

Nutrient Management

NM-1
June 2008
(Revised)

ESTIMATING CORN SILAGE YIELD

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

Realistic Yield Goal The primary criterion used to determine how much nitrogen should be applied to a field is based on the establishment of a realistic yield goal. A long-term realistic yield goal for corn silage can be established by estimating the average silage yield on a given field or management unit over a number of years.

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

Soil productivity information, which is based on soil properties, can be found in a soil survey or on the Web Soil Survey. However, this published information is sometimes out of date due to crop cultivar improvements and other advances in technology that influence crop yields.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

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estimates may be lower than yields obtained by a good farm manager and using published estimates may result in the under-application of nutrients.

For example, if a producer is able to show that his or her long-term yield is 25 tons per acre and the published silage estimate is 20 tons per acre, the producer could and should apply 175 pounds of nitrogen rather than the 140 pounds recommended for the lower yield. Long-term, site-specific yield goals will be the most reliable means for determining nitrogen application rates.

Methods of Estimating Yield

There are many methods used to estimate the average corn silage yield such as weigh wagons or drive-on scales to weigh trucks full of harvested silage. The most accurate method is to weigh the harvested silage and divide the weight by the exact acreage of the field. However, if weigh wagons or drive-on scales are not available or the exact field acreage is unknown, a simple, alternate method can be used to estimate the average silage yield.

Best Time to Estimate Yield

Corn silage yield should be estimated in late August or September, just prior to 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.

Equipment Needed

- hanging scale
- tripod
- tarp or tub with a rope for weighing silage samples
- measuring tape
- corn knife, machete, tree pruner or other stalk cutting device

Choosing and Locating Areas

Choosing a sampling site is the first step in estimating corn silage yield. To choose a sampling site, 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 on page 3 illustrates one example of 5 randomly chosen sample areas.

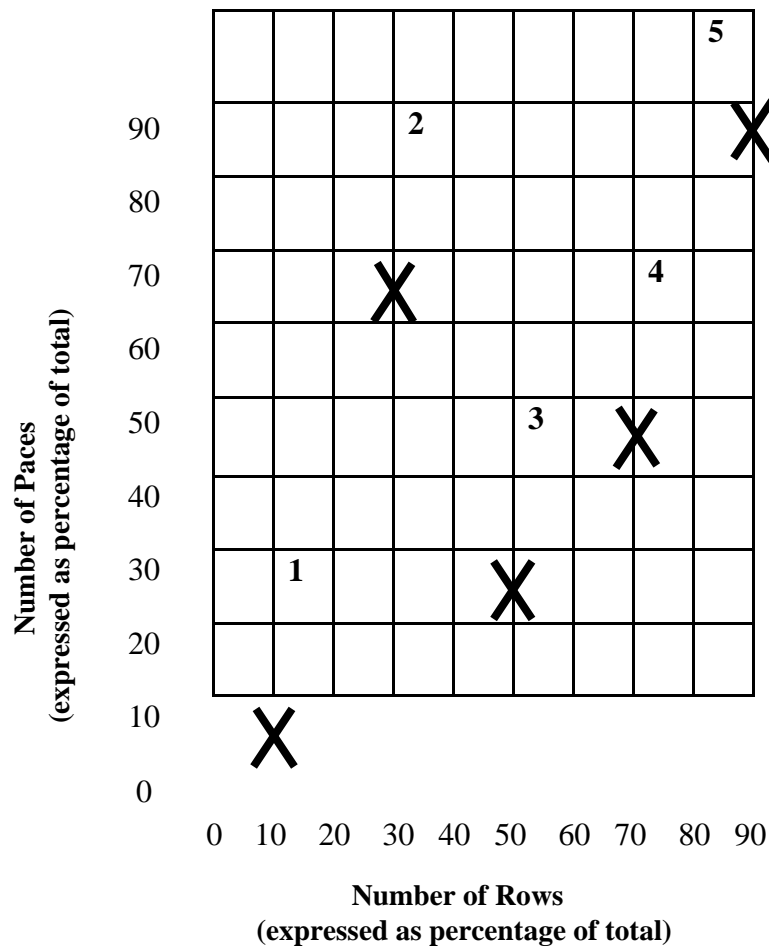


Figure 1. Example of 5 randomly selected sample areas in a field

In order to locate each sample area:

- (1) count the number of rows across the field width, and
- (2) determine the length of the outside row by counting the number of paces.

