# Slow Release IBDU — Promising New Tests

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A 31 PERCENT nitrogen source which dissolves slowly. That's what George Haddad, then of Swift & Co., told me when he first mentioned IBDU in 1967. Now, as 1974 closes, a look back into our testing in turf research accentuates the comparative values.

Through 20 different tests since 1967 in laboratory, greenhouse, experimental green and larger turf plots, solubility, releases and responses have been recorded.

It should be understood that several other workers, including O. R. Lunt of California, Don Waddington of Penn State, Gaylord Volk of Florida, Paul Rieke of Michigan State, Tom Hughes of Illinois and others have also researched IBDU as part of their programs.

### What is IBDU?

IBDU is a compound with each molecule a standard size which deteriorates by hydrolysis or dissolving. Isobutylidene diurea IBDU is made as a precipitate powder and uses a by-product of film manufacture. It is very slowly soluble. According to the water insolubility tests (standard in testing of ureaforms and polyforms) IBDU is over 93% cold water in soluble. However, these tests are really designed for ureaforms, to better differentiate molecule sizes, and are inadequate for expressing IBDU characteristics. For example, the initial visual growth response is about 10 days, even when particles are applied. In contrast, the soluble (cold water soluble) fractions of ureaform as sold, show expected initial response in 3-5 days.

Another laboratory test used in nitrogen assay is a calculated Availability Index based on fast to slow release portions. When standard IBDU is ground to a fine powder, the solubility and availability are increased. See Table 1.

### Solubility is Slow

When a few pellets of IBDU are placed in a beaker for several weeks and the water is changed often, the particle still appears similar. Large particles lasted more than three months as kept in water. Principle: even a low concentration in solution around the particle surfaces slows down further solution. (Like cold iced tea dissolves only so much sugar). Principle: the coarser (and denser) the particle the longer the initial supply could last. So an early question to the company was, how about a big particle for incorporating into soil during construction of new turf areas such as greens, tees and sodded or seeded home lawns?

### Some Tests

In one laboratory test a finely woven nylon cloth was made into small bags and in each we placed equal portions of actual nitrogen (0.2 gm). Figure 1 shows how water was dripped onto each bag and the solution and mechanical movement of soluble portions occurred. The urea (left dish) dissolved readily and crystallized as it dried — its normal salt effect. The uramite (center) shows some salt (the limited urea present) and some fines. The IBDU has very little salts or fines.

In a greenhouse test (figure 2) nine identical bags, each containing 0.2 gm actual nitrogen, were placed into the soil of a two gallon pot of growing ryegrass. Then as normal watering, absorption, leaching and growth occurred, it was reasoned that all the available nitrogen that could move out of the bag would be adsorbed by the adjacent roots.

The portion retained in each bag was measured by retrieving the bag and its contents tested by the Kjel-

*(continued on page 58)*

**Table 1. Water Insoluble and Availability Index of IBDU Samples.**

| Size after Crushing | Water Insoluble Nitrogen | Availability Index |
|---|---|---|
| mesh and | % | as a number |
| Standard as bagged | 29.9 | 55 slowest |
| —14 | 27.3 | 61 |
| —20 | 20.9 | 77 |
| —40 | 20.2 | 97 fastest |

**Table 2. Comparative Yield of Bluegrass Clippings One Year After Applying IBDU**

| Size mm | | Relative Yield |
|---|---|---|
| Very coarse over | 2.0 (release was slow) | 100% |
| Coarse | 2-1 | 75 |
| Medium | 1-.5 | 70 |
| Fine | .5-.25 (release was earlier) | 45 |
| Check | none | 35 |

dahl nitrogen assay in laboratory. This gave the relative values shown in Figure 3. The soluble nitrogen onto peat was one standard, and its dissipation from the bag was 97 percent within three days. The slow initial release of IBDU is indicated in the least release shown in the left side of Figure 3.

Generally it has taken ten days for initial color or growth to show from IBDU even where heavy rates and finer particles were used. In contrast, two to three days would be normal for urea or nitrates. In two field tests the coarser IBDU (above 2mm) gave limited response for the first month when applied on nitrogen depleted turf.

