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Information

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Nutrient Management

NM - 4
Revised September 2004

ESTIMATING CORN GRAIN YIELD

Corn grain is an important feed crop grown in Maryland. Of all the grain crops, corn is highest in total digestible nutrient content. It assimilates relatively large amounts of available nutrients from the soil. Its ability to remove large quantities of nutrients, especially nitrogen can affect the fertilizer management practices on a field, particularly the amount of nitrogen that should be applied.

Realistic Yield Goal

The primary criterion used to determine how much nitrogen should be applied to (or how much phosphorus may be removed from) a field is based on the establishment of a realistic yield goal. A long-term realistic yield goal for corn grain can be established by estimating or measuring (weigh wagons, etc.) the average grain yield on a given field or management unit over a number of years. There are several acceptable methods that may be used to derive such an estimate.

State Regulations

The State of Maryland Nutrient Management Regulations require that nitrogen application rates for corn grain be based upon the expected crop yield for a specific field or management unit. In the absence of long-term, site-specific yield records, yield goals can either be based upon established yields from nearby fields with similar soil types and management conditions, or from soil productivity information.

Soil productivity information, which is based on soil properties, can be found in a soil survey manual and in Maryland's Agronomic Soil Capability Assessment Program (MASCAP). However, this published information is sometimes out of date due to crop cultivar improvements and other advances in technology that influence crop yields. Published yield estimates may be lower than actual yields obtained by a good farm manager, and thus using published estimates may result in the under application of nutrients.

For example, if a producer is able to show that his long-term corn grain yield is 150 bushels per acre, and the published grain yield estimate is 125 bushels per acre, the producer could and should apply 150 pounds of N rather than the 125 pounds recommended for the lower yield. Long-term, site-specific yield records will be the most reliable means for determining nitrogen application rates.

Methods of Estimating Yield

There are several different options to measure corn grain yield.

One option is the yield monitor, which utilizes satellite technology to provide yield measurements at different locations in a field and determines an average yield for that entire field.

Another option to measure corn grain yield is to harvest the grain with a combine and transfer the grain from the combine to a weigh wagon. A third option is to transfer the harvested grain from the combine to a truck, which is then driven to a location where there are drive-on scales.

An accurate measure of the amount of grain actually harvested can be determined by dividing the harvested grain weight by the exact acreage harvested.

However, if none of the previous options are practical or the exact field acreage is unknown, a simple, alternate method can be used to estimate grain yield.

In fields impacted by foraging wildlife, a weighed yield at the time of harvest will result in a lower estimate of yield than what was actually produced in the field.

In this situation, an alternate method for estimating the average grain yield is highly desirable.

Best Time to Estimate Yield

Corn grain yield should be estimated as close to harvest time as possible.

Equipment Needed

- Hanging scale
- Tripod
- Tub with rope for weighing collected corn ear samples
- 5-gallon buckets or bushel baskets
- Tape measure

Choosing & Locating Areas

Locations of sampling sites within fields are predetermined. The first step in estimating corn grain yield is to randomly select 5 areas in the field to sample. It is very important to **randomly** select sample areas so that preference is not shown toward better areas of the field. Figure 1 illustrates an example of 5 randomly chosen sample areas.

In order to locate each sample area,
(1) count the number of rows across the field width (**do not count turn rows**), and
(2) determine the length of the outside row by counting the number of paces (**do not count turn rows**).

The information in Table 1 (see page 3) represents how the 5 randomly selected sample areas in Figure 1 are located in a field.

Figure 1. Example grid showing 5 randomly selected sample areas in a field.

