

- 1) Any recommendation is guidance and should be used with the understanding that adjustments or modifications are prudent but should be based on experience, observation, agronomic principles, and valid comparisons
- 2) Fertilizer recommendations from OSU guides published before 2000, when tested, usually have been correct, especially for N rates
- 3) Some revisions slightly change time of N application
- 4) New methods or tests for assessment of N rate have been developed that provide field specific rate recommendations. Two examples are the Pre-Sidedress Nitrate Test for silage and sweet corn production
- 5) Phosphorus rates sometimes are reduced in newer guides. As vegetable crops with root rot resistance are developed, less phosphorus is needed
- 6) Potassium rates are increased when residue is removed rather than returned such as baling wheat and grass seed straw

Irrigated spring-planted small grains—mineral soils

Eastern Oregon—east of Cascades

E.H. Gardner, T.L. Jackson, B.G. Wilcox, R. Todd, L. Fitch, M. Johnson, and V. Pumphrey

Good management practices are essential if optimum fertilizer responses are to be realized. These practices include adequate irrigation, use of recommended varieties, selection of adapted soils, weed control, disease and insect control, good seedbed preparation, proper seeding methods, and timely harvest. Follow recommended soil sampling and testing procedures to estimate fertilizer needs. The Oregon State University Extension Service agent in your county can provide you with soil sampling instructions, sampler bags, and information sheets.

Note: For fertilizer suggestions for irrigated spring-planted small grains on peat and muck soils in Klamath County, see OSU Extension publication FG 70, *Irrigated Spring-Planted Small Grains—Peat and Muck Soils (Klamath and Lake Counties)*.

Nitrogen (N)

Irrigated grain requires a good supply of available N; however, excessive rates of N can reduce grain quality and increase the risk of lodging. An optimum response to N fertilization depends on adequate irrigation. The N applications suggested in this guide are based on the maintenance of good soil moisture throughout the growing season.

Of the suggested N application, at least one-fourth of the N should be applied before or at planting time. The urea or diammonium phosphate forms of N may cause seedling injury if banded close to the seed at planting. The remainder of the N should be plowed down, injected, or applied through the sprinkler system.

The amount of N fertilizer required depends on the following factors: the preceding crop, the N carryover from the previous crop, the amount and type of residue to be plowed under, and possible leaching losses due to overirrigation.

The following recommendations are for mineral soils. For muck soils in Klamath County, see OSU Extension publication FG 70, *Irrigated Spring-Planted Small Grains—Peat and Muck Soils (Klamath and Lake Counties)*.

N fertilizer rates based on soil test

The amount of residual N in the soil varies considerably.

A soil test for nitrate-N (NO₃-N) helps in evaluating the N carryover from the previous crops in the case of mineral soils with low organic matter content.

Nitrogen soil tests are not recommended following alfalfa (or other legumes).

Soil samples for NO₃-N should be taken following a growing season and prior to the application of N fertilizer.

Soil samples should be taken from the 0- to 2-foot and 2- to 6-foot soil depths on deep soils. The soil samples should consist of soil cores removed from the entire 0- to 2-foot and 2- to 6-foot depth of soil. On soils shallower than 6 feet, take soil samples from 0–2 feet and from 2 feet to the rooting depth.

It is important to follow correct soil sampling procedures as outlined in OSU Extension publication EC 628, *How to Take a Soil Sample. . . and Why*. This publication is available from county Extension offices.

Soil test results for N are reported in ppm. One ppm N in a 1-foot depth of soil equals about 4 lb N/a (Table 1).

As an example:

Table 1.—N fertilization rates for spring-planted small grains.

Soil depth (ft)	If the soil test for NO ₃ -N is (ppm)	Apply this amount of NO ₃ -N (lb/a)
0–2	4	32
2–6	3	48
		Total 80

The total NO₃-N soil test values are used to estimate the N fertilizer requirement as indicated in the following table.



E. Hugh Gardner, Extension soil scientist emeritus; T.L. Jackson, Extension soil scientist emeritus; Rodney Todd, Extension agent, Klamath County; Bert G. Wilcox; Luther Fitch; Malcolm Johnson; and Vance Pumphrey; Oregon State University.

This publication is out-of-date but may contain some useful information

- 1) Any recommendation is guidance and should be used with the understanding that adjustments or modifications are prudent but should be based on experience, observation, agronomic principles, and valid comparisons
- 2) Fertilizer recommendations from OSU guides published before 2000, when tested, usually have been correct, especially for N rates
- 3) Some revisions slightly change time of N application
- 4) New methods or tests for assessment of N rate have been developed that provide field specific rate recommendations. Two examples are the Fertilization rates for spring-planted small grains based on total NO₃-N test values.
- 5) Phosphorus rates for NO₃-N are reduced in newer guides. As vegetable crops with root rot resistance are developed less phosphorus is needed
- 6) Potassium rates are increased when residue is removed rather than returned such as baling wheat and grass seed straw

If the soil test for NO ₃ -N is (lb/a)	Apply this amount of N	
	Wheat (lb/a)*	Oats and barley (lb/a)*
0-40	120-160	60-100
40-80	80-120	20-60
80-120	40-80	0-20
120-160	0-40	0
160-200	0	0

*These application rates are suggested for silt loam, loam, and clay loam soils. For sandy soils, increase the application rates by one-fourth.

If the soil test value for NO₃-N is less than 2 ppm in the 0- to 2-foot soil depth, apply a minimum of 30 lb N/a when well-tillered wheat plants are not present regardless of the soil test value for N below 2 feet. This application will ensure adequate initial growth of wheat plants.

N fertilizer rates based on previous crop

Where a soil test is not used, N fertilization is based on the preceding crops.

