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Recommended Citation

South Dakota State University, Cooperative Extension, "Fertilizing Oats" (1984). *SDSU Extension Fact Sheets*. 755.
https://openprairie.sdstate.edu/extension_fact/755

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FS 678

FERTILIZING OATS

Cooperative Extension Service
South Dakota State University
U.S. Department of Agriculture

FERTILIZING OATS

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High oat yields require large quantities of available plant nutrients. For example, each bushel of oats will take up approximately 1.3 lb nitrogen, 0.4 lb phosphorus (P_2O_5), and 1.2 lb potassium (K_2O) per acre.

In addition to the primary nutrients (nitrogen, phosphorus, and potassium), there are 10 other essential nutrients necessary for plant growth. They are the secondary nutrients (calcium, magnesium, and sulfur), and the micronutrients (boron, chlorine, copper, iron, manganese, molybdenum, and zinc.).

Fortunately, most South Dakota soils can supply the necessary amounts of secondary and trace elements needed for maximum yields. The use of fertilizers containing these nutrients seldom significantly or profitably increases oat yields. Many South Dakota soils, however, can not provide the necessary amounts of nitrogen, phosphorus, and potassium required by today's high yielding quality oats.

Nitrogen

Today's oats is usually seeded on fields that are continuously cropped. Additional nitrogen from fertilizer, manure, or legumes will nearly always increase oat yields, except where previous production practices have created high available nitrogen reserves. Oats seeded in fallowed soil may require little or no additional nitrogen. Above normal levels of nitrate-nitrogen will usually be found in fallowed soil following the noncrop year. The deep (0-2 ft) nitrate soil test can measure such reserves.

Nitrogen in excess of the amount needed for optimum plant growth and grain yield will usually result in higher protein levels. Oats is very susceptible, however, to lodging where excessive nitrogen exists. Therefore it is very important to measure soil nitrate reserves with the nitrate soil test before applying nitrogen fertilizer.

The amount of actual nitrogen recommended for a desired yeild can be determined by subtracting the nitrate-nitrogen soil test values from the total nitrogen requirement shown in Table 1. If a deep (0-2 ft) nitrate-nitrogen soil test is not taken, nitrogen needs can be estimated using the soil organic matter level. The organic matter test, however, does not measure the wide fluctuations of available nitrogen in soil, and its use may result in recommendations for more or less nitrogen fertilizer than the crop actually needs.

Table 1. Nitrogen recommendations

Yield goal	Soil plus fertilizer nitrogen required[1]
bu/A	lb/A (0-2 ft)
40	52
60	78
80	104
100	130
120	156

[1]Fertilizer nitrogen to apply is equal to the value in the table minus soil nitrate-nitrogen to a 2-ft depth.

To estimate the fertilizer nitrogen needed without a 2-ft nitrate-nitrogen test, use the following formula based on the organic matter test: required nitrogen minus 30, 45, or 60 lb for a low (less than 2.5%), medium (2.5-4.0%), or high (more than 4.0%) organic matter test, respectively. If the previous crop was black fallow, substract an additional 45 lb from each category.

Phosphorus

Phosphorus applications as either fertilizer or manure, are often needed to obtain maximum oat yields. Soil test level and yield goal will determine the amount of additional phosphorus that is needed (Table 2).

Table 2. Phosphorus recommendations

	Soil test phosphorus, lb/A				
	V. low 0-5	Low 6-15	Med. 16-25	High 26-40	V. high 41 +
Yield goal,	3	10	20	33	41
bu/A	lb P_2O_5/A recommended [1]				
40	22	22	19	10	0
60	32	30	24	10	0
80	42	38	30	13	0
100	52	46	35	15	0
120	62	55	41	17	0

[1]Recommendations listed are for the center of each soil test range.

Fallowing does not increase available soil phosphorus reserves. Soil phosphorus levels will not fluctuate from high to low in 1 or 2 years. Neither will they change from low to high in a few years unless fertilizer rates in excess of crop needs have been applied.

