

Understanding and Using Nitrogen₁

by Dr. Roy L. Goss₂

¹Presented at the 38th Northwest Turfgrass Conference, Sheraton Hotel, Spokane, WA, September 17-20, 1984.

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With the exception of two products, melamine urea and oximide, nitrogen sources for turfgrass fertilization have remained rather constant over a number of years. Nitrogen sources are classified as (organics), (synthetic organics), or (inorganic). Organic or synthetic organics contain carbon as part of their molecular structure while organics do not. Inorganic forms of nitrogen are soluble and so is the synthetic organic, urea. True organic forms of nitrogen (derived from plants and animals) are not soluble until the source material is completely broken down by soil microorganisms and proteins and other N-containing compounds are converted to plant useable nitrogen - NO₃⁻ (nitrate ion) or NH₄⁺ (ammonium ion). This is a slower process.

Chemists have learned that reacting soluble urea with formaldehyde, isobutraldehyde, and other materials can alter the structure of urea so that it is no longer soluble and nitrogen is released over a long period of time. Hence, we have slowly soluble nitrogen. Urea formaldehyde (Nitroform methylene urea, Formolene, etc.), oxamide, melamine urea, and IBDU are all slowly soluble forms of N. Methylene urea is the fastest acting form of these slowly soluble sources due to shorter "molecular chains." Materials such as sulfur coated urea (urea prills coated with molten sulfur) and Osmocote (urea prills coated with a plastic-like material) are slow release since urea inside the "shell" becomes liquid when water is applied and is slowly released through microscopic pores or cracks in the shell.

WHAT HAPPENS TO THESE PRODUCTS AFTER APPLICATION?

There are many myths and false claims made about slowly soluble and slow release products and with the foregoing description, let's briefly examine the factors that influence release of plant available N.

Water: All nitrogen-containing compounds require water "the universal solvent" to dissolve and carry the nitrogen to a position for plant uptake. This reaction is hydrolysis. If the nitrogen is not in solution, a plant cannot absorb it.

Favorable Soil Temperatures: All organic or synthetic organic forms of N require soil temperatures over 50°F for optimum N release (may be as high as 70°F). Soil microorganisms that decompose organic matter and nitrifying bacteria are sluggish or relatively inactive at low temperatures. These soil microorganisms supply an important (enzyme) - (urease) which is essential for breaking the complex molecule urea into simpler N compounds. Nitrifying bacteria do the rest, taking simple N compounds through a series of reactions to NH₄⁺ and NO₃⁻. The NH₄⁺ is not stable in the soil and is rapidly converted to NO₃⁻ when all conditions are optimum (water, temperature and bacteria). At low soil temperatures the NH₄⁺ may remain in this form and does not leach readily if the soil has any cation exchange capacity (organic matter or clay) but can be utilized by grasses in this form. The NO₃⁻ is not bound or attached to clay or organic matter and is readily utilized or leached.

Soil microorganisms: Soil microorganisms must be present in large numbers to provide the functions discussed above. Sands devoid of organic matter or recently fumigated soils may be

devoid or have low populations of microorganisms and explains why ammonium nitrate or ammonium sulfate provide faster plant response.

Leaching Responses

For simplicity I shall categorize the most commonly used N compounds into fast, intermediate and slow leach rates.

[Fast]: (Solubles)

Ammonium nitrate 33.3%

Calcium nitrate 14%

Sodium nitrate

Potassium nitrate

Urea 46%

Ammonium sulfate 21%

[Intermediate]

Methylene urea - variable N

IBDU 31%

Sulfur-coated urea 32-36% (depending on sulfur shell thickness)

[Slow]

Urea formaldehyde 38%

Natural organics including sewage sludges - variable N

SOME KNOWN FACTS ABOUT NITROGEN SOURCES

To help guide you in making judgments in the use of nitrogen and in purchasing, I have listed some facts you may find useful.

1. Urea is the least expensive form of nitrogen, followed by ammonium nitrate and ammonium sulfate.

2. Organic nitrogen is usually the most expensive followed by urea formaldehyde (including methylene urea), IBDU, melamine urea and sulfurcoated urea.

3. IBDU and SCU - slowly soluble and slow release, respectively, become soluble in the presence of water at temperatures above freezing, BUT DO REQUIRE HIGHER TEMPERATURE for the conversion of urea to NH₄ or NO₃. They are both ureas.