The first outdoor research, in 1967, was Purdue's most important with IBDU. We used a small sieve to sort the particles into coarser (above 1 mm — so held on screen) and finer (those through the screen).

This was used side by side in test No. 3 at 2, 4, 6, 8, 10 lbs. N/1,000 sq. ft. as applied 11 July 1967. Throughout 1967 the finer gave more release than the coarser. For the first 50 days, even 4 lbs. of finer produced 70% more clippings than did 10 lbs. coarser. However, the next year the 10 lbs. gave longer and continued response. (Figure 4 shows the color or growth comparisons at 50 days).


**Figure 1.** Salt and fine particle movement from bags after being dripped into bags and solution dried.

**Figure 2.** Bag being placed into rootzone of pot. Later retrieved for anaylsis for residual staying in the bag.

Extending this idea, in test 4 on 22 August 67 from one bag of IBDU five sizes were sorted by hand screens as follows: less than .25 mm, .5, 1.0, 2 and more than 2 mm. Figure 5 gives comparative yields of replicated plots at 18, 54 and 119 days of growing weather or 9 Sept. 67, 16 Oct. 67 and 1 May 68. Again, the faster release from finer particles is clearly shown at initial 18 days. Totally, one of more consistent and uniform pattern on bluegrass in this experiment was the 6 lbs. of .5 to 1.0 mm particles. It about doubled yields of the check at each harvest. The coarser particles continued well beyond the 119 days shown. After one year the clipping for one harvest (See Table 2) from equal nitrogen rates illustrates residual release.

### Large Particles Research

Would you believe 24 lbs. N/1,000 applied at one time? or 18? or 12? without turf damage or excessive growth? In test 9 we had up to three years of growth response on a putting green where 1 gm. particles (as compressed pillows ⅜ x ¼ x ⅞ inch as shown on Figure 6) were placed at 4 inch depth at 24 lbs./1,000 sq. ft. in a new Purr-Wick green.

Repeated samplings showed the roots would form a fibrous mass around each particle (almost a cocoon effect). Further, the size of the particles gradually decreased over the three years before completely dissolving.

The author has repeatedly encouraged the manufacturer, Mitsubishi Co. of Japan, and USA licensee, Swift & Co., to develop a coarser grade of ¼-⅜ inch diameter as hard pellets for at least two years' release for use in construction. Figure 6 shows representative experimental sizes tested. (Currently a special coarse container grade is available for ornamental horticulture containers. It also contains fritted P and K, plus minor elements).

One failure was experimentally tried in the fall of 72. An intimate mix of finer IBDU and gypsum plaster was pelleted by rolling and drying. Three sizes, larger (above ⅜ inch), medium (⅜ to ¼ inch) and small (less than ¼ inch) were sorted. The initial application was superb as Figure 7 shows. Our high rates were from 8 to 16 lbs. N/1,000. When freeze and thaw came, the particles slumped and thus the hard ball was reduced to a soft patty and the beneficial effect of coarseness was reduced. In contrast, the compressed hard pellets of previous supply have repeatedly been satisfactory.

Over the years grants from companies have supported research on products in the turf program at Purdue. It has allowed a wide and continuous range of testing products. Milorganite has been a long-term standard based on research in early 1950 and much more. Ureaform formulations were extenstively tested in later 50's, and one is a standard in current tests. The failures of some peat based, powdered and coated sources are also history. For example, standard osmocote particles have been quite large for use on greens, so cracked easily and was picked up by mowers excessively. In fact, a review shows over 20 products from companies have been tested at Purdue since 1950 for turf, and of these, only four are currently on the market.

