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Observe Greenness, Density, Effect on Nematodes

Five-Year Study of Nitrogen Sources for 328 Bermuda

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One of the most important, yet controversial, problems with which the supt. must deal is the choice of proper nitrogen source with which to fertilize his grass. The air is saturated with claims and counter claims made by proponents of one material or another. This "advice," instead of helping one to arrive at an intelligent decision often is confusing.

Any discussion of nitrogen sources must necessarily characterize the forms which can be obtained. In general, nitrogen sources can be divided into two broad categories, inorganic and organic. Inorganic forms are those like nitrate of soda, sulfate and ammonia or ammonium nitrate and are distinguished from the organics in that they do not contain carbon. Organic forms contain carbon in addition to other elements and may be divided into two general groups, natural and synthetics. Natural organics include such products as activated sewerage sludge, plant meals and tankage. Synthetics are man-made and include products such as urea, urea-formaldehyde and calcium cyanamid.

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Caution with Inorganics

A number of factors must be weighed in deciding which source should be used in a given situation. Caution must be exercised in use of large amounts of the inorganics for turf since, due to their salt content, they can cause foliage burning unless liberally watered-in immediately following application. Consideration must also be given their effect on soil reaction. Those containing ammonia leave an acid residue in the soil. Their continued use on acid soils demands periodic lime applications to neutralize this residue. About 2 lbs of lime are needed to neutralize the acid resulting from each lb. of ammonia nitrogen from all sources except sulfate of ammonia, in which case about 6 lbs. of lime are required. For most soils, the use of nitrate sources like nitrate of soda, calcium nitrate and ammonium nitrate-limestone obviates the use of lime to correct soil acidity since they have a neutral or basic effect on the soil.

Most of the organic sources, natural or synthetic, do not give the rapid response

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Table 1. Five year influence of four nitrogen sources applied monthly, quarterly, and semi-annually on the greenness of Tifton 328 Bermuda under greens management.

Source of Nitrogen	Annual Nitrogen Rate of 18 lb/-1000 sq. ft. Appd.:	Avg. greenness° ratings from 5 plots during					
		1956	1957	1958	1959	1960	5-year Average
Urea-formalde-hyde 38% N	Monthly	3.8	3.0	2.7	2.0	2.6	2.8
	Quarterly	3.9	2.7	2.9	2.6	2.8	3.0
	Semi-annually	2.6	1.9	2.2	2.2	2.7	2.3
	Average	3.4	2.5	2.6	2.3	2.7	2.7
Activated sewer-age sludge 6% N	Monthly	3.4	2.3	2.4	2.1	2.5	2.5
	Quarterly	3.1	2.4	2.8	1.7	2.9	2.6
	Semi-annually	2.4	2.4	3.1	2.4	2.4	2.5
	Average	3.0	2.4	2.8	2.1	2.6	2.5
Ammonium Nitrate 33.5% N	Monthly	3.1	2.8	3.5	3.1	2.9	3.1
	Quarterly	3.0	2.8	3.5	3.6	3.4	3.3
	Semi-annually	2.1	2.9	3.3	3.4	4.0	3.1
	Average	2.7	2.8	3.4	3.4	3.4	3.2
Urea 45% N	Quarterly	2.4	2.2	3.4	2.2	3.0	2.6
Check	None	5.0	4.2	3.8	4.8	4.8	4.6

°The lower the numerical rating, the greener the grass.

Table 2. The 5-year influence of four nitrogen sources applied monthly, quarterly, and semi-annually on the sod density of Tifton 328 Bermuda under greens management.

