

# International Conference on Enhanced-Efficiency Fertilizers

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## NEEM AS A NITRIFICATION INHIBITOR

Kartik LAIJAWALA

Nico Orgo Manures, India



# Neem as a Nitrification Inhibitor

Kartik Laijawala

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## Of Urea

- Urea is the most widely used nitrogenous fertiliser in the world.
- More than 90% of world urea production is destined for use as a nitrogen-release fertilizer.
- Many countries spend valuable foreign exchange importing Urea.

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## The Greenhouse Effect

- Nitrogenous fertilisers have a tremendous greenhouse effect.
- 300 times that of CO<sub>2</sub>.

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## What is Neem?

- Azadirachta Indica, native to the Indian subcontinent.
- Used in agriculture, public health, toiletries, cosmetics and livestock production and health.

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## The tree itself



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## Neem

- It is necessary to regulate the nitrogen supply to crops by slowing down the rate of hydrolysis or nitrification or both.
- Antibacterial properties found to help nitrification inhibition.

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## Yield jump?

- Rice yields increased by an average 9.6%

Crop	↑ yield
Wheat	6.9%
Potato	10.5%
Sugarcane	15.5%
Cotton	10.3%

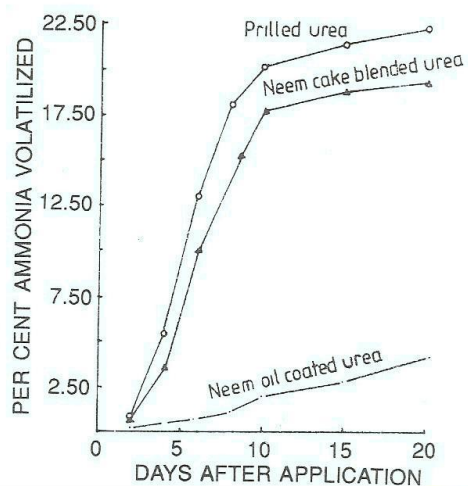
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## Uptake and apparent recovery

- Increased uptake by 4.5% to 19.4%
- Apparent recovery ↑ by 2.1% to 18.4%

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## Neem as an inhibitor



Source: NEEM Research and Development

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## The fate of applied urea

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## Hydrolysis

- Urea rapidly undergoes hydrolysis.
- Nitrogen converts into two by-products, both of which are readily lost to the atmosphere.
- On average 30% of ammonia nitrogen will be lost.
- Even more can be lost if Urea is not moved into the soil.

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## Nitrification

- As Urea is moved into the soil, it is moved away from the threat of Nitrogen loss through volatilization.
- Once underground nitrification takes place.
- Nitrogen is readily utilized by plants once it is moved into the soil. Both ammonical ( $\text{NH}_4^+$ ) and nitrate ( $\text{NO}_3^-$ ) nitrogen are taken by plants.

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## Leaching

- After the process of nitrification, plants continue to utilize Nitrogen in both stable ammonical ( $\text{NH}_4^+$ ) and broken-down nitrate form ( $\text{NO}_3^-$ ).
- Leaching.
- Nitrate nitrogen is an ion, very little is held in the soil profile.

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## Denitrification

- Another avenue of nitrogen loss can occur through denitrification.
- Denitrification by bacteria reduces nitrate into two by-products, nitrogen gas ( $\text{N}_2$ ) and nitrous oxide ( $\text{N}_2\text{O}$ ). Both are readily diffused into the atmosphere and lost.

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## Inhibitors help?

- With the effect of volatilization and nitrification held in check, more nitrogen is sustained in a useable form for a longer lasting effect. Plants are able to take full advantages of the nitrogen you supply in the stable ammonical form.
- In addition, leaching is held to a minimum.

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## NI

- Stop or slow down the conversion of ammonium to nitrate
- The ultimate goal of any NI is to increase the efficiency of the N fertilizer applied.
- Also, nitrification inhibitors help reduce the environmental impact of greenhouse gases.

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## NI

- Many research trials have confirmed NI products are effective in delaying the conversion of ammonium to nitrate.
- The use of NI products should be viewed as a form of risk insurance.

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## What do we do?

- We have a big job to do in educating farmers about the potential benefits of nitrogen inhibitors.
- The industry and Government would also need to talk about how the significant costs involved in moving this research from the lab to the land can be borne equitably by all parties.

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## What do we do?

- We'd want to improve nitrogen use efficiency
- The farmer must save money, we must target to reduce the burden on his pocket

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## Nitrate Vulnerable Zones

- All EU countries must reduce the nitrate in Drinking Water to a maximum of 50mg/l
- The NVZs covered large areas of land that had been identified as exceeding or being at risk of exceeding 50mg/NO<sub>3</sub>/l.

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## Nitrate Vulnerable Zones

- Farmers fertiliser use restricted
- At EU level, the application of manure is limited to 170 kg nitrogen per hectare per year.
- An inhibitor effectively increases his Urea use efficiency.

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## Opportunities

- Create a slow release nitrogen fertiliser.
- Reach a previously untapped market.
- Gain from goodwill generated through environmentally friendly practices.
- Carbon Credit potential can be explored.

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## Easy to use

- Only 6 l/ton application required.
- Easy to blend.
- The blending can be done by the farmer himself.

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## N-Guard

- N-Guard provides you with all benefits of slow-release nitrogen without much added cost.
- N-Guard, being Neem based, has a hidden benefit, soil-borne insect control and a reduction in phytonematodes.

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## N-Guard

- Reduces the loss of Nitrogen through ammonia volatilization, Nitrate leaching and other processes.
- Increases Nitrogen Use Efficiency.
- Reduces nitrification rate, thereby preventing ground water contamination with nitrates.

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## N-Guard

- Helps in continuous availability of nitrogen to plants at appropriate stage of plant growth.
- Cuts down nitrogenous fertiliser use by 25% - 50%.
- Helps in managing soil borne insects, diseases and nematodes.

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## Our Research

Sr. No.	Treatment	Yield (Kg/Ha) 3 Pickings	% increase over control
1. <control>	Normal Urea	944	-
2.	N-Guard Coated Urea	1654	75.21%
3.	N-Guard Coated Urea w/ 25% reduced dose of Urea	1470	55.72%

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