

# Soil testing makes dollars and sense

By Meryl Rygg McKenna

Successful farming involves more than poking seeds into the ground and waiting for Mother Nature.

Ideally, all land in production would contain the nutrients necessary to maximize yield. In reality, much of this region's soil needs some help.

Chuck Gatzemeier, certified crop adviser based in Cut Bank, estimates that 80 percent of Montana farmers employ some soil sampling. Those who don't may see sampling as unnecessary expense, not an investment that pays off in better crops.

The ultimate goal of sampling is to gather a nutrient inventory of each field as accurately and inexpensively as possible. For best results, the majority of fields to be cropped should be sampled, although experts say farmers need not test for every nutrient every year. Gatzemeier recommends a complete soil test at least every fourth crop year and nitrate testing every year.

The nutrients required in largest quantities (macronutrients) include nitrogen, phosphorous, potassium and sulfur. These are the most common soil supplements.

Micronutrients are just as important, but in much smaller quantities. Some examples are boron, chlorine, copper, iron and manganese. Complete testing includes all known micronutrients as well as soluble salts, organic matter and pH levels.

## **Sample criteria**

Industry and university studies conducted in Montana in the early 1980s showed best results from taking a core of soil from a minimum of 15 holes scattered in one field. A rule of thumb is to pull cores from 15 holes per 350-acre field; pull from 20 or more on fields 400 acres or larger. More acreage needs more holes for the best representation.

Grid sampling is used in some places, but not much in Montana, according to Gatzemeier, because of the time and expense involved with the generally much higher sample numbers. The most common sampling in this region includes 15 holes per field, with some from the top, side and bottom of a hill, respectively.

A type of sampling that is increasing in Montana breaks a field into three zones, the middle zone being an area that produces, say, 40 bushels per acre, with the poorest zone producing 30 bushels per acre, and the best zone 50. Each zone is treated as a separate field. The soil amendment industry calls this precision ag or smart sampling. As a result, a producer can spread fertilizer at variable rates, according to zone.

Rocky or gravelly soil doesn't allow the probe to go very deep, so soil testers likely need to add more holes to gain enough quantity for testing.

Soil testers take the core of dirt from the top 6 inches of the probe and put it into one bucket. The top 6 inches of dirt from each hole in that field will be added to the same bucket.

Where possible, soil from the probe from 6 to 24 inches deep is placed in a separate bucket to be tested for nitrogen and sulfur, and sometimes chloride. Those nutrients are the most mobile – water easily carries them deep into the ground.

The 24-inch depth is sufficient for nearly all crops except winter wheat, which sends its roots deeper than spring crops. Testers take 24 to 36 inches, even 48 inches, if there is that much soil, to measure nitrogen in winter wheat fields. Most other nutrients are concentrated closer to the surface. These samples will be analyzed separate from the top 6 inches.

Specific soil types call for specific testing. The amount of organic matter and soluble salts is important – certain crops tolerate saltier conditions better than other crops. The cation-exchange capacity (CEC) tells the availability of soil nutrients. Characteristics such as soil texture – sand, loam and clay – influence CEC.

Even from a distance, soil color gives clues about its content. Much of Montana's soil is gray, meaning it is high in calcium and has a high pH level. White likely indicates a discharge area for saline (salty) seeps.

Because much of the region has only about 6 inches of topsoil, farmers do well to keep cover on it wherever possible, to prevent erosion.

### **Economic and ecological benefits**

Cost savings from soil sampling comes from knowing which nutrients are present so fertilizer is added only as needed. This is especially true with zone sampling, which makes it possible to supplement at variable rates instead of covering the whole field at one rate.

Nitrate concentration in groundwater is a real concern. Knowing how much nitrogen the soil needs can help farmers strike a healthy balance. Gatzemeier said most of the streams flowing into the Judith and Marias rivers, for example, are higher in nitrates than they should be.

When recommendations from testing are put into practice, the very next crop will show improvement in health and yield.

Taking samples is easy compared to properly interpreting the results.

“That's when we open up our manual,” Gatzemeier said. “We need to make recommendations according to the specific crop that will be grown on each field.”

Ten years ago, Montana State University published fertilizer rate recommendations for common crops, based on studies conducted within the state and region. Guidelines are available for various types of soil, telling what yield can be expected from a given amount of nutrients.

On leased land, many farmers choose to add only the nutrient levels that the immediate crop will take out. Land owners, however, may choose to start building up the soil toward the guidelines in the manual.

Decisions regarding soil fertility are increasingly complex. Remembering the 4Rs of nutrient management can help: apply the right fertilizer source at the right rate at the right time and in the right place.

In these decisions, planning and paying attention to economics can really pay off. Suppose phosphorus is \$200 per ton cheaper this year than last. This could be the time to apply extra to build up the soil for the future. Applying the right amount of fertilizer can maximize yields, improve protein percents in small grains and improve overall profits.

For more information on certified crop advisers, or to find one near you, go to <http://www.certifiedcropadviser.org>.