A Breakthrough in Organic Turfgrass Management

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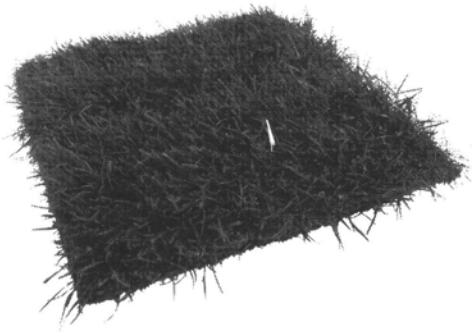
Integrated Pest Management (IPM) programs have been developed for almost all agricultural and ornamental crop production systems over the past two decades but only recently have IPM and organic management systems been considered a truly primary approach in professional turfgrass management. The reasons for the dramatic increase in organic approaches are centred upon public concern for the environment which has resulted in legislation at both the state and federal level in reducing or eliminating pesticide and synthetic fertilizer usage.

Although the industry has been 'pushed' into using IPM and organic approaches, a multitude of research reports as well as on-site experiences have shown that switching partially or even wholly to organic management techniques has resulted in renewed and greatly increased turfgrass performance while reducing or eliminating pesticide and synthetic fertilizer usage.

One of the more significant problems associated with organic turfgrass management programs, particularly in the golf course and sports turf industry, has been the inability to develop and maintain the high levels of overall turf quality and aggressiveness (recuperative potential) with natural organic fertilizers that are now expected.

Natural organic fertilizers are inherently low in available nitrogen levels ranging, for the most part, between 2 and 8% with only blood meal and bat guano approaching the 10-12% levels. These relatively low nitrogen levels (compared to synthetic sources) make it necessary to apply inordinately high amounts of material to achieve the desired seasonal effects since all natural organics depend upon soil microbial activity for nitrogen/mineral release.

As such, when soil temperatures are low as in the spring and fall, release rates are limited at a time when cool-season turfgrasses are at their peak of performance and need higher levels of nitrogen in the development of root zones and lateral stems. This is particularly the case when using materials lower than 6% N having a comparatively high C/N (Carbon/Nitrogen) ratio which would result in even slower mineral release.



To overcome this problem, the industry has developed 'organically based' fertilizers that have increasing levels of inorganic nitrogen added to meet the high N demands. These 'bridged' products have been successful but cannot be considered 100% natural organic and can result in increased nitrogen loss through surface runoff and leaching to groundwaters, depending on how high the percentage of inorganic N. Inorganically 'amended' materials also do not have the same ability to stimulate increases in soil microbial activities and populations so necessary for a healthy soil under reduced or limited pesticide programs.

It has been well documented over the years that increased soil microbial populations and activities compete with and suppress the populations and activities of soil-borne plant pathogens resulting in significantly less disease occurrence and subsequent damage (references 1, 2). Aside from temperature and adequate water levels, the amount and types of organic matter and fertilizers will have an extremely profound effect upon nutrient availability as well as disease suppression. Some types of organic amendments, particularly those with comparatively low C/N ratios, have been known to greatly suppress levels of disease incidence (3, 4).

The literature published regarding the effects and potential use of organic fertilizers and amendments on professional turf, particularly in the last 10 years, is voluminous but can be summarized as follows:

Disadvantages

1. Nitrogen levels too low to maintain higher performance turf requiring a more rapid response.
2. Very high levels of material need to be applied to achieve desired results.
3. Almost all materials are applied in a pelletized, solid application which can easily be picked up during mowing and take considerable time to breakdown and release mineral nutrients.
4. Materials having high C/N ratios have extremely long residual times and may 'bind' available nitrogen.
5. Seasonal effectiveness: organic fertilizers depend upon microbial activities for mineral release and, as such, on irrigated systems, are much more effective during the warm summer months and not adequate during the high growth fall and spring seasons.
6. Bulky to store and transport due to comparatively low nitrogen analysis.
7. May have a naturally foul smell.
8. Usually much more expensive compared to inorganics and urea.

Advantages

1. Environmentally friendly: little or no nitrate leaching or runoff into ground or surface waters.
2. Increased soil microbial populations and activities.
3. Decreased disease incidence due to enhanced competitiveness by increased soil microbial populations.
4. Decreased thatch accumulation due to increased soil microbial populations.
5. Increased nutrient availability due to enhanced decomposition by soil microbial populations.
6. Increased soil water holding capacity.
7. Little to no salt index making high temperature applications safe.

In view of the previously listed disadvantages, the most desirable natural organic fertilizer would have the following properties:

A. The highest level of nitrogen available, preferably over 12% N.
B. The lowest C/N ratio possible, preferably under 20 for more rapid microbial breakdown and nitrogen availability, particularly during the spring and fall months.
C. Easy application, preferably a liquid soluble/flowable spray application to avoid particle pickup during mowing and to enhance response time.
D. High microbial populations and activities after application.