What if the Sample Area is Untypical of the Field?

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 5 paces and measure the sample area from that point.

If the damage reoccurs throughout the field, continue to sample according to the predetermined area.

The information in Table 1 on page 4 represents how the 5 randomly selected sample areas in Figure 1 were located in a field.

Table 1. Process used to locate the 5 sample areas in Figure 1.

sample area	sample row	# 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	0.3 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

**Obtaining
Yield Samples
and
Determining
Yield**

The next step in estimating corn silage yield is to obtain yield samples and measure the yield. This can be done following the steps in Table 2 below.

Table 2. Obtaining yield samples and measuring 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).										
3	Consult Table 3 below to determine the corresponding row length that needs to be counted (the row length represents 1/1000 th of an acre). <table border="1" data-bbox="550 1024 1252 1287"> <caption>Table 3. Row spacing and corresponding row length</caption> <thead> <tr> <th>row spacing</th> <th>row length to count (1/1000th of an acre)</th> </tr> </thead> <tbody> <tr> <td>36"</td> <td>14'6"</td> </tr> <tr> <td>30"</td> <td>17'5"</td> </tr> <tr> <td>20"</td> <td>26'</td> </tr> <tr> <td>15"</td> <td>34'10"</td> </tr> </tbody> </table>	row spacing	row length to count (1/1000 th of an acre)	36"	14'6"	30"	17'5"	20"	26'	15"	34'10"
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36"	14'6"										
30"	17'5"										
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4	Count and record the total number of corn stalks in the appropriate row length.										
5	Cut every fourth corn stalk at 8-12 inches from the ground.										
6	Count and record the number of stalks sampled.										
7	Weigh and record the weight of the stalks sampled.										
8	Repeat this sampling procedure for the remaining sample areas.										

9	<p>Calculate the average stalk weight for each of the 5 sample areas by using Equation 1.</p> <p style="text-align: center;"><u>Equation 1 – Average Stalk Weight (pounds)</u></p> $\text{average stalk weight} = \frac{\text{weight of stalks sampled}}{\text{number of stalks sampled}}$
10	<p>Calculate the average number of the total stalks over all 5 of the sample areas.</p>
11	<p>See Equation 2 for the silage estimate calculation. Multiply the average stalk weight by the average number of stalks per sample area to get the silage weight and by 1000 to get the silage yield estimate in pounds per acre. Divide the silage yield estimate by 2000 to express it as tons per acre.</p> <p style="text-align: center;"><u>Equation 2 – Silage Yield Estimate (tons/acre)</u></p> $\frac{(\text{avg. stalk weight (lbs)} \times \text{avg. \# stalks per sample area} \times 1000^*)}{2000}$ <p>* There are 1000 sampling units in an acre.</p>

Silage Yield Estimate – An Example

A yield check was done for Field 1A on the Smith farm. There were a total of 90 rows and the outside row was 150 paces. Follow the steps in Table 4 below to determine the silage yield estimate for Field 1A.

Table 4. Silage yield estimate procedure for Field 1A on the Smith farm.