Source of Nitrogen	Annual Nitrogen Rate of 18 lb/-1000 sq. ft. Appd.:	Avg. sod density° ratings from 5 plots during:					
		1956	1957	1958	1959	1960	5-year Average
Urea-formalde-hyde 38% N	Monthly	3.6	3.2	2.1	2.6	3.4	3.0
	Quarterly	3.0	2.9	2.9	2.7	3.6	3.0
	Semi-annually	3.2	2.0	1.6	2.6	3.0	2.5
	Average	3.3	2.7	2.2	2.6	3.3	2.8
Activated Sewer-age Sludge 6% N	Monthly	3.5	2.3	1.8	2.0	3.1	2.5
	Quarterly	2.7	2.3	2.0	2.1	3.0	2.4
	Semi-annually	3.3	2.5	1.8	1.7	2.4	2.3
	Average	3.2	2.4	1.9	1.9	2.8	2.4
Ammonium Nitrate 33.5% N	Monthly	3.3	2.9	3.4	3.4	3.6	3.3
	Quarterly	2.9	2.9	2.8	3.3	4.0	3.2
	Semi-annually	3.0	3.3	2.8	3.0	4.3	3.3
	Average	3.1	3.0	3.0	3.2	4.0	3.3
Urea 45% N	Quarterly	2.9	2.8	2.8	1.8	3.3	2.7
Check	None	4.1	3.9	3.2	4.4	4.8	4.1

°The lower the numerical rating, the greater the sod density.

Table 3. The effect of applying four nitrogen sources to Tifton 328 for five consecutive years upon the soil population of sting nematodes at the end of this period.

Source of Nitrogen	Anual Nitrogen Rate of 18 lb/1000 sq. ft. Applied:	Sting Nematode Count* in		Grams of Roots per Core**
		1959	1960	1960
Urea-formaldehyde 38% N	Monthly	105.3	46.0	.31
	Quarterly	78.2	41.0	.35
	Semi-annually	96.3	48.3	.30
	Average	93.3	45.1	.32
Activated Sewerage Sludge 6% N	Monthly	123.3	121.3	.43
	Quarterly	128.0	108.0	.33
	Semiannually	93.8	100.8	.28
	Average	115.0	110.0	.34
Ammonium Nitrate 33.5% N	Monthly	149.5	53.5	.36
	Quarterly	57.5	43.0	.29
	Semi-anually	131.0	48.5	.34
	Average	112.6	48.3	.33
Urea 45% N	Quarterly	47.3	55.5	.35
Check	None	89.0	36.8	.30
5% LSD		NS	47.5	NS

*Number of nematodes in 150 cc of soil, average of 4 replications.

**Core—6 ins. deep and 1 in. diameter.

obtained by the inorganics, but due to this lesser initial availability, have a somewhat longer-lasting effect. The natural organic forms require much less care in application since they do not have a high salt concentration that may burn grass. Most of the organic sources, however, are more expensive per unit of nitrogen than the inorganics. In determining the cost per pound of nitrogen from any given source containing only nitrogen, multiply the per cent of nitrogen in the material times 20 and divide the product into the per-ton cost of the material.

Study Made at Tifton

A study, begun in the spring of 1956, at the University of Georgia Coastal Plain Experiment Station in Tifton was designed to evaluate four nitrogen sources for Tifton 328 Bermuda. This grass was chloropicrin planted on a Tifton loamy sand (previously treated with methyl bromide-chloropicrin soil fumigant) in the spring of 1956 and has since been managed similar to golf greens with respect to irrigation, topdressing, mowing, pest control, etc. The Bermuda was overseeded with rye each fall which received the same fertilization as the Bermuda. The four nitrogen sources used were two synthetic organics, urea 45 per cent N and urea-formaldehyde 38 per cent N; one natural organic, activated sewerage sludge 6 per cent N; and one inorganic, ammonium nitrate 33.5 per cent N.

Each of these materials except urea was applied at the rate of 18 pounds of nitrogen per 1,000 sq. ft. per year in monthly applications of 1½ lb. N/1,000; quarterly applications of 4.5 lb. N/1,000; and semi-annual applications of 9 lb. N/1,000. Urea was used only in quarterly applications. Phosphorus and potash were applied in the form of an 0-10-20 fertilizer, For each two pounds of nitrogen, the grass received the equivalent of one pound of P_2O_5 and two pounds of K_2O. Lime was applied as needed to maintain a favorable soil pH.

