



Soil and Tissue Testing: A Valuable Aid in Soybean Fertilization

Original Author: Shauna Mellish

Original Published Date: April 2014

Reviewed: January 2018

The goal of any crop fertility program is to match the nutrient application with the crop yield potential and crop nutrient requirements, as determined by soil analysis. Yield potential for soybeans in PEI ranges between 30-40 bushels/ac (0.82 – 1.09mT/ac) depending on variety, weather, and soil type. By recording soybean yield at harvest, you can accurately determine the yield potential of your soil over time. Applying nutrients beyond the yield potential of your soil will not result in yield increase but will result in wasted resources and loss of nutrients to the environment.

The best way to ensure that you are meeting the nutrient needs of the crop is to have your soil analyzed. A soil is the best measure of the nutrient needs of your crop because it is based on the supply of nutrients already available in the soil. It is important to collect the right number of soil samples, from a variety of locations within the field to ensure your soil test is representative of the whole field. For proper soil sampling techniques please refer to the fact sheet “The Why and How of Soil Testing” on the PEIDAF website.

For optimum soybean growth, soil pH should be between 6 and 6.5. If soil pH falls 0.2-0.3 units below the optimum pH range, liming should occur in order to increase soil pH.

Soybeans are able to produce their own nitrogen by “fixing” nitrogen from the air with help from nitrogen fixing soil bacteria called rhizobia. The soil bacteria are concentrated in nodules within the root system through the process of nodulation. Nodulation occurs as a result of either inoculation of rhizobia to the seed, or during crop establishment through local populations of rhizobium present in the soil. With good nodulation, soybeans are able to fix enough nitrogen to meet their own crop requirements without any additional nitrogen being applied. If nitrogen is applied, it can result in decreased nodule nitrogen fixation causing a yield reduction.

When determining the amount of phosphorus (P) and potassium (K) required by soybeans, it is important to understand the critical nutrient value in the soil. The critical nutrient value indicates whether or not there are sufficient quantities of the nutrient available to the plant for proper function and development. When a soil test indicates a nutrient is above the critical nutrient value, little or no yield response to applied nutrients will occur. When a nutrient in the soil is approximately equal to the critical nutrient value, little or no yield response will be observed from applied nutrients however, it is important to replace the nutrients lost from the soil supply taken up from the current crop. When a nutrient in the soil supply falls below the critical nutrient value, nutrient application is required to ensure yield potential is met.



Table 1. Soil test values and recommendations for phosphorus and potassium for soybean crops on PEI.

| PEI Analytical Labs Soil Test Value (ppm) | Soil Test Rating | P required (lbs/ac) | K required (lbs/ac) |
|--|------------------|------------------------|------------------------|
| 0 to 157 | L- to L | 50 | 100+ |
| 158 to 269 | M to M+ | 30 | 60 |
| 270 + | H to H+ | 0 | 0 |

It is important that P and K are available in adequate amounts when soybeans are grown in order to meet maximum potential yield. For typical soil test values and fertility recommendations for soybeans on PEI, refer to Table 1. Soybeans will often respond better to nutrients applied in the rotation years versus in season application unless the soil test is low to medium for P and K. If fertility is required in the soybean year, it should be broadcast and incorporated prior to planting. Manure is an excellent source of P and K when available, and is ideally used on fields testing L to M in the rotating years.

Plant tissue analysis can assist in identifying crop growth limitations related to nutrient deficiencies or toxicities. The plant tissue analysis reflects what the plant is able to absorb from the soil and is not a reflection of what nutrients are present in the soil supply.

Soybean tissue analysis is to be done at first flowering. The top fully developed trifoliolate (three leaflet plus stem) from at least 20 plants is collected randomly from the area to be sampled (for a minimum of 100 grams of fresh material). Ensure the sample is free of soil or other debris that would influence results, and place in a paper bag. Problem areas or areas of interest should be sampled separately. Samples should be delivered to the lab for analysis immediately to prevent spoilage.

Similar to the critical nutrient values of soil samples, the critical nutrient concentration of a plant tissue analysis can be used to determine if sufficient nutrients are available in the plant to achieve optimal performance. Critical and maximum normal concentration values for soybean leaf tissues are outlined in Table 2. Tissue concentrations at or below the critical concentration indicates that the level of nutrients are insufficient for maximum crop growth and yield. Although nutrient deficiencies identified by the tissue analysis cannot be corrected within the current crop season, the results can be used as a planning tool for nutrient applications in future crops, or to validate the current crop fertility program. For example, if K is identified as deficient in a tissue analysis you can compare this result with a soil test from the same location to identify if there is not enough K in the soil supply or whether there is another factor limiting the uptake of K, such as low pH or presence of a soil hardpan.

