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# FERTILIZER Helps Crops

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# Fertilizer Helps to Grow Better Crops on Most North Dakota Soils

Farmers' experience and a large number of field experiments have shown that fertilizer can be used profitably to increase the yield and quality of crops on most North Dakota soils.

Some farmers have used fertilizer for many years with good results. It has been used extensively on potatoes and sugar beets. Many farmers in the commercial corn area use fertilizer as a standard practice. In general, farmers who have used fertilizer on small grains and alfalfa have had good results.

Field experiments conducted in all parts of the state have shown the general profitability of using fertilizer on farm crops. In hundreds of trials with grains, fertilizer has been highly effective in increasing yields. In these trials, use of phosphate on wheat sown on fallow has increased the yield 4.8 bushels per acre on the average. The response to phosphate has varied somewhat, depending on season. Grains have responded to phosphate in about 80 percent of the trials.

Barley and oats sown on fallow have also shown excellent response to phosphate. In 30 trials with barley on fallow on farms scattered throughout the barley growing area, phosphate has increased the yield 8.0 bushels per acre on the average.

Trials with grain sown on land cropped to small grain or corn the previous year have shown that nitrogen fertilizer, in addition to phosphate, is usually needed for best results.

Trial plots testing effect of fertilizer on potatoes, corn, alfalfa and grasses have shown good results in most cases.

## WHAT CROP EFFECTS ARE USUALLY SEEN?

Well nourished crops usually grow faster and ripen earlier.

With plenty of phosphate, plants commonly develop large, fibrous root systems. This seems to help plants withstand effects of drouths of short to intermediate duration. Phosphate helps plants to make rapid early growth, thereby smothering weeds and making more effective use of moisture.

Stooling of grains is usually greater if they are well supplied with nutrients. A SUBSTANTIAL INCREASE IN THE YIELD OF GRAIN IS SOMETIMES OBTAINED FROM INCREASE IN STOOLING ALONE EVEN THOUGH NO OTHER GROWTH DIFFERENCE MAY BE SEEN. FAILURE OF A FERTILIZED CROP TO GROW FASTER OR TALLER DOES NOT NECESSARILY INDICATE THAT THERE IS NO RESPONSE.

Phosphated grain commonly ripens 3 to 5 days earlier. On occasion it ripens 10 or 12 days earlier. IN YEARS WHEN RUST OR HEAT INJURE CROPS, THIS ADVANCEMENT WILL OFTEN HELP TO ESCAPE THE MOST SERIOUS DAMAGE.

Phosphate often makes the difference of ripe corn instead of soft corn. With adequate nitrogen, corn generally makes better growth. High nitrogen gives more lush growth of leaves and stalks, increasing tonnage of forage.

The use of nitrogen on grasses increases growth, and may increase the protein content. It has been especially effective in increasing the yield of grass seed. Phosphate fertilizer usually improves the phosphorus content of forages.

## CHOOSE FERTILIZER TO FIT SOIL AND CROP CONDITIONS

### Field History Is Important

Phosphorus is usually the first element to become deficient. Phosphorus alone will not give good results where other nutrients are markedly deficient. Crops grown on fallow are usually well supplied with other nutrients. Phosphorus has not produced important effects on the yield of grasses. Phosphate fertilizer has a marked evening effect on grains grown on saline soil or so-called "white alkali".

Nitrogen is commonly very deficient for non-legume crops grown on land that wasn't fallowed the previous year. Where there has been a strong program of manure or legume use, this is less likely to be true. Combinations of nitrogen and phosphorus are usually much more effective than either nitrogen or phosphorus alone for non-legume crops grown on non-fallow land. Nitrogen is particularly likely to be limiting where the soil contains a large amount of low protein plant fiber such as straw and roots of mature plants.

Inclusion of some nitrogen with phosphorus may be worthwhile on crops sown early on soil that warms up slowly or on sandy soils that cannot store much nitrogen during the fallow process because of low water holding capacity.

Grasses respond well to nitrogen in both forage and seed production.

Potassium: In general, North Dakota soils furnish sufficient potassium for the needs of small grains, corn and alfalfa. The value of potassium fertilizer for corn grown on certain high lime soils might profitably be tested by farmers having this type of soil.

Potassium is more likely to be needed on sandy soils than on clayey soils, and is more likely to be deficient on non-fallow land than following fallow.

