Estimating Corn Silage Yield

Introduction

Corn silage is a crop grown widely by dairy producers to provide dairy cattle with a high-energy, very digestible source of feed. Silage can remove large amounts of available nutrients from the soil, especially nitrogen. Corn silage production can affect the fertilizer management practices on a field, particularly the amount of nitrogen that should be applied.

Realistic Yield Goal

A realistic yield goal is the primary criterion used to determine how much nitrogen should be applied to (or how much phosphorus may be removed from) a field. A producer can determine a long-term realistic yield goal for corn silage by estimating the average silage 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

Nitrogen application rates for corn silage are based upon expected crop yields or production goals for a specific field or management unit. The State of Maryland Nutrient Management regulations specify the process to determine yield goal [from COMAR 15.20.08.05C (1) & (2)].

(1) The calculation of expected crop yield shall be based upon one of the following:

> *(a) An average of the 3 highest-yielding years for the crop out of the latest consecutive 5-year cropping sequence; or*
> *(b) If yield information exists for more than 5 years for a given field or management unit, crop yield calculations may be based on the average of 60 percent of the highest-yielding years for all consecutive years that crop yield information is available.*

(2) If field or management unit-specific yield or plant production goal information is unavailable or unrepresentative due to the inclusion of new seed varieties, irrigation, or new technologies, a consultant or certified farm operator shall use one of the following:

(a) Any soil productivity information;
(b) The average yield based upon an average of the 3 highest-yielding years for the crop out of the latest consecutive 5-year cropping sequence from nearby fields or management units with similar soil type and management conditions; or
(c) Any data acceptable to the Department.

Published Soil Productivity Information

The most up-to-date soil productivity information can be found on the Web Soil Survey (WSS), an online tool available from the U.S. Department of Agriculture at http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. The WSS provides users with electronic access to full soil survey report information as well as the most current soils data for counties in Maryland.

In time, this published information may become 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. Therefore, using published estimates may result in the under-application of nutrients.

For example, if a producer is able to show a long-term yield of 25 tons per acre and the published silage estimate is 20 tons per acre, the producer should apply 155 pounds of nitrogen rather than the 120 pounds recommended for the lower yield. Long-term, field-specific yield goals is the most reliable means for determining nitrogen application rates.

Timing Yield Estimates for Silage

Corn silage yield should be estimated in late August or September, just prior to or during harvest. This should provide yield estimates for moisture contents between 65-70%. Corn should be in full dent and the stalks should still be green.

Methods of Estimating Yield

Two different methods to measure corn silage yield using specialized equipment follow.

- A yield monitor utilizes satellite technology to provide yield measurements at different locations in a field and determines an average yield for that entire field.
- Weigh wagons or drive-on scales can be used to weigh wagons or trucks full of harvested silage. Divide the weight by the exact acreage of the field.

If the previous methods are impractical or the exact field acreage is unknown, a simple, alternate method can be used to estimate corn silage yield.

Note: 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 corn silage yield in undamaged parts of the field is highly desirable.

Alternate Method for Estimating Corn Silage Yield

Estimating corn silage yield involves (1) choosing sample areas; (2) obtaining and weighing the samples; and (3) calculating the silage yield.

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

The following equipment is needed to estimate corn silage yield:

- hanging scale;
- tripod;
- tub with rope for weighing silage samples;
- tape measure for measuring row width and length of harvest area; and
- corn knife, machete, tree pruner or other stalk cutting device.

Choosing Sample Areas

The first step in estimating corn silage yield is to randomly select five 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).

Figure 1. Example grid shows five randomly selected sample areas in a field

Number of paces
(expressed as percentage of total)
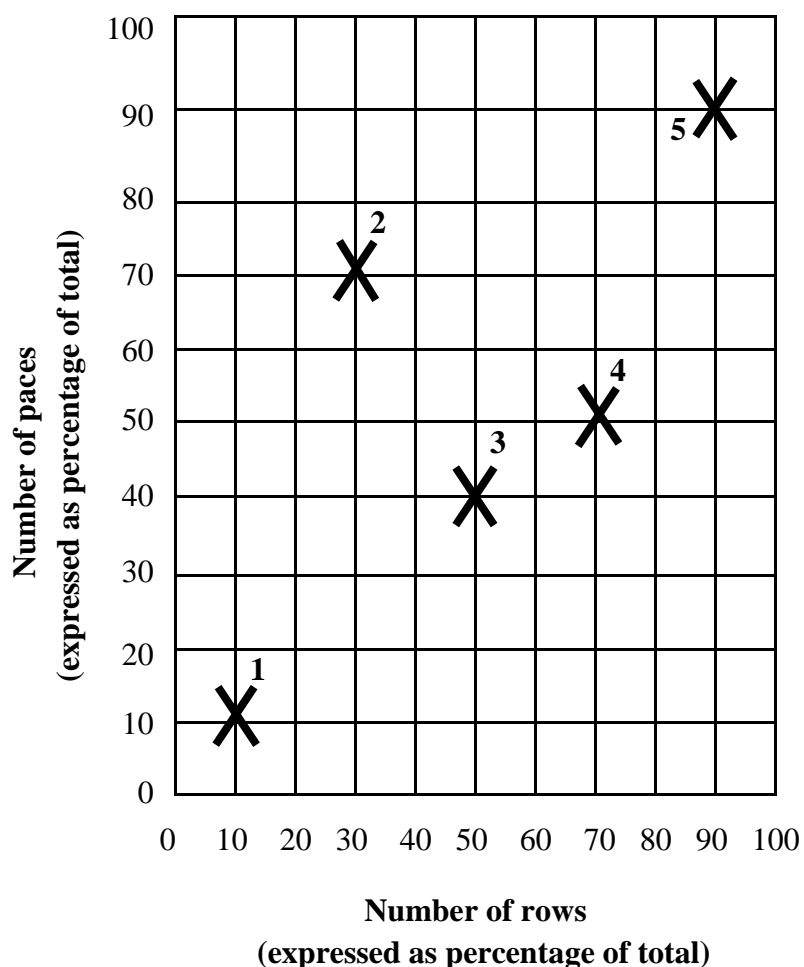
Number of rows
(expressed as percentage of total)

Table 1 shows how the five random sample areas in Figure 1 are selected in a field.

