



ENHANCED EFFICIENCY FERTILIZER



The Fertilizer Institute





The Fertilizer Institute (TFI) is the leading voice in the fertilizer industry, serving to promote and protect all facets of the fertilizer industry. It represents the public policy, communication and statistical needs of producers, wholesalers, retailers, trading firms and transporters of fertilizer.

Today's farmers and consumers have many more viable nutrient management choices than they did just 10 years ago. Thanks to advancements in technology, fertilizer consumers now have several options when deciding how to supply crops with the essential nutrients. They include **slow and controlled-release fertilizers** and **stabilized nitrogen fertilizers** — all which enhance nutrient use efficiency. Although some enhanced efficiency fertilizers have been around for more than 50 years, recent advances in technology now make them cost-effective and viable for general agriculture crops such as corn, wheat, other small grains and cotton.

If you're seeking control, efficiency and increased predictability for agriculture crop nutrient needs, look no further.





ENHANCED EFFICIENCY FERTILIZER Today, farmers are adopting nutrient management plans to help increase efficiencies in their use of fertilizer. The use of enhanced efficiency fertilizers can contribute significantly to protecting the environment by reducing nutrient losses and improving nutrient efficiency while improving yields.

SEARCHING FOR THE IDEAL FERTILIZER Nutrient management plans, precision agriculture and improved application techniques are examples of ways the agriculture industry is increasing efficiencies. The fertilizer industry has provided numerous advancements with its products, and continues to strive for greater efficiencies. The use of enhanced efficiency fertilizers provides the agriculture industry with another avenue to achieve the concept of an ideal fertilizer. Three characteristics cited by S. Shoji and A. T. Gandeza in their 1992 publication *Controlled Release Fertilizers with Polyolefin Resin Coating*, that have long been considered essential to the ideal fertilizer, include:

- A single application throughout the growing season;
- High maximum percentage recovery in order to achieve a higher return to the production input; and
- Minimum detrimental effects on soil, water and atmospheric environments.

Slow or controlled-release fertilizers and stabilized fertilizers can meet the concept of an ideal fertilizer.

Fertilizer nutrients allow farmers to produce bountiful crops using less area, which saves land for parks and wildlife. Without commercial fertilizers, the world's 16 million square miles of wildlife habitat would be compromised and more than one-third of the world's food needs would be unmet. Since the mid-1800s, farmers have been applying nutrients (nitrogen, phosphorus and potash) to soil to increase the productivity of soil and ultimately the output and nutritional content of food. Continued development of enhanced efficiency fertilizers offers more options than ever before.

In United States agriculture, slow and controlled-release fertilizers are predominantly used on strawberry, citrus and other fruit, nut and vegetable crops. Currently, the vast amount of enhanced efficiency fertilizers are consumed in nurseries and greenhouses, on golf courses, home lawns and gardens, and by landscape gardeners and other professional lawn care professionals. However, U.S. farmers may soon be applying more of these products to corn, wheat, cotton and other crops as new technologies become economically viable.



DEFINITIONS

Simply stated, enhanced efficiency fertilizers are products that minimize the potential of nutrient losses to the environment. Slow and controlled-release fertilizers include absorbed, coated, occluded or reacted. All four types deliver extended, consistent supplies of nutrients to the crop. Stabilized nitrogen fertilizers include urease and nitrification inhibitors and nitrogen stabilizers, which extend the time that nitrogen remains in a plant available form. The official terms, which are defined and regulated by the Association of American Plant Food Control Officials (AAPFCO), follow.

SLOW OR CONTROLLED-RELEASE FERTILIZER A fertilizer containing a plant nutrient in a form which delays its availability for plant uptake and use after application, or which extends its availability to the plant significantly longer than a reference "rapidly available nutrient fertilizer" such as ammonium nitrate or urea, ammonium phosphate or potassium chloride. Such delay of initial availability or extended time of continued availability may occur by a variety of mechanisms. These include controlled water solubility of the material (by semipermeable coatings, occlusion, or by inherent water insolubility of polymers, natural nitrogenous organics, protein materials, or other chemical forms), by slow hydrolysis of water-soluble low molecular weight compounds, or by other unknown means. SOURCE: Official Publication 57, AAPFCO.

STABILIZED NITROGEN FERTILIZER A fertilizer to which a nitrogen stabilizer has been added. (A nitrogen stabilizer is a substance added to a fertilizer which extends the time the nitrogen component of the fertilizer remains in the soil in the urea or ammoniacal form.) SOURCE: Official Publication 57, AAPFCO.

NITRIFICATION INHIBITOR A substance that inhibits the biological oxidation of ammoniacal nitrogen to nitrate nitrogen. SOURCE: Official Publication 57, AAPFCO.

