Future Farming™

Case Study

Biostimulant enhanced ammonia provides cost reductions to agriculture production

Enhance Max™
Broad Spectrum Organic Catalyst

Biostimulant enhanced ammonia provides cost reductions to agriculture production

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Abstract:

The use of biostimulants for enhancing efficiency of fertilizers has a chequered history with many field demonstrations leaving economic validation wanting.

Success of the innovation Black Urea® prompted further research into using carbon bio-catalysts for improving the production economics of irrigated agriculture in Queensland, Australia, where anhydrous ammonia is a common fertilizer used in flood irrigation systems.

Anhydrous ammonia is a toxic gas applied to soil under temperature controlled pressure. This has a deleterious impact to the soil organic matter and biota which facilitate fertilizer use efficiency. By mixing a modified humate base and bio-catalysts (EnhanceMax™) with anhydrous ammonia during its application, we can reduce the impact and stabilise the ammonia as ammonium complexed with organic matter and stored as heterotrophic protein.

This capture, control and store mechanism can reduce the environmental losses of fertilizer nitrogen and promote a more sustained availability of nitrogen to the rhizosphere. Current two year commercial scale demonstrations in irrigated cotton have produced equivalent yields to usual practice even when reducing application rates by 20%. This has reduced the cost of nitrogen per production unit (bales of cotton lint) by >15%.

This improved nitrogen use efficiency not only improves the growers' production economics, but improves global goals by directly impacting the reduction in carbon footprint due to fertilizer use.

Key Words:

biostimulants, anhydrous ammonia, nitrogen use efficiency, Black Urea

Background:

Interim Report:	October 2012 - Year 2 of 3
Crop:	Irrigated Cotton
Location:	"Brookglen", St George. QLD. Australia.
Researcher:	David Hall – Pathway Ag Research Consultants
Benefactor:	EcoCatalysts Pty Ltd / Advanced Nutrients Pty Ltd

Treatments (each year):

Anhydrous Ammonia supplied by Incitec Pivot Ltd – Big N is a registered trademark of Incitec Pivot Ltd

Biostimulants supplied by Advanced Nutrients Pty Ltd – EnhanceMax is a Trade Mark of EcoCatalysts Pty Ltd.

1. BIG N® @ 183kgs/ha (AA(150))
2. BIG N® plus EnhanceMax™ @ 183kgs/ha + 6.7L/ha (AA(150)+EM)
3. BIG N® plus EnhanceMax™ @ 146kgs/ha + 5.5L/ha (AA(120)+EM)

Treatment Legend:

AA(150)	Anhydrous Ammonia @ 150kgsN/ha
AA(150)+EM	Anhydrous Ammonia @ 150kgsN/ha + 3.65% EnhanceMax
AA(120)+EM	Anhydrous Ammonia @ 120kgsN/ha + 3.65% EnhanceMax
and	
AA(150)	Usual Practice
AA(120)+EM	Enhanced Efficiency Fertiliser (EEF)

Method:

The fertility of the soil at the commencement of this trial should be noted as being typical of the St George Irrigation district, i.e. a grey clay soil with a moderately alkaline surface which increases with depth. There are no significant sub soil constraints although the ESI in the 30 – 60 cm strata is 0.027, I don't consider this to be serious as there is sufficient irrigation water to prevent any ion competition. Potassium, other cation levels and trace elements are non -limiting. The field has a natural fertility gradient north to south.

During September of each year (2010, 2011) soil tests were taken from Field 134 to the depths of 0 – 10 cm and 10 – 30 cm. The amount of applied nitrogen was based on the results of these soil tests, with the full amount being 150 kgsN/ha (183kgs/ha of fertilizer) and the 20 % less amount being 120 kgsN/ha (146kgs/ha fertilizer).

Each treatment was applied in four replications to plots approx 1.0-1.2 ha each, a total of 5 – 5.5 ha per Treatment. Plots were placed in randomized row design to facilitate commercial farming practices.

The field had been already furrowed up prepared for sowing.

