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To: AAPFCO representatives

From: Nathan Slaton, Associate Professor-University of Arkansas
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XC: Jamey Johnson, Leo Espinoza, and Morteza Mozaffari

Re: Zn fertilizers and Efficiency factors

Zinc fertilizer is often required to prevent early-season Zn deficiencies in rice and corn produced on alkaline, low cation exchange capacity soils in eastern Arkansas. Failure to provide adequate plant-available Zn can result in significant yield loss and/or increase crop production expenses. Proper Zn fertilization is of special concern for the 2007 cropping season because the cost of Zn fertilizer has increased significantly and farmers are examining alternative Zn fertilization methods in an effort to reduce production costs.

In Arkansas we have spent a considerable amount of time and resources researching methods of identifying Zn-deficient soils and strategies of Zn fertilization (e.g., methods of application and evaluation of various Zn sources) in effort to provide growers with sound and sustainable agronomic recommendations. Despite significant research and educational efforts, each year we spend a considerable time addressing questions on different fertilizer products and manufacturer claims concerning application rates of both granular and liquid Zn products.

The major issues are that 1) the Zn in some fertilizers (namely organic complexed fertilizers) is marketed as being 'more efficient' and can be used at lower rates than university recommendations and 2) the Zn in some fertilizers is less plant available (e.g., water-soluble Zn content) than others and influences crop nutrition and/or yield. Our research has addressed both of these issues.

Research clearly shows that Zn application rate and water-soluble Zn content of granular Zn fertilizers are critical factors influencing early season Zn nutrition to rice (Slaton et al., 2005. Soil Sci. Soc. Amer., 69:443-452). This field research evaluated four granular Zn fertilizers with a range of water-soluble Zn contents applied across a range of Zn rates. The research conclusions were that:

1. A minimum of 40-50% water-soluble Zn applied at the recommended rate of 10 lbs Zn/acre was required to optimize Zn nutrition to seedling rice grown the year of fertilizer application. This conclusion supported previous research regarding water soluble Zn content of granular fertilizers applied preplant.

2. The evaluated granular fertilizers should be applied at ~10 lbs Zn/acre to 1) optimize Zn nutrition to the current crop and 2) build soil-test Zn which provides residual Zn to crops grown afterwards (substantiated current Zn rate recommendation).
3. Zn fertilizer recommendations should be based on a standard product (e.g., highly water soluble $ZnSO_4$ or its equal) so that fertilizers with lower water-soluble or plant-available Zn content could be adjusted (e.g., increased) accordingly to allow growers to compare the economics among products.
4. Water-soluble $ZnSO_4$ and a 10% granular lignosulfonate fertilizer performed equally when applied across a range of Zn rates indicating the efficiency ratio of granular $ZnSO_4$ and lignosulfonate Zn fertilizers is 1:1 when based on elemental Zn rates.
5. Previous research evaluated a manufacturer's recommendation to apply 1 lb Zn/acre as 10% lignosulfonate Zn fertilizer (10 lbs fertilizer/acre) and showed that rice yields were significantly lower with this treatment compared to yields of rice receiving Zn applied at recommended rates (Wilson et al., 1996; pp.196-200; Ark. Rice Res. Studies 1995. Univ. Ark. Res. Ser. 453).

These same issues (e.g., Zn rate) are also beginning to occur among liquid Zn formulations that are used primarily for post-emergence Zn fertilization strategies (e.g., foliar feeding) but product labels also list recommendations for preplant applications at low Zn rates that are not likely sufficient for optimum crop growth on Zn-deficient soils. Applied research comparing the effectiveness of various liquid Zn formulations is scarce making it difficult to refute such claims.

To summarize, farmers depend on unbiased, research-based recommendations to maintain high crop yields and sustain soil productivity. The fertilizer industry should work towards establishing micronutrient fertilizer quality guidelines that will protect growers from and police claims made by some fertilizer manufacturers and/or marketing groups that are not supported by unbiased, replicated research. Many of these claims are indeed supported by some vague research but the origin, consistency, and statistical significance of much of this research are not known. Fertilizer labeling laws within individual states attempt to protect the grower from false claims but state regulatory agencies are likely overwhelmed by the large number of fertilizer and soil amendment products that are marketed. Clearly, this is a complex and controversial issue that will require a great deal of thought and effort to resolve the problem. However, it seems that an effective resolution would serve to enhance the micronutrient fertilizer industry's service to the agricultural sector.

Selected References on Zn Fertilization and Zn Fertilizers:

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Wilson, C.E., Jr., N.A. Slaton, R.J. Norman, B.R. Wells, and D.M. Miller. 2001. Efficient use of fertilizer. pp. 43-54. *In* N.A. Slaton (ed.) Rice Production Handbook. Ark. Coop. Ext. Serv. MP192.

Wilson, Jr., C.E., N.A. Slaton, P.A. Dickson and R.J. Norman. 1996. Phosphorus fertilizer management for rice grown on alkaline soils. p.196-200. *In* R.J. Norman and B.R. Wells (eds.) Arkansas Rice Research Studies 1995. Ark. Agric. Exp. Stn. Res. Ser. 453. Fayetteville, AR.

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