Until recently, the only way to approach the properties listed above was to blend an amended 'organically based' material which would have a base level of natural organic component mixed with a high N analysis inorganic or urea fertilizer. Unfortunately, although these materials meet plant nitrogen demands, they fall short with regard to increasing soil microbial activities/populations and decreasing disease incidence and are not in compliance with 'natural organic' standards. These inorganic/organic blends also have much more potential for eventual nitrogen movement to ground and surface waters. The only 100% natural organic that comes close to the above properties is blood meal which has up to 12% nitrogen and can be suspended in water for spray applications but, unfortunately, blood meal is extremely expensive to produce eliminating any feasible commercial use. Only one recently developed material (spring, 2001) called BioSOF Plus meets all the criteria outlined above. This material has the highest level of natural organic nitrogen to date in the industry at 14.0% which is plant derived from a complex series of extractions from soybeans. The material is composed of approximately 20% free amino acids and 70% short chain proteins and peptides which makes the material extremely dispersible in water and, as such, very flowable allowing for liquid spray applications or additions to fertigation systems. BioSOF Plus has almost unlimited storage capacity and transport is acceptable due to the solid, powdered nature of the material and high nitrogen content. The protein content of BioSOF Plus is in excess of 90% which gives it the extremely low C/N ratio of 2.2 making it a powerful soil microbial biostimulant. In view of these characteristics, BioSOF Plus represents a significant breakthrough in the organic management of professional turf.

Objectives and Methods

The objectives of this report are to compare BioSOF Plus with a standard and comparable inorganic source having approximately the same analysis and milorganite, a popular composted sludge used extensively in the turf industry. Data

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were taken on overall turf quality every two weeks from experimental field plots of 'Providence' and 'PennCross' creeping bentgrass throughout the growing season of 2000. Microbial activity and population analysis for these materials was obtained by sampling of the soil profile 3, 7 and 10 days after each application of all materials followed immediately by a standard plate count method of quantifying soil microorganisms. Rates of application were 0.1, 0.2 and 0.3 lb N/1000 sq. ft. applied monthly on native soil sites and 0.3 lb N/1000 sq. ft. weekly on standard USGA sand greens and modified USGA sand greens mixed with 30% native soil.

Results

Turfgrass quality ratings between BioSOF Plus and inorganic treatments were surprisingly similar for all three soil types tested. Application rates between 0.1 and 0.3 lbs N/1000/month on native soil resulted in virtually no significant differences between BioSOF Plus and the inorganic treatments over the course of the growing season. A weekly application rate of 0.3 lbs N/1000 sq. ft. on both the USGA sand green profile and the modified sand profile again indicate that there are no observable differences in turfgrass quality between BioSOF Plus and inorganic treatments.

Microbial population counts for all three soil profiles showed dramatic differences between BioSOF Plus, inorganic and milorganite within three days after each application. Applications of BioSOF Plus to the USGA pure sand profile resulted in explosive growth of microbial populations compared to the inorganic and milorganite treatments. BioSOF Plus applications for the modified sand and native soil profiles were similar yielding up to 600% more microbial activity compared to the other treatments within 72 hours.

Conclusions

Turf Quality Ratings

Turf quality ratings for all soil types showed no differences between BioSOF Plus and inorganic treatments indicating, for the first time, that a 100% natural organic material can perform equally as well as an inorganic during a 'spoon feeding' program, particularly to USGA sand greens. The low C/N ratio of BioSOF Plus (2.2) and the fact that the material is composed of highly degraded short chain protein/peptides and amino acids results in intensive soil microbial activity leading to an extremely rapid mineralization process and nitrogen availability levels approaching that of immediately available inorganic applications.

Soil Microbial Activity

Applications of BioSOF Plus result in extremely rapid and large increases in existing soil microbial populations compared to milorganite and inorganic nitrogen treatments. This rapid response is again due to the low C/N ratio of the material as well as the fact that the BioSOF Plus was applied as a flowable liquid spray (flowable powder) which would carry the material into the soil more effectively as well as have a much larger surface area for microbial activity.

The results obtained during the 2000 growing season clearly indicate BioSOF Plus to be equally as effective as inorganic applications with regard to overall turf quality but much more effective in stimulating existing soil microbial populations, even on a 100% sand profile, compared to inorganic and milorganite treatments. Although turf response was similar to inorganic treatments, there was no observable 'flush' of growth with BioSOF Plus applications and there is literally no chance of foliar burn due to the organic nature of the product. It can reasonably be concluded that soil borne disease activity would be much less on BioSOF Plus treated turf compared to inorganic or even milorganite treated turf due to the explosive increases in soil microbial populations.

The most important conclusion is the fact that BioSOF Plus meets all the criteria listed above as the 'most desirable' organic fertilizer source having the highest level of organic N in the industry at 14.0%, flowable characteristics of the material allowing for more effective liquid applications from spray tanks or fertigation systems, an extremely low C/N ratio with rapid and significant stimulating effects on soil microbial populations. The physical characteristics of BioSOF Plus as well as plant and soil responses clearly make this material a breakthrough in organic management of turf as well as other agricultural systems. ♦

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Editor's Note: Dr. Brian Holl will be addressing the topic of Organic Amendments, followed by a Panel Discussion on Organics at the upcoming Ontario Turfgrass Symposium. January 22-24, 2002.

Publication of this article does not imply the endorsement of BioSOF Plus by the Sports Turf Association. Availability in Canada will depend on the supplier obtaining registration of the product under the Fertilizer Act.