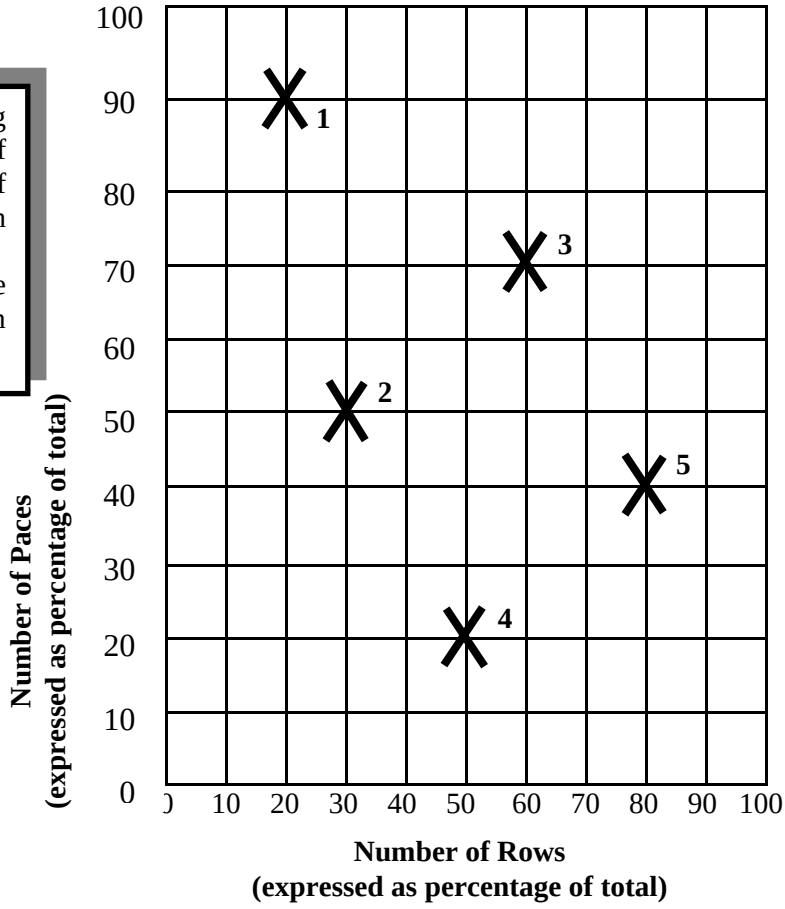

Table 1. Values used to describe the sample areas depicted in Figure 1.

Sample Area	Sample Row	Number of Paces in Sample Row to the Sample Area
1	*0.20* **x** total number of rows	*0.90* **x** total number of paces
2	*0.30* **x** total number of rows	*0.50* **x** total number of paces
3	*0.60* **x** total number of rows	*0.70* **x** total number of paces
4	*0.50* **x** total number of rows	*0.20* **x** total number of paces
5	*0.80* **x** total number of rows	*0.40* **x** total number of paces

Obtaining Yield Samples & Determining Yield

The next step in estimating corn grain yield is to obtain yield samples and measure the yield. The procedure is described stepwise for obtaining samples, determining moisture content and calculating yield.

Obtain and Weigh Corn Ear Samples

(1) Weigh the tarp or tub to be used or place it on the hanging scale and tare the scale to zero.
(2) Measure the row spacing in inches between the rows.
(3) Using Table 2, determine the corresponding row length that needs to be sampled (the product of row length x row width represents about $1/1000^{th}$ of an acre).
(4) Using Figure 1 as a guide, enter the field and harvest the exact areas as planned.

If the planned sample area shows evidence of severe yield limitation (such as planter skip, wildlife damage, etc.) as an isolated occurrence and is not representative of the rest of the field, continue along the row until out of the damaged area.

Take 5 additional paces and measure the sample area from that point.

(5) Pick **all** the ears within the designated row length. Strip the ears of husks and place them in a bucket or basket.
(6) Weigh and record the weight of corn ears from each sample area. Make sure the tub hangs freely – not touching or resting on anything but the scale.
(7) Repeat this sampling procedure for the remaining sample areas.

Table 2. Row spacing and corresponding row length for $1/1000^{th}$ acre sample area.

Row Spacing	Row Length to Sample
36"	14'6"
30"	17'5"
20"	26'
15"	34'10"

Determine Grain Moisture Content

(8) Randomly select 1-2 ears from each of the five samples.
(9) Shell the grain and mix the kernels thoroughly from each sample. Select a small quantity from each sample and mix well for moisture determination.
(10) Take the composite corn grain sample to a grain elevator where percent moisture can be measured with a moisture meter

OR

use a canister-type moisture meter to estimate moisture

OR

weigh a portion of the sample, then dry it for 3 days in a conventional oven at 150 degrees Fahrenheit and weigh again. To calculate percent moisture for each sample, use Equation 1 (see page 4). The first step in the calculation is to subtract the oven dry weight from the fresh weight. That number (weight of water or moisture) is then divided by the fresh weight to obtain the proportion of moisture. Multiply the proportion of moisture by 100 to obtain the percent moisture in corn grain.

Equation 1
Corn Grain Percent Moisture

$$\left(\frac{\text{fresh weight - dry weight}}{\text{fresh weight}}\right) \times 100 = \%\ \text{moisture}$$

(11) Record percent moisture.
Note: Microwaving the sample for moisture determination is **not** recommended.

Calculate Corn Grain Yield

(12) Find in Table 3 and record the equivalent weight (lbs.) of corn ears at the calculated average moisture percent.
(13) Use Equation 2 (see page 5) to calculate grain yield expressed as bushels of corn grain per acre @ 15.5% moisture.

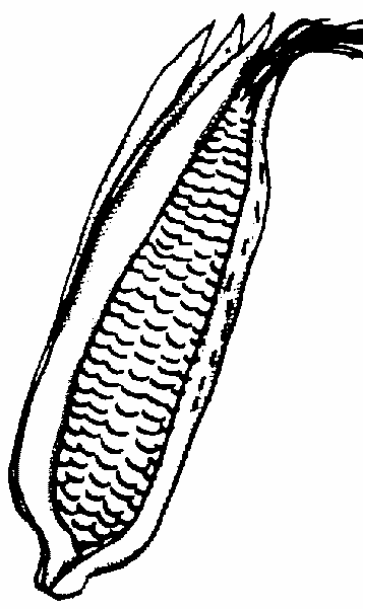

Table 3. Equivalent weight of corn ears (weight of corn ears at a range of moisture contents equal to 1 bu shelled corn grain @15.5% moisture).

