Agronomic Spotlight

Assessing Corn Yield Potential

- Assessing corn yield potential can help when making harvest decisions.
- Corn yield can be estimated as early as the R3 (milk) growth stage using the yield component method.
- Once corn reaches physiological maturity the ear weight method can be used.
- Historical, normal growing degree unit (GDU) averages can be used to determine the approximate time between corn growth stages or estimate when corn will reach physiological maturity.

Estimating corn yield potential prior to harvest can help to plan harvest and feed supply or marketing decisions. Keep in mind that environment stress during grain fill may have an impact on yield potential. Losses may be the result of stand reduction, incomplete kernel set, decreased kernel weight or premature plant death.[1] The yield component and the ear weight methods are two techniques used to estimate corn grain yield potential prior to harvest. Each method may produce yield estimates that are within 20 bu/acre of actual yield.[2,3]

Crop uniformity has a large influence on the accuracy of any estimation method. Random sampling should be conducted throughout a field to provide the best yield estimate. One sample for every 10 to 15 acres is sufficient unless conditions are variable. More samples will be needed to represent a non-uniform field and improve the accuracy of the estimate.

Yield Component Method

This method can be used as early as the R3 (milk) stage of corn growth. It is risky to make estimates prior to R3 because stresses can affect kernel development and may cause kernel abortion.[3] This method is based on the assumption that grain yield can be estimated using the number of ears per acre, number of kernel rows per ear, number of kernels per row, and kernel weight. The first three components can be measured from field samples, but kernel weight is unknown until physiological maturity and must be represented by a calculated factor. The average value for kernel weight (90) is derived using 85,000 kernels per 56 pound bushel. Some agronomists think that 80 to 85 is a more appropriate factor for current use as kernel size has increased since this formula was first developed.[3]

Step 1. At each sample site, measure 1/1000th of an acre (17 feet, 5 inches for 30-inch rows or 23 feet,10 inches for 22-inch rows) then count and record the number of harvestable ears. Do not sample ears that are considered nubbins, abnormal, or have aborted kernels and do not count dropped ears or ears on severely lodged plants. Only count where there are complete rings of kernels around the cob and avoid counting kernels on the extreme ends of the ear.[3]

Step 2. Count the number of kernel rows per ear on every fifth ear and determine the average.

Step 3. On the same fifth ears, count the number kernels per row and determine the average.

Step 4. To determine an estimate of yield potential per acre at each sample site, multiply the number of ears times the average number of rows times the average number of kernels and divide by 90 or the factor that best represents growing conditions (Table 1).

Table 1. Kernel Number/bu Based on Growing Conditions During Grain Filling.[3]

Growing Conditions	Factor	Range in Kernel Number/bu.
Excellent	**75 to 80**	**75,000 to 80,000**
Average	**85 to 90**	**85,000 to 90,000**
Poor	**95 to 105**	**95,000 to 105,000**

Step 5. Repeat this procedure at a representative number of sample sites in the field. Calculate the average yield potential for all of the sites to get an estimate of the yield potential of the entire field.

Example: Harvestable ear count is 30. The average number of kernels per ear from every fifth ear is 511. Growing conditions were average (85° F). The estimated yield potential for that site would be (30 X 511) divided by 85, or a 180 bu/acre estimate of yield potential.[3]

Poor conditions during grain filling can cause lower kernel weight, which can result in an underestimation of yield potential using the yield component method. Conversely, the method can overestimate yield potential if kernel weight is higher than normal, during superior growing conditions.[2] Kernel size and weight can vary by corn product and environmental conditions, which can compromise the accuracy of the estimate.

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Ear Weight Method

The ear weight method should only be used after corn has reached physiological maturity. This method may be more accurate than the yield component method because it is based on actual kernel weight. It does have a factor to account for average shellout percentage.[2]

Sample several representative sites in a field. Count the number of harvestable ears in 1/1000th of an acre at each site. Weigh every fifth ear and calculate the average ear weight per site. Hand shell kernels from those ears and determine the average grain moisture content with a moisture tester.

Calculate the estimated yield potential by:

Step 1. Multiply the number of ears by the average ear weight.

Step 2. Multiply average grain moisture content by the factor 1.411.

Step 3. Add 46.2 to the average grain moisture content (step 2).

Step 4. Divide result from step 1 by the result from step 3.

Step 5. Multiply result from step 4 by 1,000.

Example: The number of harvestable ears is 24. Average ear weight of every fifth ear is 0.5 pound. The average grain moisture content is 30%. The estimated yield potential is [(24 x 0.5) divided by (1.411 x 30) + 46.2)] times 1,000, or 135 bu/acre.[2]

There are several other methods to estimate corn yield potential that are less widely used than the yield component and ear weight methods.[6]

Predicting Corn Harvest Date

Corn growth and development is driven by temperatures with faster growth occurring during warm temperatures and slower growth during cool temperatures. GDUs represent the daily accumulation of heat between 50° and 86° F, the limits of corn growth. Historical normal GDU averages can be used to determine the approximate time between corn growth stages or to estimate when corn will reach physiological maturity (Tables 2 and 3). Estimating the time required to reach physiological maturity can help determine harvest or drying and storage options.

Table 2. Corn reproductive growth stages with estimated calendar days and growing degree units (GDU) by stage for a typical 120 day corn product in the corn belt.[5]

Growth Stage	Approximate Kernel Moisture[7]	Days to Black Layer	Percent Total GDUs Accumulated	GDUs to Black Layer
R3 - Milk	80%	36	72.5%	775
Late Milk		32	76%	675
R4 - Dough	70%	28	79.5%	575
Early Dent		24	83%	475
R5 - Dent	55%	20	87%	375
Late Dent		15	91%	250
R6 - Mature (black layer)	30-35%	0	100%	0

Field drydown rate from 30 to 25% is 0.75% per day or to get below 25%, 0.25% per day.[4]

Table 3. Relationship between kernel growth stage and development (~100 day relative maturity corn product).

Growth Stage	Calendar Days to Maturity (Average)	GDUs to Black Layer*	% of Maximum Grain Yield	Approximate % Kernel Moisture
Silk (R1)	55-60	1100-1200	0	—
Blister (R2)	45-50	875-975	0-10	85-95
Late Milk-Dough (R4)	35-40	650-750	30-50	60-80
Early Dent (R5)	25-30	425-525	60-75	50-55
Fully Dented (5.5 to 5.75)	13-17	200-300	90-95	35-40
Physiological Maturity (R6)*	0	0	100	25-35

*Black layer formation and/or milk disappearance from kernels under development. Premature frost or extended cold temperatures may cause black layer formation at earlier stages and wetter moistures.

Source: Corn development. 2013. University of Wisconsin Department of Agronomy. http://corn.agronomy.wisc.edu

Sources:
[1] Nielsen, R.L. 2011. Effects of stress during grain filling in corn. Corny News Network, Purdue University.
[2] Thomison, P. 2010. "Predicting" corn yields prior to harvest. C.O.R.N. newsletter. Ohio State University.
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[4] Bergland, D.R. and Endres, G.J. 1999. Corn growth and management quick guide. North Dakota State University.
[5] Hall, R.G. Corn growth stages with estimated calendar days and growing-degree units. South Dakota State University.
[6] Lauer, J.L. 2002. Methods for calculating corn yield. Agronomy Advice. University of Wisconsin.
[7] Nielsen, R.L. 2008. Grain fill stages in corn. Corny News Network, Purdue University.
Web sources verified 08/31/2015.

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development, & Agronomy by Monsanto.