4. All forms of urea, ammonium nitrate and sulfate will lower soil pH. Calcium nitrate will raise soil pH.

5. Leaching losses are higher from urea, ammonium nitrate and sulfate, calcium nitrate, potassium nitrate and sodium nitrate than from UF, IBDU, SCU, melamine urea and natural organics.

6. Plant tissue burning is greater from solubles than slowly soluble and slow release due to higher salt indices, and should be applied in smaller amounts more frequently.

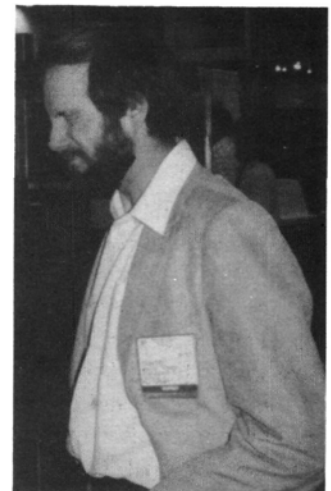
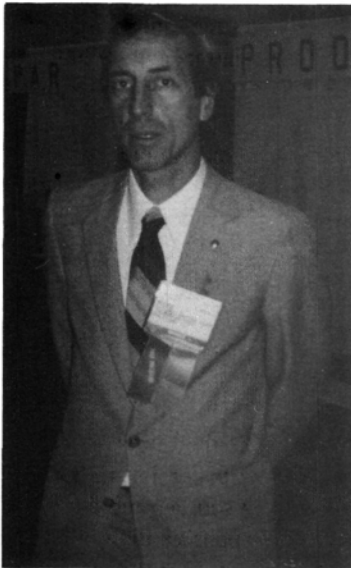
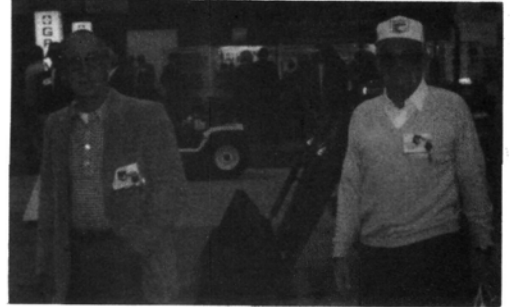
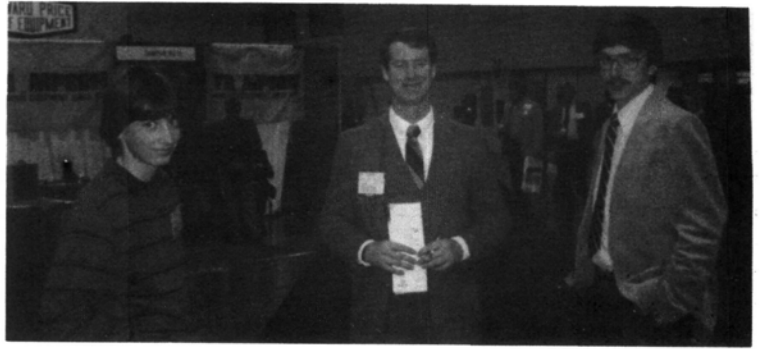
7. Plant nitrogen availability during the first 10 days is greater for solubles than slowly soluble or slow release. SCU and methylene urea releases faster than IBDU and UF.

8. IBDU releases N over a slightly longer period of time than SCU, but not as long as UF.

9. Ammonium sulfate reduces incidence of Fusarium patch and takeall patch (*Ophiobolus*) more than urea sources.

In conclusion, the purpose of this paper is to show comparative differences among various N sources and their modes of action. Some sources are more expensive than others considering purchase price per pound of N but may not cost significantly more when you consider labor costs of application, leaching losses and mistakes made by inexperienced operators. These are some of the facts and individuals must make their own judgments based upon their relative positions and budgets. Also remember that blends are often good compromises.

PHOTOS FROM D.C.



Midwest Breezes



The deepest sympathy of the members of the Midwest Association of Golf Course Superintendents is extended to the Dearie family due to the death of Gerald Dearie, Sr. Mr. Dearie passed away on February 6th, 1985.

