SOYBEAN FACTS

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Fertilizing Soybeans in Michigan

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Soybeans will respond to good soil fertility and plant nutrient management. The keys to success are managing soil pH in the proper range, identifying crop nutrient needs and applying the required nutrients at the optimum rates and times.

Soil testing is the foundation for any soil fertility/ nutrient management program regardless of the crop being grown. A representative soil sample measures the pH and nutrient status of the soil and provides crop-specific lime and nutrient recommendations. Following these recommendations will ensure that you realize the greatest return on your investment in lime and fertilizer.

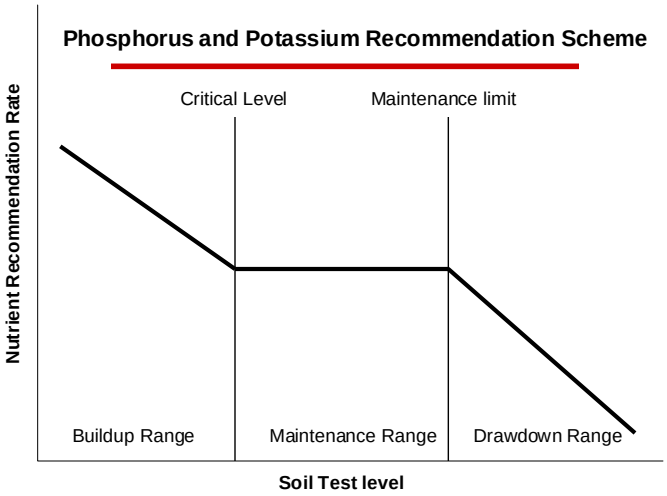
Soybean yield losses occur when soil pH levels fall below 6.0. Maintain soil pH between 6.0 and 6.5 to optimize nutrient availability, maximize biological nitrogen fixation and reduce soybean cyst nematode pressure. Apply dolomitic lime whenever lime is recommended and any <u>one</u> of the following is true.

- Magnesium soil test level is less than 35 ppm on coarse-textured soils or 50 ppm on fine-textured soils.
- Magnesium is less than 3% of exchangeable bases on an equivalence basis
- Potassium exceeds magnesium as a percent of the exchangeable bases on an equivalence basis.

Soybeans yield well over a wide range of calcium to magnesium ratios so achieving an "optimum" Ca/Mg ratio is not required to maximize yields as long as each nutrient is present in sufficient quantities.

Michigan State University's potassium and phosphorus nutrient recommendations are based on the concepts illustrated in Figure 1.

Figure 1. MSU phosphorus and potassium recommendation scheme



In the build-up range, nutrient recommendations exceed crop removal rates until the critical level is reached. Once the soil test level has reached the critical level for either P or K, enough of that nutrient will be available to produce 95 to 97% of the soil's maximum yield potential. The critical level for phosphorus when soybeans are grown is 15 ppm. The critical limit for potassium is calculated by the following formula:

critical limit = 75 + (2.5 x CEC)
CEC = cation exchange capacity

In the maintenance range, nutrient recommendations equal crop removal rates. In the drawdown range, nutrient recommendations are less than crop removal rates. Soybeans remove 0.8 pounds per acre of P_2O_5 and 1.4 pounds of K_2O per bushel per acre.

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Soybeans are excellent nutrient scavengers. They are so efficient that many growers don't apply fertilizer directly to soybeans. Instead, they apply phosphorus and potassium prior to planting corn and rely on the soybean plant's ability to utilize the residual soil nutrients. Research conducted in Illinois supports this strategy. The researchers showed that small differences in soybean yields occurred between annual and biennial phosphorus and potassium fertilizer applications. Soybean yields tended to be the highest when the biennial fertilizer application was made before planting corn. If biennial fertilizer applications are planned, make sure application rates are sufficient for both crops. Biennial fertilizer applications are not recommended on organic soils or mineral soils having cation exchange capacities less than 6 meq/100 g as the risk of losing the potassium through leaching losses increases significantly. Spring applications of potassium fertilizers are recommended on these soils.

University researchers have also shown that soybeans do not respond significantly to starter fertilizers when soil test levels are above the critical levels. If starter fertilizer is applied, always place the fertilizer 2 inches to the side and 2 inches below the seed. Starter fertilizers for soybeans applied in this manner can contain up to 100 pounds per acre of P_2O_5 and up to 60 pounds per acre of K_2O without causing seedling injury.

University research projects from across the U.S. have failed to demonstrate an economic yield response when nitrogen fertilizers are applied to soybeans. The reason for this is that bacteria living on soybean roots fix atmospheric nitrogen making it available to soybeans. Therefore, Michigan State University does not recommend applying nitrogen fertilizer to soybeans.

Researchers from Michigan State University and Ohio State University report average yield increases of at least 1.3 bushels per acre from using inoculants on fields having a history of soybean production. MSU agronomists now recommend applying inoculants whenever soybeans are planted. Please see the SOYBEAN FACTS fact sheet entitled "Soybean Seed Applied Inoculation" for more detailed information about inoculating soybeans.

Manganese is the most common micronutrient deficiency in Michigan. It is likely to occur on organic soils having pH levels greater than 5.8 and on black sands, lakebed soils and depressional areas having pH levels above 6.5. Deficiency symptoms show up as interveinal chlorosis (yellowing between the veins) on the new growth and stunting in severe cases. Manganese fertilizer applications will not increase soil test levels so manganese deficiency symptoms will show up in the same areas whenever soybeans are grown. Deficiencies can be corrected with a foliar application of 1-2 pounds of actual manganese applied in 30 gallons of water per acre. Apply the fertilizer when the plants are 6 inches tall, check the new growth for deficiency symptoms after 7 to 10 days and make a second application if necessary. Manganese sulfate is the preferred source unless glyphosate is tank mixed with manganese. In this case, always use the EDTA chelate form of manganese to reduce the potential for impacting glyphosate performance. Please see the SOYBEAN FACTS fact sheet entitled " Maximizing Glyphosate Performance" for additional information on reducing glyphosate antagonism.

There is increasing interest in applying foliar fertilizers to soybeans. Foliar fertilization of soybeans has been extensively evaluated by land grant universities and the Tennessee Valley Authority for more than 30 years. Results have been quite varied. Both yield increases and decreases have occurred in these trials. The bottom line is that there is little replicated research supporting foliar applications of fertilizers to soybeans except in fields where manganese deficiency is likely to occur.

Additional information about increasing soybean yields and profitability can be found online at http://web1.msue.msu.edu/soybean2010/.

References include: "Nutrient Recommendations for Field Crops in Michigan", D. Warncke, J. Dahl, L. Jacobs, and C. Laboski, "Foliar Fertilization of Soybeans", K. Kelling, New Horizons in Soil Science, November, 2003, No. 5, "Tri-state Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa" M.L. Vitosh, J.W. Johnson and D.B. Mengel, "Secondary and Micronutrients for Vegetable and Field Crops", M.L. Vitosh, D.D. Warncke and R.E. Lucas, "Effects of Annual Versus Biennial Phosphorus and Potassium Applications in Corn-Soybean Rotation", S.A. Ebbelhar, E.C. Varsa, T.D. Wyciskalla and C.D. Hart, Illinois Fertilizer Conference Proceedings, 2004.