South African greenhouse trials of Black Urea™ on Maize (*Zee Mays*)

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Abstract: Pot trials were conducted at the research farm of the University of Pretoria in order to establish the efficacy of Black Urea™ compared to normal granular Urea, as sources of nitrogen on maize (corn) production. The aim was two-fold; firstly to compare it as a banded nitrogen source, and secondly as a source of top dressed nitrogen at planting. The pots were leached to simulate normal field conditions. In the trials the Black Urea™ proved superior to normal Urea particularly when top dressed.

Keywords: Black Urea™, Urea, NUE, Band placed, Top dressed, Maize,

Introduction

Nitrogen use efficiency (NUE) is of significant importance in crop production systems due to its impact on farmer's economic outcomes and environmental impact. NUE may be reduced in crop production due to many factors including poor root development, reductions in plant vigour, losses of soil nitrogen (volatilisation, leaching, denitrification), fertiliser placement and probably other unknown mechanisms.

EcoTech has invented a proprietary (Patent filed) carbon based coating to urea to improve production systems economics and impact by improving plant uptake and utilization and reducing soil losses. The resultant product is Trade Marked as Black Urea™.

In South Africa it is compulsory to register fertilizers under Act 36 of 1947. A new category has been created for any product that is claimed to have any soil or plant enhancement effects, and is subsequently given an "M" registration. A distributor of the product in South Africa commissioned Dr van Vuuren and Prof. Claasens to provide independent verification of the product claims in order to obtain "M" registration and to confirm typical Australian field trial results (Table 1) would be applicable in South Africa.

Table 1. Typical Australian field trials results

CROP	APPLICATION	SOIL	Result - UREA	Result - Black Urea™
Dry land Wheat Quirindi	50 kg/ha Aerial application	Black Basalt pH 6.5	4.23t/ha or 151kg/$1.00-spent	4.89t/ha or 212kg/$1.00 spent = 40% increase ***Advantage $398/ha***
Dry land Wheat Quirindi	100kg/ha Aerial application	Black Vertisol pH 8.4	4.05t/ha	5.12t/ha ***Advantage $111.80/ha***
Dry land Wheat Wee Waa	60kg/ha Surface spread	Red Basalt pH 7.0	3.0t/ha Protein12.3%	3.2 t/ha Protein 13.1% ***Advantage $24/ha***
Pivot Irrigated Cotton. Bonshaw	250kg/ha Surface spread	Sandy loam pH 5.5	4.1 bales/ha	4.32 bales/ha ***Advantage $84/ha***
Dry land Pasture Eureka	80kg/ha Surface spread	Red volcanic pH 5.0	After 3 weeks 8t/ha dry matter	After 3 weeks 10t/ha dry matter ***Advantage $36/ha***
Irrigated Corn Caroona	160kg/ha Side dress	Black Vertisol Ph 8.5	11.5t/ha or 142kg/ $1.00 spent	12.3 t/ha or 149kg/$1.00 spent *Advantage $284/ha*
Dryland Barley Caroona	80kg/ha Surface spread	Black Vertisol pH 8.3	4.8t/ha or 118 kg/$1.00 spent	5.2/ha or 126 kg/$1.00 spent ***Advantage $89/ha***

MATERIALS AND METHODS

A typical soil from the research farm of the University of Pretoria was used (Table 2). Soil was sieved through a 2mm sieve and homogenised. Six (6) kgs of soil was used in every pot.

Table 2. Chemical analysis of the soil used in the trial (before pH adjustment)

Depth	pH(H_2O)	Resistance (ohm)	CEC cmol(+)/kg	Texture	Bray1P (mg/kg)	1 N Ammonium Acetate (mg/kg)			
						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.

TREATMENTS:
Four maize (corn) seeds were planted in pairs on the sides in the pots.
Different fertilizer placements were used in the pots:

1. 50 kg of N/ha equivalent of each nitrogen source was band placed in the centre of the pot, 10 cm deep.
2. 50 kg of N/ha equivalent of each nitrogen source was placed on the top of the soil and washed in the next day equivalent to 25ml rainfall.

After the plants emerged, the strongest growers were left and the weaker plants removed. Two plants were left on opposite sides in every pot.
All treatments were done in triplicate.
All treatments received all the additional essential nutrients in a 1N Hoagland solution.
Pots were placed on a rotating round table in the green house and allowed to grow for six weeks.
Soil moisture was kept at 50% of saturated field water capacity.
Two weeks after emergence the pots were leached by the addition of 3 litres of water
Biomass at six weeks is accepted internationally as an indication of potential yield.
Top growth was cut off above the soil, weighed, dried at 65ºC and the dry mass determined.

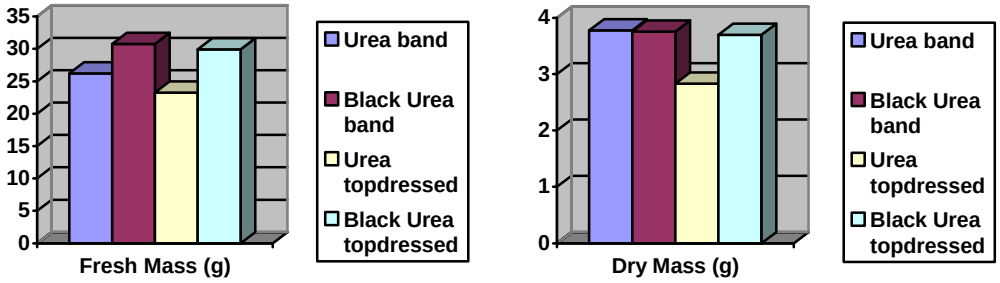
RESULTS and DISCUSSION:
The averages of the fresh (wet) and oven dried (65°C) biomass of the top growth are given in Table 3.

Table 3. Averages of the biomass production after 6 weeks.

Treatment	Placement	Fresh mass (g)	Dry Mass (g)
Urea	Band	26.24	3.78
Black Urea™	Band	30.78	3.76
Urea	Top Dress	23.25	2.83
Black Urea™	Top Dress	29.94	3.70

- Black Urea™ increased fresh mass production by 17% when banded but this did not translate to an increase in dry mass, probably due to the limitations of a closed system.

- In the top dressing simulation Black Urea™ against proved significantly superior to Urea increasing fresh mass by 28% and dry mass by 30%.
- This trial also supports the generally accepted view that band placement will produce greater biomass than top dressing thought to be due to a decrease in nitrogen losses, however, it is evident that by top dressing with Black Urea™ similar biomass production is achievable as that with band placement with normal Urea.



CONCLUSION:

Large scale Australian field trials have proven that Black Urea™ can be used in dryland systems at rates of 20-35% less than granular urea without suffering losses and can be used to significantly increase production economics in irrigated systems. This greenhouse trial suggests that similar results and benefits to farmers can be expected in South Africa. “M” registration has been granted to Black Urea™ in South Africa.