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Soybean Response to Fertilization

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When can you expect soybeans to respond to fertilization? How large is a response likely to be? How much fertilizer will be needed to obtain the maximum economic response? These are questions that College of Agriculture personnel must answer in making recommendations. Farmers should also consider these questions when deciding how much fertilizer to use.

Answers to questions such as these must be found in the results of tests done by researchers in Kentucky and other states. For example, in the case of potash fertilization of soybeans, one of the most dramatic responses was obtained in a North Carolina test. The soil was a sandy loam and tested very low in potassium. The response was from seven bushels per acre with no potassium added to 48 bushels per acre with about 90 pounds of potash per acre added. This was an extreme example. A more normal expected yield increase on soils testing low in potassium might be about 25 percent, or for example, from 28 to 35 bushels per acre. On soils testing medium in potassium, yield responses are less likely to occur and will be much smaller. Soils testing in the high range are not likely to respond to added fertilizer.

The story on soybean response to phosphorus fertilization is very similar to that of potassium. This is illustrated very well by the following table:

Soybean Response to Phosphorus Fertilization*

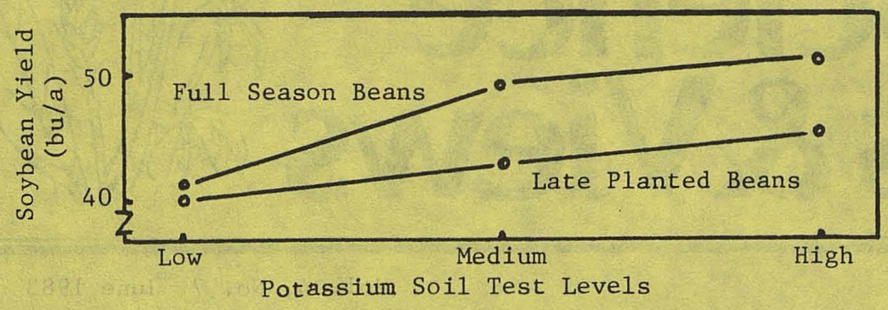
	Phosphate (lbs/a)		
Soil Test	0	40	80
	---------- yield (bu/a) ----------		
Very Low	11	27	37
Low	33	39	41

There was a good response to phosphorus at both soil test levels, but the low soil test did not respond as much as the very low soil test. When the soil test reaches the medium level or higher, yield responses to added phosphorus are unlikely.

*Bulletin Y-69. Soybean Production, Marketing and Use. NFDC-TVA 1974.

Soybean Response to Residual Fertilizer

Not all the fertilizer applied for a crop is used. Often this unused fertilizer (especially phosphorus and potassium) remains in the soil and can be used by future crops. This is basically what happens when we build soil test levels. A UK experiment conducted at Lexington to see how potash applied in previous years would affect soybean yields gave results illustrated in the following graph:



The low, medium and high soil test levels resulted from different rates of potassium fertilization in prior years. The difference between the low and high soil test levels is about the same response as might be expected by adding potash fertilizer to soils testing low in potash.

Response to Nitrogen (N) Fertilization

Soybeans are heavy users of N. Fifty bushels of beans contain about 200 pounds of N. Add to this the 50 pounds contained in the stems and leaves and we see that a 50 bushel bean crop must take up 250 pounds of N. A test with uninoculated soybeans in North Carolina had a yield of 18 bushels per acre when no N was added. With 200 pounds of N/A, the yield increased to 43 bushels per acre. This shows that large amounts of N must be available for high bean yields. Fortunately, when soybeans are well nodulated, they are capable of providing their own N. For this reason, well nodulated soybeans very rarely respond to added N.

Response to Minor Elements

The University of Kentucky does not predict response of soybeans to minor elements based on soil analysis of these nutrients. Rather, the likelihood of response is based on previous experiences with observed deficiencies in a specific area or on the soil pH. Only two minor element deficiencies of soybeans have been observed to any extent in Kentucky. These are molybdenum and manganese. Both are closely tied to soil pH. Molybdenum responses might occur when the soil pH falls below 6.2. Manganese problems are mainly confined to terrace and bottomland soils in McLean, Hopkins, and Daviess Counties. These soils are usually not well drained and have a pH of 6.5 or above. The higher the pH, the greater likelihood of manganese deficiency.