Bluestem Breezes
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Estimating Soybean Yield Potential

This week's column will be the first in a two-part series. Ignacio Ciampitti, K-State Crop Production and Cropping Systems Specialist provides us information on estimating soybean yields through a simplified method. In next week's column, we'll use this information to walk through using K-State's new mobile app for estimating soybean yields: KSUSoyYieldCalc.

Many producers would like to estimate the yield potential of their soybeans well before reaching the end of the season. In contrast with corn, soybean can easily compensate for abiotic or biotic stresses. The final number of pods is not determined with finality until close to the end of the season (R5 stage). Thus, when estimating soybean yield potential, we have to keep in mind that the estimate could change depending on the growth stage at the time the estimate is made and weather conditions. For example, wet periods toward the end of the reproductive period can extend the seed-set period, promoting greater pod production and retention, with larger seed size and heavier seed weight.

From a physiological perspective, the main yield driving forces are: 1) plants per acre, 2) pods per area, 3) seeds per pod, and 4) seed size. Estimating final yield in soybean before harvest can be a very tedious task, but a simplified method can be used for just a basic yield estimate. This method is based on an article by Dr. Shaun Casteel (Soybean Specialist, Purdue University). For details, see:
http://www.agry.purdue.edu/ext/soybean/News/2012/2012_0814SOYSimplifiedYieldEstimates.pdf

When can I start making soybean yield estimates?
There is not a precise time, but as the crop approaches the end of the season (R6, full seed or R7, beginning of maturity) the yield estimate will be more accurate. Still, you can start making soybean yield estimates as soon as end of the R4 stage, full pod (pods are 3/4 inch long on one of the top four nodes), or at the onset of the R5 stage, beginning seed (seeds are 1/8 inch long on one of the top four nodes), knowing that the yield prediction is less precise at those early stages.

Is plant variability within the field an issue in soybean?
Variability between plants relative to the final number of pods and seed size needs to be considered when trying to get an estimation of soybean yields. In addition, variability between areas within the same field needs also to be properly accounted for (e.g. low vs. high areas in the field). Yield estimations should be made in different areas of the field, at least 6 to 12 different areas. It is important to properly recognize and identify the variation within the field, and then take enough samples from the different areas to fairly represent the entire field. Within each sample section, take consecutive plants within the row so as to have a fairly good representation.

Simplified approach to estimating soybean yields

The main difference between the "conventional" and "simplified" approaches is that the conventional approach uses the total number of plants per acre in its calculation; while in the simplified approach, a constant row length is utilized to represent 1/10,000th area of an acre.

Driving forces of soybean yield

1) Total number of pods per acre: The total number of pods within this constant row length should be counted. After counting all the plants within the 21-inch row sections that represent 1/10,000th of an acre, a final pod number per acre can be estimated. A similar procedure should be used in different areas of the field to get a good overall estimate at the field scale. One good criterion is to only consider pod sizes that are larger than ¾ or 1 inch long. Smaller pods can be aborted from this time on in the growing season until harvest.

2) Total number of seeds per pod: Soybean plants will have, on average, 2.5 seeds per pod (ranging from 1 to 4 seeds per pod), primarily regulated by the interaction between the environment and the genotypes. Under severe drought and heat stress, a pessimistic approach would be to consider an average of 1-1.5 seeds per pod. This value is just an approximation of the final number of seeds per pod, and can change from the time the estimate is made until the end of the growing season.

3) Seed Size: Seed size can range from 2,500 (normal to large seed weight) to 3,500 (small seed size) seeds per pound. This season, conditions are mostly favorable in Kansas for promoting large seed sizes. In more stressful years, such as 2012 and 2011, seed size is normally smaller, meaning a larger number for the seeds per pound (e.g. 3,500 seeds per pound). In the simplified estimation approach published by Dr. Casteel, you do not need to actually measure the number of seeds per pound in order to estimate yields, as is done in the conventional approach. Instead, a seed size conversion factor is used. If the conditions are favorable and large seed size is expected, the conversion is 15 units; while if abiotic or biotic stresses are present during the seed-filling period, a seed size factor of 21 units is used.