The fertilizer, with and without amendments, was applied 10cm deep in the band by Cold Flow application method in mid September both years. The biostimulant was dribbled on top of the fertiliser in the soil before the press wheel closing the slot.

Planting of Sicot 74 BRF variety cotton (*Gossypium hirsutum*) took place the 10-11th November 2010 and 3-4th October, 2011. Both years considered late due to wet conditions, especially so in Year 1.

According to the assessment of the protocol, soil samples (0 – 10 cm and 10 – 30 cm depth) were to be collected approx. 7, 14, 21 and 28 days post emergence and again post harvest. Analysis required for a minimum of nitrate, ammonium, phosphorus, sulphur and biological indicators. Plant nutrient analysis conducted under ASPAC approved methods and biological indicators by Flourescein Diacetate Activity (FDA) method.

This sampling programme unfortunately didn't occur in Year 1 except for a single test taken 29th November due to rain making it impossible to sample the soil. Year 2 allowed samples to be collected 7, 19, and 28 days after emergence is an otherwise weather constrained environment.

In-crop operations was handling under commercial conditions by the farm owner and management. Tillage, irrigation, weed and pest control and other farm operations is run under a Best Management Practice (BMP) Program and was the same for all treatments operated as one entire field.

The field was picked on 2nd May 2011 and 22nd April, 2012 Year 1 and 2 respectively. Private contractor with yield measurements taken directly from the yield monitoring equipment in the 4 row cotton picker.

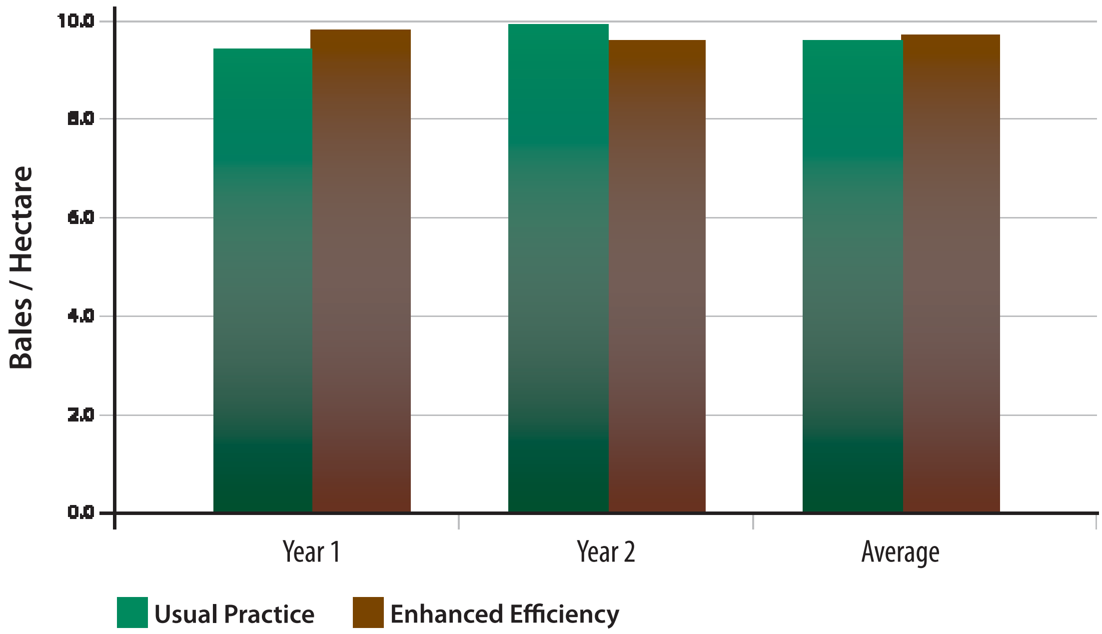
Within each trial plot there were 4 passes (16 m width per plot) by the machine which provided data for each pass; this was recorded separately rather than bulking the results as some passes were on the outside and others on the inside. Results were all analysed individually to allow greater rigour and data integrity.

Results:

A summary of yield results and economic analysis is accompanying in Appendix 1.