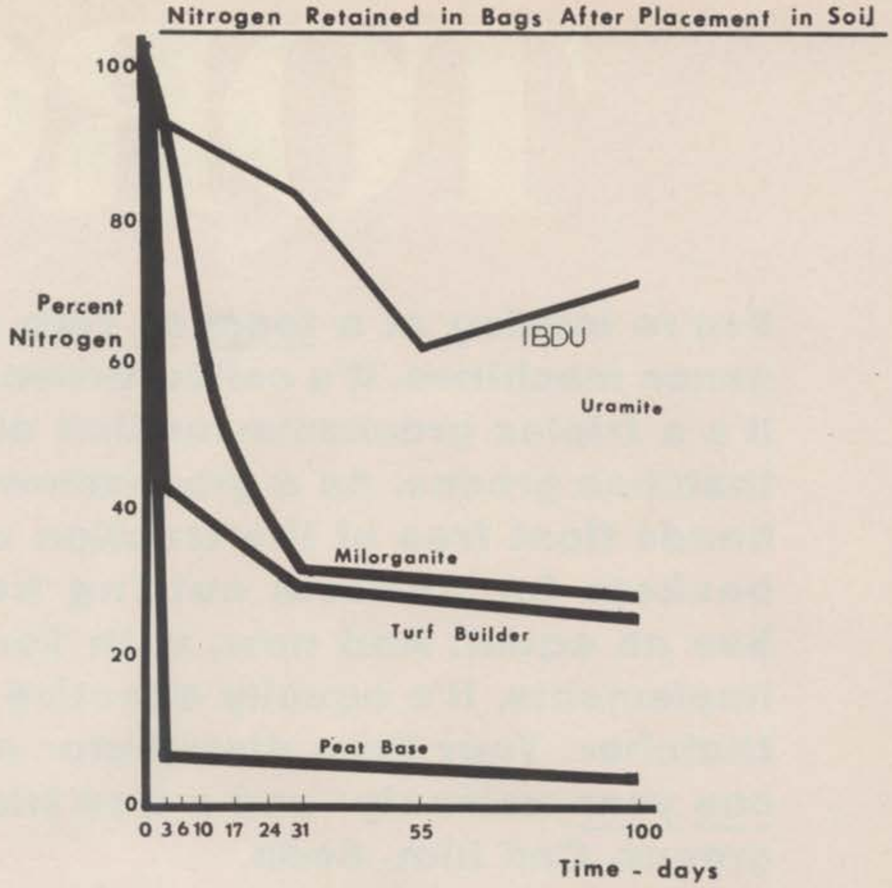


**Figure 3.** Percent nitrogen retained in bags after placement in soil.

### A Look Towards the Future

IBDU, like other special slow release nitrogen sources, will continue to be premium in price. The raw products and manufacturing processes are expensive.

Ideally, three sizes of IBDU are needed. (However, only one size, .7 to 2.0 mm is availble in '75). For greens, less than 1 mm in order to filter into fine turf easier. For fairways, athletic fields and lawns, 1-3 mm size for annual use. Beyond these, a construction grade of 3-5 mm could be 3 year background release.

The fact that IBDU can be specifically processed to release N at the desired rate offers efficient use of labor both in application and in maintenance. The fact that it is free of potential for leaf burn means it may be applied under widely varying weather conditions. The fact that it can provide nitrogen stored as particles dispersed at the turf surfaces means special benefit as the cation exchange complex (storage ability of a soil) is not so critical.

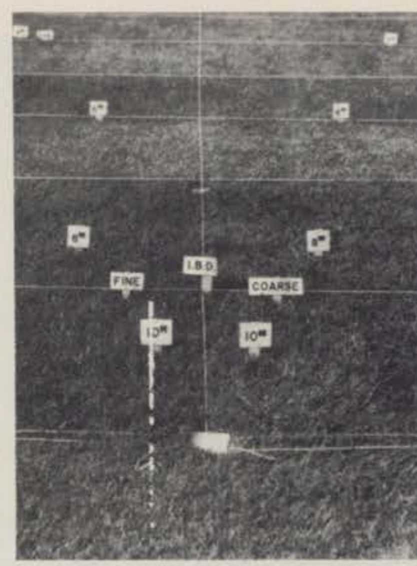


**Figure 4.** Finer grains on left show more response than coarser on right (taken from the same bag) at 50 days after application on Kentucky bluegrass.

How does this apply to a golf course in 1975? Look at an example — the strong consistent release exceeds 15 weeks, so a turf manager can anticipate repeat applications at about that interval or twice per year in cool season grass areas.

Of greatest potential turf managers have the opportunity to standardize and streamline applications when IBDU is the sole or major source of nitrogen. The initial visual grass response is about ten days after application. Then release is related to coarseness of particle and moisture supply. And the tail-off of supply is gradual. From these three basic facts, even once a year applications may well be adequate where repeat applications have been made.

