

CURRENT PRINCIPLES AND FUTURE KNOWLEDGE

Aristotle, in his work *Ethics* where he is beginning to define the nature of politics, explains that he should, "...not forget the difference between reasoning *from* principles, and reasoning *to* principles..." This reminder of Aristotle's is relevant to us as scientists and practicing professionals. In science, we certainly have principles that we are taught and that we rely upon. Principles such as diffusive movement of nutrients, maximum nutrient influx rates of roots, and cation exchange are but just a few of the many we use in our discipline. When we diagnose crop nutrition problems or interpret research results, we often move *from* these principles to come up with explanations of what we observe.

The way in which principles sometimes come into play can be surprising, resulting in conclusions that may not at first be obvious. A recent surprise to me was that placing nitrogen deeper is not always the best practice for minimizing losses of nitrous oxide. It turns out that moisture at various depths is important, and if there is too much moisture deeper in the profile, denitrification can actually be greater compared to a shallower placement. The principle of nitrogen transformation hasn't changed, but it operates in a way that challenged my initial assumptions. I once heard a scientist say that if we aren't surprised now and then, we aren't doing science. We as humans are good at making assumptions – often the wrong assumptions. Science reminds us of that.

Some things that we encounter, however, don't seem to be explained by a simple reworking of the principles we already have. An example for me is the role of mycorrhizae in determining crop response to added phosphorus. These ancient fungi have influenced almost every phosphorus fertility study that has ever been conducted. They have contributed to the variability in those studies and they influence the extent to which a crop responds to phosphorus rate, placement, and timing. Still, our understanding of them is not extensive. Undoubtedly, as we learn more, we will be moving to new principles.

And so it is with science. We are caught somewhere between past knowledge that has provided principles we move *from*, and future knowledge that will provide new principles that we are moving *to*. In either case, we need to be surprised now and then. If we are not, we likely are not engaging in science.



BETTER CROPS

WITH PLANT FOOD

International Plant Nutrition Institute
3500 Parkway Lane, Suite 550
Norcross, Georgia 30092-2844
www.ipni.net

T. Scott Murrell

Dr. T. Scott Murrell
IPNI North America Program
Northcentral Region Director