If we accept that the highest yield may not always be the most profitable crop, the pursuit of reducing input costs may result in a reduction in overall yield per hectare. This may reduce one input cost but the reduced scale may increase other costs. It is therefore desirable to maintain or increase yield whilst reducing the input costs of fertilizer. Over the first two years of this demonstration, the resultant yield between a full application of 150kgsN/ha (Usual Practice) and the reduced 120kgsN/ha generated via the enhancement (Enhanced Efficiency), maintained yield with no significant difference (Graph 1).

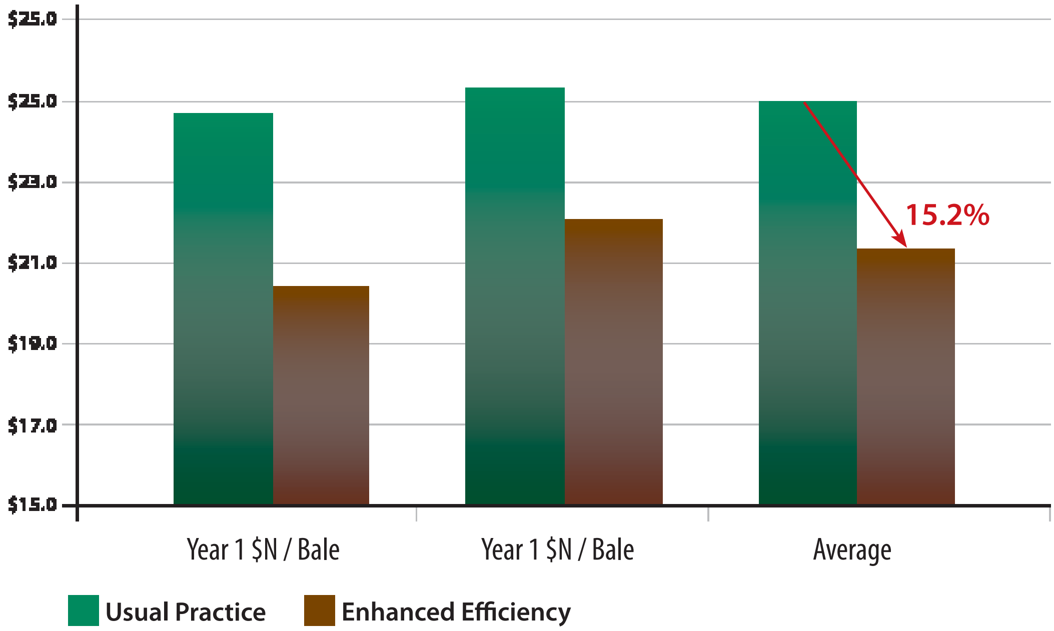
Graph 1: Yield Data, Nitrogen Reduced By 20% In Enhanced Efficiency Application. 2011 "Brookglen".



Nitrogen carried an impost of A$1.32/kgN over the study period. A simple economic analysis of the nitrogen related production costs, discovered the cost of nitrogen per bale (227kgs) of cotton lint, over the two years planting 2010 and 2011, averaged $25.02 when applied as anydrous ammonia (Usual Practice).

The biostimulant enhancement of the fertilizer (Enhanced Efficiency) allowed a reduction in nitrogen applied that reduced the cost of nitrogen per bale of cotton to A$21.22 per bale (Graph 2).

Graph 2: Comparative Analysis - Nitrogen Cost Per Production Unit (Bale Cotton, 227kgs). 2011 "Brookglen".



Conclusion:

The focus of this study is on the commercial benefit if any of using biostimulants with conventional fertilizer use to improve production economics through increased fertilizer use efficiency.

In the case of using the organic acid based biostimulant, Enhance Max™, with Anhydrous Ammonia, BigN®, in irrigated cotton production, the answer is affirmative to an increase in economic benefit. The results of the study thus far, have yielded a reduction in nitrogen cost per unit of production of 15.2% with no loss of overall yield produced.

ENHANCE MAX™
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