

Specialty Fertilizers for Enhancing Nutrient Use Efficiency and Minimizing Environmental Degradation

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INTRODUCTION

Global food hunger is increasing at an alarming rate and to mitigate this situation farmers are applying huge quantity of chemicals as well as fertilizers that not only degrade soil health but also deteriorate environmental safety standards. To reduce the cost of cultivation and maintain environmental safety speciality fertilizers are now gaining huge demand in agriculture. Specialty fertilizers are innovative sources of nutrients applied in specific growth conditions of soil and plant for special action and achieving higher recovery, efficiency. Specialty fertilizers reduce possible loss of nutrients, particularly losses of nitrate nitrogen between applications and uptake by the plant through gradual nutrient release. They also reduce the loss of ammonia due to evaporation, which substantially decreases the risk of environmental pollution.



Fig 1: Types of Specialty Fertilizer

Types of Specialty Fertilizers

1. Slow and controlled release fertilizers
2. Stabilized fertilizers (nitrification or urease inhibitors)
3. Biochar fertilizers
4. Customized fertilizers
5. Fortified fertilizers
6. Liquid formulation of fertilizers
7. Organically chelated micronutrients (OCMN)
8. Nano fertilizers

Characteristics of Ideal Specialty Fertilizers

Specialty fertilizers are popular because of their higher recovery and efficiency. An ideal specialty fertilizer should have following characteristics:

1. They must not have any unfavorable side effects on soil fertility
2. They should not degrade to toxic substances in the soil

3. They should not be toxic to plants, animals and man
4. Fit into the complex production systems of the producers to be economically viable and environmentally safe
5. Stable during production, storage, transport and use
6. Cost effective
7. While in case of urease inhibitors, they should be compatible with other urea containing fertilizers

Fertilizer Application Based Environmental Hazards

Unbalanced and huge application with improper management of fertilizers degrade the soil, air and other environmental ecosystem and decline in soil microbial habitat at a large scale. Polluted environment has detrimental impact on human and animal health, decreases crop quality, hampers soil microbial habitat on a large scale.

Table-1: Environmental hazards related to fertilizer application

Environmental based problems	Causative agents or mechanism
Eutrophications	Erosion and surface runoff of ions
Methaemoglobinemia	Nitrate ion consumption through food and water
Acid rain	Nitrous oxide and Sulphur dioxide gas emissions
Ground water contamination	Nitrate ion contamination

Specialty fertilizer based Mitigation Strategies towards Environmental Degradation and Enhancing Nutrient Use

1. Checks Nutrient Loss, Surface Runoff and Increase Nutrient Use

Specialty fertilizers application increases the nutrient uptake by the crops in mostly available form and this in turn reduces the loss of nutrients with water as well as runoff stream. This process reduces the deposition of nitrate and phosphate in nearby water bodies and stops the algal bloom event. Proper and balanced uptake of nutrient enhances crop productivity and increase nutrient use efficiency.

2. Control Release of Green House Gases

Specialty fertilizer such as biochar fertilizers have the tendency and capability to absorb carbon dioxide gas released through various

agricultural processes. A Methanogenic organism absorbs methane gas and reduces the chances of global warming and associated environmental degradation (Fu et al. 2021).

3. Enriched and Steady Nutrient Supply

Various micronutrient chelated fertilizers have the ability to make stable bond with organic matter that reduce the loss of nutrients and increase the availability time of nutrients to the crops. Specialty fertilizers are enriched with macro and micro nutrients that add nutrients to the soil pool and enhance crop productivity. Specialty fertilizers are also slow releasing and coated in nature due to which these are resistant to loss and support the whole crop growth period. Water soluble fertilizers quickly support plant growth by enhanced nutrient uptake.

4. Better Soil Health and Microbial Biodiversity

Higher amount of nutrients and organic component based specialty fertilizers when added to the soil improve soil physical, chemical as well as biological properties. Enhanced soil organic matter provides base for the microbial growth and it supports various nutrient transformation processes in soil. Biochar fertilizers add organic matter in soil and improve soil properties in long term manner.

5. Carbon Sequestration

Application of biochar based specialty fertilizers has the tendency to capture atmospheric carbon dioxide and sequester in soil pool for longer period of time. Specialty fertilizers also reduce the loss of carbon dioxide to the outer environment by minimizing the transformation processes associated with carbon compounds.

CONCLUSION

Application of speciality fertilizer reduces the heavy nutrient requirement by the crop plants,

reduces the loss of nutrients, increases productivity of various crops and ultimately checks the environmental degradation processes. The rising global hunger and demand for food can be mitigated by balanced and enriched speciality fertilizers application in agriculture. Soil that supports the crop production can be enriched with quality materials application though speciality fertilizer use in agriculture. Global warming, eutrophication, ground water contamination and blues baby syndrome as well as other health hazards can be checked by the application of speciality fertilizers.

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