Tennessee Dairy News

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It's Corn Silage Time in Tennessee!

- Kristy M. Hill

John Ward, nor anyone else, has probably ever stood on the side of your corn fields and yelled that phrase with enthusiasm. None-the-less, it's that time of year when campus is buzzing with excitement over the impending football season, and many dairies are buzzing with activity preparing for the corn silage harvest. Some of you may have already begun! It's every producer's goal to harvest high quality silage. Many factors that affect forage quality are out of your control, such as the weather. However, there are other areas that you can control which can optimize forage quality. Many times, we are so focused on just getting the job done that we overlook some important tasks and details along the way. None of the following information is new, but it might remind you of one task that could result in higher quality silage.

Harvesting at Optimum Maturity and Dry Matter

Though it will differ slightly between hybrids, the best combination of yield and digestibility of corn silage is usually between 32-35% dry matter (DM). Many producers rely on examining the kernel milkline and harvesting at 1/2 to 2/3 milkline (see Figure 1). The accuracy of this tool is highly influenced by hybrid. Confirm dry matter approximations by drying a representative sample of the crop. To get a representative sample, take about 10 plants per field and collect a sample from the chopped material. A microwave oven can be used to reasonably estimate dry matter content. See page 5 for instructions.

Chopping Height

Corn silage is typically chopped at a height of 6-8 inches. Increasing the chop height will decrease yield, but increase energy concentration. It will also increase DM concentration, which is undesirable if the crop is already high in dry matter percentage (Thomas, 2006). In general, brown mid-rib (BMR) and high Neutral Detergent Fiber (NDF) digestibility hybrids should not be chopped higher than 8 inches. However, increasing chopping height is necessary with drought stressed corn. Nitrates accumulate in the lower portion of the stalk. So, raising the cutter bar to leave about 12-18" of stalk can help reduce nitrate levels in silage. If you suspect nitrates may be a problem, you can submit a sample to the UT Soil and Forage Test Lab for analysis or contact your local County Extension Agent. Some county offices have the nitrate testing kit readily available.

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Harvest Time Safety Tips:

- Remember, safety shields are for your protection.
- Packing tractors should have a cab or a roll-over protective structure.
- Use safety belts when operating machinery with roll-over protection.
- Do NOT use safety belts on machinery that does not have roll-over protection.
- Educate all workers on silo gas dangers.
- Never enter a tower silo if you are alone.
- Ventilate tower silos before entering.
- Educate all workers on dangers and symptoms of heat exhaustion.
- Drink plenty of water and sports drinks.
- Never leave children unattended around machinery.
- Caution children on dangers of harvest time.
- Remember, long work days lead to physical exhaustion which may impair judgment and reaction time.
- Keep a cell phone in every working area.

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Chop Length and Processing

Typically, the theoretical length of cut (TLC) recommendation is 1/4-1/2" with 3/8" TLC being the standard to increase ease of packing and digestibility and to prevent storage losses and ration separating. However, if the corn silage will be processed, the chopper should be set at 3/4" TLC as the processor will further reduce the particle size and result in silage equivalent to an unprocessed 3/8" TLC. Likewise, if the corn silage is packed in a silage bag, TLC should be increased to 3/4" as the additional mechanical treatment of the forage by the packing fingers will reduce particle size; decrease the number of whole cobs; and decrease the number of whole kernels in the final silage (Jirovec et.al., 1999).

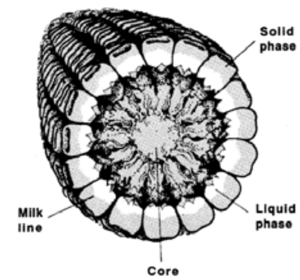

Figure 1. The kernel milkline is a rough indicator of plant moisture. Break an ear in half, and use the tip half. As the plant matures, the milkline will move towards the cob. When milkline appears in upper 1/4 of kernel, harvest time is near. It is time to take a DM sample.

Chopper and processor maintenance and settings are essential factors in silage quality and will also decrease fuel use and costs. Dull or worn knives tend to beat rather than cut, and they can easily increase the power requirement for the cutterhead by 100%! (Schuler, 2005). Additionally, it is always a good practice to check the actual length of cut throughout harvesting, as settings will change with chopper use. Reset the chop length if necessary. Roll clearance on processors should be set at 1-3 mm depending on the specific equipment used and the maturity of the crop (Schuler, 2005). Replace worn rolls, which will result in poorly processed corn with many unbroken kernels. Good processing should result in all of the kernels being broken, nicked or damaged with no cob fragments larger than 1/4 inch.