Grain Percent (%) Moisture	Total Weight of Corn Ears as Pounds (lbs.)
11.0	66.04
11.5	66.50
12.0	66.97
12.5	67.46
13.0	67.97
13.5	68.49
14.0	69.02
14.5	69.57
15.0	70.13
15.5	70.70
16.0	71.28
16.5	71.87
17.0	72.47
17.5	73.09
18.0	73.71
18.5	74.34
19.0	74.98
19.5	75.62
20.0	76.28
20.5	76.94
21.0	77.60
21.5	78.27
22.0	78.94
22.5	79.62
23.0	80.31
23.5	80.99
24.0	81.68
24.5	82.37
25.0	83.06
25.5	83.75
26.0	84.44
26.5	85.14
27.0	85.83
27.5	86.53
28.0	87.22
28.5	87.91
29.0	88.61
29.5	89.30
30.0	90.00
30.5	90.69
31.0	91.39
31.5	92.08
32.0	92.78
32.5	93.48
33.0	94.18

Adapted from the Agronomy Guide, Penn State University

Equation 2 - Corn Grain Yield Estimate

$$bu_{@\ 15.5\%\ moisture}/A = \frac{\text{(total weight of moist ears harvested in lbs.) X 1000*}}{\text{(5^) (equivalent weight of corn grain in lbs.)}}$$

***There are 1000 sampling units in an acre.**
^There are 5 sample areas in a field.

Corn Grain Estimate - An Example

A corn grain yield check was done for Field 1A on the Garfield farm. Measured row spacing was 30 inches. There were 90 rows (not counting the turn rows) and the distance of the outside row was 150 paces. Weights (lbs.) of the corn ears harvested from each of the five sample areas were 10, 9, 11, 14 and 12, and the percent moisture for a composite sample was 22.5.

Pre-Determine Sample Areas

Total # of rows = 90
Total # of paces = 150

Sample Area	Sample Row	Number of Paces in Sample Row to Sample Area
1	0.8 x 90 = 72	0.4 x 150 = 60
2	0.6 x 90 = 54	0.7 x 150 = 105
3	0.3 x 90 = 27	0.5 x 150 = 75
4	0.5 x 90 = 45	0.2 x 150 = 30
5	0.2 x 90 = 18	0.9 x 150 = 135

Determine Length of Row to Sample

Measured row width = 30"
*Row length to sample = 17'5"
(*value from Table 2)

Determine Total Weight of Corn Ears (lbs.) from 5 Sample Areas

10 lbs. + 9 lbs. + 11 lbs. + 14 lbs. + 12 lbs.
= **56 lbs.**

Obtain Equivalent Weight of Corn Ears from Table 3

From Table 3, 1 bushel of shelled corn at 15.5% moisture has an equivalent weight of 79.62 lbs. of corn ears when the moisture content is 22.5%.

Calculate Bushels of Corn Grain per Acre

To calculate bushels of corn grain per acre @ 15.5% moisture, use Equation 2.

$$\frac{\text{bushels}_{@\ 15.5\%\ \text{moisture}}}{\text{acre}} = \frac{(56)(1000)}{(5)(79.62)}$$

$\simeq$ **140 bu corn grain/acre**

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1st printing: November 2002

CORN GRAIN YIELD WORKSHEET

Field #_____ **# of Rows in Field_____**

Row Spacing (in.)_____ **Field Length in Paces_____**

Sample Area	Sample Row	Paces to Sample Area	Lbs. of Moist Corn Ears Sampled
1	0.2 X # of rows = _____	0.9 X # of paces = _____	
2	0.3 X # of rows = _____	0.5 X # of paces = _____	
3	0.6 X # of rows = _____	0.7 X # of paces = _____	
4	0.5 X # of rows = _____	0.2 X # of paces = _____	
5	0.8 X # of rows = _____	0.4 X # of paces = _____	
Total weight of moist corn ears harvested (lbs.)			

Average % moisture	

Equation 2 - Corn Grain Yield Estimate

$$bu_{@\ 15.5\%\ moisture}/A = \frac{\text{(total weight of moist ears harvested in lbs.) X 1000}}{\text{(5)(equivalent weight of corn ears in lbs.)}}$$

Corn Grain Yield Estimate

$$\frac{\text{(\_\_\_\_\_ lbs.) X 1000}}{\text{(5)(\_\_\_\_\_ lbs.)}} = \text{\_\_\_\_\_ } bu_{@\ 15.5\%\ moisture}/A$$

This worksheet is used in conjunction with the Nutrient Management Information Sheet (NM-4) entitled "Estimating Corn Grain Yield".