G92-1102 Fertilizer Management for Dry Edible Beans

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Fertilizer Management for Dry Edible Beans

Soil sampling and proper fertilization of dry beans will assist the producer in obtaining consistent top yields.

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Excellent yields of high quality dry beans can be obtained in western Nebraska. Traditional growing areas are the Panhandle and the southwestern part of Nebraska near Colorado. The highest bean yields are produced on fertile soils. Dry beans respond to fertilizer if the soil test shows the nutrient to be in the low to medium fertility range.

Soil samples representative of the field should be taken preplant from the tillage layer (usually 0-8") for pH, phosphorus, potassium, zinc, iron and salinity and to a depth of 30 inches for nitrate nitrogen. Information from these tests allows the producer to make sound decisions on fertilizer needed and determine the potential for any soil-related problems.

Nitrogen Recommendations

Dry beans, a member of the legume family, are able to symbiotically fix nitrogen from the air. The nodules on the roots contain bacteria that fix nitrogen for plant use. Inoculum containing the Rhizobium bacteria can be purchased and applied with the seed or to the soil in the seed furrow. If dry beans recently were grown on the land and the beans were well-nodulated, inoculation is unnecessary. If there is no history of bean production on the field, inoculation of the beans at planting time will be essential.

Recent research in the Nebraska Panhandle has shown the addition of nitrogen fertilizer can increase

seed yield if nitrate nitrogen levels in the soil are low. Dry beans need 100 to 125 pounds of nitrogen per acre, in addition to the plant's ability to fix nitrogen, to obtain optimum seed yield. This additional nitrogen can be residual soil nitrogen, fertilizer nitrogen, nitrogen in irrigation water, nitrogen in manure or a combination.

Nitrogen rates can be reduced if irrigation water has a high nitrate level. An irrigation water credit can be calculated by taking the parts per million nitrate nitrogen in water times a factor of 2.72. This number is equal to the pounds of nitrogen applied per acre with each one foot depth of water applied.

Table I. Nitrogen credit for irrigation water

Total Inches of Water Applied	**Nitrate Content of Water ppm**			
	5	10	15	20
	Pounds of Nitrogen Applied Per Acre			
6	7	14	20	27
12	14	27	41	54
18	20	41	61	81

Surface irrigation water nitrate levels fluctuate over time but normally will be relatively low. During the irrigation season, nitrate levels in the North Platte River in the Panhandle ranged from 1.6 to 5.5 ppm nitrogen in a five year period from 1985 to 1990. The median level was 3 ppm. This nitrogen credit has already been added into the nitrogen recommendations in *Table II*.

Table II. Nitrogen recommendations

Residual Nitrate Soil Levels 30 Inch Sample ***lbs of nitrate nitrogen/A***	**Fertilizer Nitrogen to Apply** ***lbs/A***
<49	75
50-74	50
75-99	25
>100	0

The use of nitrogen fertilizer for dry beans does have some limitations. Excess use of nitrogen fertilizer can delay maturity. The same effect is seen when planting dry beans in a newly plowed alfalfa field. Planting dates and/or varieties should be adjusted to compensate for the delayed maturity. Nitrogen fertilizer also will increase the amount of foliage produced. This can be a serious problem in fields with histories of white mold. The incidence of white mold damage, when present, can be increased as much as 30 percent with nitrogen fertilization.

Phosphorus Recommendations

Dry beans respond to phosphorus fertilizer when soil test levels are low. Banding phosphorus is more efficient than broadcasting it. Currently, 70 percent of the phosphorus applied to dry beans is banded at planting time. Obtaining a soil test and following the phosphorus rates recommended in the table will produce the best results.

Table III. Phosphorus recommendations

Phosphorus Soil Test Levels ***ppm P***		**Phosphorus to Apply** ***lbs of P_2O_5***	
Bray P_1	*Na(HCO_3)*	*If Band*	*If Broadcast*
0 to 5	0 to 3	20	40
6 to 15	4 to 7	10	20
>16	>7	0	0

Potassium Recommendations

In the western half of Nebraska, where dry beans traditionally are grown, soils are very high in potassium. Soils testing over 125 ppm potassium have not shown a response to potassium fertilization of dry beans.

Table IV. Potassium recommendations

Potassium Soil Test Levels ***ppm K***	**Potassium to Apply** ***lbs of K_2O/A***
0 to 40	60
41 to 74	40
75 to 124	20
>125	0

Zinc Recommendations

Zinc is the most common micronutrient deficiency of dry beans in Nebraska. Zinc deficiency can occur when the topsoil has been removed by leveling or erosion. Soils low in organic matter, compacted soils, sandy soils and/or soils with a pH greater than 7.3 may exhibit zinc deficiency. It also can be a problem when beans follow sugar beets.

Table V. Zinc recommendations

Extraction Method		**Zinc Index**	**Zinc to Apply *(lbs/A)***			
AB-DPTA	*DPTA*		**Soil pH Less Than 7.3**		**Soil pH More Than 7.3**	
ppm Zn			*Row Applied*	*Broadcast*	*Row Applied*	*Broadcast*
0-0.9	<.5	<3	1	5	2	10
1.0-1.5	.6-1.0	3.1-4.5	1	3	2	5
>1.5	>1.0	>4.5	0	0	0	0

Iron Recommendations

Iron deficient dry beans can occur on soils having a pH value higher than 7.4, free calcium carbonate

and/or low organic matter. In addition, cool wet springs increase the probability of iron chlorosis. As these soils warm up or lose moisture, iron chlorosis often disappears without any iron treatment. If chlorosis persists, yield losses can occur. Soil application of iron is generally not effective. Deficiency is best corrected by spraying the crop with a 2 percent ferrous (iron) sulfate solution at the rate of 20 to 30 gallons per acre. Aerial application does not provide enough coverage because of gallonage limitations.

Table VI. Soil test rating for iron

Extraction Method		Interpretation
AB-DPTA	DPTA	
ppm Fe		
<3.0	<2.5	Deficient
3.1-5.0	2.6-4.5	Marginal
>5.0	>4.5	Adequate

Other Micronutrients and Sulfur

Applications of boron, chlorine, copper, manganese and/or molybdenum have not resulted in yield increases from Nebraska soils. The use of sulfur fertilizer generally is not needed in the major dry bean growing regions of Nebraska. The most likely need for sulfur would occur on sandy soils with low organic matter, and soils irrigationd with water very low in sulfate-sulfur.

Salinity

Of all crops grown in Nebraska, the dry bean is the most sensitive to soluble salts. A saline/alkali soil test should be conducted on soils in which a salt problem is suspected. Salts from soils testing over 2 mmhos/cm normally cause some injury to bean plants and reduce yields.

The most common effect of salts is on the plant's ability to absorb water. The symptoms of salt injury on the bean plant are stunting, smaller, thicker, darker green leaves, or in some cases, burning around the leaf margins. The effects of salts can't be separated from water stress since salts contribute to moisture stress in the plant. The bean plant is most sensitive to salt effects during germination and early growth.

Most soils normally don't have salt concentrations high enough to cause injury to beans, but under drought and high temperatures salts may accumulate near the soil surface and injure the developing seedling. The same conditions of high temperatures and low soil moisture also can affect preplant herbicide performance, which may lead to herbicide injury. The possibility exists for all these factors to interact and dramatically reduce bean yield. The best strategy to counteract the salt stress problem is to irrigation the crop early and leach salts out of the soil zone where the crop is germinating and beginning development.

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