Density, Greenness Rated

Each month during the growing season, visual numerical ratings were made on all treatments with respect to greenness and density of the sod. Treatments

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with the darkest color and the greatest density were given a rating of 1 and the poorest appearing treatments were recorded as 5. Intermediate treatments were given ratings of 2, 3 or 4. Each treatment was replicated five times, and the average monthly rating of these plots for each year is shown in tables 1 and 2.

Table 1 shows the influence of each of the nitrogen sources and frequency of application upon the greenness of the Bermuda during each of the years in study. It is apparent that there was little difference between the overall performance of urea-formaldehyde and the activated sewerage sludge for the five-year average of all treatments. Semi-annual applications of urea-formaldehyde resulted in a more desirable color than any other application frequency of any source. The five-year average performance of the activated sewerage sludge and ammonium nitrate showed essentially no difference between application frequencies. Of considerable economic importance is the fact that quarterly applications of urea gave results equal to the sewerage sludge. One lb. of nitrogen from sewerage sludge costs about four times as much as a lb. of nitrogen from urea, if phosphorus is not considered. The inorganic source, ammonium nitrate, was slightly inferior to the other sources, although in many instances the economy of this source would still justify its use.

The sod density ratings, table 2, showed essentially the same relationship to treatment as did greenness. Generally, a greater average density was obtained with activated sewerage sludge than any other source with only small differences between application frequencies. Semi-annual applications of urea-formaldehyde and quarterly applications of urea also resulted in excellent sod density. Ammonium nitrate was inferior to the other sources, but was considerably superior to the check treatment.

Had Burning Effect

Much of the "apparent" inferiority of the ammonium nitrate was observed to be due to its burning effect on the grass, even though care was exercised in watering it in immediately after application. This same effect, to a lesser extent, was observed on the urea treatments. This effect should be considered by those anticipating the use of these materials. Practically no burning was observed on

the urea-formaldehyde or activated sewerage sludge treatments even following the infrequent very high application rates.

It was noted in 1959 that a general unthrifty appearance of the grass existed, seemingly unrelated to the fertilizer treatments. Since no disease or insects were apparent, it was felt that nematodes might be reponsible for this condition. Samples of soil were obtained from each plot in four replicates and counts of sting nematodes were made. One-half of each plot was then treated with a nematacide, DBCP, (nemagon EC-2 formulation used) at 12 gal. per acre of 50 per cent by volume emulsifiable concentrate. Counts were again made in 1960 along with samples of soil from which roots were separated and weighed. These data are presented in table 3.

It is apparent that the nematacide applied in 1959 was effective in reducing the sting nematode population on all treatments except those receiving activated sewerage sludge. These plots continued to have a relatively high population of nematodes in 1960. It was felt that the high population resulting from this source might be due to a possibly greater quantity of roots capable of supporting these parasites. For this reason root samples were taken. These data, however, show that no significant difference in root production existed between the nitrogen treatments. There were significant differences in nematode population in 1960, activated sewerage sludge treatments containing the greater number. An improvement in turf quality was observed where the nematacide was used, on all treatments except those receiving the sewerage sludge.

Battle with the Weeds

Richmond (Calif.) G & CC reports that for the last two seasons a fine leaf weed, Dog's Fennel, resembling the leaf of a carrot, was taking over its course. The origin of the weed can't be traced but it has been prevalent around Bay area courses. Ragged in growth, it made it impossible for the Richmond maintenance crew to mow fairways evenly, giving rise to many bad lies. The USGA green section recommended controls and after two sprayings of a suggested herbicide, growth of the weed was retarded. More recently a fertilizer, containing 47 per cent nitrogen, was applied and Richmond's fairways are starting to come back.