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Agronomy Advice

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Methods for Calculating Corn Yield

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Predicting corn yield prior to harvest is often useful for yield monitor calibration, and for making feed supply and marketing decisions. The BEST and most accurate method for estimating yield, other than weighing harvested grain from the entire field, is to harvest and weigh representative samples from a plot area after plants have reached physiological maturity. Below are a number of methods for calculating corn grain yields listed in order of decreasing accuracy. To properly calculate yield you must determine grain moisture, harvested area and grain weight.

Determining Moisture

Remember, corn yields are standardized to 15.5% moisture and 56 pounds per bushel. Obtain a grain moisture sample by removing several rows of corn kernels the full length of 10 randomly selected ears from each row sampled and thoroughly mix the grain. Place grain in moisture proof container to avoid moisture loss. Establish moisture content with an accurate moisture determination system.

Determining Harvested Area

Machine Harvest

Measures the total row length of the area harvested and multiply the average row width. Measure length of row with a measuring wheel when row lengths are greater than 100 feet. For row lengths less than 100 feet use a steel tape. Be sure to measure the width of the strip at several places to account for the “guess” rows. The measured area must include half the distance between the first and last rows harvested and the ones next to them not harvested in the area.

For example, if 2000 feet are harvested “down and back” with a six-row corn head, and the average row width is 30 inches (2.5 feet) the calculations are:

(6 rows) x (2 passes) x (2000 feet) x (2.5 feet) divided by 43560 feet^2 per acre = 1.38 acre

Hand Harvest

Yield should be determined at 5 to 10 sites in the field and the average reported. In a 1/1000th acre area, collect and count all harvestable ears. Table 1 gives row length equal to 1/1000th acre for several row widths. A larger area of 1/100th acre is preferable and can be obtained by harvesting 10 rows.

Table 1. Row length equivalent to 1/1000th acre at various row widths.

Row width	Length for 1/1000th acre
inches	feet inches
7	74’ 10”
15	34’ 10”
20	26’ 1”
22	23’ 10”
30	17’ 5”
36	14’ 6”
38	13’ 10”
40	13’ 1”

Determining Grain Weight (Shelling Percentage)

Weigh 10 randomly selected ears. Shell ears and weigh grain. Calculate shelling percentage using (grain weight / ear weight) x 100. Shelling percentages of normal ears usually average about 80% when fields are ready for combine harvest (20 to 25% grain moisture).

Method for Calculating Machine Harvested Corn

For **grain corn**, first determine acreage harvested as described above. Calculate pounds of dry matter (1-grain moisture %) and convert to 15.5% moisture. Finally divide acreage and test weight of 56 pounds per bushel.

For example, if the total grain weight from 1.38 acre is 15,000 pounds at 22 % kernel moisture (1-0.22=0.78), the yield is calculated as follows:

15,000 pounds x 0.78 = 11,700 pounds dry matter

11,700 ÷ 0.845 = 13,846 pounds at 15.5% moisture

13,846 ÷ 56 = 247 bushels at 15.5% moisture

247 bushels ÷ 1.38 = 179 bushels per acre at 15.5% moisture

For **ear corn**, determine acreage harvested, total ear weight, and kernel moisture. Use Table 2 to find the pounds of ear corn required for a bushel of 15.5% shelled corn.

For our example above, suppose we harvested 18,820 pounds of ears at 22% kernel moisture (use Table 2) from 1.38 acre with a corn picker, the calculations would be:

18,820 ÷ 76.2 pounds ear corn at 22% moisture per shelled corn equivalent at 15.5% moisture = 247 bushels at 15.5% moisture

247 bushels ÷ 1.38 acre = 179 bushels per acre at 15.5% moisture

Method for Hand Harvested Shelled Corn

This method is similar to methods for machine harvest. Take special care in measuring area.

Weigh grain from $1/1000^{th}$ acre and measure total grain weight and moisture.

