Choosing 'designer' or 'generic' fertilizers

BY BOB STAIB

The price differences are obvious and they all deliver nitrogen, but there the similarities between fertilizers end. Each type, from basic to 'designer,' has features that may make your applications more effective

The essence of fertilizer is nitrogen, and all types of fertilizers available to the landscape and grounds management industries offer nitrogen. What makes them distinctive is the nitrogen delivery mechanism, their cost and the way they can fit into your turf and landscape operations.

Back to basics

For the purpose of simplification, consider the four major catagories of nitrogen fertilizers:

- soluble nitrogen (ammonium sulfate, urea)
- coated soluble N (sulfur coated urea, polymer coated urea, polymer coated sulfur coated urea)
- natural organic N (activated sewage sludge, digested sewage sludge, fish meal, dried blood meal, composted turkey manure)
- reacted (synthetic) organic N (ureaform, methyleneurea, liquid methyleneurea, isobutylidenediurea)

These products range in price from very expensive to inexpensive; from soluble nitrogen levels of as little as 2% to as much as 46%; and from quick to slow release into the soil, among other characteristics.

Mode of release

By understanding the methods of release, you will know what separates the more engineered, 'high tech' fertilizers from the more basic varieties.

Bacteria known as nitrobacter and nitrosonomas (that occur abundantly in most plant supporting soils) rapidly convert ammonic nitrogen to the readily available nitrate (NO3+) form that most plants prefer. Nitrate nitrogen moves freely in the soil solution and is subject to leaching and runoff.

When nitrate N accumulates faster than plants can take it up, two things happen:

TABLE 1. MAJOR FERTILIZER PRODUCTS (NITROGEN AVAILABILITY)

Type: Soluble nitrogen	Coated soluble nitrogen	Natural organic nitrogen	Reacted (synthetic) organic nitrogen
	sulfur coated urea (37 to 39% N)	activated sewage sludge (6% N)	ureaform (38% N)
ammonium sulfate (21% N)	polymer coated urea (38 to 44% N)	digested sewage sludge (2% N)	methyleneurea (40% N)
urea (46% N)	polymer coated sulfur coated urea (38 to 39% N)	fish meal (10% N)	liquid methyleneurea (15 to 21% N)
		dried blood meal (12% N)	isobutylidenediurea (31% N)
		composted turkey manure (10% N)	

1. Vegetative growth becomes rapid, lank and lush; and

2. Under irrigation or rainfall, some of the nitrate N moves beyond the root system to go where the water goes. Soluble nitrogen must be used judiciously to minimize this. Also, soluble N sources have a high salt index, giving a greater burn potential when contacting leaf surfaces. For these reasons, the standard industry recommendation for turfgrass has been to apply no more than 1 lb. of soluble N per 1,000 sq. ft. per month of growing season.

What urea does

Urea is the soluble N source most commonly used in our industry. The enzyme (urease) exists universally in soil on plant tissue and organic matter. Urease quickly converts urea to carbon dioxide and ammonic nitrogen. In higher pH soils, volatile ammonia may be formed with a resultant loss to the atmosphere.

Because urea has a high N content and is generally the cheapest form of nitrogen in cost per pound, it is the most commonly used of the soluble N fertilizers. It is very reactive with chemical aldehydes, and thus is the raw N source for the slow-release synthetic organic fertilizers. The spherical urea prills lend themselves to uniform coatings of molten sulfur and/or semipermeable polymers. Each of these processes prevents the rapid accumulation of nitrate nitrogen described above.

