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### **Fertilizing Small Grains**

Cooperative Extension, South Dakota State University

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*Cooperative Extension Service*

## Fertilizing Small Grain

IN SOUTH DAKOTA

### Fertilizing Small Grain

Soils on many South Dakota farms have been depleted by continuous cropping to such an extent that low soil fertility limits small grain yields even more than a lack of available soil moisture.

It is a common sight throughout the state each spring to see nitrogen deficient, pale yellowish-green stunted small grain fields, such as the one depicted in the picture below (left). This field could just as well look like the picture at the right, which shows a typical response to a nitrogen application.

However, in many cases, a mixture of nitrogen and phosphorus, or phosphorus alone, may be required, rather than just nitrogen. In this particular instance, the fertilized oats yielded 78 bushels, the unfertilized oats 42 bushels per acre. This is an increase of 36 bushels per acre or a return of \$3.00 for each fertilizer dollar invested for an application of 40 pounds nitrogen, 20 pounds phosphate per acre.

South Dakota research results indicate that 50 pounds of nitrogen and 20 pounds of phosphate are removed from the soil by a 60-bushel oat crop. Forty bushels of barley removed 47 pounds of nitrogen and 20 pounds of phosphate, while a 20 bushel wheat crop removed 35 pounds of nitrogen and 15 pounds of phosphate. These figures represent the actual

By E. J. Williamson and Lloyd E. Davis, Extension soil specialists;  
and Paul Carson, associate professor of agronomy.

The pale, yellowish green small grain in this field is a good indication of a serious nitrogen deficiency.



pounds of nitrogen and phosphorus that can be found in the grain and straw.

It is evident today that many South Dakota soils are no longer able to supply these required nutrients for optimum yields under their present status of fertility. Consequently, additional nutrients are required for optimum small grain yields.

Plants are unable to utilize 100% of the nutrients applied the first year. In general, 60% of the nitrogen and 30% of the phosphorus applied is used by the plants with the balance carried over for subsequent crops. Thus, to fertilize for optimum yields of small grain, you should keep in mind this nutrient utilization efficiency.

#### PLACEMENT OF FERTILIZER FOR SMALL GRAIN

Fertilizer for small grain may be applied in several different ways: (1) applying with a grain drill attachment, (2) broadcasting on the surface prior

The dark green strip down through this field has been fertilized with nitrogen. This is a typical response.



Table 1. Effect of Time of Fertilizer Application on Yield of Oats, 1959

Time of fertilizer application*	Yield of oats, Bu./A.	
	Deuel county Kranzburg silt loam	McCook county Vienna silt loam
No fertilizer applied.....	31.3	21.0
Applied at planting on surface and not worked in.....	47.7	29.4
2 weeks after planting.....	41.9	33.7
4 weeks after planting.....	43.1	26.6
6 weeks after planting.....	32.9	29.1
8 weeks after planting.....	33.7	28.2
10 weeks after planting.....	34.0	27.9

\*40 pounds of nitrogen and 30 pounds of P<sub>2</sub>O<sub>5</sub> applied per acre.

to planting followed by plowing, light disking, or harrowing, (3) topdressing on the surface after planting or after grain is up.

The grain drill attachment is the most effective method for applying fertilizer for small grain, especially phosphorus deficient soils and on salty and calcareous soils. The advantage of the grain drill attachment compared to broadcasting is illustrated in

figure 1, which shows the yield effect on oats grown in Minnehaha County. Figure 2 shows the effect on yield of wheat grown in Perkins, Harding, and Corson Counties.

The drill attachment places the fertilizer close to the seed so that it is immediately available to plant roots. It also eliminates nitrogen deficiencies resulting from cool and early wet spring conditions. Germination is not damaged by applying fertilizer with the seed, provided recommended rates of fertilizer are used. Up to 30 pounds of nitrogen per acre may be applied by drill attachment, even in a relatively dry soil seed zone. This applies to most nitrogen fertilizer and mixed fertilizers. However, urea (nitrogen) should not be applied with a drill attachment due to its biuret content which may damage germination. To safely use urea, it should be broadcast and incorporated with the soil.