Potatoes and sugar beets are more likely to respond to potassium than are most of the other farm crops grown in North Dakota. Unless enough nitrogen is used to raise yields to a fairly high level, potatoes grown on non-fallow land do not respond particularly well to phosphorus and potassium.

## THE ANALYSIS TELLS WHAT'S IN THE BAG

The fertilizer analysis expresses the number of pounds of plant food contained in 100 pounds of fertilizer. Thus a 100-pound bag of fertilizer bearing the numbers 4-24-12 contains 4 pounds of total nitrogen (N), 24 pounds of available phosphoric acid ($P_2O_5$) and 12 pounds of water soluble potash ($K_2O$).

The fertilizer ratio expresses the relative amounts of N, $P_2O_5$ and $K_2O$. Two fertilizers of differing analysis may have the same ratio. Thus 8-32-0 and 6-24-0 both have 1-4-0 ratios though their analysis is different.

Fertilizer recommendations are often made in terms of pounds of plant food from fertilizer of given ratio.

*See inside for fertilizer chart*

# SUGGESTED COMMERCIAL FERTILIZERS, RATES PER AC

Give consideration to soil properties, cropping history, soil moisture, weediness and the crop to be grown.

MOISTURE - Fertilizer commonly helps plants to do better during short to intermediate periods of drouth. Eve o, response to fertilizer is most certain on soils that are well supplied with moisture at seeding time. Last ye ummer fallow is usually in this condition. Where soil moisture is good enough to warrant risking seed and oth he use of fertilizer is probably also a good risk. On drouthy, sandy and gravelly soils and on soils with low eserves at seeding time, favorable rainfall is necessary to produce a paying crop either with or without fertiliz heck soil moisture on all land at seeding time.

WEEDINESS - Although fertilizer applied in the row with the seed commonly helps crops get ahead of weeds, pr for response to fertilizer are not good on land badly infested with weeds. PHYSICAL CONDITION - Hard, cloddy soi soils in poor physical condition for seed bed preparation and the growing crop offer generally poor prospects for able fertilizer use. DRAINAGE - Water logged soils offer poor prospects for response to fertilizer. SALTINESS - commonly respond well to fertilizer on slightly to moderately salty soils. Where saltiness causes crops to die e seasons of good moisture, prospects for profitable use of fertilizer are poor.

| Crop for which fertilizer is applied | SUGGESTED METHODS OF FERTILIZER USE AND PREFERRED FERTILIZE |
|---|---|
| All small grains (Hard wheat, durum, barley and oats) | Rates are for grain drill attachment; double or triple for broadcast a is recommended for greatest efficiency. For small grains following fal ed. For small grains following fallow on land recently legumed or ma 0-1-0. Following small grains flax or corn and on light colored and s Rate of phosphorus should be increased by 50 percent on slightly to mod |
| Corn (for grain) See column at right for silage and fodder corn | Rates are for planter attachment application; double or triple when br The attachment should place fertilizer in bands at same depth or sligh application is recommended. Corn on land recently legumed or manu grains, flax or corn on light colored sandy soils: 4-5-0; 1-2-0; 1-4-( 1-2-0. |
| Flax | Rates are for grain drill attachment application; double for broadcast Flax following sod or on land not recently legumed or manured: 4-5-0, applications of nitrogen should probably not exceed 10 pounds per acr |
| Potatoes | Rates are for planter attachment application. If broadcast the amount Potatoes on loam or heavier textured soils following fallow or on land 0-1-0, 0-2-1, 1-4-0, 1-6-3. Potatoes following small grains corn or f soil not recently legumed or manured or following fallow on light colo Potatoes following fallow on sandy soils not recently manured, but wel Potatoes following small grains corn or flax on sandy soils not recent |
| Sugar Beets | Rates are for planter attachment application; double for broadcast ap application recommended. Sugar beets on loam and heavier-textured so Sugar beets on sandy soils and "high lime" soils: 0-2-1, 1-6-3. |
| Alfalfa and sweet clover | Rates suggested are for all methods of application. Apply broadcast grain drill attachment at time of seeding, or broadcast and till ligh tablished stands. |
| Grasses (for hay, pasture, or seed) | Rates based on broadcast application. Broadcast before seeding o in stands. Does not require working into soil. Avoid applications when |

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See left side chart for suggestions on methods of application and ratio of fertilizer most likely to give good results under specific soil and management conditions.

High analysis fertilizers are generally lowest in cost per unit of plant food. Differences in analis require adjustments in rate of application to apply equivalent amounts of plant fo. Fertilizers with similar ratios, but differing in analysis, may be as good as thoseisted in the table below and may be substituted with good results.

