainability. Nitrate nitrogen is the most leachable of all elements, and our polluted waterways are a testimony to this problem.

Chemical nitrogen is also the major villain in the serious depletion of organic carbon, which threatens the economic feasibility of many growing operations.

Liquid humates such as humic acids have many attributes, but the most important in this context are exceptional nitrogen storage capacity and high organic carbon levels.

For years now it has been accepted that urea while providing a high level of nitrogen for growing plants during suitable weather and soil conditions, has always proven to be unstable in high or low moisture conditions with 65% or more of the nitrogen being lost in the atmosphere or leached below the plant root depth, leaving the plants lacking available nitrogen when they most need it, which is during the grain head set and associated fill out process which governs not only production quality but also protein content of the grain.

The following trials were conducted by Agronomist Mr J Ferguson and his staff at his soil and plant laboratory at 188 Moorina Road Moorina, Queensland.

**Trial Method**

Ten plot trials were set up using the same type of soil as a medium.

“Black Urea®” was placed in half the plots while normal urea taken from the same batch as that used for coating was placed in the other five plots and checked to insure that all plots contained the same nitrogen level.

Water was then added at a different related amount to stimulate a range of soil moisture contents from almost dry soil through to optimum moisture and on to very high moisture content as the governing factor in the release of nitrogen from urea appears to be the moisture content of the soil.

Nitrogen levels of the soil were checked at every two week intervals up to ten weeks. The nitrogen content of the soil at the start of the trial was regarded as 100% and reading obtained at intervals are recorded as percentage of nitrogen still remaining in the plots as compared to the original amount.

It should be noted that no plants were grown in the plots during trials, therefore the sink effect that is created by living growing plants was not taken into account.

The trial was divided into five sections to cover different moisture contents in the soil.

Trial No 1 Low Moisture
Trial No 2 Low to Medium Moisture
Trial No 3 Optimum Moisture
Trial No 4 Moderately High Moisture
Trial No 5 Very High Moisture

In conclusion on consideration of these trials along with other investigations that I have been involved in, together with available information, I am confident that this material referred to as “Black Urea®” has a big future in farming.

Based on information to hand, I believe that this product used at 70% rate of chemical urea will not only produce better quality crops and production but will lower costs and be a lot more friendly to the environment and the farm soil.

The next step to providing the advantage of this product should be trials carried out on farm sites to see how it performs in the actual field.

Should you require any further information on these trials or classification of any point covered please telephone me at your convenience.

I hereby certify that the above trials and information were carried out by me or under my supervision and all results are correct as recorded at the time of testing.

Regards,

John Ferguson

**“Black Urea®” and Urea Plot Trials**

All readings below are % of nitrogen left in soil plots at time of testing as compared to nitrogen added to the plots at the start of testing.

**Trail 1** **Low Moisture**

| Weeks | Black Urea® | Urea |
|---|---|---|
| 2 | 95% | 55% |
| 4 | 84% | 30% |
| 6 | 75% | 15% |
| 8 | 70% | 3% |
| 10 | 62% | 1% |

**Trail 2** **Low To Medium Moisture**

| Weeks | Black Urea® | Urea |
|---|---|---|
| 2 | 93% | 66% |
| 4 | 85% | 45% |
| 6 | 70% | 28% |
| 8 | 63% | 10% |
| 10 | 52% | 4% |

**Trail 3** **Optimum Moisture**

| Weeks | Black Urea® | Urea |
|---|---|---|
| 2 | 90% | 75% |
| 4 | 80% | 42% |
| 6 | 65% | 26% |
| 8 | 52% | 8% |
| 10 | 46% | 5% |

**Trail 4** **Moderately High Moisture**

| Weeks | Black Urea® | Urea |
|---|---|---|
| 2 | 90% | 68% |
| 4 | 76% | 40% |
| 6 | 65% | 15% |
| 8 | 50% | 4% |
| 10 | 45% | 3% |

**Trail 5** **Very High Moisture**

| Weeks | Black Urea® | Urea |
|---|---|---|
| 2 | 85% | 60% |
| 4 | 70% | 35% |
| 6 | 60% | 10% |
| 8 | 52% | 2% |
| 10 | 48% | 1% |


Cotton Field Not Emulating Trail Data From Previous Page

# Demonstration of Black Urea® in Sugar Cane

Background Information
High fertiliser prices in 2008/2009 have significantly impacted the production economics of sugar cane. The grower needed to find a way to improve profits in order to remain viable. In a bid to prove, or otherwise, the claims made regarding Black Urea®, the grower undertook to test the product performance under commercially relevant and scientifically valid conditions.

Demonstration Goal
1. To demonstrate that Black Urea® at 73% application of the usual granular Urea practice will produce superior economic results.

| | | | |
|---|---|---|---|
| Grower: | Kevin Mann | Location: | Home Hill, Qld |
| Crop: | Sugar Cane | Agronomist: | Advanced Nutrients |

Demonstration Method

| | |
|---|---|
| Black Urea® Demonstration Plots: | Black Urea® @ 160kg/ha applied with stool splitter. Product cost of $1,115/t on farm (excl. GST) |
| Urea Demonstration Plots: | Granular Urea @ 220kg/ha applied with stool splitter (usual farm practice). Product cost of $1,015/t on farm (excl. GST) |

All sites set for three year rotation of the same rates of application.

Crop was grown under normal commercial practice will all plots treated the same with the exception of nitrogen application rates. Each demonstration plot was harvested separately with bin numbers recorded. Bin Numbers were then matched with Inkerman Sugar Mill results of Yield, CCS, Units and income per Unit ($4.00/u).

Rainfall
Avg Annual Rainfall
2008: 1000 mm
2007: 1200 mm

Paddock History
2008: Sugarcane
2007: Sugarcane
2006: Sugarcane

Soil
Location: Home Hill
Type: sandy loam
pH: 6

Results
Primary Demonstration – Replicated 3rd Ratoon Crop

**Black Urea®**

| Plot ID | Plot Size (ha) | Yield (t) | Av. Yield (t/ha) | CCS | Total Units | Units per ha |
|---|---|---|---|---|---|---|
| 15.1 | .33 | 36.66 | 111.09 | 15.50 | 568.23 | 1721.91 |
| 15.2 | .48 | 35.19 | 73.31 | 15.50 | 545.45 | 1136.35 |
| 15.3 | 3.77 | 310.86 | 82.46 | 17.11 | 5318.79 | 1410.82 |
| **Total** | **4.58** | **382.71** | **83.56** | | **6432.47** | **1404.47** |

**Urea**

| Plot ID | Plot Size (ha) | Yield (t) | Av. Yield (t/ha) | CCS | Total Units | Units per ha |
|---|---|---|---|---|---|---|
| 1.1 | 9.28 | 718.51 | 77.43 | 15.05 | 10813.58 | 1165.80 |
| 5 | 9.75 | 807.12 | 82.79 | 14.72 | 11879.66 | 1218.43 |
| 7 | 6.48 | 722.17 | 111.45 | 15.98 | 11542.14 | 1781.19 |
| **Total** | **25.51** | **2247.80** | **88.11** | | **34235.38** | **1342.04** |

**Economic Analysis**

| | Black Urea® | V | Urea | Variance | Comment |
|---|---|---|---|---|---|
| Production Units per ha | 1404.47 | v | 1342.04 | 62.43 | Increase in units per ha |
| Income per ha (@$4/u) | $5617.88 | v | $5368.16 | $249.72 | Increase in income per ha |
| Fertiliser cost per ha | $178.40 | v | $223.30 | -$44.90 | Decrease in input costs per ha |
| TOTAL BENEFIT BY USING BLACK UREA | | | | **$294.62** | INCREASE IN PROFIT PER HA |

Secondary Demonstration – 5th Ratoon Crop
This demonstration was not replicated, results are further clouded by significantly different soil types with regards sodium levels and should be accepted as an indicative guide only to the possible benefit of Black Urea®.

| Plot ID | Plot Size (ha) | Yield (t) | Av. Yield (t/ha) | CCS | Total Units | Units Produced per ha | Production Increase |
|---|---|---|---|---|---|---|---|
| Black Urea® | | | | | | | |
| 14.1 | 7.23 | 818.17 | 113.16 | 16.68 | 13649.64 | 1888 | 90% |
| Urea | | | | | | | |
| 8 | 7.01 | 464.82 | 66.31 | 15.00 | 6970.62 | 994 | |

Conclusion and Discussion
The demonstration proves that Black Urea® applied at 73% of the usual farm practice for nitrogen will significantly improve farm profits under commercial farming conditions. The same plots and practices will be used for a further two years to further demonstrate the long term benefits of using this enhanced efficiency fertilizer. The results further imply an environmental benefit of using Black Urea®, if less is used to achieve more as has been demonstrated; logically less “free” nitrogen is available for migration into environmental pathways and subsequent resultant damage. The manufacturing and distribution of 27% less fertilizer will provide a significant reduction to sugar cane productions carbon footprint.