Management of Silos

Bunker/Trench Silos

Before harvesting begins, the bunker or trench silo should be prepared. All old silage should be removed and floors and sides should be repaired if necessary. If water seeping in at the edges of walls is an issue, line the walls and floor with a solid sheet of black plastic. Leave a 6-8' flap over each of the silo walls; fold excess black plastic over the top of the pile after packing; and cover the bunker with additional white plastic.

The golden rule of "fill it quick and pack it tight" is essential as oxygen needs to be forced out of the silage as quickly as possible – this is achieved by correct packing. However, in the rush of harvest, adequate packing is sometimes overlooked because the trucks are coming in faster than the silage can be packed. The packing process should receive as much attention to detail as the chopping process. Inadequately packed silage will result in extended plant respiration, an increase in growth of undesirable organisms and an increase in spoilage at feed-out (Stone, 2006). The minimum target packing density is 14 lb of DM/cu ft in trench and bunker silos, though many dairies often exceed this minimum requirement. Variables influencing silage density include: crop DM, particle length, packing intensity, thickness of the layer being packed and packing vehicle weight. When packing, equipment should run continuously. Ideally, forage should be distributed in 4" layers prior to packing. To estimate the amount of packing weight needed, multiply the estimated tons of crop delivered to the silo in an hour by 800 (Table 1). Before harvesting begins, check to see if you have enough wheel weights, liquid in tires or

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Table 1. Calculations for packing tractor weight/filling rate for trench and bunker silos.

Optimum packing vehicle weight (lbs)	=	Filling rate (tons/hr) X 800
Optimum filling rate (tons/hr)	=	Vehicle weight (lbs.) / 800

front-end or 3-point hitch weights. If enough weight cannot be secured on the packing tractor, alternatives include slowing down the harvest and using multiple packing tractors. Packing silage using the progressive wedge method (with a slope of about 30°) is the best approach, as it will minimize the amount of silage exposed to oxygen *if* the top surface is covered as filling progresses (see Figure 2). When the trucks are coming in too fast for this method, the 'wedge' can be flattened into more of a platform, increasing area available for packing tractors.

Covering the silo is the least favorite job at harvest. It is a physically demanding task that must be performed after many long hours or days of hard work, but covering the silo in a timely manner can reduce spoilage and be very profitable. Use plastic that is at least 5mm thick – skimping on plastic thickness to save money will result in higher losses from oxygen and water infiltration. A dual layer plastic (black inner and white outer) resists deterioration well. Using tires to weight the plastic is popular, but other alternatives include gravel filled silo bags, cut tires and truck tire sidewalls. Just make sure there is sufficient weight on the edges of the plastic to resist the wind, and regardless of the material used, the entire surface should be covered to prevent air movement under the plastic. After harvesting, the plastic must be monitored routinely for tears and holes and patched immediately with an effective adhesive tape to reduce spoilage.

Despite your best efforts and planning, harvesting will be interrupted by rain events, equipment breakdowns or simply getting a night's sleep during multi-day harvests. So, should you cover the silo? Yes. It is best to do a quick cover with a minimum number of tires if filling and packing will be stopped for more than a few hours. After you have finished laughing (or groaning) at the previous statement, consider that when you leave a layer of silage exposed to oxygen, the entire layer (several inches thick) will not ferment properly. The result will be brown or brackish bands of yeasty or moldy silage on the silage face throughout feed-out. This aerobically unstable silage will have a major impact on feed intake and milk production. If the progressive wedge packing method is used, the plastic can be placed on the bunker and 'unrolled' as filling and packing continue making a quick cover job easier and requiring less labor.