UREASE INHIBITOR A substance which inhibits hydrolytic action on urea by the urease enzyme. When applied to soils the effect of the urease inhibitor is less urea nitrogen lost by ammonia volatilization. SOURCE: Official Publication 57, AAPFCO.





HOW DO ENHANCED EFFICIENCY PRODUCTS WORK?

SLOW AND CONTROLLED-RELEASE FERTILIZERS

- Nutrient sources with low solubility in water due to a complex molecular structure which releases nitrogen through microbial decomposition or reduced solubility.
- Materials releasing nutrients through a membrane which may or may not itself be soluble (encapsulation).
- Nutrient-releasing materials incorporated into a matrix which itself may be coated.
- Materials releasing nutrients in delayed form due to a small surface-to-volume ratio.
- Fertilizers taken into an absorbent material in which availability of nutrients is decreased through occlusion.

STABILIZED NITROGEN FERTILIZERS

- Materials/chemical compounds that keep nitrogen available for plant use longer to prevent the loss of nitrogen to groundwater or the atmosphere, and increase the efficiency of the nitrogen applied.

OVERALL ADVANTAGES Slow and controlled-release fertilizers and stabilized nitrogen fertilizers can increase the efficiency of nutrients applied, generally resulting in higher crop yields, while working to reduce nutrient transport to air and water.

ADVANTAGES OF ENHANCED EFFICIENCY FERTILIZERS

- Improve nutrient efficiency and contribute to improved environmental stewardship;
- Produce significant savings in labor, time and energy;
- Contribute to advanced fertilizer management programs and to innovative farming systems;
- Reduce the potential loss of nutrients to air and water;
- Enhance nutrient uptake by the plants through gradual nutrient release;
- Reduce ammonia volatilization losses with urease inhibitors;
- Improve the mobilization and the uptake of phosphate; and
- Reduce seedling damage for urea and urea containing fertilizers.





REGULATION For consumer protection, fertilizers are regulated at the state level. The Association of American Plant Food Control Officials (AAPFCO) is an organization of fertilizer control officials from each state in the United States, Canada and Puerto Rico who are actively engaged in the administration of fertilizer laws and regulations; and, research workers employed by these governments who are engaged in any investigation concerning mixed fertilizers, fertilizer materials, their effect, and/or their component parts. AAPFCO strives to gain uniformity by consensus among each of these entities without compromising the needs of the consumers, protection of the environment or fair competition among the industry.

ENVIRONMENTAL BENEFITS In addition to ensuring the soil, and in turn the plant, is provided with sufficient nutrients to grow an abundant supply of food for the world, the fertilizer industry is committed to the environmentally sound and efficient use of its products. Modern farming practices use fertilizer nutrients to build high yielding, nutritious crops, and also make it possible for people to continue to use large areas of land for forests, parks and wildlife areas.

The development of enhanced efficiency fertilizers has added an important facet to the fertilizer industry's environmental stewardship program. With the use of these crop nutrients, farmers can improve efficiencies, by reducing losses to the environment. Since enhanced efficiency fertilizers are designed to be applied less often per growing season, their use can reduce the number of trips across the field made by farmers.



GOVERNMENT PROGRAMS Federal policy makers recognize the important environmental benefits and yield improving capabilities of enhanced efficiency products and technologies. In the 2002 Farm Bill, Congress included language encouraging (but not requiring) the U.S. Department of Agriculture (USDA) to list urease and nitrogen inhibitors as best management practices for farmers participating in the Natural Resources Conservation Service's (NRCS) nutrient management and conservation programs. The adoption and use of these inhibitors by farmers could be eligible for increased funding levels under the agency's Environmental Quality Incentives Program (EQIP), Conservation Security Program (CSP) and other federal nutrient management and conservation programs.

In 2003, NRCS re-evaluated and updated its national conservation practice standard for nutrient management (code 590) to include a tiered system of incentive payments or cost-sharing that would reward agricultural producers that go beyond the minimum NRCS requirements for basic nutrient management planning. These include but are not limited to enhanced efficiency fertilizers and practices such as:

- Using urease and nitrification inhibitors to impact the biological and chemical processes that cause nitrogen transformation into forms that leach readily from the soil or into the atmosphere as nitrous oxide or ammonia;
- Using special fertilizer formulations to cause slow release of nutrients (particularly nitrogen);
- Using precision agriculture technology to determine recommended application rates and precisely apply nutrients;
- Using nitrogen tissue tests to determine supplemental application rates for nitrogen; and
- Timing split-applications of nitrogen to provide the maximum amount of plant availability nitrogen at a time that coincides as closely as possible to the period of rapid nitrogen uptake by plants.

NRCS has approved these enhanced nutrient management practices and is currently urging state conservationists to adopt similar tiered nutrient management programs for crop and livestock producers in their states.

For more information contact a TFI member company involved with enhanced efficiency fertilizer products.

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