Upcoming Events — Mark Your Calendar

- March 4-5-6** — Purdue Conference. This will be Dr. Daniel's last conference before he retires.
- March 11th** — Monthly meeting of MAGCS at Nordic Hills C.C. - Evening meeting.
- March 12th** — LESCO & Stauffer Chemical seminar at Elmhurst C.C. Speakers: Duich & Randell
- March 28th** — CGSA Green Seminar at Butterfield.
- May 20th** — MAGCS monthly meeting at Silver Lake C.C.
- June 17th** — MAGCS monthly meeting at Sunset Ridge (tentative)
- June 24th** — ITF Golf Day at Glen Oak C.C.
- November 12** — Midwest Clinic at Medinah C.C.

For those of you who missed the Washington, D.C. conference, it was a good one. The conference hall for the equipment was huge, it seems to be getting bigger every year (and is). There were good wide aisles to walk thru but unfortunately the floor layout I feel was taken from the street layout and that made it confusing with all of the diagonal aisles. It was difficult to systematically cover the floor.

The educational sessions sometimes left something to be desired, I feel that "The Thinking Superintendent" sessions are carried along too far with some speakers not having enough time and of course some speakers have nothing to say really. The seminars put on before and after the conference were again well attended and quite educational.

The hotels were on the most part a long way off from the Convention Center and the buses didn't go from hotel to hotel. If you had friends in another hotel you would have to take a taxi most times.

Washington was/is a tourist delight with so much to see and do. It was very educational for everyone who took the time to see the nations capital, especially for the families with school age children.

"Tug of War"

March Winds blow in many ways,
Fearless Winter can count It's Days.
Springtime will It-self evolve,
When Winter/Spring priority is solved.
For a while They'll fight and struggle,
Persistent Spring will burst the bubble.
And while Winter will withdraw,
In face of Spring's overwhelming thaw.
It will stall, play tricks and sputter,
But Spring will prevail, one way or another.

Kenneth R. Zanzig

Marvin H. Ferguson — 1918-1985

Dr. Marvin H. Ferguson, internationally-recognized turfgrass researcher and prominent golf course architect, died suddenly in Bryan, Texas on Jan. 10. He was 66.

Marv received his undergraduate degree from Texas A&M and his Ph.D. in plant sciences from the University of Maryland. He engaged in turfgrass research for both the USGA Green Section Award for distinguished service to golf through turfgrass research. His work was critical to the evolvement of the USGA specifications for putting green construction.

As a golf course architect, Marv concentrated his efforts in the Southwest. Among his courses are Wolf Creek Golf Club, Olathe, Kan.; Country Club of Missouri, Columbia, Mo.; LeVieux Chenes De Lafayette, Lafayette, La.; Cielo Vista Municipal Golf Course, El Paso, Tex.; and Ben Geren Regional Park Golf Course, Ft. Smith, Ark.

Marv served on the ASGCA Board of Governors from 1972-74. He also served as Research Director of the ASGCA Foundation since 1973.



Who are these guys? Dennis Wilson gave me the picture and wants to have the fellows identified.



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(Reel vs. Rotary Mowers cont'd.)

LARGE TURF REELS VERSUS LARGE ROTARIES

It is difficult to discuss the 11- to 15-foot reel versus rotary as there are few rotaries of this size on the market at this time and the history of the performance of 11- or 15-foot rotaries is limited in the self-contained units. The pull type P.T.O. driven bat wing rotaries have been around for a long time, but the self-contained have only been out for a few years.

The first determination must be whether we are going to be cutting formal, semi-formal, or informal turf. It is simple to say that formal turf should be cut by reels for appearance sake, and informal turf should be cut by rotaries. The broad area of semi-formal turf for parks or large areas that do serve as playgrounds, etc., requires more analysis. Again, coming into play in the semi-formal turf is the height of cut desired, whether a skip/mow plan can be installed, and how important is the quality of turf on a particular area.

The most effective method of mowing turf would be by ground driven gang mowers on formal or semi-formal turf. It is by far the least costly method of maintaining large areas. Most manufacturers have frames for transporting these units with standard tractors. By the use of hydraulics to mow, lift, and go, one important element is that any tractor can be used for towing and the tractor can be used for other applications.

Self-contained units, while they limit the use of the tractor, are extremely efficient when cutting large areas of turf in remote areas, i.e., school districts, municipal park applications, etc. Transport requirements have to be considered, and generally the self-contained units will travel up to 25 mph so as not to delay traffic. It is very easy to use self contained units to cut a 15-foot swath, unless the area is broken up with trees, bushes, or shrubs. Consider also the safety of reel type mowers versus the rotary operations at parks, schools, or areas where people are present during the mowing operations.