# Black Urea® Trials "Oban", Jimbour 2002

Trials were conducted on the property of Mr Russell Dent at "Oban" Jimbour, to test the performance of Black Urea® against normal Urea on a crop of winter Kaputar Barley (Feed Barley).

Trial

- The trial was conducted on paddock 2 of the property "Oban" where the paddock was divided into 3 sections. In section 1, Black Urea® was applied @ 50Kg/Ha. Section 2 had no fertilizer application (control) whilst section 3 was placed under normal practice of applying Urea @ 80Kg/Ha.
- SAP Tests were conducted on sections 1 & 3, at early fruiting stage.
- Yield Tests were conducted on each of the 3 sections at harvest time.
- Protein Tests were also carried out on each of the 3 sections.

Information

| | |
|---|---|
| 2001: | Planted Barley on pre-plant SF16 @ 40Kg/Ha. Crop failed as result of drought conditions. |
| 2002: | Pre-plant Black Urea® and Urea as stated above. No Starter Fertiliser used in 2002. |
| Planting: | The crop was planted week 2 June 2002 with good sub-moisture and after receiving 35mm of rain. |
| Rainfall: | During the growth of the crop the following rainfalls were recorded: Week 4 August recorded 80mm. |
| Soil Test: | Last Soil Test taken and analysed 29/3/01 |
| SAP Test: | Samples were taken for SAP testing on sections 1 & 3 on 25/9/02 (A copy of SAP Test Results can be supplied upon request) |
| Harvesting: | The crop was harvested Tuesday 22/10/02, a yield test was carried out on each section and samples taken for a protein test. (See Yield Results following) |
| Protein Levels: | Protein Results are attached to the Trial Results following: |

This trial work was overseen by Independent Agronomist, Mr John Ferguson, of "The Best on Earth" laboratory, Caboolture Queensland.

**Barley Trials 2002, “Oban” Jimbour – Paddock 2**

| | | |
|---|---|---|
| Black Urea® | Control | Urea |
| 50Kg/Ha<br>(21 units of Nitrogen) | No Fertiliser Application | 80Kg/Ha<br>(37 units of Nitrogen) |
| Section 1 | Section 2 | Section 3 |

Trial

The Trial was simply to test the response of Black Urea® against Urea @ the recommended application rate of approx 65% (Actual application rate was 63%)

Urea = 46% N applied @ 80Kg/Ha
Black Urea® = 42.78% N applied @ 50Kg/Ha

**Yield Results & Net Return Figures**

| Trial | Fertiliser Rate | Yield Tonnes/Ha | Fertiliser Cost/Ha | Grain Values/Tonne | Return $/Ha | Net Return $/Ha |
|---|---|---|---|---|---|---|
| Section 1 | Black Urea® @ 50Kg/Ha (21 units of N) | 3.71 | $29.70 | $310.00 | $1,150.10 | $1,120.40 |
| Section 2 | Control No fertiliser application | 2.38 | Nil | $310.00 | $737.80 | $737.80 |
| Section 3 | Urea @ 80Kg/Ha (37 units of N) | 3.63 | $28.80 | $310.00 | $1,125.30 | $1,096.50 |

Conclusion
The Net Return per Hectare figures show that the Black Urea®, applied @ 63% rate of Urea, yielded $23.90 per Hectare more. Considering that the cost of fertiliser to farm of the Black Urea® was greater, the results were very pleasing.

Summary
This was a repeat Trial as results of a similar Trial on Sorghum 2001/2002 showed the same trend that higher yields and greater profits were obtained by using Black Urea® @ approx 65% rate of Urea. The Black Urea® is obviously working in releasing Nitrogen as it is required by the plant and the Nitrogen is not being lost by volatilization or by leaching. We will continue similar Trials in the future and see if we can obtain consistency with future results.

# Effect Of Black Urea® In Comparison To White Urea On An Irrigated Cotton Crop In Northern New South Wales

Why attempt the trial?
The Grower had attempted the trial with the help of Advanced Nutrients, to compare the Advanced Nutrients product Black Urea® directly with white urea and investigate the difference in yield and quality of an irrigated cotton crop in Northern New South Wales at Mungindi.

| | | | |
|---|---|---|---|
| Grower: | Corish Farms | Manager: | Brett Corish |
| Agronomist: | Jim O'Connor | | |
| Location: | "Tundunna" Mungindi NSW | | |
| Field: | | Crop: | Irrigated Cotton |

**Rainfall**
Aver. annual total: 550 mm
2005 total: 450 mm
2005 GSR: 380 mm

**Paddock History**
2004: Cotton
2003: Cotton
2002: Fallow

**Fertiliser**
2004: Urea + Starter Blend
2003: Urea + Starter Blend

**Crop Stress Events**
1 Water Logging Event

How was the trial done?
The Trial was done using an irrigated cotton crop with both the Black Urea® and White Urea pre-plant applied with the same existing machinery, a ground rig. Both products where applied at the same time and all other management decisions for the crop where kept constant so as to the only difference remaining was the Black Urea® and White Urea applied.

This trial was replicated over three fields in areas of 2.4 hectares as all three fields treatment areas consisted of rows 600 metres in length and treatment areas of 40 metres in width giving a total trial area of 2.4 hectares.

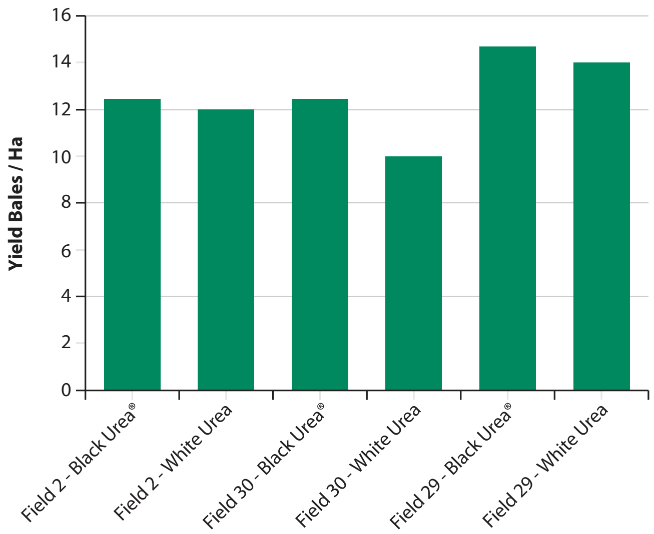
The applications of Black Urea® and White Urea where Pre-Plant with White Urea applied at the same rate per hectare as Normal (as per soil test results) and with Black Urea® applied at 95% of that rate as per Table 1

**Table 1: Application Rate and Timing**

| Application Rate | Product Applied | Application Rate /Ha |
|---|---|---|
| Pre-Plant | Black Urea® | 390kg/ha |
| Pre-Plant | Urea | 410kg/ha |

What where the Results?
Table 1 & Figure 1 depicts the yield of the treatments of Black Urea® and White Urea by field, the yields in Module weights and bales per hectare and acre (based on an average turn-out of 39%). The Black Urea™ treatments on average yielded significantly higher -1.12 bales per hectare than the White Urea treatments.

### Figure 1: Yield Comparisons between Field Treatments




### Table 2: Yield of Treatments by Field

| Application Rate | Field | Module Weight Kg | Yield Bales/ha Bales/ac |
|---|---|---|---|
| Black Urea® | 2 | 11,760kg | 13.16/ha 5.32/ac |
| White Urea | 2 | 11,460kg | 12.83/ha 5.19/ac |
| Black Urea® | 30 | 11,640kg | 13.03/ha 5.27/ac |
| White Urea | 30 | 9,480kg | 10.61/ha 4.29/ac |
| Black Urea® | 29 | 13,560kg | 15.18/ha 6.14/ac |
| White Urea | 29 | 13,020kg | 14.57/ha 5.90/ac |
| Average Black Urea® | - | 12,320kg | 13.79/ha |
| Average White Urea | - | 11,320kg | 12.67/ha |

### Financial return per hectare:

Field 2:
- Black Urea® 13.16 bales/ha @ $500/bale equates to $6,580.00/ha
- White Urea 12.83 bales/ha @ $500/bale equates to $6,415.00/ha
- A $143 per hectare profit after the added cost of Black Urea®

Field 30:
- Black Urea® 13.03 bales/ha @ $500/bale equates to $6,515.00/ha
- White Urea 10.61 bales/ha @ $500/bale equates to $5,305.00/ha
- A $1188 per hectare profit after the added cost of Black Urea®

Field 29:
- Black Urea® 15.18 bales/ha @ $500/bale equates to $7,590.00/ha
- White Urea 14.57 bales/ha @ $500/bale equates to $7,285.00/ha
- A $283 per hectare profit after the added cost of Black Urea®

Field Averaged:
- Black Urea® 13.79 bales/ha @ $500/bale equates to $6,895.00/ha
- White Urea 12.67 bales/ha @ $500/bale equates to $6,335.00/ha
- A $538 per hectare profit after the added cost of Black Urea®
  (Black Urea® cost $22 more per hectare applied)

In Conclusion
From the results given applications of Black Urea® at 95% of the White Urea application rate, resulted in considerable increases in yield across all three treatments, in both module weight and yield per hectare/acre, hence giving the grower a significant increase per hectare in dollars where the Black Urea® was applied.

