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Fertilizing Barley

Cooperative Extension South Dakota State University

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Cooperative Extension Service
South Dakota State University
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Research has identified at least 13 mineral elements that are essential for quality high barley yields. Nitrogen, phosphorus, and potassium are considered the primary plant foods; calcium, magnesium, and sulfur are elements of secondary importance; and boron, chlorine, copper, iron, manganese, molybdenum, and zinc are called the trace elements.

The grain and straw portions take up approximately 1.5 lbs of N, .6 lb of P_2O_5, and 1.4 lbs of K_2O from the soil for each bushel of grain produced. High yield potentials obviously require large soil reserves of nutrients in an available form.

Recommended rates of plant food elements will vary, depending on desired yield and existing soil reserves. These rates are shown in Tables 1, 2, and 3.

South Dakota research shows better barley yields can be achieved by seeding reasonably early, as is true for many other common crops. Adequate fertility becomes increasingly important with early seeding.

Nitrogen

Barley requires greater amounts of nitrogen for each bushel of grain produced than just about any other element.

Much of South Dakota's barley is seeded in soil that is cropped annually. Seldom will such soils provide enough nitrogen to meet the crop needs of that element for today's potentially high yielding varieties, so additional nitrogen will be needed.

Phosphorus

Barley requires considerably less phosphorus than either nitrogen or potassium for each bushel of grain produced. Nevertheless, many South Dakota soils are no longer able to provide adequate amounts of phosphorus to meet the needs of today's higher yielding varieties. Many fields seeded to barley are deficient in phosphorus.

Optimum yield levels will not be possible without additional phosphorus on such fields. Inadequate soil phosphorus reserves also result in delayed maturity in barley and other crops.

Phosphorus soil levels will not fluctuate from low to high in just 1 or 2 years, as will soil nitrogen reserves, unless unusually high rates of fertilizer or manure were recently applied. For this reason, soil only needs to be tested for phosphorus every 3 to 4 years.

Potassium

Potassium requirements for barley, as for all other crops, greatly exceed those of other mineral elements with the exception of nitrogen.

Reserves of available potassium are quite high in most South Dakota soils; thus high rates of potassium fertilizer are seldom recommended. Potassium deficiencies do exist on some soils, particularly in the eastern third of the state.

Continued removal of the entire crop will lower the potassium reserves and eventually cause deficiency. This points up the need to periodically monitor fertility with soil tests.

Secondary and trace elements

Adequate supplies of these elements are basically just as important in achieving high yield levels of quality barley as are nitrogen, phosphorus, and potash, but are required in much smaller amounts. To date research by SDSU and other upper midwest universities has not shown any significant yield increases from the use of secondary and trace element fertilizers.

Table 1. Nitrogen recommendations, lbs N/A

Yield goal, bu/A	Nitrate Nitrogen: Nitrogen needed, lbs N/A*	Nitrogen soil test: % Organic Matter: Non-fallow: Low 2.0	Non-fallow: Medium 3.0	Non-fallow: High 4.0	Fallow: Low 2.0	Fallow: Medium 3.0	Fallow: High 4.0
		Nitrogen recommended, lbs N/A					
25	48	20	0	0	0	0	0
35	67	30	20	0	0	0	0
45	86	40	30	20	20	0	0
55	105	60	45	20	30	0	0
70	133	70	55	30	40	25	0
85	162	85	65	45	60	35	20
100	190	100	80	60	70	45	20

*For use with nitrate-N tests only, taken at 2-foot levels.
Example for 35 bu/A yield: **67** (N needed) - **40** (nitrate soil test) = **27** lbs N recommended.

Table 2. Phosphorus recommendations, lbs P_2O_5/A

Yield goal, bu/A	Phosphorus soil tests, lbs P/A: Low 6 - 15	Medium 16 - 25	High 26 - 35
	P_2O_5 recommended, lbs/A		
25	30	20	0
35	40	20	0
45	40	20	0
55	45	30	15
70	50	40	15
85	60	45	15
100	65	50	15

Table 3. Potassium recommendations, lbs K_2O/A

Yield goal, bu/A	Potassium soil tests, lbs/A: Low 51-120	Medium 121-210	High 211-300
	K_2O recommended, lbs/A		
25	40	0	0
35	60	15	15
45	65	15	15
55	85	20	15
70	100	25	15
85	130	30	15
100	150	40	15

Farmers are cautioned against investing in or using such fertilizer elements until it has been definitely shown that they will profitably increase yields.

Fertilizer application

Application methods can greatly affect yield results. Impressive barley yield increases can be obtained by seeding early. Adequate fertility becomes especially important to early seeded plants with limited root systems growing in cool soil conditions. This means fertilizer applications should also be made early during the growing season.

Nitrogen applications can be broadcast and worked in before or applied with the drill fertilizer attachment during seeding. Severe seedling injury can take place if the total amount of actual nitrogen plus potash (K_2O) reaches or exceeds 25 lbs per acre.

Various ammonium forms of nitrogen (such as urea) are more toxic than others. Total amounts of ammonium type nitrogen fertilizer plus potash applied with a drill attachment with the seed in dry sandy soil conditions should not exceed 10 to 12 lbs actual per acre. If 10- to 14-inch rows are used, the amount of drill applied nitrogen and/or K_2O should be divided by 2.

Topdressing nitrogen on established stands of barley before it reaches the early flag leaf growth stage is also effective. Severe foliar burn and potential yield loss can occur when topdressing barley with liquid nitrogen solution, if rates exceed 25 lbs actual nitrogen per acre. Nitrogen applied at later growth stages tends to increase protein levels rather than yield.

Phosphorus and potassium plant food will be most effective if applied with a drill fertilizer attachment at seeding, or if broadcast and worked in prior to seeding. Broadcast phosphorus rates can be reduced up to 40% without sacrificing yield, if applied in a drill attachment. Very low volume foliar feeding fertilizer practices (2 to 3 gal per acre) appear to be very questionable practices, according to midwest research to date.

Malting barley production

Malting market premiums provide additional income to some barley growers; however, management practices (date of seeding, fertility level, and combine operation) can all affect malting quality. Most production practices that help assure top yields will help aid the grower in producing barley with the plumpness and protein levels acceptable to the malting industry.

Reasonably early seeding is perhaps the most important. Recommended rates of nitrogen fertilizer on barley planted the second to third week of April have increased research plot yields without creating protein levels that exceed the malting industry's limit of 13.5%.

It appears that the malting industry is quite rigid about broken skins and kernel plumpness requirements but is more flexible regarding protein level from year to year. In summary, the protein levels of barley seeded late or in soil containing or receiving nitrogen in excess of the crop's need can exceed acceptable industry levels for malting purposes.

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