Tower Silos

One of the biggest advantages of having multiple uprights is the opportunity for quality control of inventory. Lower quality silage (i.e., over mature, dry silage) can be stored in one silo that can be used exclusively for heifers, dry cows or lower producing cows. When ensiling in tower silos, the optimum harvest DM differs from the optimum DM needed in bunker or trench silos. If storing in an oxygen-limiting structure, DM of corn silage should be between 40-65%, depending on hybrid. When using a more conventional concrete and stave structure, ideal corn silage DM for a silo less than 60' is 32-36%. For structures over 60', increase DM by 2% for every 10' in vertical silo height. As with

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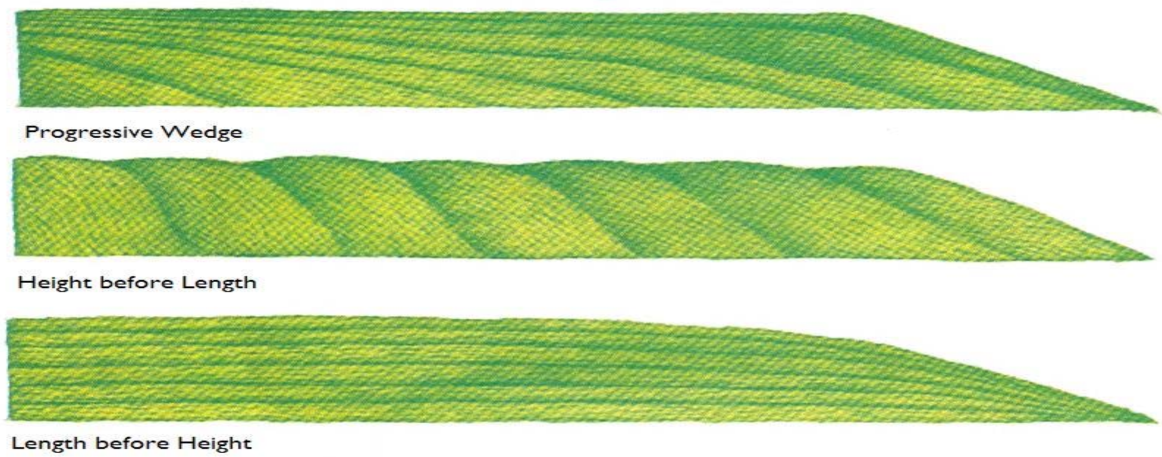
Figure 2. The progressive wedge method of packing corn silage in a bunker or trench silo.



Original source: NCR 574 Corn Silage Production, Management and Feeding. May 1995. Reprinted from Key Silage Management Topics.

bunker/trench silos, rapidness in harvest, filling and sealing are essential to reducing air exposure. Compaction can be increased by adding wetter material on top and covering. Check that doors close and seal properly.

Bagged Silage

As with any storage option, storing silage in bags has its advantages, disadvantages and its own set of challenges. It can be a cost effective alternative; add convenience during expansion or for new operations; offers flexibility by storing different quantities, qualities or cuttings; and are generally safer than using packing tractors or climbing uprights. However, significant DM losses can occur if the site is unsuitable or if they are not vented or maintained properly.

When selecting a site for silage bags, it is critical to have a clean, hard and well-drained surface of packed gravel, concrete or blacktop that will facilitate both filling and emptying. If multiple bags will be used, leave about 4' of space between them, as silage will settle, increasing the overall footprint of the bags. Fill the bag as quickly as possible and pack tightly to exclude oxygen (to a targeted packing density of 14 lb DM/cu ft) but not so tight that the sides of the bag ripples. Use bag vents to release gases that will build up during fermentation. Failure to do this will result in the bag becoming pressurized and ripping or blowing open. To discourage rodents and wildlife, keep the area free of grass and weeds. Consider installing a double stranded electric fence; bird netting (must not be so low as to touch the top of the bag) and/or mothballs (whole or dissolved in water) along the perimeter of the pad. Even with the fore mentioned suggestions, the bags must be monitored routinely for tears and holes and patched immediately with an effective adhesive tape to reduce spoilage.

Take Time to Analyze

Once the harvest is over, reflect on what went right; what went wrong; and what you could improve next year. Tools that can help you with this self-analysis include a fermentation analysis (which will reveal a lot about the quality of the crop going in and the effectiveness of packing and

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sealing) and a forage analysis. Other tools that are available include the glossary of silage smells and the silage trouble-shooting guide from Key Silage Management Topics available on our website.

Additional Resources

- *Pioneer Forage Manual*. 1990. Pioneer Hi-Bred International, Inc.