Table 1. Process used to locate the five sample areas in Figure 1

Sample Area	Sample Row	Number of Paces in Sample Row to Sample Area
1	0.1 x number of rows	0.1 x number of paces
2	0.3 x number of rows	0.7 x number of paces
3	0.5 x number of rows	0.4 x number of paces
4	0.7 x number of rows	0.5 x number of paces
5	0.9 x number of rows	0.9 x number of paces

To locate each sample area:
1) Count the number of rows across the field, omitting turn rows. Record the number of rows on the top of the Silage Estimate Worksheet on page 6 (hereafter called "worksheet").
2) Determine the length of the outside row by counting the number of paces, again avoiding turn rows. Record the field length in paces on the top of the worksheet.
3) Based on the number of rows and paces, determine actual sample areas (*Sample Row* and *Paces to Sample Area*) in the field and record in Section **(A)** on the worksheet.

Dealing with Atypical Areas

Sample according to the predetermined pattern unless the area shows a severe limitation such as wind or animal damage. If a severe limitation is present, continue along the row until you are out of the damaged area. Once out, take five paces and measure the sample area from that point.

If the damage occurs throughout the field, continue to sample according to the predetermined pattern.

Obtaining Yield Samples and Determining Yield

The next step in estimating corn silage yield is to collect and weigh corn stalk samples according to the steps outlined in Table 2.

Table 2. Collecting corn stalks and estimating yield in a given field

Step	Action
1	Weigh the tarp or tub to be used or place it on the hanging scale and tare the scale to zero.
2	Determine the row spacing (inches between the rows). Record on the top of the worksheet.
3	Consult Table 3 to determine the corresponding row length that needs to be counted (the row length represents 1/1000th of an acre). **Table 3. Row spacing and corresponding row length** <table><tr><th>Row Spacing</th><th>Row Length to Count (1/1000th of an acre)</th></tr><tr><td>36"</td><td>14'6"</td></tr><tr><td>30"</td><td>17'5"</td></tr><tr><td>20"</td><td>26'3"</td></tr><tr><td>15"</td><td>34'10"</td></tr></table>
4	Go into the field and harvest the exact areas as planned starting at pre-determined sampling locations and walking determined row length from Table 3. 1) Count the total number of corn stalks in the appropriate row length and record in Section **(A)** on the worksheet. 2) Determine total number of stalks per sample area at **A6** and average number of stalks per sample area at **A7** and record on the worksheet. 3) Cut every fourth corn stalk at 8-12 inches from the ground. 4) Count and record the number of stalks sampled on the worksheet, Section **(B)**, column **X**.
5	Weigh and record the weight of the stalks sampled on the worksheet, Section **(B)**, column **Y**.
6	Repeat this sampling procedure for the remaining sample areas.
7	Calculate the average stalk weight for each of the five sample areas and record answers on the worksheet, Section **(B),** column **Z**.
8	Calculate the average stalk weight over all five of the sample areas at **B6** & **B7** following directions on the worksheet.
9	Calculate silage yield estimate on the worksheet in Section **(C)**.

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SILAGE ESTIMATE WORKSHEET

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

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

(A) Calculation of average number of stalks per sample area

Sample Area	Sample Row	Paces to Sample Area	Total # of stalks per sample area
1	0.1 X # of rows = _____	0.1 X # of paces = _____	**A1 =**
2	0.3 X # of rows = _____	0.7 X # of paces = _____	**A2 =**
3	0.5 X # of rows = _____	0.4 X # of paces = _____	**A3 =**
4	0.7 X # of rows = _____	0.5 X # of paces = _____	**A4 =**
5	0.9 X # of rows = _____	0.9 X # of paces = _____	**A5 =**
A6	Total weight of corn stalks harvested (lbs.) **(A1+A2+A3+A4+A5)**		**A6 =**
A7	Average **(A6)/(5)**		**A7 =**

(B) Calculation of average stalk weight

Sample area	X **# of stalks sampled**	Y **Weight of stalks sampled (lbs.)**	Z **Average stalk weight (lbs.) (Y/X)**
1			**B1 =**
2			**B2 =**
3			**B3 =**
4			**B4 =**
5			**B5 =**
B6	Total **(B1+B2+B3+B4+B5)**		**B6 =**
B7	Average **(B6)/(5)**		**B7 =**

(C) Calculation of silage estimate (tons/acre)

C1	Average stalk weight (lb.) **(B7)**	
C2	Average # of stalks per sample area **(A7)**	
C3	Yield (tons/acre) $$\frac{(B7 \times A7 \times 1000)}{2000}$$ • Where 1,000 is the number of sample areas per acre, and • 2,000 is the number of pounds in a ton	

This worksheet is used in conjunction with the University of Maryland Extension Factsheet NM-1, "Estimating Corn Silage Yield."

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