BLACK UREA / BLACK DAP

# The Effect Of Black Urea® In Comparison To White Urea On An Irrigated Cotton Crop In Southern Queensland

Why attempt the trial?
The Grower had attempted the trial with the help of Advanced Nutrients, to compare the Advanced Nutrients product Black Urea® directly with white urea to investigate the difference in yield and quality of an irrigated cotton crop in Southern-Queensland at Talwood.

| | | | |
|---|---|---|---|
| Grower: | Corish Farms | Manager: | Glen Harney |
| Agronomist: | Jim O'Connor | | |
| Location: | "Yattlewondi", Talwood, QLD | | |
| Field: | 2 | Crop: | Irrigated Cotton |

Rainfall
Aver. annual total: 500 mm
2005 total: 450 mm
2005 GSR: 380 mm

Paddock History
2003: Cotton
2002: Fallow
2001: Wheat

Fertiliser
2003: Urea + Starter Blend
2002: Urea + Starter Blend

Crop Stress Events
1 Water Logging Event

How was the trial done?
The Trial was done using an irrigated cotton crop with both the Black Urea® and white Urea pre-plant applied with the same existing machinery, a ground rig. Both products where applied at the same time and all other management decisions for the crop where kept constant so as to the only difference remaining was the Black Urea® and White Urea applied. Advanced Nutrients Enhance Plus™ was also added to help buffer against excess levels of sodium which is a major constraint to production in the area.

This application was done using separate areas of the same field incorporating control (white urea application) and treatments in individual areas of 2.4 hectares for each treatment. Each treatment area consisted of rows 600 metres in length and treatment acres of 40 metres in width giving a total trial area of 2.4 hectares.

The Application of Black Urea® and White Urea were applied at Pre-Plant with White Urea applied at the same rate per hectare as Normal (as per soil test results) and with Black Urea® applied at 95% of that rate as per Table 1.

**Table 1: Application Rate and Timing**

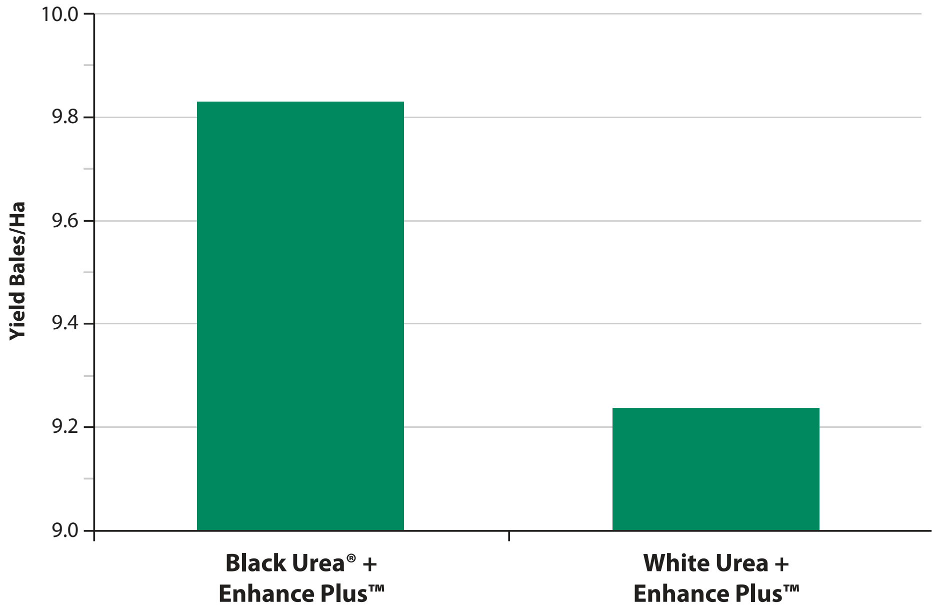
| Application Rate | Product Applied | Application Rate /Ha |
|---|---|---|
| Pre-Plant | Black Urea® | 390kg/ha |
| Pre-Plant | Urea | 410kg/ha |

What where the Results?
Table 2 & Figure 1 depict the yield of the treatments of Black Urea® and White Urea by field, the yields in Module weights and bales per hectare and acre (based on an average cut-out of 39%). The Black Urea™ treatments on average yielded 0.59 bales per hectare higher than the White Urea treatments (see table 2).

**Table 2: Yield of Treatments by Field**

| Product Applied | Field | Module Weight Kg | Yield Bales/ha Bales/ac |
|---|---|---|---|
| Black Urea® + Enhance Plus™ | 2 | 14,300 kg | 9.93/ha 4.02/ac |
| White Urea + Enhance Plus™ | 2 | 13,460 kg | 9.34/ha 3.78/ac |

**Figure 1: Yield Comparisons between Field Treatments**



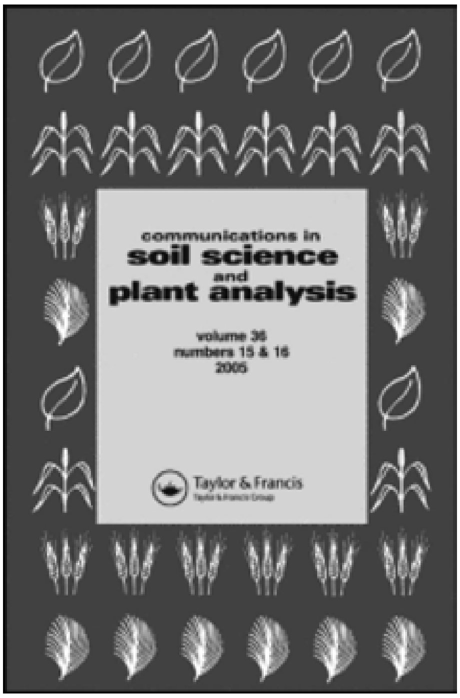

**Financial return per hectare:**

- Black Urea® 9.93 bales/ha @ $500/bale equates to $4,950.00/ha
- White Urea 9.34 bales/ha @ $500/bale equates to $4,650.00/ha
- A $278 per hectare profit after the added cost of Black Urea®

  (Black Urea® cost $22 more per hectare applied)

In Conclusion

From the results given applications of Black Urea® at 95% of the White Urea application rate, resulted in an increase in yield across all treatments, in both module weight and yield in bales per hectare/acre. In the Black Urea® treatment cotton yield in bales per ha was improved by 0.59 bales/ha and 0.24 bales/ac. From this we can conclude that when comparing Black Urea® to White Urea (with the addition of Enhance Plus™ to both treatments) Black Urea® can improve yields. Unfortunately at the time of printing no quality data was available for comparison.

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**Greenhouse Pot Trials to Determine the Efficacy of Black Urea Compared to Other Nitrogen Sources**

J. A. Janse van Vuuren a; A. S. Claassens
Soil Science Consultant, Highveld, Centurion, South Africa Department of Plant Production and Soil Science, University of Pretoria, Pretoria, South Africa

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# Greenhouse Pot Trials to Determine the Efficacy of Black Urea Compared to Other Nitrogen Sources

J. A. Janse van Vuuren[1] and A. S. Claassens[2]
[1]Soil Science Consultant, Highveld, Centurion, South Africa
[2]Department of Plant Production and Soil Science, University of Pretoria, Pretoria, South Africa

Abstract: Two separate pot trials were conducted at the research farm of the University of Pretoria to establish the efficacy of Black Urea as compared to normal urea and limestone ammonium nitrate as sources of nitrogen for maize (corn) fertilization. The aim was two-fold: first to compare it as a banded nitrogen source, and second to compare it as a source of topdressed nitrogen at planting. In the first trial, the pots were not leached to establish the possible salt effects in the fertilizer band. In the second trial, the pots were leached to simulate normal field conditions. In both trials, Black Urea proved superior to normal urea.

Keywords: Band placed, Black Urea, LAN, maize, pot trials, top-dressed, urea

## INTRODUCTION

In the late 1980s in pot and field trials conducted with amorphic coarse lime granules mixed with band-placed fertilizer, we established the importance of ensuring a more acceptable environment for the young maize seedling (van Vuuren 1991; van Vuuren, Meyer, and Claasens 2006). The lime neutralized most of the acid formed during the nitrification of reduced nitrogen (N) that had been band placed at planting. We were able to keep the pH in the band area at the original pH of the surrounding soil.

