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Estimating Soybean Yields – Simplified

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Estimating soybean yields prior to harvest can be frustrating and somewhat unreliable. Soybeans have a great ability to compensate for various growing conditions. Early to mid-season stresses can limit the ***number of pods*** that are retained. The potential number of ***seeds per pod*** is driven by growing conditions shortly after flowering no matter the growth stage. In other words, stressful conditions can trigger the development of 1- or 2-seeded pods rather than 3- or 4-seeded pods. Favorable conditions during seed fill will not increase the number of seeds in advanced pods (seed number already determined), but stressful conditions can arrest seed development and reduce the number of seeds in a pod. However, favorable conditions can lead to more pod production and retention as has been seen in many areas with the rains over the past few weeks. Late season rains can also increase yield by extending seed fill and the final ***size of the seeds***.

Pod number, seeds per pod, and seed size are the driving forces of soybean yield. The combination of these factors allows soybean to adapt to growing conditions over long periods (weeks and even months) and still yield well. Though, these same factors can make it difficult to estimate soybean yields prior to harvest.

When Should I Take Yield Estimates?

Any yield estimate improves as you get closer to harvest – soybean or corn. The confidence level increases because the plants have responded to more of the growing season (pod retention, seeds per pod, and seed size). Soybean yield estimates can begin as soybeans enter into R5 (first seed, Figure 1). At this point, a fair portion of the pods have developed and seeds are filling throughout the whole plant. Flowering will continue at a limited rate and will soon cease. Pod development (retention and number of seeds per pod) will lag behind the pattern of the flowering. The yield potential at this point can be low or it can be high depending on the remaining 4 to 6 weeks of the growing season. Yield estimates will improve as the plants continue developing over the following ~15 days and enter R6 (full seed, Figure 2), which last another ~20 days. Pod retention and seeds per pod will become clearer, and the potential for large, average, or small seeds will be more discernible.

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Figure 1. Soybean at R5 (first seed). Seeds are 1/8" long in one of the pods at the top 4 nodes.


Figure 2. Soybean at R6 (full seed). Seeds filling the pod capacity in one pod at top 4 nodes.

Problem With Previous Yield Estimate

Pre-harvest yield estimates have included the plant population as a factor since most people do not want to count all the pods in 1/1000th acre. I do not want to count thousands of pods for one yield estimate of one field! Some try to get around the system by determining the plant population then count the number of pods on a couple of plants. This is not reliable or reproducible. The plant-to-plant variability of soybean can be wide due to numerous factors such as plant spacing, pest pressures, and early season development differences. Let's assume a plant stand of 100,000 plants/acre, and one plant is selected for pod count. If you count the plant that has 25 pods then you would estimate 35 bu/acre. However, if you count the next plant it has 50 pods and the yield estimate would be 70 bu/acre.

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Individual plant production will vary and we must take a representative sample without being extraneous. Every field will have variations based on soils, pests, fertility, and other factors. I have simplified the process of estimating soybean yields, so that you can scout multiple areas quickly while maintaining representative estimates.

The system is based on 1/10,000th acre and the following formula:

$$\boldsymbol{Pods \times Seeds\ Per\ Pod \div Seed\ Size\ Factor = Estimated\ Bushels\ Per\ Acre}$$

Step 1 – Pods

Count the number of pods in 1/10,000th of acre. Yes, 1/10,000th of acre! Nearly 90% of our Indiana soybean acres are planted in 30-, 15-, or 7.5-in rows, so just remember **21**. You will count the number of pods in 1 row for 30-in width, 2 rows for 15-in width, or 4 rows for 7.5-in width to equal 1/10,000th acre (Figure 3). Each one of these counts will be **21 inches** in length.

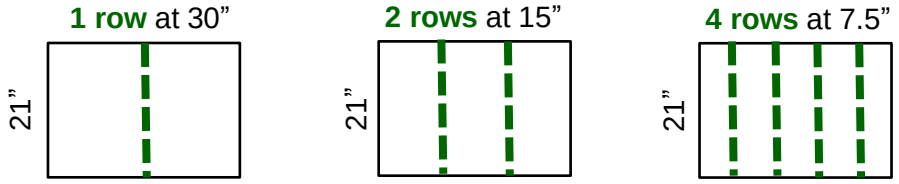

Figure 3. Number of rows to count to equal 1/10,000th of an acre.

We certainly have other row widths, and this simplified system can be adapted to your row width. If you have a different row width, divide 627.26 by your row width (inches) to calculate the linear length (inches) of 1 row to equal 1/10,000th acre. For example, an 18-in row width would require 34.8 inches of 1 row to equal 1/10,000th acre (627.26 ÷ 18 inches).

This simplified system is more reliable when you have 8 or more plants in the sampled area, which translates to 80,000 plants per acre. If plant stands are less than 8, you should count additional areas to decrease the variability of the overall yield estimate for the field. If you want to have an idea of final plant stand, multiply the number of plants sampled by 10,000. However, you do not need plant population to estimate yield with this approach.

You will count the total number of pods in the 1/10,000th acre. You will need to use discretion to which pods you will include in the count. A good rule of thumb is to count the pods that are greater than 1”, with the knowledge that some of the smaller pods may or may not make it.

Step 2 – Seeds Per Pod

The starting point is an average of ***2.5 seeds per pod***, since there can be a range of 1-, 2-, 3-, and 4-seeded pods. This value is conservative since we do not know exactly how the rest of the season will finish. The soybean plants may arrest seed development on several 3-seeded pods or some pods are aborted completely. You can quickly increase or decrease the yield estimate by changing this one value. You can more confidently adjust this value because you are more likely to remember the frequency of 2- or 4-seeded pods within a few hundred pods.

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Step 3 – Seed Size Factor

The starting point is ***seed size factor 18***, which equals a fairly representative seed size of 3,000 seeds per pound. If you expect larger seeds (maybe from late season rains) you will use a smaller seed size factor such as 15 (2,500 seeds per pound). Similarly if seed fill will be limited (i.e., small seeds) due to lack of water or other late season stresses, you should use a larger seed size factor like 21 (3,500 seeds per pound).

Table 1. Seed Size Factors.

Seeds Per Pound	Seed Size Factor
2500 (large seed)	**15**
2666	16
2833	17
3000 (normal seed)	**18**
3166	19
3333	20
3500 (small seed)	**21**

$$\boldsymbol{Pods \times Seeds\ Per\ Pod \div Seed\ Size\ Factor = Estimated\ Bushels\ Per\ Acre}$$

Examples:

A. Good soybean growth, good pod retention, and adequate late season moisture.

$$400\ Pods \times 2.5\ Seeds\ Per\ Pod \div 18 = 55.5\ bu/acre$$

B. Good early soybean growth, fair pod retention, BUT little late season moisture.

$$300\ Pods \times 2.5\ Seeds\ Per\ Pod \div 21 = 35.7\ bu/acre$$

C. Fair soybean growth, limited pod retention, BUT good late season moisture.

$$250\ Pods \times 2.5\ Seeds\ Per\ Pod \div 15 = 41.7\ bu/acre$$

We have soybean yield potential across the board this year from 10 to 60 bu per acre. In fact, some areas will have this range in the same field. The biggest factors will be the number of pods and the seed size, and thus, the examples I provided. Early season drought stress does not mean yields will be devastating nor does great early season growth guarantee good yields. The weather in the last week of July and August will ultimately determine our yield potential.

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