Phosphorus is converted to less available forms when mixed extensively with soil. This is part of the reason phosphorus fertilizer is more effective when banded with the seed using a drill attachment than when broadcast and worked into the soil. If phosphorus is band applied near the seed, recommended rates in Table 2 can be reduced by one third.

Small amounts of phosphorus placed with the seed have occasionally increased oat yields at high and very high soil test levels. Ten pounds of phosphorus (P_2O_5) applied as a starter on these soils may be necessary for maximum yields.

Potassium

Potassium requirements of oats greatly exceed those of all other essential elements with the exception of nitrogen. Fortunately, most South Dakota soils contain very large reserves of available potassium; therefore, only small amounts (if any) are recommended as fertilizer. There are, however, a number of fields (particularly in the eastern third of the state) that are low in this nutrient. Potassium additions on these fields will be necessary to reach maximum yields. Potassium fertilizer recommendations are given in Table 3.

Table 3. Potassium recommendations

	Soil test potassium, lb/A			
	Low 0-100	Med. 101-200	High 201-350	V. high 351 +
Yield goal,	50	150	275	351
bu/A	lb K_2O/A recommended [1]			
40	39	25	0	0
60	59	38	0	0
80	79	51	17	0
100	99	64	21	0
120	119	77	25	0

[1]Recommendations listed are for the center of each soil test range.

Secondary and Micronutrients

Secondary and micronutrients are as essential as the primary nutrients for high yield levels. Most South Dakota soils, however, have adequate available reserves of these nutrients. SDSU research has not shown significant profitable yield increases from fertilizer containing these nutrients. This may change with continued cropping and release of new varieties.

Fertilizer Application

Phosphorus and potassium should be applied before seeding and incorporated by tillage, applied by injection, or applied with the seed at planting. Broadcast phosphorus rates can be reduced by a third when banded with a grain drill in contact with or close to the seed. Nitrogen can be applied anytime before stooling with equal results.

Thinner plant stands or reduced seedling vigor can occur if too much nitrogen and/or potash are placed in contact with the seed. This type of injury happens more easily in dry or sandy soils. The total amount of actual nitrogen plus potash placed with the seed in a drill attachment (6-inch row spacing) should be kept below 25 lb/A in such soils. If either urea or DAP (18-46-0) nitrogen sources are used, limit drill applications to 12 lb/A. Reduce these values correspondingly for wider row widths. These drill application amounts can be doubled for heavier textured, moist soil.

Topdressed nitrogen after seeding should be applied before stooling for best results. Lack of rainfall after topdressing can make topdressing less effective than preplant incorporation.

Topdress applications of liquid nitrogen fertilizer are as effective as dry nitrogen when applied prior to stooling. Liquid nitrogen rates in excess of 25 lb nitrogen per acre can cause considerable leaf burn. Rates greater than 50 lb/A may cause enough leaf burn to reduce yield. Liquid nitrogen should not be applied once the flag leaf emerges.

Fertilizing Reduced and No-Till Oats

Limited adjustments in fertilizer rates and placement may be necessary with reduced tillage. Available nitrogen levels in soil are usually lower, resulting in higher nitrogen fertilizer needs. The deep (0-2 ft) nitrate-nitrogen soil test will measure nearly all change in available soil nitrogen levels regardless of tillage. If the deep soil test is not taken and nitrogen recommendations are made using the less accurate organic matter test, nitrogen recommendations should be increased 30 lb/A from the calculated values.

Surface residues and fewer opportunities for incorporation increase the potential for volatilization losses of nitrogen from surface applied urea. Nitrogen may also be tied up by surface residues. Incorporation or injection of nitrogen fertilizer, therefore, will often result in more efficient nitrogen use.

Topdressed phosphorus fertilizers will remain near the surface with reduced and no-tillage systems. If soil test levels are low or conditions are dry, deeper incorporation, injection, or starter applications may be necessary.

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File: 3.3—1.5M—2-84—2.3Mrpt—3-85mb—ES 151—95.

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