Where limestone ammonium nitrate (LAN) is used as a starter fertilizer, large losses of N occurred, due to leaching in the absence of an effective root system. When top-dressing N (urea, LAN, or ammonium sulfate) after planting, the reduced N forms are susceptible to volatilization. Field trials conducted in Australia using advanced nutrients with Black Urea compared to normal urea seemed promising (Table 1).

## MATERIALS AND METHODS

First Pot Trial

Two soils were used in the pot trial experiments. An artificially acidified soil from the research farm of the University of Pretoria was used. Soil was sieved through a 2-mm sieve and homogenized. The chemical characteristics of the soil used are given in Table 2. The pH(H2O) of the artificially acidified soil was 3.8. The same soil was limed to a pH(H2O) of 6.0 using laboratorygrade calcium carbonate. Six kg of soil was placed in every pot (5L).

Treatments

Four maize (corn) seeds were planted in pairs on the insides of the pots. Three different fertilizer placements were used in the pots: 1) 50 kg of N ha21 equivalent of the different N sources were band placed in the center of the pot, 10 cm deep; 2) 50 kg of N ha21 equivalent of the different N sources were placed on the top of the soil and immediately washed in; 3) 50 kg of N ha21 equivalent of the different N sources were placed on the top of the soil and washed in the next day. After the plants emerged, the strongest growers were left, and the weaker plants were removed. Two plants were left in every pot on opposite sides.

Nitrogen Sources

Three sources of N were used: Black Urea, urea, and LAN.

Replicates

All treatments were done in triplicate. The control pots received 50 kg ha21 N in addition to the rest of the treatments. All treatments received all the additional essential nutrients in a 1N Hoagland's solution. No leaching occurred during the period of the trial. Pots were placed on a rotating round table in the greenhouse and allowed to grow for 6 weeks. Soil moisture was kept at 50% of saturated field water capacity. Biomass at 6 weeks was accepted internationally as an indication of potential yield.

***Table 1.*** Field trials conducted in Australia

| Crop | Application | Soil | Yield with urea | Yield with black urea |
|---|---|---|---|---|
| Dryland wheat "Mayfield," Quirindi | 50 kgha$^{-1}$ aerial application | Black basalt, pH 6.5 | 4.23 Ton ha$^{-1}$ 151 kg for A\$1.00 | 4.89 ton ha$^{-1}$ 212 kg for A\$1.00, 40% increase, advantage A\$398 ha$^{-1}$ |
| Pivot irrigated cotton "Ginaween" bonshaw | 250 kgha$^{-1}$ surface spread | Sandy loam, pH 5.0–5.5 | | 0.22 Bales ha$^{-1}$ more, advantage A\$84 ha$^{-1}$ |
| Dryland pasture "Jnardi," Eureka | 80 kgha$^{-1}$ surface spread | Red volcanic, pH 5.0 | After 3 weeks, 8 ton ha$^{-1}$ dry matter | After 3 weeks, 10 ton ha$^{-1}$ dry matter, advantage A\$36 ha$^{-1}$ |
| Dryland wheat "Cashmere Vale," Wee Waa | 60 kgha$^{-1}$ surface spread | Red basalt, pH 7.0 | 3.0 ton ha$^{-1}$ protein 12.3% | a) Ton ha$^{-1}$ b) Protein 13.1%, advantage A\$24 ha$^{-1}$ |
| Irrigated corn "Goodgerwim," Caroona | 160 kgha$^{-1}$ side dress | Black Vertisol, pH 8.5 | 11.5 ton ha$^{-1}$ 142 kg per A\$1.00 | 12.3 ton ha$^{-1}$, 149 kg for A\$1.00, advantage A\$284 ha$^{-1}$ |
| Dryland barley "Goodgerwim," Caroona | 80 kgha$^{-1}$ surface spread | Black Vertisol, pH 8.3 | 4.8 ton ha$^{-1}$ 118 kg per A\$1.00 | 5.2 ton ha$^{-1}$, 126 kg for A\$1.00, advantage A\$89 ha$^{-1}$ |
| Dryland wheat "Dimby Downs," Quirindi | 100 kgha$^{-1}$ aerial application | Black Vertisol, pH 8.4 | 4.0 ton ha$^{-1}$ | 5.0 ton ha$^{-1}$, advantage A\$111.80 ha$^{-1}$ |

*Note.* A\$ = Australian dollars.

***Table 2.*** Chemical analysis of the soil used in the pot trials

| Depth | pH ($H_2O$) | Resistance (Ohm) | CEC ($cmol_{(+)}kg^{-1}$) | Texture | Bray 1 ($mgkg^{-1}$) P | 1N Ammonium acetate ($mgkg^{-1}$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ca | Mg | K | Na |
| 0–30 cm | 5.75 | 1620 | 6.26 | SaClLm | 2 | 374 | 175 | 106 | 7 |
| 30–60 cm | 5.95 | 1760 | 5.97 | SaClLm | 1 | 313 | 184 | 73 | 1 |

*Notes.* SaClLm = sandy clay loam; CEC = cation exchange capacity.

## RESULTS AND DISCUSSION

The averages of the fresh (wet) and oven dried (65 uC) biomass of the top growth are given in Table 3.

Averages and the standard deviations were determined for the different treatments. Clearly the topdressed urea (fresh mass) in the acidic soil showed a highly significant (two standard deviations) yield decrease compared to the average. The dry mass did not show a similar tendency, probably due to the complication of the closed system. (No leaching occurred for the duration of the trial.)

Using the averages of the band placement as basis for comparison of the different topdressed treatments relative to the band-placed treatment, Table 4 illustrates the effects clearly.

Urea showed 31.7% and 81.0% decreases in biomass production compared to the band-placement treatment. Black Urea showed 16.5% and 27.9% decreases, and LAN showed 6.8% and 27.6% decreases. In practice, topdressed N is seldom or never washed in the same day; usually this occurs a couple of days after application by normal rainfall. The biomass decrease in the Black Urea treatment (27.9%) was the same as the LAN (27.6%). In South Africa, LAN had been viewed as a safer source of N for top dressing.

Second Pot Trial

The same pots used in the first trial were used in the second trial. They again received a 1N Hoagland's solution containing all the essential plant nutrients with the exception of N. Only the control received N in the Hoagland's solution. The rest of the treatments were identical. Two weeks after emergence, the pots were leached by the addition of 3 L of water. The averages of the biomass production are given in Table 5.

Averages and standard deviations were again determined for the different treatments. On both the acid and limed soil, the urea treatments showed a significant decrease (one standard deviation) in yield compared to the averages of all the treatments.

Using the averages of the band placement as a basis for comparison of the different topdressed treatments relative to the band-placed treatment, Table 6 illustrates the effects clearly.

On the limed soil, the urea showed an average of 18.3% (fresh and dry mass) yield decrease compared to the band placement. Black Urea showed a 2.2% (fresh and dry mass) yield decrease, and LAN had a 1.6% yield decrease. On the acid soil, the urea showed an average 67.1% decrease in yield compared to the band-placed treatment. Black Urea showed a 41.6% yield increase (fresh and dry mass), and LAN had a 33.8% yield increase.

***Table 3.*** First pot trial: biomass averages after 6 weeks

| Treatment | Placement | | Fresh mass per pot (g) | | Dry mass per pot (g) | |
|---|---|---|---|---|---|---|
| | | | Limed soil | Acid soil | Limed soil | Acid soil |
| Control | | | 30.86 | 6.90 | 13.29 | 2.70 |
| Urea | Band placed in pot | | 47.74 | 10.88 | 17.17 | 3.74 |
| | Top-dressed, washed in the same day | | 41.84 | 7.43 | 14.78 | 3.05 |
| | Top-dressed, washed in the next day | | 41.10 | (2.07**) | 13.00 | 1.80 |
| LAN | Band placed in pot | | 45.65 | 9.35 | 16.09 | 3.56 |
| | Top-dressed, washed in the same day | | 37.34 | 8.71 | 12.58 | 2.85 |
| | Top-dressed, washed in the next day | | 42.63 | 6.77 | 13.84 | 2.71 |
| Black Urea | Band placed in pot | | 44.70 | 10.68 | 16.04 | 4.88* |
| | Top-dressed, washed in the same day | | 39.41 | 8.92 | 12.96 | 2.80 |
| | Top-dressed, washed in the next day | | (38.18*) | 7.70 | 13.58 | 1.76 |
| | Band placed in pot | A[a] | 46.15 | 10.07 | 16.95 | 3.69 |
| | | SD | 1.81 | 1.46 | 0.87 | 0.82 |
| | Top dressed washed in the same day | A | 40.38 | 8.88 | 14.22 | 3.04 |
| | | SD | 3.19 | 1.48 | 1.66 | 0.39 |
| | Top dressed washed in the next day | A | 41.16 | 6.32 | 14.11 | 2.18 |
| | | SD | 2.49 | 2.41 | 1.48 | 0.43 |

[a]A = average; SD = standard deviation.