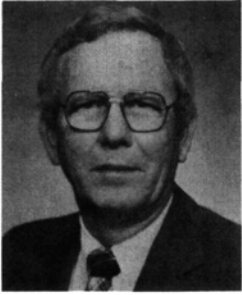
Because of the relatively short time that the self-contained rotaries have been on the market, life cycling is very difficult to achieve: however, we do have the experience that the self-contained reel units sometimes last between 8 to 12 years. So, while the initial purchase price may be higher, the cost is more than made up by the efficiency of operation, the time that the unit lasts and, of course, time saving of the 15-foot cut.

RECOMMENDATIONS

Based on cutting quality, it appears to be fairly obvious that for formal turf, reel type mowers should be used. For semi-formal turf, much depends on the area, its location, and the quality of turf desired. To mow informal, or "rough turf", the rotary machines are definitely more desirable.

From a standpoint of economy, the reel type mower apparently uses less fuel, and could be the monetary difference in the subject of repairs and/or initial costs. It is apparent that with rotary mowers, one would have less problems with rough areas but more problems with filters and dust. The reel type mowers do need occasional sharpening, and some simple skills in blade adjusting must be taught. So, in conclusion, the best recommendation that can be made is to analyze the turf areas involved, determine the level of turf maintenance required, consider life cycle and fuel usage, and adopt the most efficient maintenance equipment to meet your plan.

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Good Vegetable Gardens Begin with Good Soil Preparations

By James A. Fizzell, Sr. Ext. Adviser
University of Illinois

Good soil is essential for a successful garden. Soil provides plant nutrients, air, and water. If these materials are not available, or if the soil is in poor condition (hard and crusty when dry or sticky when wet), vegetables will not grow and develop properly.

A soil that is in good "tilth" (physical condition) is loose and easy to work, and has water-holding capacity, drainage, and aeration. You can improve soil tilth by adding organic matter. Apply manure, compost or similar material to the soil and work it in before planting, or turn under a green manure crop.

Organic materials to be spread per 100 square feet of garden are listed in the table below. The table also shows the pounds of nitrogen to be added per 100 pounds of material. **Note:** corn-cobs, sawdust, wood chips, leaves, and straw vary considerably in nitrogen content, and you may need to apply supplemental fertilizer containing nitrogen during the growing season. Do not use lawn clippings from grass that has been treated with sprays containing fungicides, insecticides, or herbicides.

Organic material	Material per 100 square feet	Nitrogen to be added per 100 pounds of material
corn-cobs	50 pounds	1-1½ pounds
sawdust	50 pounds	1¼-1½ pounds
woodchips	50 pounds	1¼-1½ pounds
leaves	75 pounds	½-1 pound
straw	60 pounds	½-1 pound
hay	60 pounds	None
peat moss	6-10 cubic feet	None
compost	10-20 cubic feet	None
lawn clippings	4 bushels	None

1 pound of nitrogen = 10 pounds of 10-10-10 fertilizer or 3 pounds of ammonium nitrate (33-0-0); etc.

Manure is a common form of organic matter used in gardens. It will also fulfill part of the fertilizer requirements of the soil. Because manure is low in phosphorus, you should add 1 to 1½ pounds of superphosphate to each bushel of manure. Use 500 to 1,000 pounds of horse or cattle manure per 1,000 square feet. Sheep and goat manure should be used at one-half this rate.

Compost can be made from leaves, straw, grass clippings, manure, and any other disease-free waste vegetable matter. To make compost, pile these materials in layers as they accumulate during the season. Cover each 6" layer of organic material with about 2 inches of top soil and add a handful of fertilizer to each layer.

This fertilizer treatment will hasten decay and improve the fertility of the compost. Water the pile to keep it damp, and occasionally turn and mix the soil and decaying material. The compost will be ready to spread over garden soil in 6 to 12 months.

Green manure or cover crops, such as rye or oats, improve soil tilth when they are plowed under in the spring or fall. The seed can be broadcast over prepared soil areas and between rows of late vegetables. Incorporate the seed into the soil with a rake, hand cultivator, or harrow.

