Site-Specific Management Guidelines

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SSMG-4

How to Determine an Accurate Soil Testing Laboratory

Summary

Many people have said that soil testing laboratories are good enough considering the amount of field variability. With the advent of global positioning system (GPS) technology, soil sampling variability is minimized. Now, soil testing laboratories must be more accurate and reproducible to match the improved accuracy and precision achieved with GPS soil sampling. How can you know if the laboratory you are using produces good numbers? You can determine laboratory accuracy by: 1) knowing the difference between accuracy and precision, 2) know what questions to ask a laboratory, and 3) setting realistic expectations of laboratory quality.

Accuracy versus Precision

Laboratory accuracy is measured by how close analytical results are to the "true" average soil test value. Precision is a measure of the repeatability of soil test results. Accuracy and precision have four possible combinations, as shown in **Figure 1**. The situation of no accuracy and no precision is the worst case scenario. In contrast, accuracy plus precision is the best case scenario and the goal of the soil test industry. A laboratory could be precisely inaccurate or imprecisely accurate. If I had to choose between accuracy or precision, I would choose precision. If a laboratory is consistently (precision) high or low, I can make adjustments accordingly. However, if a laboratory is erratic (imprecise), the data are worthless in terms of managing field fertility.

The long-term goal of managing soil fertility is to monitor trends over time to see if the fertility is increasing, decreasing, or unchanged. This demands that a laboratory be precise in order for agronomists to determine trends that are real versus trends that are an artifact of laboratory variability.

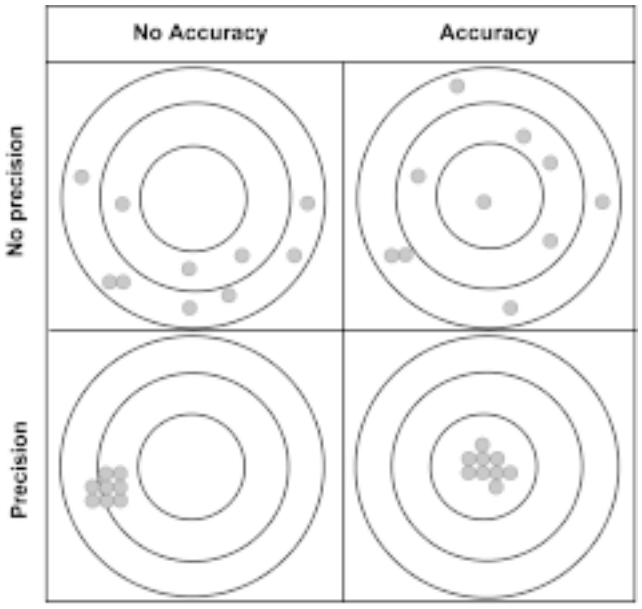

Figure 1. The effects of different combinations of accuracy and precision.

Question to Ask the Laboratory

The most common mistake people make when trying to determine if a laboratory is accurate is to send split samples to two laboratories. More than likely, results will come back different. In fact, if split samples are sent to 10 laboratories, chances are three or four results will be similar and the other six will probably not align with the rest.

Why go to all of this work when someone has already done this sampling splitting? The North American Proficiency Testing (NAPT) program is a national sample exchange program for agricultural laboratories. The program is managed through the American Society of Agronomy. The majority of the agricultural laboratories participate in this voluntary program. Ask your laboratory to send you a copy of its most recent quarterly report. If it refuses, consider selecting another laboratory.

Another option is to send soil samples with known (certified) soil test values to the laboratory. These soils can be purchased for $25 per pound from Dr. Robert Miller, coordinator for the NAPT program. His address is:

Dr. Robert Miller
Soil and Plant Science Department
Colorado State University
Ft. Collins, CO 80523
Phone: 970-493-4382
E-mail: rmiller@lamar.colostate.edu

Setting Realistic Expectations of Laboratory Quality

Laboratory *accuracy* should be within ±10 percent of the "true" soil test value. Laboratory *precision* should be ± 20 percent for a good laboratory. Laboratory accuracy and precision change as soil test levels increase, as shown in **Table 1**.

Table 1. Laboratory accuracy and precision change as soil test levels increase.

Test	Soil test level	Accuracy		Precision	
		Good	Bad	Good	Bad
		±	±	±	±
pH	6.5	0.2	0.5	0.2	0.5
Bray	10 ppm*	1	5	2	4
	20 ppm	2	10	4	7
	50 ppm	5	25	10	18
K	50 ppm	5	25	10	18
	100 ppm	10	50	20	35
	200 ppm	20	100	40	70
Zn	0.5 ppm	0.1	0.5	0.2	0.4
	1.0 ppm	0.1	0.5	0.2	0.4
	2.0 ppm	0.2	1.0	0.4	0.7

*parts per million

For example, if a soil test should result in a Bray reading of 20 parts per million (ppm), good laboratory accuracy would be in the range from 18 to 22 ppm. If a laboratory averaged an 18 ppm Bray reading on the sample, the acceptable repeatability would be from 14 to 22 ppm. Therefore, if a 20 ppm Bray reading is expected, a 14 ppm reading would be considered the same as 20 ppm, based on **Table 1**. The same example for a bad laboratory could possibly result in a Bray range of 3 to 17 ppm. If more accuracy is required, a laboratory would need to analyze the same sample one time a day for five days and report the average and charge about $50 to $70 per sample.

Conclusion

Laboratory precision is more important than accuracy, but we should expect both. Determine laboratory quality by asking for the laboratory's NAPT quarterly report or send certified soils to the laboratory. Realistic quality should be ± 10 percent accuracy and ± 20 percent precision. ■

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