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DOING A GOOD JOB OF SUPPLYING SOME NUTRIENTS? DON'T FORGET TO MONITOR OTHER NUTRIENTS

One characteristic of a successful cropping program is that plant essential nutrients are absorbed at adequate amounts so that crop yields are not limited by any nutrient deficiency. In much of the former grasslands of the Northern Great Plains (NGP), the fertility level of the original soils was relatively high. Much of the land was converted from natural grasslands to annual cultivated crop production in the late 1800s to the early 1900s. This means that the land has now been cropped for about 100 years or more. Most of the early crops grew well and the only yield limitation was usually a result of a lack of adequate moisture in a year of low rainfall. However, after a decade or two of cropping, yields were observed to decrease even during years of adequate moisture. Through trials, it was found that if a N-fixing legume crop such as sweet clover was grown as a green manure crop and plowed down, the subsequent crop yielded well. This showed that the first nutrient to become yield limiting was N. Phosphorus was the next nutrient to limit yields. Inadequate availability of these two nutrients is common because crops take them up in relatively large amounts and the majority of what is taken up is removed in the harvested portion of small grain cereal and oil seed crops.

Most of the fertilizer programs used in the NGP are dominated by N and P applications. By adding adequate N and P, production has been sustained for decades. But other crop nutrients have been removed steadily, even though in many instances in small amounts. Many soils can supply adequate amounts of many of the other plant essential nutrients for decades if not centuries. However, specific nutrients decrease in availability sooner for certain crops on specific soils. Often, the higher the level of production that is targeted and attained using high rates of N and P the sooner other nutrients can become yield limiting.

One example is high yielding barley silage production in central Alberta. Much of the land used for barley silage production is near cattle feedlot operations and the manure from the feedlot is applied back onto the land that the silage came from. It was thought that the manure applications would sustain yields, but barley yields began to decline. They even seemed to become worse when higher than normal N fertilizer rates were applied. Along with low yields, the barley was observed to have weak straw prone to lodging, a large proportion of sterile florets resulting in poorly filled heads and shriveled kernels resulting in low bushel weights. Initial observations indicated that the crops were deficient in copper (Cu). This was surprising because prior to the mid 1980s, agronomists in Alberta thought Cu deficiencies were limited to some deep organic soils (>18 in. or 45 cm.) and Cu deficiency did not affect crops growing on mineral soils (Alberta Agriculture and Rural Development). However, field research confirmed that there were definite Cu deficiencies when plant available copper was less than 0.4 ppm DTPA extractable. The application of manure was useful for maintaining or even increasing levels of organic matter, but the increased organic matter was found to tie up plant available Cu. Fortunately the addition of adequate rates of soluble Cu fertilizers can correct Cu deficiencies.

Another example is sulfur (S) deficiencies for canola or other high S requiring crops. Deficiencies of S tend to develop sooner on coarse textured or sandy soils that are low in soil organic matter and under higher rainfall areas. In some cases low canola yields can be caused to decrease even more when N fertilizer rates are increased without adding any S fertilizer. This is attributed to the need to balance N with an adequate amount of S. For example, canola requires a lower N to S ratio than cereal crops, respectively 7:1, compared to 10:1.

It is important to monitor other plant nutrients besides N and P on a regular basis. This can be done by regularly taking soil samples and having the soils tested for all potentially deficient macro and micro nutrients for your area. The soil sampling should be supplemented with plant analysis results from growing crops to confirm if low soil test levels result in sub-optimal plant test levels. It is economically beneficial to notice a developing nutrient deficiency before it becomes severely yield limiting and correct the deficiency using fertilizer applications.

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Abbreviations in this article: N = nitrogen; P = phosphorus; ppm = parts per million.

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