(An older but still excellent resource. It is out of print, but copies are available through our office)

- *The Silage Management Handbook*. 2006. Lallemand Animal Nutrition.
- *Key Silage Management Topics*. 2006. Lallemand Animal Nutrition.

(Excellent resources on all silage types, from harvesting to feed-out. Both are available through Lallemand Animal Nutrition or www.qualitysilage.com)

- *University of Wisconsin Team Forage website* http://www.uwex.edu/ces/crops/teamforage/
- *UT Soil and Forage Test Lab* 5201 Marchant Drive; Nashville, TN 37211; 615-832-5850

References

- *S. Gay, R. Grisso and R. Smith. 2003. Determining Forage Moisture Concentration. Virginia Cooperative Extension. PN 442-106.*
- *C. Holland and W. Kezar. 1990. Pioneer Forage Manual – A Nutritional Guide. Pioneer Hi-Bred International, Inc.*
- *Jirovec, A.G., K.J. Shinners, R.D. Shaver & M.A. Ball. 1999. Processing whole-plant corn silage with crop processing rolls. ASAE Paper AETC-105, presented at the 1999 ASAE Agricultural Equipment Technology Conference. Louisville, KY Feb 8-10, 1999. 17pp.*
- *Key Silage Management Topics. 2006. Lallemand Animal Nutrition.*
- *R.T. Schuler. 2005. Fuel saving tips for corn silage harvesting. In Wisconsin Crop Manager. V.12, No.25, August 25, 2005. University of Wisconsin Extension.*
- *B. Stone. 2006. Management of bunker silos. In Key Silage Management Topics. p.20-28. Lallemand Animal Nutrition.*
- *E.D. Thomas. 2006. Crops for Silage. In Key Silage Management Topics. p.5-12. Lallemand Animal Nutrition.*

Determining Dry Matter With Your Microwave

Materials needed:
Microwave, accurate scale, microwave-safe plate, paper towel, a 10– to 12– ounce cup of water (i.e. coffee mug), pencil and paper.

1. *Obtain a representative sample*
2. *Place a paper towel on the plate*
3. *Weigh the plate and paper towel. Record as "plate weight"*
4. *Add approx. 100 grams of the sample to the plate and spread evenly*
5. *Weigh the plate and sample. Record as "initial weight"*
6. *Place cup of water in corner of microwave and the sample in the center of the microwave*
7. *Microwave on high for 2-3 minutes*
8. *Remove sample, weigh and record the weight.*
9. *Change water in cup to prevent boiling over*
10. *Microwave again on high for 2 minutes or less*
11. *Remove sample, weigh and record the weight.*
12. *Repeat steps 6-11, reducing the time to 30-second intervals until the weight does not change more than 1 gram (this means the sample is dry). Record as "final weight"*

TIP: Be sure to change the water with each 'cooking' and heat in short intervals to prevent burning. If the sample burns, you must either start over again or use the last recorded weight (realizing that you will not get a true dry matter measurement).

To calculate DM:

1. *Subtract 'plate weight' from initial and final wts:*
   Initial wt - plate wt = wet wt
   final wt - plate wt = dry wt
2. *Determine % moisture:*
   $$\frac{(\text{wet wt} - \text{dry wt}) \times 100}{\text{wet wt}}$$
3. *Determine % DM:*
   100 - % moisture = % DM

Example:
Plate = 185 grams
Initial wt = 362 grams
Final wt = 245 grams

Wet wt = 362g - 185g = 177g
Dry wt = 245g - 185g = 60g

$$\% \text{ Moisture} = \frac{(177g - 60g) \times 100}{177g} = 66\% \text{ moisture}$$

% DM = 100 - 66 = 34% Dry matter

Gay et.al. 2003

Use of Inoculants to Improve Silage Quality

- Gary Bates, Professor, Plant Sciences

Proper fermentation is key for successful corn silage production. One of the tools available to aid in fermentation is silage inoculants. In what situations do these inoculants help, and should they be used?

Silage inoculants are bacteria that are added to speed up and help improve the efficiency of lactic acid production. The bacteria in the inoculants have generally been specifically selected to produce primarily lactic acid during fermentation, rather than lactic acid and acetic acid, like much of the natural occurring bacteria. Since lactic acid lowers pH more effectively than acetic acid, inoculants help lower the pH faster than naturally occurring bacteria. Inoculants will also drop pH to a lower level than will the naturally occurring bacteria.

