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North Idaho Fertilizer Guide

WHEAT

These fertilizer guidelines have been developed by the University of Idaho and Washington State University based on relationships between soil test and yield response. The fertilizer rates suggested are based on research results and are designed to produce above-average yields if other factors are not limiting production. Thus, the fertilizer guide assumes good management.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples were properly taken and represent the area to be fertilized; and (2) the crop history information supplied is complete and accurate.

Optimum production and economical returns from wheat are achieved when the crop is managed properly. Lack of adequate fertilization, poor stands, poor weed control and disease are major contributors to low yield.

NITROGEN (N)

The amount of nitrogen fertilizer required on any field depends on:

1. The variety and its potential yield in your location. The nitrogen guidelines in this publication were developed using Gaines and Nugaines varieties. Gaines and Nugaines require high levels of available soil nutrients and superior management to achieve their high yield potential. If you plant other varieties, you may need to adjust N rates downward.
2. Potential yield or average yield obtained from the field in past years. Research has shown that 2.7 pounds available N per acre is needed to produce 1 bushel of wheat.
3. The amount of usable N in the soil profile. This includes mineralizable nitrogen (released from organic matter during the growing season) and inorganic nitrogen in the form of nitrates (NO_3) and ammonium (NH_4).
4. Total annual precipitation and other climatic factors.
5. Percentage stand of plants.

In areas of low precipitation (16 inches or less annually), you should determine soil moisture in the profile to adjust the nitrogen rates. In these low-moisture areas and in areas with shallow soils (2 to 3 feet maximum depth), the nitrogen fertilizer guide rate should be adjusted downward.

Mineralizable Nitrogen

Soils vary in their capacity to release nitrogen from organic matter during the growing season. Since this is a factor in determining the amount of N fertilizer required to produce a wheat crop, you need to estimate mineralizable N in your soils. The rate or amount of N release depends on such factors as the amount of organic matter in the soil and soil moisture and soil temperature during the growing season.

Table 1. Nitrogen released from organic matter during the growing season (mineralizable nitrogen).

Release level*	Low	Medium	High
lb. N released	40	50	60

Three different levels of mineralizable N release occur in northern Idaho soils (Table 1). Most Palouse-region soils have a medium-release level. Low-release levels are found on eroded clay knobs and hill tops, cut-over timberland soils, soils in areas of low precipitation, soils with low water-holding capacities and soils with low organic matter content.

Soils having a high-release level include those which have thick, dark-colored surface layers (dark-colored A horizon) or surface horizons having relatively high organic matter content. This includes the Palouse or other grassland soils which have not been badly eroded.

Nitrogen Soil Test

The amount of nitrogen in the soil can be evaluated most effectively with a soil test. The soil samples should represent the rooting depth of the crop since nitrate-nitrogen (NO_3-N) is mobile in the soil.

To calculate the fertilizer N required, you must know three values: (1) total N needed to produce potential yield (Table 2); (2) mineralizable nitrogen (Table 1); and (3) the total pounds N per acre shown by soil test.

Table 2. Estimated total nitrogen need by wheat crop based on potential yield.

bu/acre*	20	40	60	80	100
lb/acre N**	55	110	160	220	270

*Potential maximum yield of wheat produced on a northern Idaho farm for which fertilizer recommendation is being made.

**Research has shown that 2.7 pounds N per acre is needed to produce 1 bushel of wheat.

Soil test value includes both nitrate (NO_3) and ammonium (NH_4) nitrogen. To convert soil test NO_3-N and NH_4-N values to pounds N per acre, total the N values (ppm) for each foot increment of sampling depth and multiply times 4. An example calculation:

Depth	Soil test reads NO_3	NH_4	Total	Total N*
(inches)		ppm		(lb/acre)
0 to 12	5	1	6	24
12 to 24	6	2	8	32
24 to 36	8	1	9	36
Total	19	4	23	92

*ppm x 4 = lb/acre

The calculation for N fertilizer needed is:

Total N needed (Table 2)	_____
Minus mineralizable N (Table 1)	_____
Minus soil test N (lb/acre)	_____
N fertilizer required (lb/acre)	_____

With potential yield of 60 bushels per acre, medium level of mineralizable N and soil test values from the example above, you would need to apply 18 pounds N per acre:

	lb/acre
Total N needed (Table 2)	160
Minus mineralizable N (Table 1)	50
Minus soil test N	92
N fertilizer required (lb/acre)	18

Add 15 pounds available N for each ton of straw or non-legume residue incorporated into the soil up to 45 pounds N per acre.

Total N Based on Potential Yield

You can estimate the amount of nitrogen fertilizer needed to produce a wheat crop in a specific field if you know the field's potential yield. This is the long-term average of maximum wheat yields for the field. Knowing the potential yield, you can calculate the amount of N needed from Table 1. The factor 2.7 pounds N per acre necessary to produce a bushel of wheat has been derived through research in northern Idaho and eastern Washington.

