

Estimating the Potential Yield of a Soybean Crop

- Regardless of crop, estimating yield potential can provide information to formulate decisions regarding storage, drying costs, and marketing.
- Potential yield estimates for a soybean crop can be made about the R5 growth stage, but estimates made at the R6 growth stage or later provide better estimates.
- Yield potential is essentially an estimate of four components: number of plants/acre, number of pods/plant, number of seeds/pod, and number of seeds/pound.

Importance of Potential Yield Estimation

Regardless of crop, estimating yield potential can provide valuable information that can be used to formulate decisions regarding storage, drying costs, and marketing. In addition, while gathering potential yield information, weed, insect, disease, and animal pressure can be evaluated. Water, hail, and other environmental issues can also be noted for future reference. As an example, loss of population due to ponding could help influence a drainage decision.

Plant spacing, soil characteristics, pest stress, and seasonal developmental differences can cause considerable plant-to-plant variation. Pod retention can be influenced by early to mid-season stresses and the potential number of seeds/pod is influenced by conditions just after flowering. Favorable conditions during seed fill will not increase the number of seeds/pod but stress conditions may stop seed development and reduce seeds/pod.⁵ Late season moisture may promote additional pod production and retention, extending the seed fill period and potentially increasing the size of seeds. Sampling a few plants to represent a field with a stand of 100,000 plants/acre or more can lead to widely different estimates of yield potential. Therefore, estimate accuracy can be improved by sampling at several field locations.

Timing of Soybean Sampling

Potential yield estimates can be made at the R5 growth stage, but estimates made at the R6 growth stage or later provide better estimates (Table 1).⁵ By the R6 growth stage, flowering ceases and pods are being filled by the developing seeds. The closer the yield estimate is made to physiological maturation, the greater the accuracy. Maturation can be influenced by plant variability, rainfall, and other environmental factors that occur during the seed filling period.

Estimation Techniques

Evaluating Yield Components: Yield potential is essentially an estimate of four components: number of plants/acre, number of pods/plant, number of seeds/pod, and number of seeds/pound. Yield potential can be reasonably estimated by

evaluating these components in at least 5 to 10 sampling sites across a field or product.

- Determine the number of plants/acre by counting the number of pod-bearing plants in 1/1000th acre (Table 2). Multiply the number of plants counted by 1000 to determine plants/acre. (Example: 30" row; 125 plants in 17' 5" = 125,000.
- Estimate pods/plant by counting the number of pods that have at least one seed from 10 randomly selected plants in the 1/1000th acre sample area. Divide the total pod number by 10 to determine the average number of pods/plant.
- Estimate seeds/pod by counting the number of seeds from 10 randomly selected pods. Divide the total number of seeds by 10 to determine the average number of seeds/pod. Generally, seeds/pod is assumed to be 2.5 but this number can fluctuate based on stress during seed fill or soybean product and can range from 1 to 4.⁵
- Estimate seeds/pound (represents seed size) by using 2,500 to 3,000 seeds to represent a normal crop.^{1,2,3,5} This estimates approximate seed size and can vary dependent on growing season conditions. However, size within products remains relatively constant. The seed size from the tag on the original bag of seed may give a reasonable estimate of seed size. If seed size is smaller than normal due to late season stress, a higher number (3,500) should be used.
- One bushel of soybean seed weighs 60 pounds.

A worksheet to help record counts and calculations is available at <http://msue.anr.msu.edu> or other University Extension sites.

Potential Yield Equation:

Yield potential estimate (bu/acre) = (plants/acre x pods/plant x seeds/pod) ÷ seeds/pound ÷ pounds/bushel.

[Example: (125000 x 25 x 2.5) ÷ 2,500 ÷ 60 = 52.08 bu/acre]

Simplified method: A simplified method of estimating yield

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potential may be useful to help increase the intensity of sampling in a field.⁵ This method is based on counting the number of pods that are greater than one inch in length in *1/10,000th acre*. Therefore, the number of pods are counted and recorded on each plant within a length of 21 inches in one row of a 30-inch row spacing; the same length in 2 rows of a 15-inch row spacing; and the same in 4 rows of a 7.5-inch row spacing.⁵ For other row widths, divide the row spacing by 627.26 to calculate the length in inches of a row that is equal to 1/10,000th acre.

