SF-719 (Revised)

Fertilizing **Soybean**

W. C. Dahnke
Soil Testing and Soil Science Dept.

C. Fanning
Extension Soils Specialist

A. Cattanach
Extension Soils/ Sugarbeet Specialist

Soybean is a long season legume crop that do best on well-drained fertile soil. While soybeans do not always respond to fertilizer the year that it is applied, it is well known that soybeans do much better on fields in which the phosphorus and potassium soil test levels have been built up by previous fertilization. Fields that are high in available nitrogen should be planted to non-leguminous plants because legumes can get their nitrogen from the air.

Inoculation: Soybean, like other legumes, can fix nitrogen from the air but will take nitrogen from the soil first if it is available. When available soil nitrogen is depleted, legumes will get their nitrogen from the air if they have been inoculated with the right strain of bacteria (rhizobia). The inoculum should be mixed with the seed at planting time. If the seed has been treated with a fungicide, check to see if it is compatible with the inoculum before using a seed treatment.

Yield Goal: Yield is influenced by: 1) local climate; 2) soil type; and 3) management (timeliness of field operations, plant population, variety, soil fertility, weed control, etc.). Yield goals should be realistic. The are usually based on long-time averages and on management ability of the grower but adjusted to conditions expected for the upcoming year (see Circular SF-822).

Excessive fertilizer use, especially nitrogen and phosphorus, has potential to degrade ground and surface water quality. Establishing realistic yield goals, carefully soil sampling fields and fertilizing crops according to soil tests will help preserve water quality.

Nutrient Recommendation: Legumes without nodules or with ineffective nodules will respond to nitrogen applications like any other crop. Since legumes have the ability to fix nitrogen, it is important to inoculate soybean seed just before planting, especially on fields that have not recently been planted to soybeans. Crop response to phosphorus and potassium are not always noticeable in the year of application.

Approximately 60 percent of the phosphorus and 50 percent of the potassium taken by soybean plants is removed from the field when the seed is harvested. One bushel of soybean contains about 0.75 pound of P_2O_5 and over a pound of K_2O per bushel. The recommended **broadcast rates** of phosphate and potash for soybean is given in Table 1.

Fertilizer Placement: Phosphate and potash fertilizer can be applied broadcast and incorporated into the soil before planting or applied as a starter at planting time. If applied as a starter, the recommended placement of the fertilizer is in a band 2 inches to the side and 2 inches below the seed. "Popup" (a small amount of fertilizer placed in contact with the seed) **should not** be used on soybean. Soybean is very susceptible to fertilizer salt injury.

Since phosphorus and potassium move very little in the soil, it is possible to "build up" or increase the available level of these nutrients in the soil. The application of approximately 20 pounds of P_2O_5 per acre will increase the phosphorus soil test level by 1. In other words, if your phosphorus soil test level is 5 and you prefer to operate at test level of 12, the application of 140 pounds of P_2O_5 (305 pounds of 18-46-0) per acre thoroughly mixed in the top 6 inches of soil will raise the soil test

NDSU EXTENSION SERVICE
North Dakota State University, Fargo, ND 58105

OCTOBER 1992

14 AGR-8-1

level by 7. Likewise, the application of 10 pounds of K_2O per acre will increase the potassium soil test by 1.

Zinc Chlorosis: Zinc (Zn) deficiencies have been found in isolated areas in the state. Problem areas are generally limited to sandy soil. However, zinc deficiencies are not uncommon on soils with high calcium carbonate levels at the soil surface or where topsoil has been removed in leveling for irrigation.

The first symptom of Zn deficiency in soybean is usually a light green color developing between the veins on the older leaves. New young leaves will be abnormally small. Bronzing of the older leaves may occur. When the deficiency is severe, leaves may develop necrotic spots. Shortened internodes will give plants a stunted, rosetted appearance.

A soil test for Zn is available from the NDSU Soil Testing Laboratory and is helpful in identifying soils with suspected Zn problems. For soils testing very low or low in Zn, (0-.5 ppm) rates of 3 to 5 pounds per acre of actual Zn as zinc sulfate (36% Zn) or 0.5 to 1 pound per acre actual Zn in an organic (chelate) form is recommended. For marginal-testing soils (.51-1 ppm), use the same rates of Zn on a trial basis. Broadcasting and plowing down Zn has been a successful method of application. A Zn deficiency on young bean plants can also be corrected by a foliar application of zinc during the first six weeks of growth. Use a foliar application of 1 pound of Zn in 25 to 30 gallons of water. Zinc sulfate and other soluble inorganic or organic sources are suitable for foliar application.

Iron Chlorosis: Iron (Fe) deficiency (chlorosis) may be observed in soybean, especially on high calcium carbonate level soils during cool, wet periods. The youngest leaves of Fe deficient plants will be distinctly yellow. The interveinal areas of the leaves will be bright yellow while the veins remain green. Soil treatments for correcting Fe deficiences are not usually effective. A suggested foliar treatment would be to dissolve 20 pounds of ferrous sulfate in 100 gallons of water and apply at the rate of 10 to 20 gallons per acre. This will usually quickly eliminate deficiency symptoms but may not result in a profitable yield increase. Variety selection for high-lime soils can help counteract Fe chlorosis. Some varieties are quite susceptible to iron chlorosis. Iron chlorosis is more common than zinc chlorosis in North Dakota.

Other Nutrients: To date, responses to other micronutrients have not been demonstrated in the state.

Remember that profitable yield of soybean is more likely on high testing soils at high levels of management. Plant recommended varieties at optimum stands in narrow rows. Weed control is very important.

Nutrient recommendations for soybean.

	Soil Test Phosphorus, ppm					Soil Test Potassium, ppm				
	VL	L	M	H	VH	VL	L	M	H	VH
Yield	Bray-I 0-5	6-10	11-15	16-20	21+	0-40	41-80	81-120	121-160	161+
goal	Olsen 0-3	4-7	8-11	12-15	16+					
bu/a	------ lb P_2O_5/acre ------					------- lb K_2O/acre -------				
30	35	20	10	0	0	55	35	10	0	0
40	50	30	10	0	0	75	45	15	0	0
50	60	35	10	0	0	90	55	20	0	0
60	70	40	10	0	0	110	65	20	0	0

Bray-I P recommendation = (1.55-0.10 STP)YG
Olsen P recommendation = (1.55-0.14 STP)YG
Potassium recommendation = (2.2000-0.0183 STK)YG

The abbreviations used in the equations are as follows:
YG = yield goal
STP = soil test phosphorus
STK = soil test potassium

Helping You Put Knowledge To Work

NDSU Extension Service, North Dakota State University of Agriculture and Applied Science, and U.S. Department of Agriculture cooperating. William H. Pietsch, Director, Fargo, North Dakota. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. We offer our programs and facilities to all persons regardless of race, color, national origin, religion, sex, handicap, age, Vietnam era veterans status, or sexual orientation; and are an equal opportunity employer.