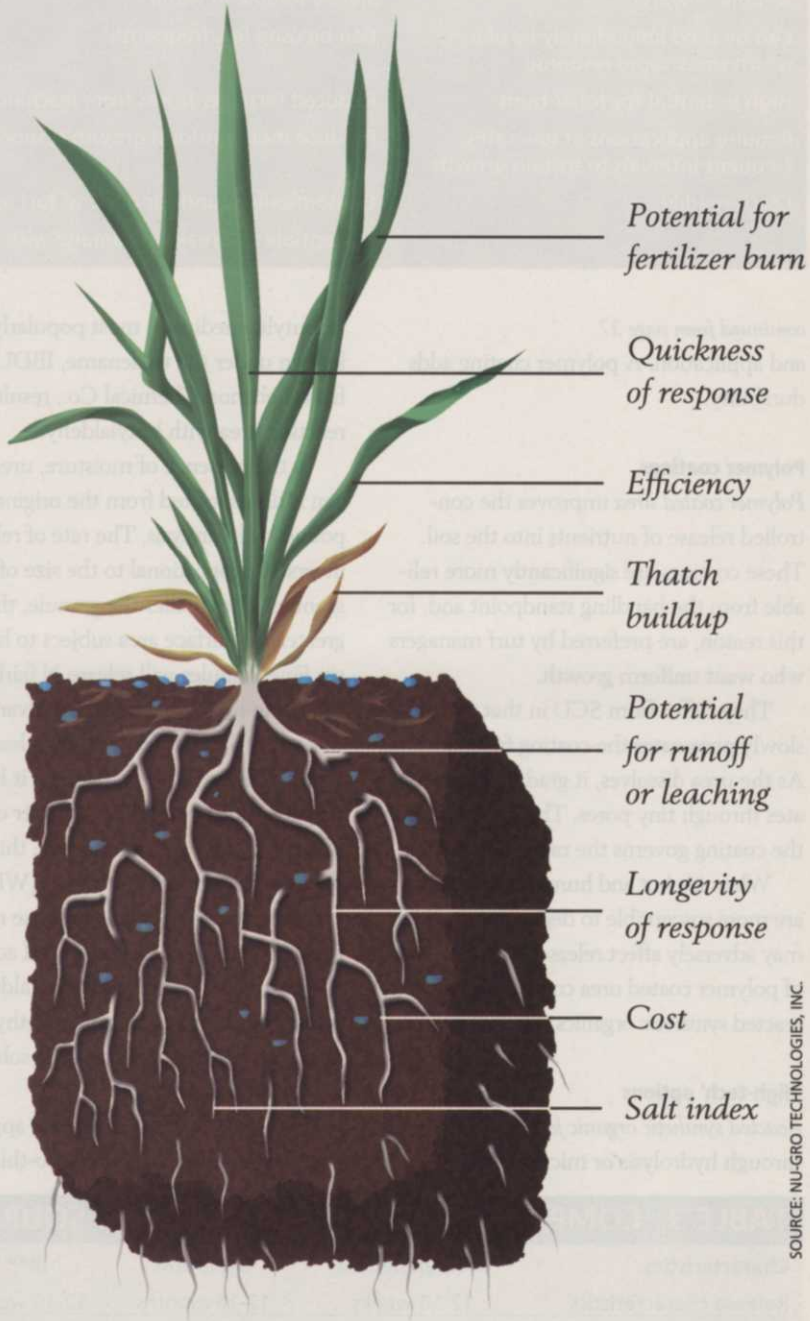
Going natural

Natural organics were the first slow-release N sources. Before fertilizers were commercialized, natural organics were the only source of plant nutrients. Most all the nitrogen is released by soil microbes that use it for food and energy.

The limitations of natural organic fertilizers are their lower N content, the potential for contaminants of toxic metals and, with some, odor. Products commonly used in the green industry, however, are safe to handle and apply with minimal odor problems.

Coated products

Sulfur coated urea (SCU) is the lowest cost slow-release nitrogen product. This was first developed by the Tennessee Valley Authority in the late 1960s. There are now seven commercial manufacturers: LESCO Inc.; NU-GRO Corp.; Pursell Technologies; The Scotts Co.; Vicksburg Chemical Co.; Agrium Inc.; and Royster-Clark Inc.



SOURCE: NU-GRO TECHNOLOGIES, INC.

Nitrogen is released by diffusion through pinholes and imperfections in the sulfur coating. The thinner the coating, the higher the N content, but the lesser the integrity of the surface. Straight SCU is more fragile than polymer coated materials because it is subject to degradation during handling

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TABLE 2. CHARACTERISTICS OF NITROGEN

Quick-release sources	Coated slow-release sources	Reacted slow-release sources
Soluble in water	Slowly soluble in water	Controlled solubility in water
Can be used immediately by plants, which show rapid response	Can be used less frequently	Supplies N gradually
High potential for foliar burn	Reduced fertilizer losses from leaching	Little fertilizer losses from leaching
Require applications at low rates, frequent intervals to sustain growth	Produce more uniform growth response	Low salt index, little burning
Leach readily	Economically sound for general turf applications	Performance not affected by coating
	Susceptible to breaking/damage with handling	

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and application. A polymer coating adds durability.

Polymer coatings

Polymer coated urea improves the controlled release of nutrients into the soil. These coatings are significantly more reliable from the handling standpoint and, for this reason, are preferred by turf managers who want uniform growth.

They differ from SCU in that water slowly permeates the coating from outside. As the urea dissolves, it gradually permeates through tiny pores. The thickness of the coating governs the rate of N release.

