BIOORGANIC TURF FERTILIZERS

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The term "bio" has begun to proliferate in the turf world. We have bioregulators, biocontrol agents of various kinds and "bio" is becoming popular in trade names. So why not bioorganic fertilizers?

What I'm talking about of course are the natural organic fertilizers—fertilizers derived from plant and animal wastes. There is growing consumer interest in these products and the industry has responded with a wide array of products and claims. This has prompted numerous telephone calls. Hence, the time seems right to discuss these products in general and examine some of the claims being made.

One thing that distinguishes one bioorganic fertilizer from another is what goes into the product. The list of plant and animal wastes used is almost endless and even varies regionally depending on what wastes are readily available. To name just a few, there's poultry manure composted to varying degrees, alfalfa meal, feather meal, bone and blood meal, tankage, sewage sludge, and even things such as sunflower hull ash. It's this almost endless array of compositions that is one of the distinguishing features of bioorganic fertilizers.

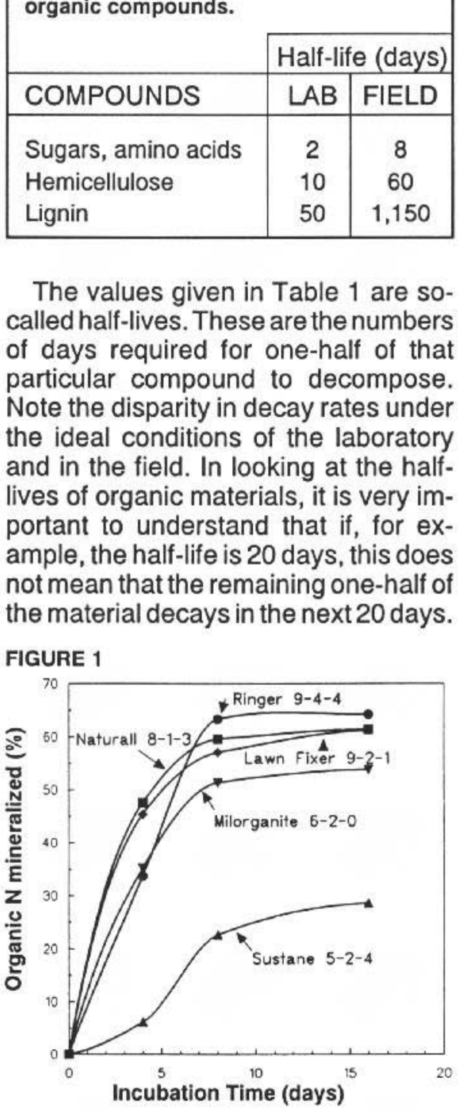
The chemical compounds in synthetic organic N fertilizers are well defined and relatively few in number. Not so with bioorganic fertilizers. There is no way of knowing from information on the fertilizer bag what kinds of compounds are present or in what quantities. The significance of this is indicated by the data given in Table 1. Rates of microbial decay of organic compounds differ greatly. In general, the more complex the compound the slower its rate of decomposition. From this it becomes evident that the rate of decomposition of bioorganic fertilizers and, therefore, the rate of N release is very much dependent on the organic makeup of the fertilizer. Since there is no way of knowing in advance what this is, one cannot readily surmise in advance what will be the N release rate of a particular bioorganic fertilizer.

TABLE 1. Approximate half-lives of some organic compounds.

	Half-life (days)	
COMPOUNDS	LAB	FIELD
Sugars, amino acids	2	8
Hemicellulose	10	60
Lignin	50	1,150

The values given in Table 1 are so-called half-lives. These are the numbers of days required for one-half of that particular compound to decompose. Note the disparity in decay rates under the ideal conditions of the laboratory and in the field. In looking at the half-lives of organic materials, it is very important to understand that if, for example, the half-life is 20 days, this does not mean that the remaining one-half of the material decays in the next 20 days.

FIGURE 1



What actually happens in shown in Figure 1. Here, even under ideal conditions, rates of decay of these bioorganic fertilizers slowed dramatically after about 8 days. This type of decay curve is what occurs for the microbial decomposition of virtually any organic material that contains a wide array of organic compounds. The sharp decline in the decay rate signifies that most of the readily decomposable compounds have been depleted. What remains is slowly decomposable compounds such as hemicellulose and lignin. It may take years for their decomposition to be complete. In other words, the release of N from bioorganic fertilizers is always considerably less than 100 percent and typically ranges between 40 and 60 percent over a single growing season.

Also note in Figure 1 that the percentages of organic N released were somewhat less for Milorganite than for Lawn Fixer, Naturall or the Ringer product and considerably less for Sustane. These product differences reflect differences in the types and amounts of organic compounds present. During their production, Milorganite goes through a short period of microbial decomposition and Sustane, being a composted product, through a much longer period. What is consumed during these periods of microbial decomposition are the more rapidly decomposable organic compounds. What remains are the more slowly decomposable materials. The end result is a slower rate and less complete release of N.