Check back next week for examples of using the simplified method to estimate soybean yields and details for running K-State's new mobile app.

For additional information, visit the Extension Office (215 Kansas, Courthouse, Alma; kamayer@ksu.edu; 765-3821). For Bluestem Breezes archives, check out wabaunsee.ksu.edu.

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August 31, 2015

Mobile App for Estimating Soybean Yields

This week's column is the second in our two-part series. Ignacio Ciampitti, K-State Crop Production and Cropping Systems Specialist walks us through using the new FREE mobile app for estimating soybean yields. And, he provides us examples of manually estimating yields through a simplified method.

If you have an Android device, there is a "free" mobile Web-App that can help estimate soybean yields before harvest. The app is called "KSUSoyYieldCalc." Complete information can be found at: https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=635

The KSUSoyYieldCalc has only four inputs for predicting the final yield:

1. Plant population (plants/acre). This component can be estimated by counting the number of plants in a 21-inch row length for 30" row spacings ($1/10{,}000^{th}$ area), and by multiplying that number by 10,000.

2. Pods per plant. Count all pods per plant in the 21-inch row length (total 10 boxes – 10 plants);

3. Seeds per pod. A good average number is 2.5 seeds per pod, but the range presented in this web-based app is from 1 to 4 seeds per pod;

4. Seed size. Seed size typically ranges from 2,500 (large) to 3,500 (small seeds) seeds/lb, with an average of 3,000 seeds/lb.

Inputs 1, 2, and 3 – The number of rows to sample will depend on the row spacing. With 30-inch row spacings, sample one row. With 15-inch row spacings, sample two rows. With 7.5-inch row spacings, sample four rows.

The last factor "seed size" is the same as the one presented in the "conventional approach." This factor normally varies from 2,500 to 3,500 seeds/lb. If the conditions until harvest will be favorable, then the "seed size" component should be a lower number (e.g., 2,500 seeds/lb). If conditions are likely to be unfavorable, resulting in a short seed-fill period, then this factor should be higher (e.g., 3,500 seeds/lb). This factor will be ultimately determined as the crop approaches maturity, but an estimation is needed considering the importance of this factor for influencing final soybean yields.

For additional instructions on sampling, refer to last week's "Bluestem Breezes" column.

Once all these components are estimated in the field, the numbers can be entered into the KSUSoyYieldCalc app.

If you prefer to run the math yourself, here is an example of the simplified approach for estimating soybean yields:

Let's say that we have 120,000 plants/acre in a 30-inch rows. Then, we should have around 12 plants in 21 inches of row. In those 12 plants, we have measured on average 22 pods per plant, with a total number of 264 pods (22 x 12).

1) If we assume a "normal" growing season condition, then the final seeds per pod will be around 2.5, and for the seed size factor, we can assume large seeds, and will use a conversion factor of 15 units.

Equation for a "Favorable" Season: 264 pods x 2.5 seeds per pod / 15 = 44 bushels per acre

2) For a "droughty" (late reproductive, from R2 to R6 stages) growing season, the final seed number and size will be dramatically affected. Thus, even if the pod number is the same as in a normal season, the yield calculation could be:

Equation for a "Drought" Season: 264 pods x 1.5 seeds per pod / 21 = 19 bushels per acre

This "simplified approach" basically relates the total number of pods in a "known" unit area (easily extrapolated to the acre unit), and is affected by the total number of seeds in the pod. This is adjusted by the estimated seed weight, which is affected by two main components: duration of seed fill and rate of dry mass allocation to the seeds.

More examples on how to use the App and estimate yields:

You can download from the Google Play link:
https://play.google.com/store/apps/details?id=com.ksu.tania90.soya1

For more information on how to estimate soybean yields, check the following resources:
"Simplified-Approach" Purdue University
http://extension.entm.purdue.edu/pestcrop/2012/issue21/index.html

"Conventional-Approach" University of Kentucky
http://www2.ca.uky.edu/agc/pubs/agr/agr188/agr188.pdf

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