This method is more reliable if there are 8 or more plants in each sample area. If there are less than 8 plants/sample, counts should be taken at more field locations to help reduce variability.⁵

The next step is determining seeds/pod. For most situations, an average of 2.5 seeds/pod can be used as a conservative estimate of seeds/pod.⁵

To determine a seed size factor, use an average value of 18, which represents a seed size of 3,000 seeds/lb. Depending on conditions during seed filling this factor can be adjusted to fit

Table 1. Soybean growth stages and approximate days from a growth stage to beginning maturity stage of growth (R7).

Growth Stage	Description	~ Days from Growth Stage to (R7)
R1	Beginning bloom - one open flower at any node on main stem	70
R2	Full bloom - open flower at two one of uppermost nodes with fully developed leaf	65
R3	Beginning pod - pod 3/16 inch long at one of four uppermost nodes with fully developed leaf	55
R4	Full pod - pod is 3/4 inch long at one of four uppermost nodes with fully developed leaf	45
R5	Beginning seed - seed is 1/8 inch long in pod at one of four uppermost nodes	35
R6	Full seed - pod containing a green seed that fills the pod cavity at one of four uppermost nodes	20
R7	Beginning maturity - one normal pod on main stem is mature color (brown or tan)	0
R8	Full maturity - 95% of pods are mature color	-

Sources: Pedersen, P. 2004. Soybean growth and development PM 1945. Iowa State University & Casteel, S. 2010.⁴

the expected seed size (Table 3).

The equation for the simplified method of estimating yield potential is:

$$\text{Pods} \times \text{Seeds/Pod} \div \text{Seed Size Factor} = \text{Estimated bu/acre.}$$

Examples:

Scenario 1. Good soybean growth, good pod retention, adequate late season moisture:

$$400 \text{ Pods} \times 2.5 \text{ Seeds/pod} \div 18 = 55.5 \text{ bu/acre}$$

Scenario 2. Good early soybean growth, fair pod retention, limited late season moisture:

$$300 \text{ Pods} \times 2.5 \text{ Seeds/pod} \div 21 = 35.7 \text{ bu/acre}$$

Scenario 3. Fair soybean growth, limited pod retention, good late season moisture.

$$250 \text{ Pods} \times 2.5 \text{ Seeds/pod} \div 15 = 41.7 \text{ bu/acre}$$

Sources:

- ¹ Staton, M. 2011. Estimating soybean yields prior to harvest. Michigan State University Extension.
- ² Oplinger, E.S. 1998. Estimating soybean yields prior to harvest. University of Wisconsin Extension.
- ³ Lee, C. and J. Herbek. 2005. Estimating soybean yield AGR-188. University of Kentucky.
- ⁴ Casteel, S. 2010. Soybean physiology: how well do you know soybeans? Purdue University.
- ⁵ Casteel, S. 2012. Estimating soybean yields - simplified. Purdue University.
- ⁶ Lindsey, L. 2012. Soybean yield estimates. C.O.R.N. Newsletter, Ohio State University.

Table 2. Length of Row in Various Row Widths Equal to 1/1000th Acre.

Row Width	Length
6	87' 1"
7	74' 8"
7.5	69' 8"
10	52' 3"
15	34' 10"
20	26' 2"
30	17' 5"

Source: Brouder, S., 2010. Corn & Soybean Field Guide. Purdue University.

Table 3. Seed Size Factors for Simplified Method.

Seeds/lb	Factor
2,500 (large seed)	15
2,666	16
2,833	17
3,000 (normal seed)	18
3,166	19
3,333	20
3500 (small seed)	21

Source: Casteel, S. 2012⁵

For additional agronomic information, please contact your local seed representative.

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. **ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.** Leaf Design® is a registered trademark of Monsanto Company. All other trademarks are the property of their respective owners. ©2014 Monsanto Company. 130906033002 09112014LGM