

BLACK UREA: A NEW PARADIGM SHIFTS FOR HUMIC ACID COATED SLOW RELEASE UREA FERTILIZER

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Amrit Lal Meena^{1*}, Minakshi Karwal², Sunil Kumar¹ and R.P. Mishra¹

¹ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250110, India

²KIET group of Institutions, Ghaziabad, Delhi NCR-201206, India

Email: amrit.iari@gmail.com

In recent time, black urea is becoming a substantial technology for reduction of nitrogen loss, cost effectiveness and greater nitrogen use efficiency. Black urea is granulated urea which is coated in an organic complex of carbon and biological stimulants which enhances the microbial activity the granule and optimizes nitrogen use efficiency. Black urea is distinctively developed to reduce the losses. Thus 30% more nitrogen than un-coated urea reaches to crops. Black urea technology works through small improvements in each leg of the nitrogen cycle in the soil. It promotes a reduction in losses through volatilization and leaching as it helps in stabilization of nutrients in the soil by the use of biological processes. Black urea controls nitrogen availability through maximizing N use efficiency. It provides lower burn potential over traditional urea fertilizers. It contains 21% carbon, which enhanced soil microbial activity and nutrient availability in soil.

Nitrogen (N) being an integral component of enzymes, amino acids, chlorophyll, and nucleic acids is the essential plant nutrient among all the nutrients. It plays a crucial role in the formation of carbohydrate and its use for stimulation of plant growth and development along with uptake of other essential plant nutrients. To ensure the required crop production, the required N is applied in the soil through various N fertilizers in plant-available forms i.e. nitrate (NO_3^-) and ammonical (NH_4^+) (Sanchari and Huq, 2018). Among all the N fertilizers, most of the nitrogen is supplied through urea fertilizer. Urea has received a special attention a major N fertilizer material within the last four decades or so and has gained the most used N fertilizer place across the world. Though urea has been accepted as most common N fertilizer globally, many agricultural researchers have reservations about the use of urea and its cost effectiveness due to problems related to urea use i.e. the adverse effect of biuret on seedling germinations and early growth; urea phyto-toxicity due to the release of ammonia and/or

accumulation of nitrite; nitrogen losses through denitrification; leaching and volatilization processes (Tisdale *et al.*, 1985).

But, research activities in the last two decades have shown that use efficiency and cost effectiveness of urea can be increased with little bit modifications of urea fertilizer i.e. coating of urea with different materials. Various scientific measures have been adopted gradually for enhancement of effectiveness, decreased manufacturing cost and increased release time of N from urea. Among these scientific measures are formaldehyde treated urea, urea solution with 1.5% biuret, granular urea and very recently the advance step of coating of urea with other nutrient elements i.e. phosphate coated urea, sulphur coated urea and/or coating with calcium/magnesium chloride. Very recently, the latest invention in the field of urea coating is the coating of urea granules with carbon material i.e. humic acid, termed as Black urea.

Application of humic acid coated urea aims to reduce the nitrogen (N) losses during soil application and improve the plant uptake of applied urea through reduced ammonia volatilization, biological denitrification and nitrate leaching. Black urea is claimed as cost effective and more efficient N fertilizer as the coating material i.e. humic acid contains the other plant nutrients like phosphorus, potassium and micronutrients, are also incorporated. Coating of urea with humic acid stimulates the microbial activity in the soil, which enhance the conversion of urea N to ammonia and nitrate more quickly and efficiently, thus accelerate the plant uptake process. Coating material i.e. humic acid being a carbon source, increase the plant conversion of nitrogen to amino acids.

Researches have proved that use of black urea as a source of N supply helps in improvements to different legs of the nitrogen cycle. Use of organically coated urea stimulate the biological processes which enhance the stabilization of nutrients in soil and nitrogen losses through leaching and volatilization can be significantly reduced. Black urea has targetably been developed to improve the profits from crop production on low fertility soils and also for sustainable farming practices (Web-2). Use of black urea in place of white urea has been proved better in terms of maximizing N use efficiency, lowered burning potential, N losses through various process and their impacts on the environment and improved soil microbial activity and nutrient availability due to presence of 21% carbon in black urea (Web-1).

Black urea concept basically works on the following principles

1. Maximize the nitrogen use efficiency

2. Minimize the input use
3. Maximize the profit

1. Maximize the nitrogen use efficiency

Use of organic material for coating gives the unique quality of extended release capabilities of N from black urea to the applied crops. Many researchers have observed that higher biological activity in black urea applied fields deliver more activity into the nitrogen cycle, which results in 25% extra N absorption into the plants (Web-2). Use of carbon organic-catalysts i.e. humic, fulvic, amino acids, ulmic, peptides, polysaccharides, vitamins, surfactants and minerals as coating material serves as an extremely high energy packet for soil microorganisms and provide a very high nutrient exchange capacity around the fertilizer granule. Use of organic material as coating material helps in:

- Stabilization of nitrogen in soil as protein (in microbes) and ammonium with a sustained release to nitrate which is controlled by the plant-soil interaction (rhizosphere).
- Stabilization of phosphorus with carbohydrate avoids the reactions with multivalent cations (tie-up).
- Coating with organic material is the only nitrogen stabilizing technology which can be used with urea, UAN, liquid urea and GAS.