*Notes.* One standard deviation = significant yield increase* (decrease*). Two standard deviations = highly significant yield increase** (decrease**).

***Table 4.*** First pot trial: percentage increase/decrease in biomass compared to the band placed treatment

| Placement | Fresh mass in limed soil | Fresh mass in acid soil |
|---|---|---|
| Topdressed urea on acid soil—not a safe practice | | |
| Banded | 47.74[a] | 10.88 |
| Top-dressed, washed in the same day | 41.84 (−12.4%) | 7.43 (−31.7%) |
| Top-dressed, washed in the next day | 41.10 (−13.9%) | 2.07 (−81.0%) |
| Topdressed Black Urea on acid soil—much less of a problem | | |
| Banded | 44.70 | 10.68 |
| Top-dressed, washed in the same day | 39.41 (−13.4%) | 8.92 (−16.5%) |
| Top-dressed, washed in the next day | 38.18 (−14.6%) | 7.70 (−27.9%) |
| Topdressed LAN on acid soil similar to Black Urea | | |
| Banded | 45.65 | 9.35 |
| Top-dressed, washed in the same day | 37.34 (−18.2%) | 8.71 (−6.8%) |
| Top-dressed washed in the next day | 42.63 (−6.6%) | 6.77 (−27.6%) |

[a]Grams per pot. Percentage in parentheses represents the change of fresh mass compared to fresh mass of banded application.

Partial explanation of the advantage of the buffered organic complex coating (Launch) on the urea can be explained by the huge surface area and high exchange capacity of some of the constituents in the coating material. Another probable contributing factor could be the stimulation of micro-organisms in the soil, which take up nutrients and which are again mineralized as the organisms die off, possibly contributing to the sustained release of N.

These figures (Forschungzentrum Dresden-Rossendorf. n.d.) correlate well with the scanning electron microscope micrograph of an aggregate of humic particles as shown in Figure 1. The length of 500 nm confirms the length of a humus particle, given in Table 7 as 200 nm.

## CONCLUSIONS

Black Urea in the first pot trial proved to be superior to normal urea on the acid soil. Black Urea in the second pot trial (leached after 2 weeks) was superior to both normal urea and LAN on both acid and the limed soil. This confirms the trial results in Australia where Black Urea outperformed urea by at least 20–30%.

Based on the pot trials in South Africa, at least 10–20% and 30–50% less Black Urea needs to be applied as topdressing on limed and acid soils, respectively, compared to urea. This has a huge financial implication for the farmer. Because of the sustained release of N from Black Urea, acidification due to nitrification from band placement of reduced N, before active root development has taken place, should be negligible and cuts down on the liming requirement.

An additional advantage could be that additional topdressing with Black Urea on very sandy soils may prove unnecessary. Savings is not just on the amount of product being used, but also less transport, labor, and mechanical operations are needed.

***Table 5.*** Second pot trial: biomass averages after 6 weeks

| Treatment | Placement | | Fresh mass (g) | | Dry mass (g) | |
|---|---|---|---|---|---|---|
| | | | Limed soil | Acid soil | Limed soil | Acid soil |
| Control | | | 39.80 | 16.26 | 5.42 | 1.97 |
| Urea | Band placed in pot | | 26.24 | 21.37 | 3.78 | 2.88* |
| | Top-dressed, washed in the same day | | 37.54 | 23.68* | 5.01 | 3.56* |
| | Top-dressed, washed in the next day | | 23.25(*) | 7.52(*) | 2.83(*) | 0.88(*) |
| LAN | Band placed in pot | | 31.70 | 14.48 | 4.00 | 1.97 |
| | Top-dressed, washed in the same day | | 28.29 | 15.18 | 4.23 | 1.99 |
| | Top-dressed, washed in the next day | | 29.65 | 18.91 | 4.13 | 2.70 |
| Black Urea | Band placed in pot | | 30.78 | 17.89 | 3.76 | 2.16 |
| | Top-dressed, washed in the same day | | 27.92 | 19.62 | 3.19 | 2.75 |
| | Top-dressed, washed in the next day | | 29.94 | 23.81* | 3.70 | 3.24 |
| | Band placed in pot | A[a] | 28.73 | 16.96 | 3.63 | 2.24 |
| | | SD | 4.17 | 3.87 | 0.70 | 0.52 |
| | Top-dressed, washed in the same day | A | 32.86 | 18.00 | 4.55 | 2.41 |
| | | SD | 5.46 | 4.27 | 0.90 | 0.89 |
| | Top-dressed, washed in the next day | A | 29.57 | 17.02 | 3.86 | 2.33 |
| | | SD | 4.46 | 6.92 | 0.98 | 1.04 |

[a]A = average; DS = standard deviation.
*Notes.* One standard deviation = significant yield increase*/(decrease*).

*Table 6.* Second pot trial: percentage increase/decrease in biomass compared to the band-placed treatment

| Placement | Fresh mass in limed soil | Fresh mass in acid soil | Dry mass in limed soil | Dry mass in acid soil |
|---|---|---|---|---|
| Topdressed urea on acid soil—not a safe practice | | | | |
| Band placed in pot | 26.24[a] | 21.37 | 3.78 | 2.88 |
| Top-dressed, washed in the next day | 23.25 (−11.4%) | 7.52 (−64.8%) | 2.83 (−25.1%) | 0.88 (−69.4%) |
| Topdressed Black Urea on acid soil—much less of a problem | | | | |
| Band placed in pot | 30.78 | 17.89 | 3.76 | 2.16 |
| Top-dressed, washed in the next day | 29.94 (−2.7%) | 23.81 (+33.1%) | 3.70 (−1.6%) | 3.24 (+50.0%) |
| Topdressed LAN on acid soil similar to Black Urea | | | | |
| Band placed in pot | 31.70 | 14.48 | 4.00 | 1.97 |
| Top-dressed, washed in the next day | 29.65 (−6.5%) | 18.91 (+30.6%) | 4.13 (+3.3%) | 2.70 (+37.1%) |

[a]Grams per pot. Percentage in parentheses represents the change of fresh mass compared to fresh mass of banded application.

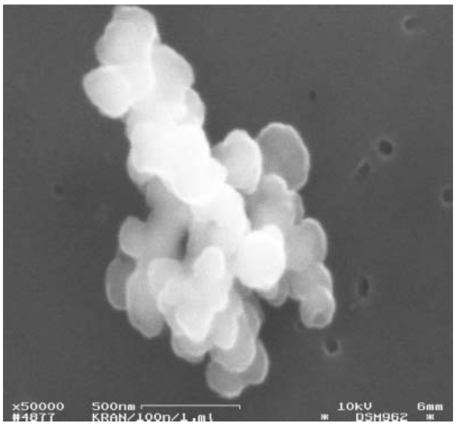


*Figure 1.* SEM micrograph of an aggregate of humic particles.

## RECOMMENDATIONS

Farmers in South Africa are under extreme pressure regarding input costs; this can only worsen in the future as oil prices increase. A sustainable approach is a necessity. We can no longer afford to ignore the basics. This is the only way in which our valuable resources (soil and environment) can be maintained. A paradigm shift is essential in adopting this exciting new product and approach.

*Table 7.* Surface area of a cube (One centimeter in diameter or a $cm^3$ of the product)

| Soil | Diameter | Surface area | CEC $cmol_{(+)}kg^{-1}$ |
|---|---|---|---|
| Stone | 1 cm | $6\,cm^2$ | |
| Sand | 2–0.02 mm | $750\,mm^2$–$750\,cm^2$ | 1.5–7 |
| Silt | 0.02–0.002 mm | 750 cm2–7500 $cm^2$ | 8–25 |
| Clay | < 0.002 mm (2 um) | $0.75\,m^2$–$750\,m^2$ | 20–120 |
| Humus | <0.02 µm (200 nm) | > $750\,m^2$ | 250 |
| Humic acid | <0.02 µm (20 nm) | 7, 500 $m^2$ | 450 |
| Fulvic acid | < 0.005 µm (5 nm) | 30, 000 $m^2$ | 1400 |

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# Research

2006 Dryland Barley Trials

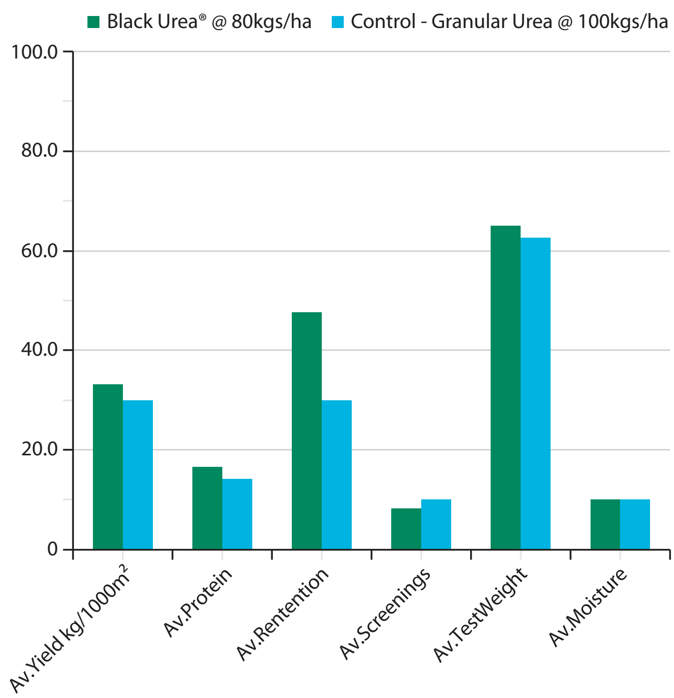
Black Urea - Granular Urea Trial Results
The purpose of this trial is to test the manufacturers claims that Black Urea™ will out perform normal granular urea when applied at less cost per hectare. Black Urea™ was applied at 80kgs/ha = $53/ha, granular urea was applied at 100kgs/ha = $55/ha in three replications under commercial farm conditions.