TABLE 2. Elemental analyses of some bioorganic fertilizers

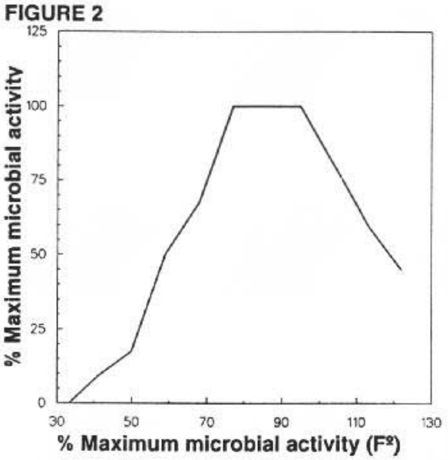
Element	L	N	S	M
	Macronutrients (%)			
N	8.04	8.82	4.43	6.62
P	1.53	0.79	2.35	1.53
K	0.63	3.73	2.66	0.28
Ca	4.03	1.78	4.06	0.78
Mg	0.27	0.41	0.72	0.32
S	1.60	3.28	2.01	0.74
	Micronutrients (ppm)			
B	14.5	27.0	48.6	20.2
Cu	10.1	74.4	151	392
Mo	2.26	4.50	6.75	1,848
Mn	34.5	228	627	88.4
Fe	1,460	9,010	25,700	56,075
Zn	28.6	184	510	1,120
	Metals (ppm)			
Cd	0.49	2.06	5.07	34.9
Cr	9,920	11,000	56.8	4,972
Ni	4.47	11 8	42.8	141
As	115	133	45.2	<33
Pb	9.56	27.9	20.4	276
Se	953	1,050	30.1	542

L = Lawn Fixer S = Sustane
N = Naturall M = Milorganite

Bioorganic fertilizers, being of plant and animal origin, are complete fertilizers in the sense that they contain all of the essential macro- and micronutrients required by plants (Table 2). In some instances the quantities present are very small, probably too small to overcome severe deficiencies, but nonetheless help replenish what is being removed by the turfgrass. There is a common perception that "natural" implies freedom from potentially harmful substances such as heavy metals. As shown in Table 2, this simply not the case and some bioorganic fertilizers contain heavy metals in concentrations that rival or exceed those in Milorganite. I by no means mean to imply here that bioorganic fertilizers should not be used because they inherently contain heavy metals. So does soil and all plants and animals. I simply want to dispel the notion that bioorganic fertilizers are free from these substances. By the way, if you're wondering why some of the bioorganic fertilizers contain high chromium (Cr) concentrations (Table 2), it's because of the leather tankage present.

Nitrogen release from bioorganic fertilizers depends on environmental conditions as well as the types and amounts of organic compounds present. Temperature is a key factor as far as microbial activity is concerned. The dependence of microbial activity on soil surface temperature is shown in Figure 2. Note that temperatures in the range of 75 to 95 degrees are required for maximum activity. At 60 degrees, the activity is only about 50 percent of the maximum. Thus, N release rates from bioorganic fertilizers are notably reduced by early spring and late fall soil temperatures.

FIGURE 2



Moisture also affects the rate of release of N from bioorganic fertilizers. While moisture influences on microbial release of surface applied organic N have not been carefully documented, related research suggests that moisture effects are generally secondary to temperature effects. Moisture becomes of major importance only when temperature is not limiting microbial activity. Under this circumstance, keeping the soil surface continuously moist through frequent irrigation can be expected to favor N release from bioorganic fertilizers.

TABLE 3. Inorganic content of some bioorganic fertilizers.

Fertilizer	Inorganic N content	% of total N
Harmony	3-6-3	<0.10
Ringer	9-4-4	7.93
Sustane	5-2-4	16.0
Lawn Fixer	9-2-1	1.75
Milorganite	6-2-0	<0.10

Turfgrass response to bioorganic fertilizer the first few days after application is almost totally determined by the amount of inorganic N (i.e., water soluble N) in the fertilizer. Bioorganic N fertilizers can vary substantially in their inorganic N contents (Table 3). The relatively high inorganic N content of

Sustane is typical for composted products. Composting results in mineralization of some of the organic N originally present.

TABLE 4. Season average color responses of turgrasses to bioorganic and synthetic organic fertilizers.

Location	Type of fertilizer	Number tested	Color rating KB	Color rating B
Iowa	Bioorganic	4	7.6	6.2
	Synthetic	3	8.4	5.8
Michigan	Bioorganic	4	8.4	5.8
	Synthetic	2	8.3	6.7
Wisconsin	Bioorganic	5	7.3	7.3
	Synthetic	3	7.6	7.1

KB = Kentucky bluegrass B = Bentgrass

How turfgrass has been found to respond color-wise to bioorganic fertilizers in general is indicated in Table 4. These data show that on a full season basis, bioorganics are capable of producing color responses comparable to those achieved with synthetic organic fertilizers. In general, there are no consistent advantages to using either of these types of fertilizer as far as turfgrass color is concerned. Thus, choice of which type to use should be based on other considerations such as personal preference and cost. Bioorganic fertilizers are not low cost fertilizers. A recent check in local lawn and garden centers revealed that home owners are paying as much as $5.00 per pound of nutrient when they use bioorganic fertilizers. Even lawn care services find it difficult to offer a bioorganic fertilization program for the same cost as for programs based on synthetic fertilizers. On a large scale, one has to factor in additional labor costs arising from the use of the relatively low analysis bioorganic fertilizers.

