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Northern Idaho Fertilizer Guide

Feed Barley

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The following fertilizer guidelines are based on relationships developed through soil test and crop yield response data. The data bank used in this research was compiled by the University of Idaho and Washington State University. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors, such as pests, soil moisture, planting date, stand, etc., are not limiting production. Thus, this fertilizer guide assumes good management.

The suggested fertilizer rates will be accurate for your field provided: (1) the soil samples are properly taken and are representative of the area to be fertilized; and (2) the crop history information supplied is complete and accurate. To assist in obtaining a good soil sample, refer to University of Idaho CIS No. 162, *Soil Sampling*.

Nitrogen

Nitrogen (N) rates for barley depend upon the previous fertilizer applications, type of soil, soil organic matter, soil depth, length of growing season, pest control and other management practices.

Nitrogen fertilizer needed for optimum production depends on (1) whether the barley is to be used for malting or feed grain and (2) whether the barley is spring or fall planted. **If growing barley for malting, lower N rates are recommended** to produce barley with low protein necessary for malting purposes.

The amount of N fertilizer also depends on:

1. The variety and its potential yield in your location;
2. Potential yield or average yield obtained from field in past years;
3. The amount of usable N in the soil profile. This includes mineralizable N (released from the organic matter during the growing season) and inorganic N in the form of nitrates (NO_3^-) and ammonium (NH_4^+).
4. Total annual precipitation and other climatic factors;
5. Density of plant stand.

In areas of low precipitation (16 inches or less annually), soil moisture in the profile should be determined to adjust N fertilizer rates. In these low moisture areas and in areas with shallow soils (2 to 3 feet maximum depth), the recommended N fertilizer rate should be adjusted to fit available soil moisture.

Total N Needed Based On Potential Yield

Estimates of N fertilizer needed to produce a crop of feed barley require knowledge of the potential yield for the field for which the fertilizer recommendation is being made. This potential yield should be the long-term average for the selected field. Based on the potential yield, the amount of N needed can be calculated assuming 4 pounds N per acre are required to produce 100 pounds feed barley with optimum protein content (Table 1). This factor has been derived through research conducted in northern Idaho and eastern Washington.

Table 1. Nitrogen required to produce feed barley crop based on potential yield.

	Potential barley yield (lb per acre)*				
	2,000	2,500	3,000	3,500	4,000
	(lb N/acre)**				
Spring barley	70	90	110	125	140
Winter barley	80	100	120	140	160

*Potential yield of feed barley produced on a given field in northern Idaho for which fertilizer recommendation is being made.

**Research has shown that 4 pounds N per acre is needed to produce each 100 pounds of barley.

*For N fertilizer recommendations on malting barley, a publication on recommendations for Northern Idaho Fertilizer Guide for Malting Barley, is expected to be available in 1986.

Once the total amount of N needed to produce a feed barley crop is known, a simple equation can be used to determine the amount of fertilizer N to be applied to meet this need. This equation requires the following inputs:

total N needed based on potential yield (Table 1) − [mineralizable N (Table 2) + soil test N (Table 3)] = fertilizer N needed

Mineralizable Nitrogen

Soils vary in their capacity to release N from the organic matter during the growing season. Since this is a factor in determining the amount of fertilizer N required to produce a barley crop, an estimation of mineralizable N must be made. The rate or amount of N released is dependent on such factors as the amount of organic matter, soil erosion, available soil moisture and soil temperature.

Five different levels of mineralizable N release are used for northern Idaho soils (Table 2). Low mineralizable N release rates are found on severely eroded soils and soils with relatively low organic matter content. Eroded knobs or hilltops and cut-over timberland soils usually mineralize low amounts of N.

Soils having high N release rates are those with relatively high organic matter contents. These soils include the Palouse and other similar grassland soils that have not been badly eroded.

Nitrogen Soil Test

An N soil test evaluates inorganic N carryover from previously fertilized crops. Soil samples taken for determination of N soil test should represent the effective root depth of the crop since NO_3–N is mobile in the soil, and barley is capable of removing N to a depth of 4 feet.

Soil test values include both NO_3–N and NH_4–N. The NH^4–N levels in soils are usually low and may be omitted. To convert soil test NO_3–N and NH_4–N values to pounds N per acre, add the N soil test values (ppm) for each foot increment of sampling depth and multiply by four (Table 3).

Calculation of Nitrogen Needed

Using the equation and the necessary data, the following work sheet can be used to calculate the N fertilizer needed:

Total N required based on potential yield (Table 1)	_____
Minus mineralizable N (Table 2)	− _____
Minus soil test N (lb/acre) (Table 3)	− _____
	_____
N fertilizer required (lb/acre)	_____

With a potential yield of 3,000 pounds per acre of winter barley, 2.5 percent organic matter (medium level of mineralizable N) and soil test values from the example in Table 3:

Total N needed (Table 1)	120
Minus mineralizable N (Table 2)	− 40
Minus soil test N (Table 3)	− 56
N fertilizer required (lb/acre)	24

A total of 24 pounds of fertilizer N is needed to produce the barley crop at the given potential yield. (**Note:** Add 15 pounds available N for each ton of straw (20 bushels grain) or nonlegume residue incorporated into the soil up to 50 pounds N per acre. Remember that 1 ton of residue is produced for each 20 bushels of wheat or 1,400 pounds of barley grain produced.)

Estimate Based on Previous Crop

You also may estimate the amount of N fertilizer required for feed barley on the basis of the previous crop. The values in Table 4 are generalized recommen-

Table 2. Mineralizable nitrogen release rates for northern Idaho soils.

