LONG TERM FIELD PERFORMANCE OF NITROGEN FERTILIZERS

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More complete information can be obtained to characterize nitrogen (N) sources or N fertilization programs if long-term studies are used. The residual effects of slow-release N sources are of particular importance in such studies. "Long-term" is not defined in this presentation because assigning an exact time or minimum time would be difficult. Certainly, making observations or collecting results from a single application or during a single season could be considered short-term. Depending on the type of information desired, various lengths of time would be needed to obtain meaningful data from long-term studies.

Field Observations

Continued use of an N source or N fertilizer program has produced satisfactory turf for many turf managers. Although individuals may not agree on a "best" N source or N program, many have stuck with practices that work for them. It should be common knowledge that long-term use of activated sewage sludge (in particular, Milorganite) has proven successful. Also, continued use of ureaform or IBDU has given good results. Sulfur-coated urea, a relative newcomer to the family of slow-release N sources, has not been available long enough to have had years of use on turfgrass like these other sources, but I am confident that long-term use of this product will also be favorable. Use of soluble N sources and various combinations of soluble and slow-release sources in mixed fertilizers have also given good long-term results. This is not to say that all materials will work in all situations, but instead that many people have selected a program that works under their conditions. We also have turf managers who are continually changing their fertilizer program for one reason or another. Their reasons are varied: N sources may not do what they expected, salesmen may sell them on the merits of another fertilizer, cost may be a deciding factor, or they may be searching for that panacea that will cure all their turf's ills.

Now, back to those who have stuck with one program, perhaps making minor adjustments as needed. How do they know that a different program or N-source would not have worked better? Usually they do not know for sure. However, if a person has a program that works, he is best advised to stick with it. Most turf managers are not in a position to evaluate several N sources or programs at one time. Comparisons among N treatments are usually left to the turf researcher.

Long-Term Research

In research studies several N sources or fertilizer programs can be observed at one time. The longer a study is conducted, the more can be learned concerning the effects of a treatment. Long-term studies are also valuable for providing mine the residual effects of slow-release N sources, which are often inefficient in the first years of use. Even if residual effects are not of major importance, it is a good idea to obtain data from several growing seasons, which can provide different weather patterns or disease pressure. Longterm studies are also valuable for providing information on responses such as turfgrass species competition, weed encroachment, disease incidence, and thatch development when these responses are desired. However, in studies designed with N-source evaluation as the prime objective, it is best to minimize the effects of things such as species changes, weeds, and diseases. The researcher likes to know for sure that responses such as slow growth, poor color, and thin turf are related directly to the availability of N from an N

Nitrogen Source Test on Merion After Seven Years

Material	Treatment (lb. N/1,000 ft²)	Appl.*	Average clipping yields 1966	1967	1968	1969	1970	1971	1972
						(grams)			
IBDU	5	2	72	121	116	108	122	94	98
Ureaform	5	2	46	68	82	90	120	75	103
Urex	5	2	102	109	103	106	124	85	100
ADM	5	2	103	129	116	125	135	105	118
Milorganite	5	3	69	87	89	88	106	67	96
Urea	3	9	76	96	80	74	91	67	82

*Number of equal applications to obtain annual rate of N shown.

source rather than being due to a turf disease or a shift in species composition.

Turf stands developed in long-term N research studies provide sites with known histories. These areas can then be used for other research subjects such as physiological responses to various stresses, soil test calibration, diseases, and weeds.

Perhaps the greatest deterrents to and disadvantage of long-term studies are time and cost. One may wonder about the value of studies involving experimental materials that never reach the market. However, it is better that these materials are dropped after research rather than being dropped after they have been passed onto the public without adequate testing.

Representatives of a few companies want to make decisions after one season's results. At the university level we feel that long-term research gives us a much better basis for our opinions and extension recommendations. Representatives of other companies agree with this philosophy, and they often provide grants to help support these studies.

Results from Long-Term Research

Perhaps the best argument for long-term research can be provided by comparing initial results with those obtained later in an experiment. The results given here were obtained in studies at Penn State.

Lawn Fertilizer Test. Milorganite and ureaform were included in a test with various lawn fertilizers having lower amounts of water-insoluble nitrogen. In treatments in which 2 pounds of N per 1,000 square feet were applied in spring and fall for two years, Milorganite and ureaform gave relatively low yields and color response in the first year. The greatest response was obtained in the first year by fertilizers having lower amounts of water-insoluble N. By August of the second year, prior to fall fertilization, the best color was found on plots fertilized with these two N sources. Fertilizer was not applied in the third year, but clipping weights were taken for 13 weeks beginning in late April and ending in mid-July. The good residual effects of Milorganite and ureaform, and also of Scott's 23-7-7, were quite apparent in the third year.

N Source Test on Merion Kentucky Bluegrass. Eight N sources were used to fertilize Merion bluegrass for 7 years. Nitrogen recovery in the clippings was calculated for the first 2 years. The inefficiency of Milorganite and Uramite (ureaform) was striking. Urex (a urea-paraffin matrix), ADM (plastic coated urea), and urea had higher recoveries.

The study was continued for 5 more years. To cut expenses, nitrogen analyses of clippings were discontinued. However, clipping yields, which give almost as good an indication of N use by the grass, were continued. Average fresh-weight yields showed that 3 pounds of N from urea produced greater yields than 5 pounds of N from IBDU in the first year and more than 5 pounds of N from ureaform and Milorganite in the first two years. The residual effects of IBDU were noted in the second year, but with ureaform and Milorganite it took longer for the response to reach that obtained from other sources.

In the summer of 1973, tests for soil N, turf color, and clipping yield showed that the greatest residual effect was obtained from ureaform. Milorganite and IBDU ranked second and third.

At least two findings in this research tie in with the actions of turf managers. First, the slow start from ureaform has been the reason for their dropping it from consideration after short-term use. Second, long-term users of ureaform and Milorganite have been able to reduce application rates as residual N has built up. Occasionally we hear of superintendents drastically reducing N rates and still maintaining adequate turf. If a man who has been using 6 or 8 pounds of N per 1,000 square feet can successfully drop to 3 pounds of N, it may be because of the N reserves that have accumulated in the soil.

Evaluation of Sulfur-Coated Urea Formulations. Not all sulfur-coated ureas are the same. Different coating methods and thicknesses are used during their manufacture. A study was started in 1974 to evaluate five TVA formulations and Gold N, a product of ICI in England. Spring applications of 4 pounds of N per 1,000 square feet were made. Initial response decreased as the coating weight of the material increased. Response was also slower when a sulfur-only coating rather than a sulfur-plus-wax coating was used. We thought that the slower releasing materials would come on during the fall. They did not. Then we thought that perhaps the residual effects would show the next spring. They did not. We applied 4 pounds of N again in 1975, expecting that we would observe some residual response if we continued for another year. It did not happen. In May of 1976, we sampled the plots for residual sulfur-coated urea and found as much as 37 percent of the applied material still there. We applied another 4 pounds of N that spring. Still no striking residual effect occurrred. We sampled for residual pellets that fall, again in 1977, and twice in 1978. No more fertilizer was applied after 1976.

The difference in residual N release over a two-year period (11/76 to 11/78) was as high as 2.5 pounds of N per 1,000 square feet. However, no visual effects from residual N were noted during this time. The first visual effect noted was in August of 1979, when SCU-17 treated plots had significantly less dollar spot and better color than Gold N plots. The slight differences observed at this time were not significant. Additional studies are now being conducted to characterize the release of N from different N sources. **WTT**