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# Fertilizing Potato

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It is generally accepted that application of mineral nutrients is required for maximum potato production in North Dakota. Early trials established the need for nutrients and were the basis for a general fertilizer recommendation for many years. Since these early trials, varying quantities of N-P-K have been applied to Red River Valley soils. The application of excess fertilizer on some fields has resulted in large variations in soil fertility from farm to farm, and even from field to field on the same farm. Therefore, general fertilizer recommendations are no longer appropriate or accurate. To achieve accuracy in potato fertilization it is necessary to apply nutrients based on soil tests and projected yield goals for each field.

## Yield Goals:

Total plant nutrient requirement for a crop depends on the total production of that crop. Establish realistic yield goals. When estimating yield goals, consider the highest yield that has been produced on a particular field and then make adjustments from that point. Usually the yield goal should be within 50 cwt of the highest yield of potatoes ever produced on the field in question. In addition to previous yields on a particular field, also consider changes in management (new varieties, better weed control, more timely operations) when estimating your yield goal (see Circular SF-822).

## Fertilizer Recommendations:

Fertilizer recommendations based on soil tests take into consideration the fertility level of individual fields. If the soil in a particular field is already high in a nutrient, as determined by soil test, a low application will be recommended and vice versa. In this way limited capital or resources can be used on fields where they will do the most good.

Excessive fertilizer use, especially nitrogen and phosphorus, has potential to degrade ground and surface water quality. Establishing realistic yield goals, carefully soil sampling fields and fertilizing crops according to soil tests will help preserve water quality.

## Nitrogen-Phosphorus-Potassium:

The level of nitrogen in soil is very dependent on weather and previous crop conditions. It is recommended that fields be tested each year. A nitrogen recommendation based on a soil test requires that the soil be sampled to a depth of 24 inches. Table 1 is based on soil nitrate-nitrogen levels of soil samples taken after September 15. If soil samples are taken between July 1 and September 15, subtract 0.5 pound of nitrogen from the recommendation for each day that the soil was sampled prior to September 15.

Phosphorus and potassium are very insoluble nutrients in soil. The level of these nutrients in the soil does not change rapidly and does not depend on weather conditions. Therefore, it is only necessary to test the soil for these nutrients once every three to five years. Sample the 0-6 inch layer of soil when testing for phosphorus and potassium.

Red River Valley potato growers have applied large amounts of phosphorus fertilizer for many years. The result of this has been a buildup of phosphorus on many farms that grow potatoes. However, the soil on some potato farms may still be low in phosphorus. The use of a soil test is the only practical way to determine the soil nutrient level in each field.

In general, the soils of North Dakota and the Red River Valley are naturally high in available potassium. Potato grown on soils that are low in potassium will respond to applications of potassium.

The phosphate and potash recommendations in Table 1 are for **broadcast applications**. Broadcast applications should be made before a deep tillage operation. Band applications of phosphate and potash on **very low testing** soils can be reduced by one third.

Since phosphorus and potassium move very little in the soil, it is possible to "build up" or increase the available level of these nutrients in the soil. The application of approximately 20 pounds of P<sub>2</sub>O<sub>5</sub> per acre will increase the phosphorus soil test level by 1. In other words, if your phosphorus soil test level is 5 and you prefer to operate at test level of 12, the application of 140 pounds of P<sub>2</sub>O<sub>5</sub> (305 pounds of 18-46-0) per acre thoroughly mixed in the top 6 inches of soil will raise the soil test level by 7. Likewise, the application of 10 pounds of K<sub>2</sub>O per acre will increase the potassium soil test by 1.

## Fertilizer Grades:

Since there are differences in the levels of nitrogen, phosphorus and potassium in each field, there is no such thing as an ideal fertilizer grade for potato or other crops. If a field is very high in phosphorus, a fertilizer grade with a 1-0-1 ratio may be ideal. If a field is very high in nitrogen, a grade with a 0-2-1 ratio may be ideal, etc. The use of a fertilizer grade high in a nutrient for which the soil already tests high can result in nutrient imbalances that can reduce yield and/or quality.

## Other Nutrients:

There is little evidence of response to micronutrients on potato in North Dakota. However, zinc (Zn) and/or iron (Fe) deficiencies may occur in isolated areas. Soil tests and observations of visual deficiency symptoms are important diagnostic tools when problems with micronutrients are suspected.

Zinc deficiency in potato results in rosetting or "little leaf" formation. Leaves become thick and brittle and the mid rib becomes "S" shaped, which gives a fern leaf appearance. Interveneal areas on older leaves gradually change from green to yellow. Leaflets are dwarfed and curl upward. With severe deficiency the entire leaflet may become yellow and dead tissue may develop around the margins and tips. Total foliage will be greatly reduced.

Iron deficiencies may develop on soils containing free lime, especially during cool, wet periods. The youngest top growth will appear distinctly yellow in iron deficient potatoes. The interveneal areas will be bright yellow with the veins slightly green. Often the tips of a leaf may be green while the area next to the base of the leaf will be yellow.

Zinc deficiencies can be corrected with soil applications of 10 to 15 pounds per acre of Zn using zinc sulfate or 1 to 2 pounds per acre of Zn in an organic form (chelates). Applications of Fe to the soil are normally not effective. Foliar applications of Zn or Fe will usually correct deficiencies. Follow recommendations and rates given for the product being used.

## Fertilizer Placement:

Fertilizer applied at the time of planting should not be in direct contact with seed pieces. The recommended placement on very low testing soils is in two bands, each band 2 inches to the side and 2 inches below the seed pieces. However, broadcasting and plowdown is acceptable on soils with low or medium soil test ratings. Many growers are applying fertilizer in "blind" rows before seed is planted. This method has given good results.

Fall application of nitrogen fertilizer is not recommended on coarse textured soils because of the danger of loss by leaching. Also avoid fall application of nitrogen on soils with a high water table and on soils subject to ponding or flooding



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