The results overall were poor due to drought conditions however the following results clearly show the claim to be true with a reduced cost of $2/ha achieving an increase in yield over 9% and trend to increased protein whilst significantly reducing screenings (-28%) and increasing retention (53%).

| | Black Urea | Granular Urea | Black Urea | Granular Urea | Black Urea | Granular Urea | BioChar 4t/ha |
|---|---|---|---|---|---|---|---|
| Kgs Per Plot | 367 | 333 | 280 | 267 | 341 | 303 | 133 |
| Moisture | 10 | 9.8 | 10.1 | 10.2 | 10.1 | 10.1 | 10.4 |
| Test Weight | 64 | 64 | 65 | 63 | 64 | 63 | 63 |
| Protein | 17.3 | 17.7 | 17.6 | 16.1 | 17.4 | 16.7 | 20.1 |
| Screenings | 7.3 | 9 | 6.8 | 10.5 | 7 | 9.8 | 16.3 |
| Retention | 45.5 | 33 | 47.5 | 28.3 | 46 | 29.5 | 21.7 |

| | Av.Yield kg/1000m² | Av.Protein | Av.Rentention | Av.Screenings | Av.TestWeight | Av.Moisture |
|---|---|---|---|---|---|---|
| Black Urea® @ 80kgs/ha | 32.9 | 17.4 | 46.3 | 7.0 | 64.3 | 10.1 |
| Control - granular Urea @ 100kgs/ha | 30.1 | 16.8 | 30.3 | 9.8 | 63.3 | 10.0 |
| %change | 9.4% | 3.6% | 53.1% | -28.0% | 1.6% | 0.3% |

| | |
|---|---|
| Crop: | Barley - Grimmett |
| Location: | Moree, NSW |
| Plot Size: | 1 ha |
| Soil Type: | black vertisol “cracking clay” |
| Soil Characteristics: | pH 7.9, CEC 25, OM 1.1%, low P, high Na |
| Rainfall: | mm Preplant |
| | mm In crop |
| Tillage: | minimum tillage |
| Herbicide: | preplant RoundUp, |
| | post emergent Ally 5g/ha |
| | with MCPA250 900ml/ha |
| Insecticide: | nil |
| Previous Crop: | Barley 2005, Sorghum 2004 |
| Agronomist: | Bernie Bierhoff |
| Researcher: | Craig Salmon |
| Manufacturer: | EcoTech (Aust) Pty Ltd |



# EVALUATION OF THE EFFICACY OF COATED PHOSPHATES

Van Vuuren, J.A.J. 1,& Claassens, A.S 2.
[1]Soil Science Consultant, Highveld, Centurion, South Africa.
[2]Department of Plant Production and Soil Science, University of Pretoria

Abstract: The increase in the price of fertilizers worldwide necessitates the development of more efficient fertilizers. Water-soluble phosphates are fixed in both acid and alkaline soils; the challenge is to increase the efficiency of these expensive fertilizer sources. The use of slow and controlled release fertilizer technology is an option, however it is too expensive for use in dry-land crop production such as grains. With the development of the coated products, which gives a sustained release of these nutrient elements, the problems are largely overcome. Green house trials were conducted in order to access the efficiency of the coating technology. The studies were initiated after the successful trials in 2007 done with Black Urea (coated with a buffered organic complex consisting of organic acids, carbohydrates, growth hormones, vitamins and enzymes). A major finding of the initial trials showed a significant increase in the efficiency of the Black Urea (30-40% on acid and 10- 20 % on alkaline soils) when applied as a top dressing, compared to granular Urea. This 2008 study was duplicated with another coated fertilizer, Black DAP, which yielded 11.85% higher biomass dry production compared to standard DAP and 16.85% higher than single super phosphate (SSP) at the same rates of application.

Keywords: Black Urea, Urea, Black DAP, DAP, LAN, Maize, Pot trials

## INTRODUCTION

In the late 80’s in pot and field trials conducted with amorphic coarse lime granules mixed with band placed fertilizer, we established the importance of ensuring a more acceptable environment for the young maize seedling (Van Vuuren 1991, Van Vuuren et.al. 2006). Water-soluble phosphates when applied on acid or alkaline soils are susceptible to fixing by the amorphic (Fe-Al hydroxides) components or precipitation as Ca-phosphates respectively.

## MATERIALS AND METHODS

Pot Trial: Black DAP:
Two soils were used in the pot trial experiments. An artificially acidified soil (Sandy clay loam with 16% clay) from the research farm of the University of Pretoria was used. Soil was sieved through a 2mm sieve and homogenised. The chemical characteristics of the soil used are given in Table 1. The pH(H2O) of the artificially acidified soil was 3.8. The same soil was limed to a pH(H2O) of 6.0 using laboratory grade calcium carbonate. Six kilograms of soil was placed in every pot (5 litres).

TREATMENTS:
- All treatments were done in triplicate and per treatment results aggregated.
- All pots received 50 kg/ha-1 nitrogen as Urea and all the additional essential nutrients in a 1N Hoagland solution (excluding P).
- Phosphorus treatments, SSP (as Control), DAP and Black DAP, were applied at 0.36 grams per pot (approx.100kgs/ha), banded 5cm deep in the pots, resulting in equivalent 21.2mgP/kg-1 (Bray 1) in the pots.
- Four maize (corn) seeds were planted in pairs on the insides of the pots. After emergence two seedlings were removed leaving the two strongest plants.
- Pots were placed on a rotating round table in the green house and allowed to grow for six weeks. Biomass at six weeks is accepted internationally as an indication of potential yield (du Toit & Fölscher, 1970).
- Soil moisture was kept at 50% of saturated field water capacity.

## RESULTS

The average of the biomass production are given in Tables 2.
DAP gave a 5%, Black DAP a 16.85%, increase in biomass production compared to the control with super phosphate. Plant analysis were done (samples dried at 65OC and milled to pass through a 0.05mm sieve) in order to evaluate the utilization of the P application. Results are shown in Table 3.
Multiplying the dry mass with the percentage P is indicative of the amount of P taken up from the different sources.
The Black DAP show a significant (10.36%) increase in P uptake compared to the other P sources.

DISCUSSION & CONCLUSION:

From the results we can see a clear benefit in the use of Black DAP over DAP or SSP to increase production of maize. Other coated fertilizers in the same family have proven in field trials that a reduction in application rate is possible with these types of coated fertilizers; further research to determine the ideal application rates is warranted.

Enhanced Efficiency Fertilizers such as these, and their reductions in application rates, have significant impacts on crop production costs and the reduction of greenhouse gases attributable to agriculture.

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## TABLES:

| Depth | pH ($H_2O$) | Resistance (Ohm) | CEC ($cmol_{(+)}kg^{-1}$) | Texture | Bray1 P ($mgkg^{-1}$) | 1N Ammonium acetate ($mgkg^{-1}$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ca | Mg | K | Na |
| 0-30cm | 5.75 | 1620 | 6.26 | SaClLm | 2 | 374 | 175 | 106 | 7 |
| 30-60cm | 5.95 | 1760 | 5.97 | SaClLm | 1 | 313 | 184 | 73 | 1 |

SaClLm = Sandy Clay Loam; CEC = Cation Exchange Capacity.

