FFF Exclusive

"Zinc is the most widespread micronutrient deficiency in the Corn Belt."

An interview with Dr. John Mortvedt of Colorado State University.

FJ: You were with TVA for a long time weren't you?

Yes, for almost 31 years.

FJ: What were your responsibilities?

I conducted research and development mainly on micronutrients and other fertilizers. Another part of my job was determining the fate of metals in sewage sludges and phosphate fertilizers after application to the soil. I was also involved with studies on nitrogen and phosphorus fertilizers, as well as working with the TVA field staff.

FJ: Did you do much of your research in greenhouses?

Yes. In addition to field research, many of my published papers are concerned with greenhouse research. We worked with university extension and research people to obtain in-field results where fertilizers are used.

FJ: What were some of your findings on sewage sludges?

We know there's a potential for heavy metal buildup when high rates of sewage sludges are used.
I think you'll find the current regulations that went into effect in February of '94 pretty well reflect this. It amounts to having some limits on heavy metals in the sludge that would allow a gradual buildup in the soil. The object is to see that N and P in these sludge are applied on a sound agronomic basis. I think the regulations should stand the test of time. After all, they're based on over 25 years of research.

FJ: A lot of sludge have high levels of salts. What happens to the salts?

Where there is low rainfall, you may have a problem. There salts won't be washed out of the root zone. So we have another limiting factor for the application of these materials.

FJ: For a grower interested in making sure he doesn't have a micronutrient deficiency, how reliable are current micronutrient soils tests?

I'm confident of the tests. Various test have been calibrated for certain types of soils in different regions of the country. The important thing is to send a soil sample to a regional lab to assure the correct procedure is used for that region. How you sample is particularly important for micronutrients, because you need to get a representative sample of the field in question. After you've obtained the sample, you've got to be very careful that you don't contaminate the sample with other micronutrients that are also at very low levels in the soil. For example, you shouldn't use any type of brass or galvanized container for storing soil samples for zinc analyses. The sample should be placed in a plastic container. Stainless steel probes also should be used to avoid contamination. Following correct procedures, I think, will produce reliable results.

FJ: Where do you sample?

Most of the time in the root zone which is generally four to eight inches deep. Once you take deep samples, and include those with shallow samples, you're going to end up with a lower value because the level of available micronutrient decreases quite quickly below the root zone.

FJ: What depth are we talking for sampling?

It depends on fertilizer placement. If we take a representative sample, then it should be in the root zone. But if you're not tilling, the levels are going to again decrease because the previously applied micronutrients won't be down towards the bottom of that 12-inch zone.

FJ: What if you're not tilling at all?

I don't know if anyone has really studied whether, after five or ten years of reduced tillage, we'll see

concentration of most of the nutrients up in that zone where they might have been incorporated. Then the question is, will plant roots be obtaining those nutrients up in the top part or below? One plus with reduced tillage is you do have conditions favorable for good root growth in the upper layer of soil.

FJ: What micronutrients should be added to starters?

Zinc and manganese especially. Those are the main two. Now with boron, the rate must be fairly low, because you can't have too high a rate of boron in the row too close to the seed.

FJ: What about iron?

Similar to zinc. One problem with iron is that soil application of many iron sources is not effective. Iron oxidizes quickly in the soil and becomes unavailable. So it's not a good practice. The keys to iron are knowing where the potential deficiency is, and trying to grow crops that are tolerant to lower levels of iron in the soil. There are studies on various varieties of corn and how they differ in tolerance to low levels of iron. Same is true for soybeans and sorghum.

FJ: We're seeing problems like this with corn in the Central Platte Valley. They can't rotate, like with sorghum and soybeans, so getting another crop in is not a very good option. They're all pretty sensitive to iron deficiency. What would you suggest they grow?

They should check with their seed dealers to see if they have some corn varieties that are more tolerant. They are identifying these varieties and I think some might work in that region. It's the easiest way I know of to control iron deficiency.

FJ: Are there any other iron additives that work in the soil? What about chelates?

There is one chelate, but it's really expensive. It needs to be used mainly for high value crops. So it isn't really economical. Iron sulfate is most economical to buy, but it doesn't stay available in the soil too long.

FJ: That's where you got involved with "gelled" fertilizers, too?

That's right. We will see potential, but they aren't ready to market yet.

FJ: What are the most common micronutrient deficiencies in the Corn Belt?

Zinc is the most widespread. Manganese would be next, then boron. Following this, we have iron and copper. Mainly, I'd be concerned with zinc, manganese, and boron for crops such as corn, soybeans, alfalfa, sugar beets and vegetables.

FJ: Foliar applying micronutrients on cotton seems to be a common practice. How does foliar fit into a sound fertility program?

Foliar fertilization works well with certain micronutrients. It's a convenient way to apply them four or five times a year and get feeding all through the summer. The main ones for cotton are manganese and boron. Manganese is used on cotton in soils high in pH. Generally, it is applied with starters, although I expect some is also foliar sprayed.

FJ: What forms of manganese would you foliar apply?

Manganese sulfate is best. It's one hundred percent water soluble.

FJ: What micronutrients can be added to fluid fertilizers?

Well, zinc is widely used with fluid fertilizers, but there is a difference between zinc and manganese. Manganese reacts with polyphosphate in a 10-34-0 solution. So it doesn't work quite as well. Sometimes manganese oxide is used in suspensions because there's less reaction. There is usually no problem applying one to two percent zinc in starters. Boron is also no problem. The only precaution is there's a possible effect on seed germination with starter fertilizers banded close to the seed row.

FJ: Should micronutrients be broadcast or banded?

Broadcasting is common. With zinc there's quite a difference between band and broadcast in terms of effectiveness. Comparing broadcast to starter, the general rule is that you put on double the amount of zinc if it's broadcast. Some say the ratio should be even higher. With boron, it wouldn't make any difference in a one to one ratio. Copper reacts in the soil pretty much like zinc. So what we say for zinc pretty well holds true for copper.

FJ: Is there much tissue testing going on with micronutrients?

Not as much as there used to be. Tissue tests should be used to verify your current fertilization program. They reflect the nutrient status at the time you sample. So it's a matter of using it as a checkpoint. It's also a great way to help verify nutrient deficiencies. Some growers have a standard practice of making these tests as a check on their fertility program.

FJ: Where do you see the environmental movement affecting agriculture?

Mainly on use of nitrogen. There is a potential for leaching nitrates into ground water. Or, when applying

nitrogen near streams, there's a potential for getting some in the water. But best management practices (BMPs) have been established for minimizing this potential, yet still have a sufficient amount of nutrient to get a good yield when the weather is favorable. Split applications are a good way to minimize any potential loss you'd otherwise have in the spring— especially on sandy soils. With phosphate, it's a matter of having good residue and management practices to minimize soil erosion. That's the main avenue for loss, because phosphates are absorbed by soils. The fate of potassium and micronutrients, on the other hand, depends on what happens to the soil colloids and not so much what is leached through the soil. An exception to this is boron, which can leach through sandy soils where there's irrigation or heavy rainfall. As long as we keep our house in order with BMPs, we should minimize more regulating.

FJ: We've heard rumbling about regulating lead, say, in zinc fertilizers. Anything to it?

It could happen. Regulations could apply limits similar to what we've seen with sewage sludge.

FJ: What does the future hold for micronutrients?

Over the past 25 years we've learned where to expect micronutrient problems and we've gone a long way toward solving them. Now we're in more of a maintenance program for most crops, in terms of micronutrients. So unless we see some changes in our farming systems, we should know how to handle micronutrient problems.

Dr. Mortvedt is extension soil specialist at Colorado State University. ❑