	Severely eroded	Organic matter content			
		less than 2%	2 to 3%	3 to 4%	more than 4%
Release level	low	moderately low	medium	moderately high	high
Pounds N released	20	30	40	50	60

Table 3. Example of calculation to convert N soil test results (ppm) to pounds N per acre. Ammonium (NH_4–N) is usually low and is often not included in soil test analysis.

Depth	Soil test reads			
	NO_3–N	NH_4–N	Total	Total N*
(inches)	(ppm)	(ppm)	(ppm)	(lb/acre)
0 to 12	2	1	3	12
12 to 24	3	2	5	15
24 to 36	5	1	6	18
36 to 48	(include if available)			
Total	10	4	14	56

*ppm × 4 = lb/acre.

Table 4. Estimated nitrogen fertilizer requirements for spring or winter feed barley crops based on previous crop.

Previous crop	Type of barley	Estimated nitrogen fertilizer to apply		
		Potential yield (lb/acre)		
		2,000	3,000	4,000
Grain (residue returned)	Spring	30 to 50*	50 to 70	70 to 90
	Winter	35 to 55	55 to 75	75 to 95
Grain (residue removed), peas, lentils, fallow	Spring	20 to 30	30 to 40	40 to 50
	Winter	20 to 35	35 to 45	45 to 55
Alfalfa or green manure crop	Spring	0 to 20	20 to 30	30 to 45
	Winter	0 to 20	20 to 35	35 to 50

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

dations based on field experiments and observations of production following the various crops. **Note, however, that N recommendations based on the previous crop are not as accurate as a recommendation based on a good soil test.**

Phosphorus

Barley has a relatively low phosphorus (P) demand, but it is important that a minimum amount be available for use by the plant (Table 5). Thus, if the soil level of P is low, a response can be obtained from applied P.

Phosphorus should be either banded or incorporated into the seedbed before or at planting. Broadcast-plowdown, broadcast-seedbed incorporated or drill-banding are all commonly used methods of application. Drill-banded P is usually the most efficient application method allowing placement with, below or to the side of the seed. The choice of application methods usually depends on convenience to the grower.

Table 5. Phosphorus fertilizer recommendations based on soil test.

Soil test* (0 to 12 inches)	Apply (lb/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

**$P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$

Potassium

Barley has a relatively low demand for potassium (K). Few soil samples have soil test values low enough to warrant the use of K fertilizer. These are usually eroded areas of hilltops and/or clay knobs. Apply K fertilizer as needed according to soil test (Table 6).

When applied, K should be incorporated into the seedbed before or at planting. Broadcast-plowdown, broadcast-seedbed incorporation or drill-banding are all effective methods of application. Drill-banded fertilizer can be placed with or below the seed or to the side of the seed. When applied with the seed, the total of N plus K (as K_2O) should not exceed a maximum of 25 pounds per acre. The choice of application methods depends upon which is the most convenient to the grower.

Table 6. Potassium fertilizer recommendations based on soil test.

Soil test* (0 to 12 inches)	Apply (lb/acre)	
(ppm K)	(K_2O)	(K)**
0 to 35	80	66
35 to 75	60	50
over 75	0	0

*Sodium acetate extractable K

**$K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$

Sulfur

Sulfur (S) requirements for barley are influenced by soil texture, soil organic matter content, previous crop and fertilizer history. A soil sample testing less than 10 ppm SO_4–S should receive 20 pounds S per acre. Use of elemental sulfur should be avoided. Sulfur deficiency appears as a yellowing of the plant early in the growing season and is visually impossible to distinguish from an N deficiency.

Micronutrients and Lime

Barley responses to micronutrients have not been observed in northern Idaho. If you are in doubt, have the soil tested and consult your local Extension county agricultural agent.

Lime applications on highly acid soils (less than pH 5.2) should be tried on an experimental basis to determine if an economical response is derived. When needed, lime should be applied at a rate of 1 to 2 tons per acre and mixed well into the soil.

General Comments

1. Weeds, insects and diseases can influence the effectiveness of a fertilizer program and reduce yields.

2. Fall applications of N should be avoided in areas of heavy winter precipitation and on sandy-textured soils. Spring applied N will be used more efficiently by the plant. Thus, a fall-spring split application may be advantageous.

3. Nitrogen applied to the crop after the boot stage or at excessive rates can result in an increased lodging hazard.

4. Losses of fertilizer N through leaching is a hazard on all soils. Nitrification inhibitors give mixed results at best.

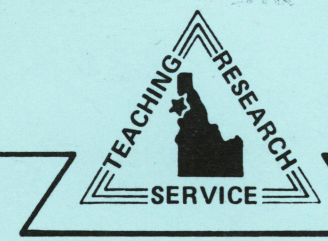
5. Early planting of spring barley has been shown to result in the highest yields; however, the potential for disease problems is enhanced.

6. Frost heaving and freezing damage can reduce plant stands, requiring an adjustment in fertilizer rates in the spring.

7. Starter or pop-up fertilizer has been tried with success. Starter fertilizers as a management tool have been most effective when soils are cold and root growth can be stimulated by a readily available supply of both P and N.

8. Care should be taken when banding fertilizer so that excessive amounts are not placed close to the seed. Excessive amounts of N and K result in salt damage during germination. Barley is especially sensitive to excess salts during germination.

9. Banding fertilizer improves N and P use efficiency. Consequently, if applying N and/or P in a band, cut the recommended fertilizer application rate 10 to 15 percent.



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