Modified ureas meet turf managers' changing needs

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For some time, urea has been a popular choice as a nitrogen source for turf grass and ornamentals. Years ago, the chemical industry made use of the fact that urea can be chemically combined with formaldehyde, in what is known as a condensation reaction, to produce commercially important plastics—and also (by altering conditions) to produce valuable fertilizer compounds that release nitrogen slowly from their chemically bound molecules.

The extent to which the condensation reaction occurs can be altered by varying such factors as temperature, acidity and time. This means that the rate at which the final product is released under varying weather conditions can be controlled quite effectively at the time the product is manufactured.

It has taken years of field trials, of course, to determine just which of the options made available by varying the urea-formaldehyde combination are best exploited by professional turf managers. Lately, the high cost of manpower— to apply fertilizer, and to mow grass—has become one of the more important considerations. In addition, the last few years have seen much concern about water pollution caused by fertilizer run-off. Some of the modified ureas now commercially available appear to offer strong advantages in cases where labor costs and pollution are prime worries.

The plant nutrient forms of urea-formaldehyde provide a high nitrogen content, consistency of performance, are safe for all types of grasses, odorless and economical, and have earned a popular place among private and commercial growers for turf and ornamentals use. At present, urea-formaldehyde condensation fertilizers make up an estimated 90% of all the "controlled release" nitrogen products sold in the U.S.

There are essentially two categories of commercial urea-formaldehyde fertilizer materials now marketed. The more completely linked urea-formaldehydes are relatively less soluble in cold water than the di- and tri-ureas, and they make up about 75% of the products called ureaforms.

O.M. Scott has two main formulations with some carefully selected differences in properties, attributable to their higher percentages of the di-, tri- and tetra-ureas. These are called methylene ureas or MUs. Note that the total nitrogen stays the same (38%) in all types, and that the bigger the molecules—the more ureas linked together—the less soluble the product is in cold water. Solubility can almost be tailored to meet specific needs.

Keeping growth under control

Data from some of our recent research, as demonstrated in the accompanying tables and graphs, show quite clearly how the methylene ureas are useful to the turf care professional. Among the performance gains:

* Chance of burning the grass can be minimized.
* Fast greening can be achieved, and good color maintained.
* Pollution by run-off nitrogen materials is reduced.
* Application frequency can be minimized to cut labor costs.
* Cutting frequency can be reduced — also to save on manpower costs.

Many of the advantages seen in turf growing can also be obtained by those working with small ornamentals, such as *Catalpa speciosa*, juniper and Cotoneaster. Growers of these will likely choose a different mix of methylene urea (a formulation tailored to give a higher percentage of cold water insoluble nitrogen) than the MUs used with turf. The different form, however, is available over a long period of time.

Recent investigation at Scotts pinpoints quite specifically how the advantages of methylene ureas reflect the chemical composition and physical properties of selected urea formaldehyde condensation products.

Burning

Nitrogen salts—such as sodium nitrate and ammonium nitrate—are familiar fertilizer materials. They are readily soluble, give nitrogen in a molecule readily utilized by the plant, and are thus quick-greening. They can, however, burn both turf and ornamentals, so they are usually applied in very dilute form.

Methylene ureas, on the other hand, as illustration A shows, are able to supply useful nitrogen, but without the burning potential. Typically, a 20-pound sample of nitrogen as methylene urea/urea has a salt index of 0.61. A widely used formulation of ammonium nitrate has a salt index of 2.99 or 4.9 times the burn potential as methylene urea/urea.

Illustration A

Salt index of various nitrogen sources.

Nitrogen Source	%N	Salt index[1/] [2/]	
		Equal weights	Equal N levels
Sodium nitrate	16	100	6.25
Ammonium nitrate	33	105	3.18
Urea	46	75	1.63
Ammonium sulfate	21	69	3.29
Methylene urea	38	4	0.11

1/ Concentration of ions in the soil solution based on sodium nitrate at 100.

2/ Nitrogen is mixed with air dried soil which is brought to 75% of field capacity and stored for 5 days at 5 degrees C.

Instead of being in a salt form, the nitrogen in MUs is largely bound in the methylene urea molecules. This keeps the burn potential low, and also determines the fertilizer's ability to "meter" its nitrogen release. This rate of release can also be gauged by a physical characteristic termed "cold water insoluble nitrogen" or CWIN. The nitrogen in ureaformaldehyde condensation fertilizers is bound into compounds that are relatively insoluble in cold water.

In the practical sense, this means that methylene ureas, with 38% or 42% CWIN, have a low burn potential to foliage, whether the fertilizer is applied to wet or dry foliage. By contrast, a conventional complete fertilizer, with its 2% CWIN index, definitely presents a burn hazzard.

Cold water insolubility also tends to reduce the loss by leaching—a particularly desirable characteristic in the case of nitrogen.

In addition, the methylene urea forms of nitrogen are not particularly volatile—certainly not so compared to ammonia compounds. Thus MUs lose little of their nitrogen values due to volatilization.

Urea in its natural form is a fine, fast-greening fertilizer. In the MUs, as marketed for turf application, up to 28% of the urea is fast improvement in turf color. (In the ornamental formulations, of MUs, only 15% of the urea is unbound.) The result is a steady availability of nitrogen that keeps color at the preferred range.

Another factor in the economics of turf maintenance is the frequency of mowing, and the bulk and poundage of cuttings that must be disposed of. Our studies indicate it is the cold water solubility that is the determining factor here—with a metered percent of the nitrogen going into solution, the growth of turf is more uniforms and less than with all soluble nitrogen sources. (illustration B)

In our own formulations, and in the other commercial urea-formaldehyde condensation product formulations, there are some distinct differences and advantages. We have obtained some good information concerning the guidelines for fertilizer choice—and they are particularly worth following in these times of mounting pressure on the team charged with turf and ornamentals maintenance.

Illustration B

Fresh weight of Kentucky bluegrass clippings removed from a 10,000 sq. ft. area as affected by methylene urea or urea.

		Weeks after application					
		1	2	4	6	Total	%
Product	Lbs. N/M	Lbs. of clipping/10,000 sq. ft.					
Methylene urea	0.9	1908	1372	2120	64	5464	68[1/]
Urea	0.9	2872	2241	2840	84	8037	100

[1/] Approximately 1/3 less clippings when turf is treated with methylene urea as compared to urea.

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