As the amount of residual N in the soil varies considerably, a soil test usually is the most accurate method of estimating N fertilizer needs except following a legume crop (Table 3).

Table 3.—N fertilization rates for spring-planted small grains based on previous crop.

If the previous crop was	Apply this amount of N	
	Wheat (lb/a) ¹	Oats and barley (lb/a)*
Grass sod or grain	140-160	80-100
Potatoes and peppermint	80-100	40-60
Productive alfalfa	60-80	20-40

*It may be necessary to increase these rates by about one-fourth to optimize yields on sandy soils.

Phosphorus (P)

Best results are obtained when P is banded at planting time. Plowing P down before planting is preferable to broadcast applications. (See Table 4).

Table 4.—P fertilization rates for spring-planted small grains.

If the soil test for P is (ppm)	Apply this amount of phosphate (P ₂ O ₅) (lb/a)*	
	Central Ore. and Klamath County	Remainder of eastern Ore.
0-10	80	60
10-20	40	0
over 20	0	0

*Increase the application rate by 50 percent if P is not banded. Increased responses to banded P occur in cold, wet soils. For muck soils in the Klamath area, see OSU Extension publication FG 70, *Irrigated Spring-Planted Small Grains—Peat and Muck Soils (Klamath and Lake Counties)*.

Potassium (K)

K fertilizers usually are not required for production of irrigated spring-planted small grain in eastern Oregon, but potassium responses may be obtained when soil test values for mineral soils for K are less than 100 ppm. In this case, 30 to 50 lb K₂O/a should be banded at planting time or plowed down prior to planting.

For muck soils in Klamath County, see OSU Extension publication FG 70, *Irrigated Spring-Planted Small Grains—Peat and Muck Soils (Klamath and Lake Counties)*.

This publication is out-of-date but may contain some useful information

- 1) Any recommendation is guidance and should be used with the understanding that adjustments or modifications are prudent but should be based on experience, observation, agronomic principles, and valid comparisons
- 2) ~~Fertilizer recommendations from OSU guides published before 2000, when tested, usually have been correct, especially for N rates~~
- 3) Some revisions slightly change time of N application
- 4) ~~New methods or tests for assessment of N rate have been developed that provide field specific rate recommendations. Two examples are the Pre-Sidedress Nitrate Test for silage and sweet corn production~~
- 5) ~~Phosphorus rates sometimes are reduced in newer guides. As vegetable crops with root rot resistance are developed, less phosphorus is needed~~
- 6) ~~Potassium rates are increased when residue is removed rather than returned such as baling wheat and grass seed straw~~

Sulfur (S)

Plants absorb S in the form of sulfate. Fertilizer materials supply S in the form of sulfate and elemental S.

Elemental S must be converted to sulfate in the soil before the S becomes available to the plant.

S fertilizer requirements vary with soil texture, leaching losses, S content of irrigation water, and the soil parent material.

The S requirements of spring cereals can be provided by:

1. Applying sulfate (SO_4) sulfur at 40–60 lb S/a at seeding on sandy soils and at 15–20 lb S/a on silt loam and finer-textured soils.
2. Applying fine-ground (less than 40-mesh) elemental S at 30–40 lb S/a the preceding year. Such an S application will suffice for 2 years.
3. Applying coarser-ground elemental S at higher rates and less frequently.

As elemental S gives a slow response, it is not recommended for application to grain fields where S deficiency symptoms are apparent. In this case, use a more rapidly available form of S such as gypsum.

S frequently is applied as a component of fertilizer materials such as ammonium sulfate and single super phosphate.

Some irrigation water contains appreciable amounts of S, which can be utilized by plants. Water containing 1 ppm S would supply 2.72 lb S/a for each foot of water applied. Growers should have their irrigation water analyzed to determine its S content.

Some S fertilizers such as elemental S increase soil acidity. Gypsum can be used as a source of S without affecting soil acidity.

Magnesium and Lime

Responses of small grains to applications of magnesium and lime have not been observed on mineral soils in eastern Oregon.

Manure

Manure can be used as a source of nutrients for small grains. Information on the use of manure is available from your county Extension agent.

For More Information

How to Take a Soil Sample ... and Why, EC 628, by E.H. Gardner (revised 1997). No charge.

A List of Analytical Laboratories Serving Oregon, EM 8677, by J. Hart (revised 1997). No charge.

To order copies of the above publications, send the complete title and series number, along with a check or money order for the amount listed (payable to Oregon State University), to:

Publication Orders
Extension & Station Communications
Oregon State University
422 Kerr Administration
Corvallis, OR 97331-2119
Fax: 541-737-0817

You may order up to six no-charge publications without charge. If you request seven or more no-charge publications, include 25 cents for each publication beyond six.

World Wide Web

Fertilizer and Lime Materials, FG 52, by J. Hart (reprinted 1997). No charge.

Irrigated Spring-Planted Small Grains—Peat and Muck Soils (Klamath and Lake Counties), FG 70, by J. Hart (reprinted 1998).

You can access the above publications, as well as FG 37, *Irrigated Spring-planted Small Grains—Mineral Soils: Eastern Oregon—East of Cascades*, our Publications and Videos catalog, and many other publications via our Web site at eesc.orst.edu

Guide to fertilization based on experiments conducted by Malcolm Johnson, Vance Pumphrey, and T.L. Jackson, Oregon Agricultural Experiment Station; Bert G. Wilcox, Oregon State University Extension Service; and on observation of growers' results.

This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties. Oregon State University Extension Service offers educational programs, activities, and materials—without regard to race, color, religion, sex, sexual orientation, national origin, age, marital status, disability, and disabled veteran or Vietnam-era veteran status—as required by Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973. Oregon State University Extension Service is an Equal Opportunity Employer.

Revised May 1985. Reprinted January 2000.