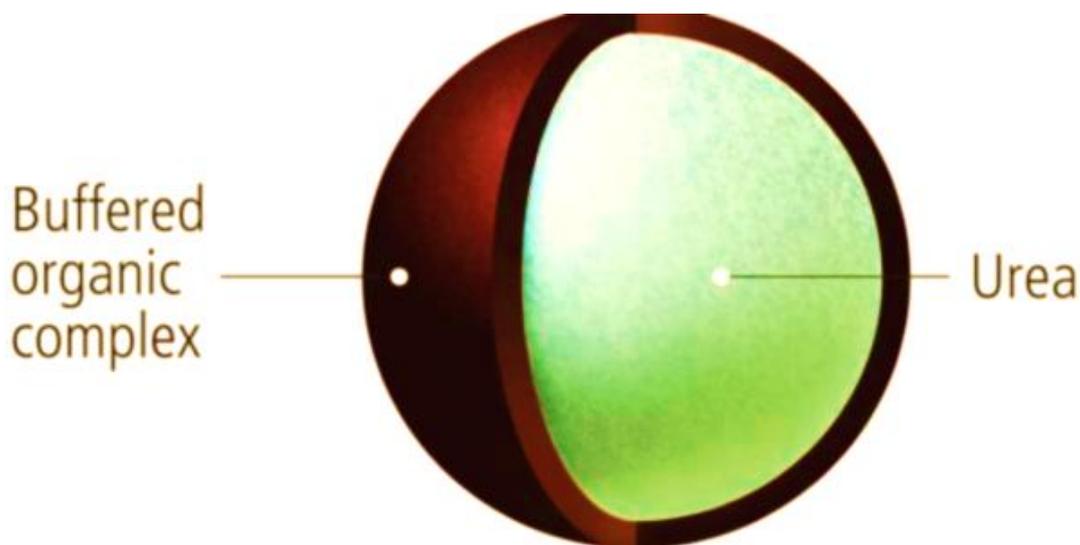


Fig 1. Use of organic material i.e. humic acid, fulvic acid, and other polysaccharides for urea coating.

2. Minimize the input use

Coating of urea fertilizer with various coating materials i.e. sulphur, neem, organic material etc. has now become a popular among the growers because of slow release of nitrogen from the fertilizer, reduced rate of application, farm labour and potential soil and environmental impacts due to N losses through various processes (Hara, 2000). The improvement in different legs of the nitrogen cycle through the involvement of biological processes in case of black urea reduces the application rate of nitrogen. Much scientific glasshouse, field and laboratory research trials over last two decades across the globe have proved that nitrogen application to various crops can be reduced up to 25% when it is applied through black urea (Web-3). That means as compared to normal white urea a minimum 25% more nitrogen will be available to plants in case of black urea which makes black urea significantly more economical and highly effective nitrogen alternative compared to normal white urea.

Table 1. Comparison between black urea and normal white urea in terms of economics

Parameters	Black urea (46% N)	Normal White urea (46% N)
Elemental N (\$/kg)	\$0.97	\$1.24
N Efficiency (%)	50	75
N available to plant (kg)	23	34.5
Effective N (\$/ kg)	\$1.93	\$1.65

(Source: <https://www.agriwestrural.com.au/AgriWest-Newsletter-August-2016.pdf>)

3. Maximize the profit

Application of nitrogen through black urea reduces the fertilizer input rate while delivering the higher yield compared with normal white urea, which gives an overall increase of 10-20% profit to the growers. The increased uptake of nitrogen as a result of slow release from black urea reduces the fertilizer load and increase the cost efficiency up to 10-20% (Web 4). Internationally conducted research trials have demonstrated 15-35% economic superiority of black coated fertilizers (Black urea and black DAP) over the normal fertilizers (Web-4).

Conclusions

Black urea has proved as a better nitrogen fertilizer compared with other urea as well as nitrogen fertilizers in terms of nutrient content, plant growth and cost effectiveness. Proper application and management practices of black urea can fulfil the target of improved benefits and reduced input costs. The input cost of farm inputs can be reduced by 15-35% with application black urea. Thus in the present scenario of changing climate, black urea is simply a more effective and economical source of nitrogen for crops.

References

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Web-1: <http://www.blackurea.com.au/index.php?page=81>.

Web-2: <http://www.turfgrassspecialists.co.nz/page/51/granular-fertilizer?#.V3NqEeLHXIU>.

Web-3: www.agriwestrural.com.au/black-urea.

Web-4: <http://sites.google.com/site/blackureatrials>.