It is well to mpare results from several rates of application over a period of years to determine e general level of crop response to different rates on your soil. Be sure to leave annfertilized strip for actual harvested yield comparisons. Fertilizer ratio refers to theroportion of the major nutrient elements nrogen, phosphorus, and potassium as expresd in the fertilizer analysis on the bag.

| Ratio | Some Analyses of Given Ratio |
|---|---|
| 0-1-0 | 0-43-0; 0-47-0; 0-63-0; 0-20-0 |
| 1-0-0 | 33-0-0; 20-0-0; 16-0-0 |
| 1-4-0 | 8-32-0; 11-48-0; 4-16-0 |
| 1-2-0 | 10-20-0; 12-24-0; 8-16-0 |
| 0-1-1 | 0-20-20; 0-14-14; 0-12-12 |
| 0-2-1 | 0-30-15; 0-20-10; 0-14-7 |
| 1-6-3 | 4-24-12; 2-12-6 |
| 1-1-1 | 10-10-10; 12-12-12; 14-14-14 |

| ZER RATIOS FOR SPECIFIC CONDITIONS | Fertilizer ratio | Representative Fertilizer Analysis | Application r (Pounds per a |
|---|---|---|---|
| application. Drill attachment application | 0-1-0 | 0-43-0 to 0-50-0 | 25-75 |
| allow: 0-1-0 or 1-4-0 ratios are recommend- | 0-1-0 | 0-63-0 | 30-90 |
| anured, or where lodging has been a problem, | 1-4-0 | 8-32-0 | 35-100 |
| sandy soils; 4-5-0, 1-2-0, or 1-4-0. | 1-4-0 | 11-48-0 | 25-75 |
| oderately salty soils. | 1-2-0 | 10-20-0 | 75-150 |
| | 4-5-0 | 16-20-0 | 50-100 |
| roadcast before seeding or before plowing. | 0-1-0 | 0-43-0 to 0-50-0 | 40-80 |
| htly below the seed. Planter attachment | 0-1-0 | 0-63-0 | 50-100 |
| 0- 1-4-0. Corn following small | 1-4-0 | 8-32-0 | 60-120 |
| -0. Corn for silage or fodder: 4-5-0; | 1-4-0 | 11-48-0 | 40-80 |
| | 1-2-0 | 10-20-0 | 75-150 |
| | 4-5-0 | 16-20-0 | 75-150 |
| st application. Drill attachment recommended. | 1-4-0 | 8-32-0 | 35-100 |
| 1-2-0. If seed bed is somewhat dry, drill | 1-4-0 | 11-48-0 | 25-75 |
| re. | 1-2-0 | 10-20-0 | 50-150 |
| | 4-5-0 | 16-20-0 | 50-100 |
| t of phosphorus should be doubled. | 0-1-0 | 0-43-0 to 0-50-0 | 100-150 |
| d recently legumed or manured: | 0-1-0 | 0-63-0 | 100-150 |
| flax on loams or heavier textured | 0-2-1 | 0-30-15 | 150-200 |
| ored soils: 4-5-0, 2-2-1, 1-2-0, 1-4-0. | 1-6-3 | 4-24-12 | 200-300 |
| ll supplied with humus: 0-2-1, 1-6-3. | 1-4-0 | 8-32-0 | 150-200 |
| tly legumed or manured: 1-1-1, 2-2-1. | 1-2-0 | 10-20-0 | 200-350 |
| | 4-5-0 | 16-20-0 | 200-350 |
| | 2-2-1 | 16-16-8 | 200-400 |
| | 1-1-1 | 10-10-10 | 300-600 |
| plication. Planter attachment | 0-1-0 | 0-43-0 to 0-50-0 | 100-150 |
| ils recently manured: 0-1-0, 0-6-1. | 0-1-0 | 0-63-0 | 100-150 |
| | 0-6-1 | 0-38-6 | 125-200 |
| | 0-2-1 | 0-30-15 | 150-200 |
| | 1-6-3 | 4-24-12 | 200-300 |
| and work in before seeding, or with small | 0-1-0 | 0-43-0 to 0-50-0 | 100-200 |
| tly in early spring or fall on es- | 0-1-0 | 0-63-0 | 100-200 |
| n early spring or fall on established | 1-0-0 | 33-0-0 | 100-300 |
| n growing grass is wet from dew or rain. | 1-0-0 | 20-0-0 | 150-500 |