Calculate percent dry matter = (1 – grain moisture %)

Multiply grain weight x percent dry matter x 1000 = Pounds of dry matter per acre

Now dry matter per acre must be converted to 15.5% moisture (1 - 0.155 = 0.845) and a test weight of 56 pounds per bushel. The calculations are:

Pounds of dry matter per acre ÷ 0.845 = Pounds of grain at 15.5% moisture

Pounds of grain at 15.5% moisture ÷ 56 = Bushels of per acre at 15.5% moisture

For example, suppose we harvest 10 pounds of grain from $1/1000^{th}$ acre at 22% moisture.

10 X 0.78 X 1000 = 7800 pounds of dry mater per acre

7800 ÷ 0.845 = 9231 pounds per acre at 15.5% moisture

9231 ÷ 56 = 165 bushels per acre at 15.5% moisture

A short cut to these calculations is to harvest $1/1000^{th}$ of an acre of corn, determine total weight and moisture content, convert total weight to total dry matter content and then multiply by 21.13.

Using our example above:

10 x 0.78 = 7.8 pounds dry matter

7.8 x 21.13 = 165 bushels per acre at 15.5% moisture

Method for Hand Harvested Ear Corn

Refer to Table 2 to determine the pounds of corn required for 1 bushel.

Weigh the collected ear corn from 1/1000th acre, shell a small sample (3 ears), and determine moisture percent using either a moisture meter or oven.

Divide the pounds of corn harvested by the appropriate bushel weight from Table 2. This will be the amount of No. 2 corn in 1/1000th of an acre. Multiplying by 1,000 will give bushels per acre.

The formula to use is:

[(pounds of harvested ear corn) / (factor from table 2)] x 1000 = bushels per acre

For example, if 13.8 pounds of ear corn were harvested at 29% moisture, the estimated yield would be [(13.8 ÷ 86.7) x 1,000] = 159 bushels per acre

Table 2. Pounds of corn required to equal one bushel of Number 2 shelled corn (at 15.5% moisture) when corn is harvested at various moisture levels. Derived from Purdue University AES Circular 472 (*in* S.R. Aldrich and E.R. Leng. 1965. Modern Corn Production. F.&W. Publishing Corporation, Cincinnati, OH).

Percent moisture in corn	Pounds of shelled corn needed to equal one bushel	Pounds of ear corn needed to equal one bushel
%	pounds	pounds
11.0	53.17	63.3
12.0	53.77	64.2
13.0	54.39	65.2
14.0	55.02	66.2
15.0	55.67	67.3
15.5	56.00	67.8
16.0	56.33	68.4
17.0	57.01	69.6
18.0	57.71	70.8
19.0	58.42	72.1
20.0	59.15	73.4
21.0	59.90	74.8
22.0	60.67	76.2
23.0	61.45	77.7
24.0	62.26	79.2
25.0	63.09	80.7
26.0	63.95	82.2
27.0	64.82	83.7
28.0	65.72	85.2
29.0	66.65	86.7
30.0	67.60	88.2
31.0	68.58	89.9
32.0	69.59	91.7
33.0	70.63	93.6
34.0	71.70	95.6
35.0	72.80	97.7
36.0	73.94	99.9

Method using Corn Ear Weight

The ear weight method can only be used after the grain is physiologically mature (black layer), which occurs at about 30-35% grain moisture. Since this method is based on actual ear weight, it should be somewhat more accurate than other methods listed below. However, there still is a fudge factor in the formula to account for average shelling percentage.

Sample several sites in the field. At each site, measure off a length of row equal to 1/1000th acre. Count the number of harvestable ears in the 1/1000th acre. Weigh every fifth ear and calculate the average ear weight (pounds) for the site. Hand shell the same ears, mix the grain well, and determine average percent grain moisture with a portable moisture tester.

Calculate estimated grain yield using the ear weight method as follows:

Multiply ear number by average ear weight.

Multiply average grain moisture by 1.411.

Add 46.2 to the result in step 2.

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

Multiply the result from step 4 by 1,000.

For example, you evaluate a field with 30-inch rows and count 24 ears (per 17 ft. 5 in. section). Sampling every fifth ear resulted in an average ear weight of ½ pound. The average grain moisture was 30 percent. Estimated yield would be:

[(24 x 0.5) / ((1.411 x 30) + 46.2)] x 1,000 = 135 bushels per acre.