Estimate Based on Previous Crop

You also may estimate the amount of N fertilizer required for wheat on the basis of the previous crop. The figures in Table 3 are generalized recommendations based on field experiments and observations of production following the listed crops.

PHOSPHORUS (P)

Wheat is a low phosphorus-demanding crop but does require a minimum amount in the soil (Table 4). Incorporate P fertilizer into the soil during seedbed preparation before or at planting.

Broadcast-plowdown, broadcast-seedbed incorporation or drill-banding with seed are all equally effective methods of application. The choice depends upon which one is most convenient for you.

POTASSIUM (K)

Wheat needs little potassium. Most probable areas of need are eroded knobs and hill tops. Incorporate K fertilizer into the soil during seedbed preparation before or at planting, according to soil test (Table 5).

Broadcast-plowdown, broadcast-seedbed incorporation or drill-banding with the seed are all equally effective and the choice of application method depends upon which one is most convenient.

SULFUR (S)

Wheat requires sulfur to produce maximum yields and a good quality flour. Apply 20 pounds S per acre to soils testing less than 10 ppm SO^4-S in the top 12-inch layer.

Table 4. Phosphorus (P) fertilizer rates based on soil test.

Soil test* (0 to 12 inches)	Apply (pounds/acre)	
ppm P	P_2O_5	P**
0 to 2	60	26
2 to 4	40	18
over 4	0	0

*Sodium acetate extractable P

**P_2O_5 X 0.44 = P or P X 2.29 = P_2O_5

Table 5. Potassium (K) fertilizer rates based on soil test.

Soil test* (0 to 12 inches)	Apply (pounds /acre)	
ppm K	K_20	K**
0 to 35	80	66
35 to 75	60	50
over 75	0	0

*Sodium acetate extractable K

**K_20 X 0.83 = K or K X 1.20 = K_20

Table 3. Estimated nitrogen fertilizer requirements based on previous crop.

Previous crop	Estimated nitrogen fertilizer to apply (lb/acre) — Potential yield (bu/acre)			
	40	60	80	100
Grain (residue returned)	50 to 70	70 to 90	90 to 110	110 to 130
Grain (residue removed), peas, lentils, fallow	20 to 30	30 to 40	50 to 65	65 to 80
Alfalfa or green manure crop	0 to 15	15 to 30	30 to 50	55 to 75

A range in values is given to allow for differences in mineralizable N.

MICRONUTRIENTS

Response of wheat to micronutrients in northern Idaho has not been observed. If you are in doubt, have your soil tested.

GENERAL COMMENTS

1. Nitrogen and sulfur are the major plant nutrients needed for wheat production. Phosphorus and potassium may also be needed. The need for these nutrients can best be determined by a soil test.

2. Split or fall applications of nitrogen may be used. If the fall application is applied too early (depending on soil moisture and temperature) you may experience nitrogen leaching in areas of heavy winter precipitation. If a large amount of nitrogen is to be applied, split the application between fall and spring, especially if heavy winter precipitation is a common occurrence in your area.

3. In areas of heavy winter precipitation or sandy soils, spring application of nitrogen may be more desirable than fall applications.

4. The ammoniacal forms of nitrogen (ammonium and ammonia) and urea are not as subject to leaching as the nitrate form. However, when temperature and moisture are favorable for plant growth, ammoniacal and urea nitrogens are quickly converted to the nitrate form. Thus, early fall applications of nitrogen, regardless of form, are subject to leaching in areas of heavy winter precipitation.

5. N-serve or other nitrogen stabilizers block conversion of ammoniacal forms of nitrogen to the nitrate form. These nitrogen stabilizers are effective in reducing nitrogen fertilizer losses in some areas. They have not been effective in deep, dark-colored soils. For more details refer to University of Idaho CIS No. 313, *N-Serve and Its Potential Use in Northern Idaho.*

6. Areas of cut-over timberland (which usually have clayey subsoils) used for wheat production are not as susceptible to leaching losses due to the slow permeability of the subsoil. However, slow permeability also makes them subject to wetness or waterlogging which can result in a loss of nitrogen by denitrification. This process converts nitrate-nitrogen to gaseous forms of nitrogen which are dissipated into the atmosphere.

7. Test the top 2 feet of soil for NO^3-N in the spring and topdress with additional nitrogen if needed.

8. Use caution in topdressing with nitrogen in the spring since nitrogen applied after the boot stage or at excessive rates can result in undesirably high-protein levels in soft white wheats and increase the lodging hazard.

If you have questions regarding the interpretation of this information, contact your county Extension Agricultural Agent or fertilizer dealer.

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Auttis M. Mullins
Dean, College of Agriculture
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