For example, on an 8,000 sq. ft. front lawn of Sodco bluegrass a single yearly application of 3 lbs. N/1,000 as IBDU coarse particles (above 1 mm) gave a slow uniform growth for one year. Further, tha advantage of applying the total at any time increased ease and accuracy of application.

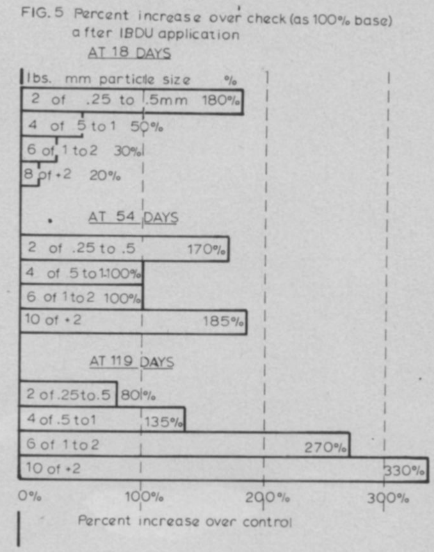


**Figure 5.**

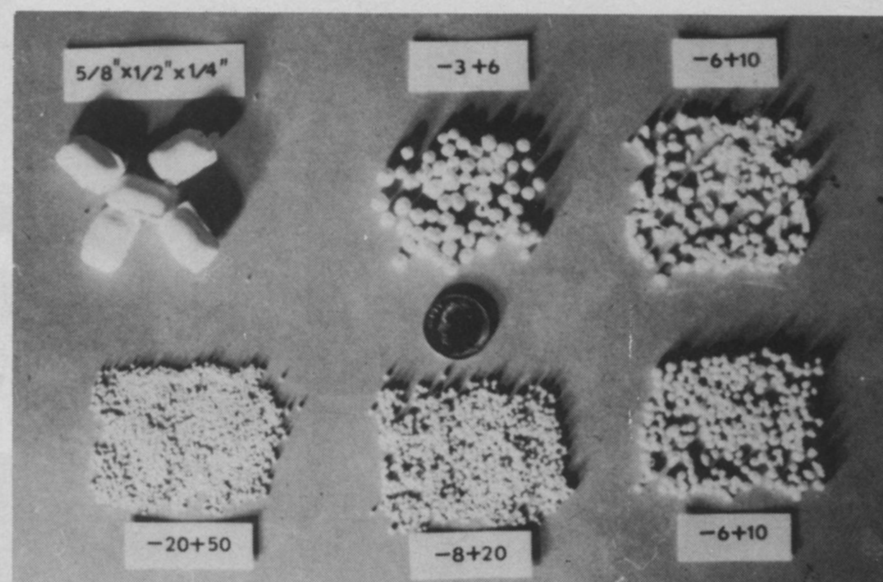


**Figure 6.** Sizes of IBDU used experimentally. Largest particles lasted three years in Purr-Wick greens.

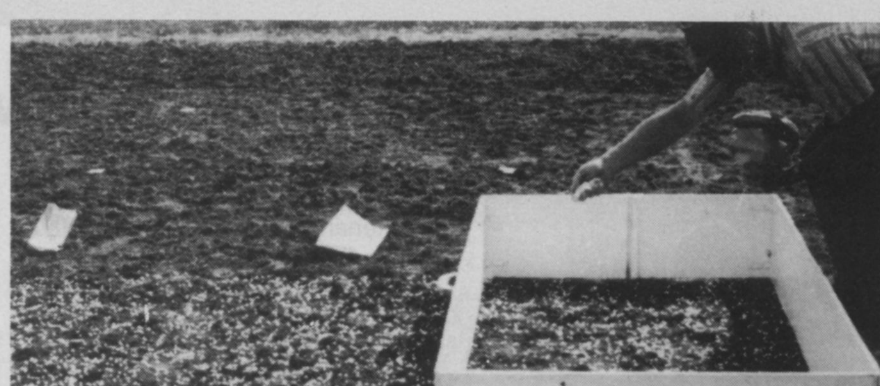

**Figure 7.** Experimental pellets applied up to 20 lbs. N/1,000, but freeze and thaw of two products in mix caused slump.