**Table 1. Chemical analysis of the soil used in the pot trials.**

| Treatment | Wet Biomass grams | % Increase in biomass | Dry biomass grams | % Increase in biomass |
|---|---|---|---|---|
| Control | 64.08 | | 5.40g | |
| DAP 0.36g (21.2$mgkg^{-1}$) | 67.65 | 5.57% | 5.67g | 5.00% |
| **Black DAP 0.36g (21.2$mgkg^{-1}$)** | 70.65 | **10.25%** | 6.31g | **16.85%** |
| Average<br>Std.Dev. | 67.46<br>3.29 | | 5.79<br>0.47 | |

**Table 2. DAP Pot trial. Biomass averages after 6 weeks**

| TREATMENT | % P in plant | Yield (grams $pot^{-1}$) | mg P $pot^{-1}$ | % Increase in P uptake |
|---|---|---|---|---|
| CONTROL | 0.18 | 5.40 | 0.972 | |
| DAP 0.36g (21.2$mgkg^{-1}$) | 0.18 | 5.67 | 1.0206 | 5.00% |
| **BLACK DAP 0.36g (21.2$mgkg^{-1}$)** | 0.17 | 6.31 | 1.0727 | **10.36%** |
| Average<br>Std. Dev. | 0.18<br>0.01 | 5.79<br>0.47 | 1.02<br>0.05 | |

**Table 3. DAP Pot Trial. Total uptake of Phosphate by plants (grams per pot)**

# BLACK™ Enhanced Efficiency Fertiliser

- Commercial Field Demonstrations

Crop: Maize
Location: Zimbabwe
Time: SUMMER 2009
Researcher: Agriculture Research Trust, Harare.
Nutrichem (Zimbabwe), Profert Plus (South Africa)

Background

Black™ coated fertilisers, (Black Urea, Black DAP) have demonstrated internationally to enhance efficiency of inorganic fertilisers. That has enabled farmers to reduce the application rates of nitrogen and phosphorus by 15-35% and achieve the same, or economically superior, results. A study conducted in northern Zimbabwe by ART Research and local fertiliser distributors, set to determine the most effective nitrogen rate applied as Black Urea, and too compare the effects of Black DAP versus non-coated DAP under different nitrogen conditions.

Materials and methods

A usual fertilizing regime in the region is granular UREA at 420kgs/ha, 125kgs/ha DAP, 45 kgs/ha MOP, 195kgs/ha gypsum. All trial plots received the gypsum and MOP at usual rates, for comparison, five different application rates of Black Urea (220, 270, 320, 370 and 420 kgs/ha) were applied with both coated (Black DAP) and uncoated (DAP) di-ammonium phosphate fertiliser. The usual rate of uncoated urea was applied with Black DAP as a control measure as was a Control with no fertiliser applied at all.

Trial Plots

Three sites (namely Chiweshe, Musana and Zvimba) were located in communal areas where the soils are sandy and having less than 15 percent clay. Maize was planted in 0.9m row spacing with 0.5m between plants. A plot size of 5 rows by 5 meters long was used and only three centre rows harvested (13.5m3)

Normal weed and pest control measures were applied.

Results

Chiweshe produced the highest site mean yield of 8.56 t/ha while Zvimba and Musana yielded approx. half that rate (Table 1). The Zvimba and Musana soils were slightly sandier than Chiweshe to the extent that the control treatment yielded less than half a tonne.

**Table 1: Grain yield (t/ha at 12.5% moisture content) of maize sown at 3 sites 2009 - 2010 season**

| Site Treatment | Chiweshe | Musana | Zvimba | Mean | | |
|---|---|---|---|---|---|---|
| BUREA 220 + BDAP | 8.79 | 5.01 | 5.07 | 6.29 | | |
| BUREA 270 + BDAP | 8.98 | 5.86 | 3.42 | 6.09 | | |
| BUREA 320 + BDAP | 8.47 | 4.52 | 4.71 | 5.90 | | |
| BUREA 370 + BDAP | 9.13 | 2.53 | 5.83 | 5.83 | | |
| OUREA 420 + BDAP | 8.71 | 4.19 | 4.48 | 5.79 | | |
| BUREA 220 + ODAP | 8.54 | 3.13 | 5.20 | 5.62 | | |
| BUREA 270 + ODAP | 8.13 | 5.48 | 3.21 | 5.61 | | |
| BUREA 320 + ODAP | 7.85 | 3.39 | 4.85 | 5.36 | | |
| BUREA 370 + ODAP | 8.39 | 3.68 | 3.91 | 5.33 | | |
| BUREA 420 + ODAP | 8.65 | 3.11 | 1.89 | 4.55 | | |
| CONTROL | 6.28 | 0.40 | 2.41 | 3.03 | | |
| | | | | | | |
| Mean Of Treatment | 8.56 | 4.09 | 4.26 | 5.64 | | |
| STD ERR | 0.75 | 0.17 | 0.42 | 0.45 | | |
| Significance | * | ** | *** | | | |
| LSD (5%) | 2.26 | 0.49 | 1.25 | 1.33 | | |
| C.V (%) | 16.0 | 8.0 | 18.0 | 14.0 | | |
| | | | | | | |
| Phosphate Comparison | 9.97% Increase In Production By Black DAP™ | | | | | |
| Black DAP™ - BUREA 220 | 8.79 | 5.01 | 5.07 | 6.29 | 11.86% | Increase in production |
| DAP - BUREA 220 | 8.54 | 3.13 | 5.20 | 5.62 | | |
| | | | | | | |
| Black DAP™ - BUREA 270 | 8.98 | 5.86 | 3.42 | 6.09 | 8.56% | Increase in production |
| DAP - BUREA 270 | 8.13 | 5.48 | 3.21 | 5.61 | | |
| | | | | | | |
| Black DAP™ - BUREA 320 | 8.47 | 4.52 | 4.71 | 5.90 | 10.01% | Increase in production |
| DAP - BUREA 320 | 7.85 | 3.39 | 4.85 | 5.36 | | |
| | | | | | | |
| Black DAP™ - BUREA 370 | 9.13 | 2.53 | 5.83 | 5.83 | 9.45% | Increase in production |
| DAP - BUREA 370 | 8.39 | 3.68 | 3.91 | 5.33 | | |

Discussion and Conclusion

Nitrogen: the broad trend across the trial showed Black Urea consistently out yields uncoated urea across all application rates and even at significantly lower application rates. The lower application rates yielded the same or similar as higher rates suggesting a strong indication that the usual application rates are probably too high in the first instance. The superior results came with the lowest of the Black Urea rates, with Black DAP, though only when averaged over the three sites. Individual farm management would produce greater overall result as each farm had a different reduction in application rate producing the best result.

- At Chiweshe the treatment of Black Urea (220kg/ha) with Black DAP (145kgs/ha) produced the best economic result with fertiliser N+P Cost per ha of $29 per tonne of grain produced.
- Musana's best result was a treatment of Black Urea (270kgs/ha) with Black DAP (145kgs/ha) which produced a tonne of grain with $49/ha of fertiliser.
- Zvimba produced a tonne of grain with $46/ha worth of fertiliser with the Black Urea (220kgs/ha) and uncoated DAP (145kgs/ha).

By comparison, the usual practice of uncoated Urea (420kgs/ha) produced a tonne of grain at Chiweshe ($38/ha), Musana ($80/ha), Zvimba ($74/ha).

A new fertiliser program across the three farms would reduce (-35.4%) fertiliser input costs by $68/ha/t (per hectare and per tonne of grain produced) and increase average yield production to 6.62t/ha from 5.70t/ha (+16.1%).

Phosphorus: a definite and strong trend of increased yield where Black DAP is used in replacement of un-coated DAP. A yield increase occurred across all farms, in all replications, at all application rates.

Improvements in yield varied from 8.5% to 12% amongst different N rates, over the total trial treatment area, average yield increased almost 10% where Black DAP was used.

Further research is being undertaken to explore further nitrogen rate reductions and also reducing Black DAP rates to 25% less than uncoated DAP as is the manufacturer's recommendation.

# Phosphate Field Demonstrations

WINTER 2006

Reseacher: Gary Murdoch-Brown

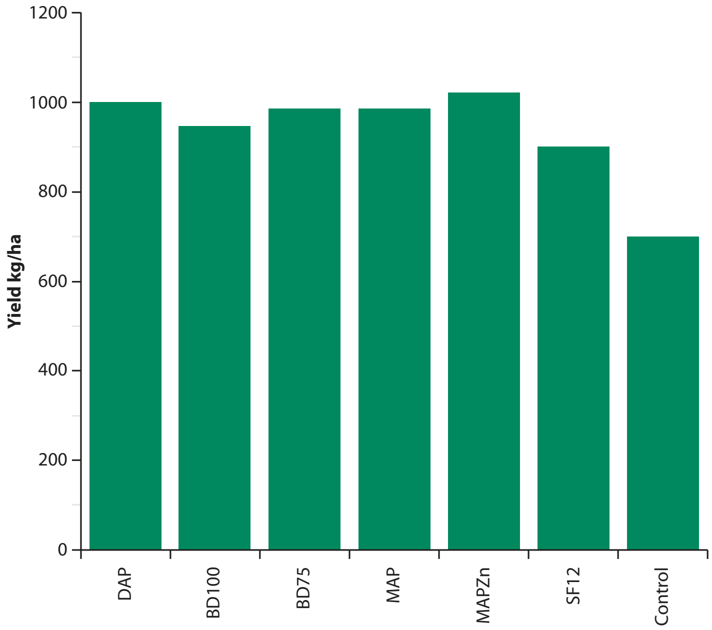
Background:
Phosphate fertilisers are known to increase productivity in many northern NSW soils. Many types are on offer and this test was to quantify which offers the best economic return amongst popular products.