Step	Action																		
1	<p>Predetermine the sample areas by randomly selecting 5 areas in Field 1A. Refer to the recorded results in Table 5 below.</p> <p>Table 5. Process used to locate 5 sample areas in Field 1A.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">sample area</th> <th style="text-align: center;">sample row</th> <th style="text-align: center;"># of paces in sample row to the sample area</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0.1 x 90 = 9</td> <td style="text-align: center;">0.1 x 150 = 15</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">0.3 x 90 = 27</td> <td style="text-align: center;">0.7 x 150 = 105</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">0.5 x 90 = 45</td> <td style="text-align: center;">0.3 x 150 = 45</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">0.7 x 90 = 63</td> <td style="text-align: center;">0.5 x 150 = 75</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">0.9 x 90 = 81</td> <td style="text-align: center;">0.9 x 150 = 135</td> </tr> </tbody> </table>	sample area	sample row	# of paces in sample row to the sample area	1	0.1 x 90 = 9	0.1 x 150 = 15	2	0.3 x 90 = 27	0.7 x 150 = 105	3	0.5 x 90 = 45	0.3 x 150 = 45	4	0.7 x 90 = 63	0.5 x 150 = 75	5	0.9 x 90 = 81	0.9 x 150 = 135
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2	<p>Count and record the total number of stalks in each sample area. Refer to the recorded results in Table 6 below.</p> <p>Table 6. Total number of stalks counted in each of the 5 sample areas.</p> <table border="1" data-bbox="553 401 1391 705"> <thead> <tr> <th>sample area</th> <th>total # of stalks per sample area</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>27</td> </tr> <tr> <td>2</td> <td>29</td> </tr> <tr> <td>3</td> <td>23</td> </tr> <tr> <td>4</td> <td>22</td> </tr> <tr> <td>5</td> <td>32</td> </tr> <tr> <td>Total</td> <td>133</td> </tr> <tr> <td>Average</td> <td>26.6</td> </tr> </tbody> </table>	sample area	total # of stalks per sample area	1	27	2	29	3	23	4	22	5	32	Total	133	Average	26.6																
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3	<p>Cut every fourth stalk. Count and record the number of stalks sampled. Refer to the recorded results in Table 7 below.</p> <p>Table 7. Number of stalks sampled for each sample area.</p> <table border="1" data-bbox="553 884 1135 1115"> <thead> <tr> <th>sample area</th> <th># of stalks sampled</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>6</td> </tr> <tr> <td>2</td> <td>7</td> </tr> <tr> <td>3</td> <td>5</td> </tr> <tr> <td>4</td> <td>5</td> </tr> <tr> <td>5</td> <td>8</td> </tr> </tbody> </table>	sample area	# of stalks sampled	1	6	2	7	3	5	4	5	5	8																				
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4	<p>Weigh and record the weight of the stalks sampled. Refer to the recorded results in Table 8 below.</p> <p>Table 8. Average stalk weight for each sample area.</p> <table border="1" data-bbox="553 1289 1391 1671"> <thead> <tr> <th>sample area</th> <th># of stalks sampled</th> <th>weight of stalks sampled (lbs)</th> <th>avg. stalk weight (lbs)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>6</td> <td>9</td> <td>1.50</td> </tr> <tr> <td>2</td> <td>7</td> <td>10</td> <td>1.43</td> </tr> <tr> <td>3</td> <td>5</td> <td>8</td> <td>1.60</td> </tr> <tr> <td>4</td> <td>5</td> <td>8.5</td> <td>1.70</td> </tr> <tr> <td>5</td> <td>8</td> <td>11.4</td> <td>1.43</td> </tr> <tr> <td colspan="3">Total</td> <td>7.66</td> </tr> <tr> <td colspan="3">Average</td> <td>1.53</td> </tr> </tbody> </table>	sample area	# of stalks sampled	weight of stalks sampled (lbs)	avg. stalk weight (lbs)	1	6	9	1.50	2	7	10	1.43	3	5	8	1.60	4	5	8.5	1.70	5	8	11.4	1.43	Total			7.66	Average			1.53
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5	<p>Calculate the silage yield estimate in tons per acre by using the silage yield estimate equation below.</p> $\frac{(\text{avg. stalk weight (lbs)} \times \text{avg. \# stalks per sample area} \times 1000)}{2000}$ $\frac{(1.53 \times 26.6 \times 1000)}{2000} = 20.3 \text{ tons per acre}$
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SILAGE ESTIMATE WORKSHEET

Field # _____

sample area	total # of stalks per sample area
1	
2	
3	
4	
5	
Total	
Average	

sample area	# of stalks sampled	weight of stalks sampled (lbs)	average stalk weight (lbs)
1			
2			
3			
4			
5			
Total			
Average			

Equation 1 - Average Stalk Weight (lbs)

$$\text{average stalk weight} = \frac{\text{weight of stalks sampled}}{\text{number of stalks sampled}}$$

Equation 2 - Silage Estimate (tons/acre)

$$\frac{(\text{average stalk weight (lbs)} \times \text{average \# stalks per sample area} \times 1000)}{2000}$$

Silage Estimate:

$$\left(\frac{\quad \times \quad}{2000} \times 1000 \right) = \quad \text{tons per acre}$$

This worksheet is used in conjunction with the Nutrient Management Information Sheet (NM-1), "Estimating Corn Silage Yield."