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## **Phosphogypsum: A Potential Source of Nutrients For Forages**

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Sulfur deficiencies for plant growth have been reported in over 35 states including Florida. Although sulfur is usually termed a secondary plant nutrient, it should be considered one of the major nutrients essential for crop growth along with nitrogen, phosphorus and potassium. Sulfur is required by plants for the synthesis of certain amino acids which are required for protein production. Thus, if sulfur is limiting, forage quality, as well as quantity, will be reduced. In fact sulfur deficiencies are often confused with nitrogen deficiency. In less severe cases of sulfur deficiency, visual symptoms may not always show up, but crop yield and quality will still be affected.

Sulfur deficiencies are becoming more pronounced and widespread throughout the world. Coarse textured soils such as those commonly found in Florida often exhibit sulfur deficiencies since they have a very low nutrient holding capacity.

Over the years, we have demonstrated that addition of sulfur can increase production of harvested forages, such as bahiagrass, up to 25 percent and protein content by 1.2 percentage units. In these studies, the sources of sulfur were ammonium sulfate and sulfate of potash.

There is a need to find alternative economic sources of sulfur which would be more affordable to traditional sulfur fertilizers. Phosphogypsum ( $\text{CaSO}_4$ ), a by-product of the wet-acid production of phosphoric acid from rock phosphate process, is a potential low cost source of sulfur and calcium for forages. Until now phosphogypsum has had little commercial use because it contains low levels of radium (8-30 psi Ra-226 g1) raising concern over its potential harmful effects. As a result of a recent E.P.A. ruling, **phosphogypsum** is only available to the public if it contains less than 10 psi Ra-226 g-1. Phosphogypsum in northern Florida meets this limit while the majority of phosphogypsum in central Florida contains Ra-26 levels above the limit. This E.P.A.

ruling is currently being appealed by the Fertilizer Institute. In Florida alone, there are over 700 million tons of by-product phosphogypsum stored in waste stacks with 30 million tons being added to the stacks annually. In the entire country the total amount of phosphogypsum in stacks is estimated at seven billion tons!

Over the past 8 years we have evaluated both the agricultural, as well as the environmental impact of phosphogypsum use on forages grown in Florida. Our results in harvested research plots indicate that regardless of rate or time of application, phosphogypsum addition increased bahiagrass yields approximately 15 percent. This increase in yield is a result of the phosphogypsum supplying sulfur and/or calcium to the forage. Phosphogypsum also increased the bahiagrass protein content by 1 percentage unit and the digestibility by as much as 8 percentage units. This can, in turn, lead to greater livestock weight gains and increased stocking rates, resulting in increased profits for ranchers. We have also conducted extensive environmental studies on phosphogypsum application to agricultural lands. Our studies have shown that when phosphogypsum is applied to land at agronomic rates (up to 2 tons per acre) that there are no detrimental effects on soil, air, or water quality. As a result we believe that phosphogypsum is a safe and inexpensive source of nutrients for forage grasses grown in Florida.