Two sites were chosen appprox 150km apart with different soil characteristics and watering systems, one rain fed, the other lateral irrigation.

Test areas were of commercially relevant size, four random replications, under commercial farming conditions. Preplant fertiliser (N, K, S) was applied at normal commercial practice for the region.

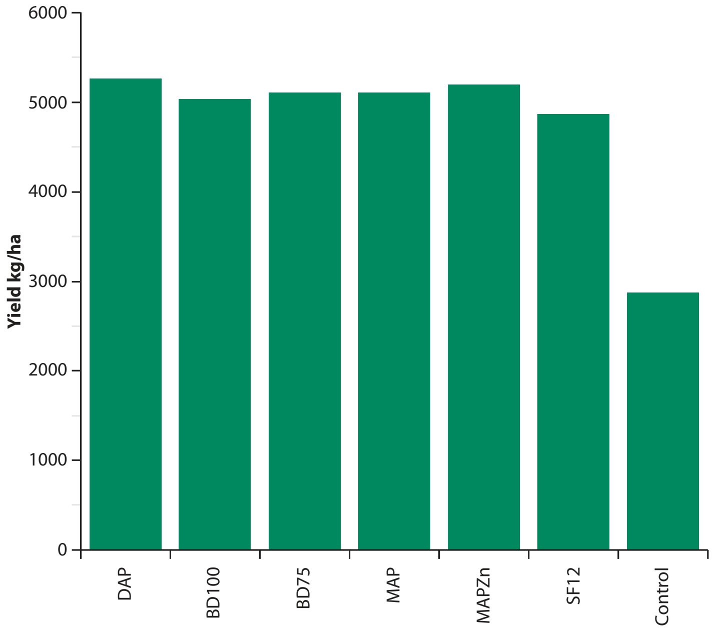
Application:
Six phosphate products were tested and a non treated control. Di-ammonium phospahte (DAP), Black DAP (BD100), Black DAP at 25% reduced rate (BD75), mono ammonium phosphate (MAP), MAP plus Zinc (MAPZn), and SF12.

## Barley Phosphate Demonstration




$ spent / kg produced
$ 0.058
$ 0.067
$ 0.049 15.4%
$ 0.058
$ 0.066
$ 0.064

## Wheat Phosphate Demonstration




$ spent / kg produced
$ 0.016
$ 0.019
$ 0.014 15.4%
$ 0.016
$ 0.021
$ 0.020

Discussion and Conclusion:
All treatments improved productivity over the control. SF12 produced significantly lower yield than all other treatments. No other treatment was significantly better than another though MAP with Zinc consistently produced the highest yield.

Economically, Black DAP applied at 25% less than the usual rate produced the best economic return. Yielding statistically the same as the usual treatments, the dollar spent per kilogram produced was significantly better at 15.4% reduced cost.

Soil Test of these fields are available upon request.

**Black DAP³ - Comparisons to Competition**

Crop: Barley (Grimmet) Dryland | Plot Size (ha): 0.5 | Location: Moree

Soil CEC: 22 | Soil SOM (%): 1.08 | Pre-Plant: 46-0-0-0 @ 100kgs/ha

| Treatment | Product | Application Rate (kgs/ha) | Yield (kgs/ha) | Protein (%) | $/ha |
|---|---|---|---|---|---|
| 1 | DAP | 80 | 1055 | 9.8 | |
| 2 | BD100 | 80 | 1055 | 10.1 | |
| 3 | DAP | 80 | 1020 | 9.8 | |
| 4 | MAP | 80 | 1050 | 9.3 | |
| 5 | MAPZn | 80 | 1095 | 9.9 | |
| 6 | MAP | 80 | 1020 | 10.1 | |
| 7 | BD100 | 80 | 1065 | 10.1 | |
| 8 | DAP | 80 | 1035 | 9.9 | |
| 9 | BD75 | 60 | 1045 | 9.6 | |
| 10 | Control | 0 | 710 | 8.8 | |
| 11 | MAPZn | 80 | 1065 | 9.5 | |
| 12 | BD75 | 60 | 1010 | 9.8 | |
| 13 | MAP | 80 | 1040 | 9.9 | |
| 14 | SF12 | 150 | 955 | 9.8 | |
| 15 | MAPZn | 80 | 1055 | 10.0 | |
| 16 | BD75 | 60 | 1040 | 9.3 | |
| 17 | SF12 | 150 | 920 | 9.9 | |
| 18 | Control | 0 | 705 | 8.3 | |
| 19 | MAP | 80 | 995 | 10 | |
| 20 | BD100 | 80 | 910 | 10.3 | |
| 21 | MAP | 80 | 1030 | 8.4 | |
| 22 | Control | 0 | 785 | 8.1 | |
| 23 | BD75 | 60 | 1035 | 9.1 | |
| 24 | SF12 | 150 | 945 | 9.2 | |
| 25 | DAP | 80 | 1000 | 10.2 | |
| 26 | BD100 | 80 | 1020 | 10 | |
| 27 | SF12 | 150 | 940 | 9.8 | |
| 28 | Control | 0 | 720 | 8.3 | |

| | | | | | |
|---|---|---|---|---|---|
| Summary | DAP | 80 | 1028 | 9.9 | $60.00 |
| | BD100 | 80 | 1013 | 10.1 | $68.00 |
| | BD75 | 60 | 1033 | 9.5 | $51.00 |
| | MAP | 80 | 1026 | 9.8 | $60.00 |
| | MAPZn | 80 | 1061 | 9.5 | $70.00 |
| | SF12 | 150 | 940 | 9.7 | $60.00 |
| | Control | 0 | 730 | 8.4 | $00.00 |

**Black DAP³ - Comparisons to Competition**

Crop: Wheat (Mercury) Irrigated | Plot Size (ha): 1.9 | Location: North Star

Soil CEC: 55 | Soil SOM (%): 2.5 | Pre-Plant: 35-0-10-5 @ 300kgs/ha

| Treatment | Product | Application Rate (kgs/ha) | Yield (kgs/ha) | Protein (%) | $/ha |
|---|---|---|---|---|---|
| 1 | DAP | 120 | 5445 | 12.4 | |
| 2 | BD75 | 90 | 5540 | 12.6 | |
| 3 | BD100 | 120 | 5480 | 12.7 | |
| 4 | DAP | 120 | 5425 | 12.7 | |
| 5 | MAP | 120 | 5335 | 13.0 | |
| 6 | SF12 | 250 | 5040 | 11.5 | |
| 7 | MAPZn | 120 | 5930 | 12.2 | |
| 8 | MAPZn | 120 | 5150 | 12.3 | |
| 9 | Control | 0 | 3200 | 9.7 | |
| 10 | SF12 | 250 | 4590 | 11.6 | |
| 11 | DAP | 120 | 5265 | 12.2 | |
| 12 | Control | 0 | 2950 | 9.9 | |
| 13 | BD75 | 90 | 5595 | 12.8 | |
| 14 | BD100 | 120 | 5170 | 12.7 | |
| 15 | SF12 | 250 | 5010 | 11.6 | |
| 16 | MAPZn | 120 | 5990 | 12.4 | |
| 17 | Control | 0 | 3050 | 7.3 | |
| 18 | BD100 | 120 | 5080 | 14.1 | |
| 19 | MAP | 120 | 5610 | 12.3 | |
| 20 | BD75 | 90 | 5460 | 12.8 | |
| 21 | BD100 | 120 | 5490 | 12.8 | |
| 22 | BD75 | 90 | 5575 | 13.0 | |
| 23 | DAP | 120 | 5940 | 12.4 | |
| 24 | MAP | 120 | 5210 | 12.4 | |
| 25 | SF12 | 250 | 5120 | 11.7 | |
| 26 | MAPZn | 120 | 5360 | 11.9 | |
| 27 | Control | 0 | 3110 | 9.1 | |
| 28 | MAP | 120 | 5955 | 11.8 | |

| | | | | | |
|---|---|---|---|---|---|
| Summary | DAP | 120 | 5519 | 12.4 | $90.00 |
| | BD100 | 120 | 5305 | 13.1 | $102.00 |
| | BD75 | 90 | 5543 | 12.8 | $76.50 |
| | MAP | 120 | 5528 | 12.4 | $90.00 |
| | MAPZn | 120 | 5608 | 12.2 | $120.00 |
| | SF12 | 250 | 4940 | 11.6 | $100.00 |
| | Control | 0 | 3078 | 9.0 | $00.00 |

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STREET: Unit 3, 218 Leitchs Rd, Brendale, QLD 4500
PHONE: 1800 207 009
EMAIL: INFO@ECOCATALYSTS.COM.AU
WEB: WWW.ECOCATALYSTS.COM.AU

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