Method using Corn Ear Length (Hicks, MN)

This method is less accurate than others described above due to the “fudge” factors used in its calculation, but it is a relatively quick and easy way to get an idea of grain yield.

Determine row width

Measure 30 feet of row length

Count the number of ears on two adjacent rows and determine an average

Find the yield at the intersection of row width and average ear number in Table 3.

Husk ears from 10 consecutive plants and determine the average length of ear with kernels. Yields in Table 3 assume half-pound dry ears 7.5 inches long. Use Table 4 to adjust the yield if ear length is shorter or longer (multiply the yield from Table 3 by the appropriate factor in Table 4).

When the number of ears on 30 feet of row is not included in Table 3, you can estimate the value. For example, suppose you have 30 ears and a 30-inch row spacing. Extrapolate between the yields given for 29 and 31 ears to arrive at 124 bu/A. Another alternative is to determine the value of 15 ears, which is 62 bu/A and double it to obtain an estimate of 124 bu/A.

Table 3. Corn grain yields for various numbers of ears in 30 feet of row and various row spacings. Values are based on an average ear dry weight of 0.5 pounds.

Number of ears in 30 feet of row	Row width (inches)				
	15	20	30	36	38
	Bushels per acre				
13	106	80	54	45	43
15	124	93	62	52	49
17	144	107	70	58	55
29	155	117	79	66	62
21	164	125	86	72	69
23	191	143	95	79	75
25	206	155	104	86	81
27	223	167	112	92	87
29	240	180	120	99	94
31	256	192	128	107	101
33	274	205	136	114	108
35	289	217	145	121	114
37	306	229	153	127	120
39	323	242	161	134	127
41	339	254	169	141	133

Table 4. Adjustment factors for estimating corn grain yield with differing average ear lengths.

Average ear length	Factor
5.0	0.4
6.3	0.6
7.0	0.8
7.5	1.0
8.2	1.2
9.0	1.4

Method using Corn Yield Components (also referred to as the "slide rule" or corn yield calculator)

The yield component method was developed by the Agricultural Engineering Department at the University of Illinois. The principle advantage to this method is that it can be used as early as the milk stage of kernel development. The yield component method involves use of a numerical constant for kernel weight that is figured into an equation in order to calculate grain yield. This numerical constant is sometimes referred to as a "fudge-factor" since it is based on a predetermined average kernel weight.

Since weight per kernel will vary depending on hybrid and environment, the yield component method should be used only to estimate relative grain yields, i.e. "ballpark" grain yields. When below normal rainfall occurs during grain fill (resulting in low kernel weights), the yield component method will OVERESTIMATE yields. In a year with good grain fill conditions (resulting in high kernel weights) the method will underestimate grain yields.

Because it can be used at a relatively early stage of kernel development, the Yield Component Method may be of greater assistance to farmers trying to make a decision about whether to harvest their corn for grain or silage. If stress conditions, such as drought, have resulted in poorly filled small ears, there may be mechanical difficulties with sheller or picker efficiency that need to be considered. Corn yield "calculators" that count kernel number roughly estimate yield and produce yield estimates that are within 20 bushels per acre of actual yield.

Calculate estimated grain yield using the Yield Component Method as follows:

Count the number of harvestable ears in a length of row equivalent to 1/1000th acre.

On every fifth ear, count the number of kernel rows per ear and determine the average. Try to use a system such as the 5th, 9th, and 13th ears from one end of the row.

On each of these ears count the number of kernels per row and determine the average. (Do not count kernels on either the butt or tip of the ear that are less than half the size of normal size kernels.)

Yield (bushels per acre) equals (ear number) x (average row number) x (average kernel number) divided by 89.605* = bushels per acre

*or multiply by 0.01116

Repeat the procedure for at least four additional sites across the field.

For example, you are evaluate a field with 30-inch rows and counted 24 ears (per 17' 5" = row section). Sampling every fifth ear resulted in an average row number of 16 and an average number of kernels per row of 30. The estimated yield for that site in the field would be (24 x 16 x 30) divided by 89.605 = 128 bushel per acre.