When it's hot and humid, the coatings are more susceptible to degradation, which may adversely affect release rates. The cost of polymer coated urea compares to that of reacted synthetic organics.

'High-tech' options

Reacted synthetic organic fertilizers release N through hydrolysis or microbial activity. Isobutylidenediurea, most popularly known under the tradename, IBDU®, from Lebanon Chemical Co., results from reacting urea with butylaldehyde.

In the presence of moisture, urea nitrogen is disassociated from the original compound by hydrolysis. The rate of release is inversely proportional to the size of the granule. The smaller the granule, the greater the surface area subject to hydrolysis. Fine granules will release N fairly rapidly in high moisture. The advantage of using IBDU on turf is that the release rate is not temperature sensitive and it has a very low burn potential. Fertilizer control officials classify 90% of the N in this product as water insoluble nitrogen (WIN).

Methyleneurea fertilizers release nitrogen by both hydrolysis and microbial activity. When urea is reacted with formaldehyde under prescribed conditions, methyleneurea polymers of decreasing solubility are produced.

Dry methyleneurea fertilizer is approximately one-third WIN and two-thirds 'sparingly' soluble nitrogen. It contains about 6% free urea. The urea and, to some degree, the shortest chain carbon-nitrogen linked polymers release nitrogen initially by hydrolysis. Then, soil microorganisms (the decomposers) use the remainder for both food (N) and energy (C), gradually releasing plant-available ammonic nitrogen back to the soil. Granular MU fertilizer releases nitrogen over 12 to 16 weeks.

Liquid methyleneurea fertilizer contains only the soluble MU polymers and more free urea. There is some controlled release, though, of much shorter duration than the granular 40% N material.

Ureaform provides longer lasting carbon and nitrogen for microbial activity. When urea is reacted with formaldehyde, the result is longer chained, less soluble carbon-nitrogen linked polymers.

Because urea is in excess in the reaction, there remains about 4% free urea. The finished product contains approximately one-third sparingly soluble nitro-

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TABLE 3. COMPARISON OF MAJOR NITROGEN SOURCES

Characteristics	Methyleneurea	Ureaform	IB**	SCU	Polymer coated	Urea
Release characteristics	12-16 weeks	12-16 months	12-16 weeks	Varies	Varies	1-4 weeks
Hydrolysis releasable	★		★	★		★
Microbial releasable	★	★				
Not dependent on coating or particle size for release	★	★				★
Nonburning	★	★	★	★☆	★☆	
Low salt	★	★	★	★	★	
Minimal leaching/volatilization	★	★	★	★	★	
Temperature response	★	★			★	

☆ Can cause mottling if coating is broken

** IB is a registered trademark of Lebanon Seaboard Corp.

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gen. Initially, about one-third of the N is released in the first 4 to 6 weeks of growing season, while the remainder is released over the next 36 to 52 weeks. What is not used in one season carries over and will be available the next. Leaching and runoff of nitrogen is practically nonexistent.

Since microbial activity is temperature dependent, release of N from ureaform will begin when soil temperatures rise above 55° F and slow down when they exceed 90° F. The advantage of using ureaform is that it contributes to increased microbial activity in any soil capable of supporting plant life. It is particularly well suited for direct application in the root zone of turf, trees and plants following core cultivation or by injection of a liquid suspension of powdered UF in the soil.

TABLE 4 U.S. MANUFACTURERS AND PRIMARY DISTRIBUTORS
1998 CONSUMPTION (DOLLARS)

Estimated wholesale of the U.S. CRF market by product type, 1998

Product	% share	$ Dollars (Millions)
UF fertilizers	43	$142.2
IBDU*	2	8.3
Sulfur coated & polymer coated	16	52.5
Polymer coated	22	74.4
Other slowly soluble products	5	16.4
Processes natural organic	12	40.6
Total	100	$334.3

Inhibiting effect

Nitrification inhibitors effect N availability and are known to provide more controlled availability of soluble N to plants (N-Serv® by Dow AgroChemicals Inc. is one type that many professionals know). When the inhibitor reduces the population of nitrobacter and nitrosonomas bacteria, the conversion of ammonic nitrogen to the nitrate form is greatly diminished. Ammonic N does not move in the soil solution, and therefore will remain in place with only gradual conversion to nitrate.

Know your options

Managing for uniform growth will pay multiple dividends, not the least of which will be a more active root system. Stretching the budget to save on fertilizer is fruitless and wasteful if you have more mowing as a consequence. **LM**

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