The argument has been presented that the relatively high purchase price of bioorganic fertilizers is at least partially offset by unique secondary benefits. One of the most intriguing side benefits is that of turfgrass disease suppression. My compilation of what various researchers have found regarding disease suppression appears in Table 5.

What these data tell me is that disease suppression can arise from application bioorganic fertilizers. However, percent times when there has been significant disease suppression are not high enough to look upon bioorganic fertilizers as substitutes for fungicides. They do have some potential for reducing fungicide need in disease control programs, but do not have the degree of reliability necessary to replace fungicides in a disease prevention program. This could change as further research succeeds in identifying the conditions under which disease suppression can be more consistently achieved with bioorganic fertilizers.

Another potential side benefit that may occur when bioorganic fertilizers are used is thatch reduction. My experience and that of colleagues at Michigan State University is that earthworms seem to be the key factor here. When bioorganic fertilizers have been applied to soils naturally populated with earthworms, earthworm activity often increases and there is an associated reduction in thatch. This is particularly true when daily irrigation is practiced.

In summary, bioorganic fertilizers make a lot of sense from the standpoint of recycling of plant and animal wastes. Excellent quality turf can be obtained through their use. But at the same time, bioorganic fertilizers are not miracle or cure-all products nor are they environmentally safer than synthetic fertilizers.

TABLE 5. Results of studies on turfgrass disease suppression by bioorganic fertilizers.

Disease	No. of Studies	No. of Trtmts.	Trtmts. w/ Suppression	Percent Effective
Gray snow mold	1	10	2	20
Dollar spot	4	31	4	13
Brown patch	4	32	11	34
Summer patch	5	146	46	32
Necrotic ringspot	5	71	42	59
Red thread	1	12	1	8

Wisconsin Entomology Report

Survey of White Grubs Needs Your Help

By Charles F. Koval, Extension Entomologist; Daniel K. Young, Associate Professor; Kerry Katovich, Project Assistant—Department of Entomology, UW-Madison

EDITOR'S NOTE: Kerry Katovich is a graduate student at the University of Wisconsin-Madison in the Department of Entomology. A native of Wautoma, Kerry earned a B.S. degree from the UW-Madison. His areas of interest are insect biogeography and larval taxonomy, especially as they relate to beetles. He plans to develop a white grub key to the species found in Wisconsin, along with details on habitat preferences such as soil type or host plants. Let's help him out, if the opportunity presents itself.

White grubs, which are the larval stages of several species of May beetles and June beetles, are becoming increasingly important as pests of many types of agricultural, horticultural, and forest crops and landscape plants. They cause damage by feeding on the roots of plants. As with many types of soil insects, they can be difficult to control, especially on perennial crops.

We have recently undertaken a study of the white grubs of Wisconsin. Our objective is to determine if there are predictable relationships between white grub species and various environmental factors. For example, we wish to determine if the different white grub species are associated with specific plant (crop), types or particular soil conditions.

To make this a representative and meaningful survey, we need your help. If you discover a white grub infestation, we would appreciate having you contact us, noting the following information:

Your name, address and phone number. State and county where larvae were observed. Specific address where larvae were observed. (Township, range, and section, if known). Approximate depth in soil larvae were found. Brief description of vegetation—include crop and dominant weeds, if present.

In addition to the information, it would be very helpful (but not required), if you could send us some live larvae. Line the interior of a small, sturdy box with a few thicknesses of newspaper. Place the white grubs in the box and cover with the soil they came from. (IMPORTANT: Use only the soil from the grub habitat, as we will be analyzing this to determine soil type.) We would like to receive as many as a dozen of each size (usually, you will find 1-3 distinct size groupings). You may also find pupae and adult beetles in the soil; these can be included also. PLEASE DO NOT include adult beetles that have already emerged from the soil.

Send samples to: Mr. Kerry Katovich, Department of Entomology, 444 Russell Labs, 1630 Linden Dr., University of Wisconsin, Madison, WI 53706 or call:
Mr. Kerry Katovich, Office: (608) 262-2078, Fax: (608) 262-3322, E-mail:
DYOUNG@ CALSHP.CALS.WISC.EDU

To ensure that the larvae do not die in transit, we recommend sending them by overnight mail or UPS.

We have very limited funds for this project, and therefore we will be unable to travel to many field sites. Therefore, all samples we receive by mail will greatly increase the value of this survey. Any assistance will be greatly appreciated.