



Are Bio-soil Stimulants Beneficial to Forage Production?

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There are many products available in the market for use in forage production, which fall into the broad category of biological soil conditioners, bio-soil stimulants, soil activators, bio-soil enhancers or additives. Usually, they are products that have been formulated to activate microbial activity in the soil and increase nutrient uptake of the plant when applied in small quantities. They may contain nutrients, enzymes, growth regulators, vitamins, minerals, humic and fulvic acids, bio stimulants and some microbes such as fungal species (*Mycorrhiza*, *Yeast*, *Trichoderma*), bacterial species (*Rhizobium*, *Cyanobacteria*, *Lactic Acid Bacteria*, *Actinomyces*), algae, and/or plant extracts. Keep in mind that for some of these microbes to work in a favorable environment, the amount of organic matter for them to decompose has to be adequate, temperatures have to be optimum (50 – 100 °F, which makes timing of application critical), and other soil macro and micro nutrients need to be in balance.

Humic and fulvic acid based products are usually the most common in the market with a varying degree of minerals and microbes. The recipes vary depending on the manufacturer, so does the price and dosage rates. The following information is provided to help producers determine which products might be more suitable for their environment and also for their forage management goals.

The large array of these products provides a large list of benefits, but there is no much information related to the real advantages and disadvantages of these products in forage production. Some of the benefits that are highlighted on brochures, websites and TV commercials include: higher yields, healthier plants, earlier germination rates, more microbial activity, fewer inputs (reduced input costs), increased chlorophyll content (for photosynthesis), increased nodulation in legumes, increased root formation, and resistance to extreme temperatures, disease and drought (reduced water consumption). Others claim higher Brix values. Keep in mind that brix levels could be affected by forage species, maturity, time of the year and time of the day the sample is collected, plants stress, temperature and soil moisture levels. There are claims that these products might enhance crop growth and yields through a wide number of mechanisms, but there is very little explanation and understanding of the modes of action on specific treatments on different forage crops.

It is important to stress that the amount of mineral nutrients in bio-soil stimulants (especially liquid ones) may be too low to be the sole major nutrient source for a long-term sustainable nutrient budget. Although these products might aid in nutrient uptake, producers need to be aware that although the removal of nutrients might be higher and it could lead to early depletion of other key nutrients (soil mining) and create a major soil nutrient imbalance. The efficacy of these products can vary depending on application rates, application time, application method, fertilizer sources, forage crop species, soil type and texture, soil organic matter, soil temperature, soil moisture, humidity and wind speed.

There are several considerations that need to be taken into account with the application of these products such as time of the day, crop growth stage, time of the year, and method of application. Products could be better applied on overcast or drizzly days, early in the morning or in the afternoon to avoid death of live microbes and to improve foliar uptake. Keep in mind that in Mississippi under extreme hot conditions, some plants might close their pores to reduce evapotranspiration which will reduce foliar uptake. Crop growth will also affect nutrient uptake, if a pasture or hay field have been grazed or cut, determining the recovery time in which plants might actively growing will be important to time application and increase the effectiveness of the product. Remember that the recovery time forage crop will depend on foliage removal (the shorter the forage is cut or grazed, the longer the recovery time will be). Also, the time of the year will have a

decisive impact on how these products will work. There is a probability that under very cold weather or very dry conditions there will be a less likelihood of effectiveness. Remember that some of these products might contain growth regulators that might help plants cope with stress. Determining the application method is also important. Spraying on a bare soil after forage has been grazed or harvested for hay might have less benefit than spraying on active new growth. Using a finer spray pattern might also be beneficial. Producers need to make sure that bio-soil stimulants could be mixed with other products. Microbes might be sensitive to products such as lime, sulfur, nitrogen based products, copper, etc.



Most of the concerns addressed here open the door for testing of commercial products and to make sure that research data from independent testing is available to aid on recommendations and improving management practices. There is a need for more trials on different soil types, locations and forage systems to establish a path towards whether a product is worthwhile in a particular system. A study was initiated at Mississippi State University in 2011 to look at some of these commercially available products. The study was conducted on a 10-year old stand of Sumrall 007 bermudagrass. The products included in the study were C-Cat, Hydra-Hume and Sumagrow. They were applied at rates of 2 qt/ac, 1 gal/ac and 1 gal/ac per application time, respectively. Products were applied

Table 1. Yield distribution of Sumrall 007 bermudagrass treated with bio-soil stimulants and nitrogen sources.

Treatment	Yield		
	Harvest Mean ¹	Total	% Increase ²
	----- lb/ac -----		
Control	698	2791	--
C-Cat (CC)	1344	5377	93
Hydra-Hume (HH)	1282	5129	84
Sumagrow (SG)	903	3613	29
Urea (U)	1917	7668	175
U+CC	1828	7311	162
U+HH	1969	7877	182
U+SG	1843	7371	164
UAN	1833	7332	163
UAN+CC	1716	6865	146
UAN+HH	1330	5321	91
UAN+SG	1797	7187	158
Mean	1538	6154	--
LSD _{0.05} ³	207	641	37

¹Average harvest yield from 4 harvests in the season.

²Yield increase was estimated on difference from the control.

³Least Significant Difference ($\alpha=0.05$) for comparing of treatments within a harvest.

Source: Lemus et al., 2011.

alone or with a nitrogen application of UAN (32% N) or Urea at a rate of 50 lb N/ac during the first 4 harvests. Preliminary results indicated that there might be some slight yield advantage of some the products in the trial when compared to a control, but not advantage when the products were applied in combination with UAN or Urea or compared to UAN or Urea alone (**Table 1**).

Before a producer purchases large quantities of a product, they should test the product in their farm: (1) test the product in a small area of the pasture or hayfield first, (2) leave a control or untreated area immediately beside or within the treated area, (3) when applying materials that contain nutrients such nitrogen, phosphorus, or potassium, it is important to apply an equivalent amount of those nutrients as a control, (4) test on many similar locations (with the same forage species, soil type, same management practices and same environmental conditions), (5) it is advisable to make more than a single application to reduce the odds that a resulting effect is simply due to chance and (6) check storage conditions and shelf life of the product since some of the products might contain live organisms or might be light sensitive.

In summary, the use of "bio-soil stimulants" might have its place to help low input sustainable forage production systems, but it might have limitations where high yields of forage production are needed for hay and intensive grazing management systems. There is also a need for more scientific research in the Southern U.S. to carefully look at changes in soil quality, forage quality and nutrient uptake. Soil testing still continues to be the best indicator of what is needed for optimum forage production and nutrient management.