The amounts of rye, rye-grass, and oats seed that should be sown per 1,000 square feet of garden, the best planting dates, and the times when the cover should be plowed under are as follows:

Rye: 3 pounds of seed; plant September 1-30, plow under in early spring.

Rye-grass: ½ pounds of seed; plant September 1-15; plow under in early spring.

Oats: 1-1½ pounds of seed; plant late August to early September; plow under or incorporate into the soil in early spring.

Fertilizer applications should be made before planting. Later in the season additional fertilizer may be necessary.



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A Few Things to Think About Before Starting the Season

by Mike Matchen, Wilmette G.C.
Wilmette, IL

There are just a few thoughts and questions to ask yourself before starting the season. They are in no particular order of importance. Hopefully, there will be something that makes you think a little.

1. Early Ordering and Budget Work Over the Winter

OK, so you have all your chemicals and fertilizers in stock and you're ready for the season, but did you just reorder the same as you've done in previous years, or did you really think about your needs and how they might be changing? Are you aware of any new products on the market and can they help you? When you did your budget, did you really think through every part of it, or did you just add a little to each budget category?

2. Did you make good use of the winter?

During the slow season, did you take the time to further train and educate your full time staff? You could do this by taking them to meetings, seminars, or by holding class in your own shop. If you have a new Pro or manager, did you take the time to get to know him and talk about the coming year.

3. Do you have a general plan for the year?

We all have to adjust to the weather, but do you have an idea of what you want to accomplish each stage of the season?

4. When was the last time you measured tees, greens and fairways?

With some of the newer fungicides being used at rates as low as 1 oz., it was very important to know the exact size of your tees, greens and fairways.

5. Ask yourself, "How can I improve myself this year"?

As hard as we try, none of us is perfect. Think about your weaknesses, as a golf course superintendent and what can be done to improve yourself this coming season.

6. Do you have your priorities straight?

The summer can be pressure filled and intense for all of us, but don't put your job before God and your family. Last summer was tough on everybody, including the person at home listening to you complain about it.

7. Do you have an outlet?

We all need an outlet for the pressure during the season. It could be golf, fishing, exercise, tennis or just getting away with your family for the afternoon, but you have to do something to relax and take your mind off your job.

Credit: Verdue 4/84

Effect of Sample Preparation and pH on the Cation Exchange Capacity of Thatch

T.K. Danneberger, A.J. Turgeon and T.R. Peck
Agronomy Journal, Vol. 76, Number 1/155-156

Where a substantial thatch layer has developed, it can serve as the primary medium supporting turfgrass growth. Chemical and physical properties of thatch are important in interpreting soil test results and plant growth response. Most research has been concerned with thatch control. Studies at the University of Illinois have focused on edaphic properties of thatch. Data from this study indicates that the nutrient-retention of a thatch layer could be substantially improved by ensuring that the thatch pH is sustained at a reasonable level.



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You may be surprised to find that your net worth is greater than you think, when you consider accelerating property values, group insurance and other factors which have swollen many estates.

To arrive at your net worth, use the worksheet provided here to add up your assets, then subtract your liabilities from them. Once you have completed this review, you will have a clearer picture of where you stand, as well as what progress you have made and some direction for the future. It's fairly simple to update your net worth calculation each year as well.

When you know exactly where you are, you'll have a much better view of where you'd like to go. Calculating your net worth means taking that first step toward developing a plan to optimize returns on *all* your assets.

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Determining your net worth	
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Stocks & bonds (current market value) \$ _____	Jewelry, antiques, art objects, boat \$ _____
Checking accounts \$ _____	Clothing and other personal property \$ _____
Savings accounts \$ _____	TOTAL: \$ _____
Certificates of Deposit \$ _____	Liabilities
Estimated value of your home \$ _____	Unpaid home mortgage \$ _____
Other real estate \$ _____	Current bills (credit cards, medical, other) \$ _____
Cash value of individual/personal life insurance \$ _____	Installment debts (car, appliances, home improvement, tuition, other) \$ _____
Death benefits payable under your company retirement plan or from fraternal organizations \$ _____	Taxes due \$ _____
IRA or Keogh funds \$ _____	Other debts \$ _____
Estimated deferred profit sharing benefits \$ _____	TOTAL: \$ _____
Vested company benefits \$ _____	Total assets - total liabilities = Net Worth \$ _____
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