Broadcasting methods are not as efficient as placement near the seed due to the fertilizer being spread through a larger soil volume, thereby diluting the fertilizer with soil and increasing the amount of phosphorus fixation. If possible, when broadcasting,

Figure 1. EFFECT OF FERTILIZER PLACEMENT ON YIELD OATS

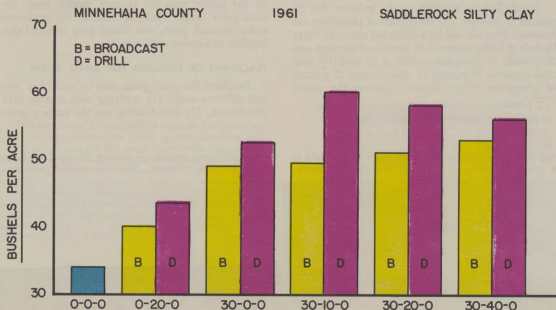


Figure 2 **SPRING WHEAT YIELDS AS REFLECTED BY FERTILIZER PLACEMENT AND SOIL MOISTURE (Fallow)**

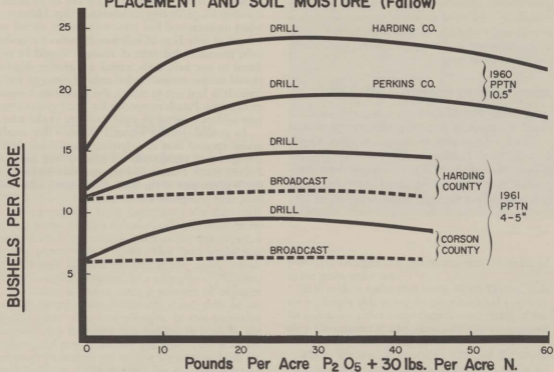


Table 2. General Recommended Fertilizer Rates and Methods of Use for Small Grain

Crop*	Soil-management condition on area	Recommended lbs. per acre			Special suggestions
		N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
<b>On Summer Fallow</b>					
Wheat	On legumed or manured fallow and on well drained soils high in organic matter where fallow was started early and kept free of weeds or where lodging has been a problem.	0	0-40	0	<b>Phosphate:</b> Adjust phosphate rates to soil test level. Lbs. P <sub>2</sub> O <sub>5</sub> /A. H M L 0 15-20 20-40
Durum					
Barley					
Oats	On soils low in organic matter, or soils slow to warm up in the spring and on soils where fallow was started late or considerable cover crop or weed growth occurred during the later part of the fallow season.	5-10	0-40	0	Rates are for drill row applications. If broadcast, double given rates.
Rye					<b>Nitrogen:</b> Adjust nitrogen rates downward if there are less than 18 inches of moist soil at seeding time. Up to 30 pounds of N/A may be applied by drill attachment even in a relatively dry soil seed zone. Nitrogen amounts over that safe at seeding should be broadcast. Fall or spring broadcast nitrogen is equally effective, but reserve about 10 lbs./A. of N. to apply in drill row with phosphate as a starter.
<b>On Nonfallow</b>					
West River:	Areas A, B1, B3, B4	20-40	0-40	0	
East River:	B2	20-40	15-40	0	
	C1, C2, C3	30-40	15-40	0	
	D1	30-50	20-50	0	
	D2, D3, D4	30-40	20-50	0	
	E	30-60	20-50	0	

Where manure or legume has been plowed down in the past 2 years, reduce nitrogen by half.

For fall seeded grains, broadcast nitrogen can be topdressed in early spring.

\*Recommendations refer to all small grain crops.

the fertilizer should be worked into the soil or plowed under. Topdressing after planting should be considered only when favorable moisture conditions prevail, and preferably no later than the third week after emergence. Results of topdressing experiments are presented in table 1.

#### ADJUST RATES TO STORED SOIL MOISTURE

On non-fallowed soils, the amount of available stored soil moisture at seeding time should serve as a guide for the amount of nitrogen to apply. Experience in North Dakota has shown that farmers can improve their chances for a good return from nitrogen fertilizer by estimating stored soil moisture and adjusting rates of nitrogen applications accordingly.

Soil moisture efficiency studies are presently underway in South Dakota, but are not of sufficient duration for predicting recommendations. However, when medium and fine textured soils are wetted to a depth of only 12 to 18 inches or 24 inches for sandy soils, recommended rates of nitrogen should be reduced to one half. Soils wetted to greater depths should receive recommended rates of nitrogen fertilizer. It is best not to reduce the phosphate recommendations. Potash treatments for small grains have very seldom resulted in yield increases in the state.

In general, present research indicates that small grains respond best to a fertilizer containing both nitrogen and phosphorus on most of the soils of Eastern South Dakota and on non-fallowed soils in the Western part of the State. On summer fallowed soils, only phosphate should be used.

This fact sheet is intended as a guide for planning your fertilizer needs for small grains. Thirteen soil areas are shown on the map. Each area has certain general fertilizer requirements, but these vary widely within many of the areas because of soil and climatic conditions. Therefore, these fertilizer recommendations should only serve as a guide for your area. **Soil tests** are the most practical method of determining your exact fertilizer needs and obtaining specific recommendations. Ask your your County Extension Agent for soil sampling information.