Table 2. Critical nutrient concentration values for soybean leaf tissues for N, P and K.

| Nutrient | Critical Concentration Value (%) | Maximum Normal Concentration Value (%) |
|----------------|----------------------------------|---|
| Nitrogen (N) | 4 | 6 |
| Phosphorus (P) | 0.35 | 0.5 |
| Potassium (K) | 2 | 3 |

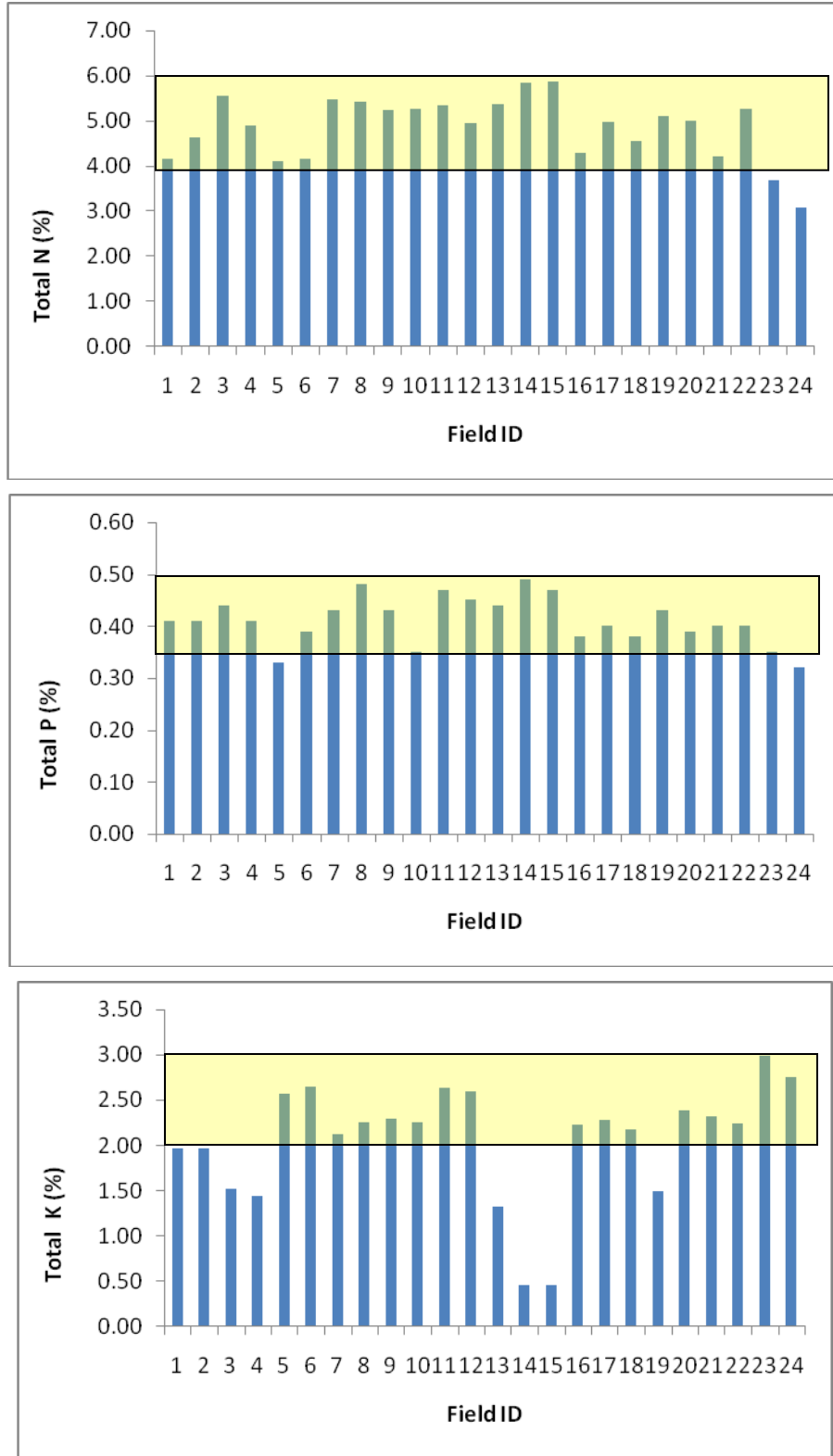


Figure 1. Total N, P and K (%) from soybean tissue analyses from soybean fields surveyed during the 2012 crop season across PEI. Values falling within the yellow shaded area are within the acceptable nutrient value range for soybean tissues.