Richard Muck and Keith Bolsen reviewed the research with silage inoculants published over a five year period (1991, Hay & Silage Management in N. America). Their review indicated that adding an inoculant improved the fermentation characteristics of corn silage about half of the time. In contrast, alfalfa silage was improved over 80% of the time. There are several possible reasons for the inconsistency in the success of inoculants in corn silage improvement. First is due to the level of carbohydrates in corn silage. The higher the sugar content, the more lactic acid formed, the better the fermentation. Corn silage has large amounts of carbohydrates, so it usually ferments quite well even without the addition of inoculants. Under normal conditions the naturally occurring bacteria result in adequate fermentation for successful silage production.

A second reason for inconsistent results is due to the large amounts of naturally occurring bacteria. Muck and Bolsen concluded that the inoculant bacteria must be 10 times the population of the naturally occurring bacteria before an economic benefit is seen. If inoculants are added but not at a great enough concentration, little benefit will be seen.

When should inoculants be used in corn silage? The best situation to add inoculants would be in any situation where fermentation conditions are less than desirable. If moisture is too high or low so that pH drop will be slow, inoculants can help speed up the process. If you know that you may not be able to pack a bunker silo as well as you would like, an inoculant can help speed up lactic acid formation and improve silage stability.

There are very few guarantees in the dairy industry. Inoculants can act as a type of insurance to help improve corn silage fermentation and quality.

Considerations for Organic Dairy Production in Tennessee

- John Campbell, Area Farm Management Specialist

The information that follows on organic dairy production is intended to be an objective assessment of issues and/or facts that need to be considered before changing to organic production. Many of these issues also apply to making major changes in conventional production systems for any farm enterprise. Producers should carefully study the potential outcomes of changes before implementing them. At a minimum, information should be solicited and compiled on forage production including organic fertilization and weed control, animal nutrition, animal health, animal genetics, grazing systems, and organic certification.

Organic Overview - Certified organic rules stipulate that land must be free of chemicals and commercial fertilizer for three years before becoming eligible for organic certification. Dairy cows must be managed under organic rules for one year. Dairy producers considering organic production

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should begin working with an organic certification company early in the planning process and definitely before beginning the transition phase. All phases of the dairy operation should be planned before starting transition. Organic rules are constantly under review. What you see in various print media may not be an up-to-date source. Visiting an organic farm would be helpful. There is now a growing demand for organic dairy products. But as in the case with all farm commodities, there is uncertainty of demand in the long run. Location of the farm plays a major role in planning. It is likely that organic milk processors will require enough producers in an area to allow for economical pick up of milk at the farm. Extensive record keeping is required to retain organic certification. Labels should be retained for all production inputs purchased. Detailed field records must also be compiled that will include dates of input application and harvest.

Financial Management and Planning - Financial plans should be developed that define the limiting resource on the farm. Whether it be land, labor, capital or management, plans should reflect utilizing available resources in the combination that gives the farm family the best chance of meeting their goals. The goals the family wishes to achieve should be an integral part of the planning process. Data on the financial performance of organic dairy farms is limited. There can be large variations in financial performance from farm to farm whether conventional or organic. Organic production is not quick fix for poor management on a conventional dairy. Cash flow deficits will likely occur during transition. These deficits may need to amortized and repaid over a period of time. Long-range profitability must allow for recouping these deficits over time. There is no cookbook organic dairy plan. Each farm is unique and must be planned accordingly. Organic production will likely require farm managers to develop new relationships with input suppliers. Much of cost data available is anecdotal. Few university research studies have been completed. UT Extension's Area Farm Management Specialists are available to assist producers with planning.

Forage Program - Grazing is a foundation of an organic system. All animals 6 months old or older must have access to pasture for a minimum number of days per year. Dry matter yield from forages must be estimated in order to plan the grain supplementation program. A fertility program for forages must be planned. It may be necessary to address weed control by eliminating problem weeds before beginning the transition. Legumes are vital for an organic pasture system. Producers must seek out and obtain supplies of organic fertilizers. Grazing systems must be designed that provide for adequate access to grass and water.

Grain Rations - All grain rations for cows and heifers must be organic. Costs of organic grain rations could be double or more that of conventional feeds. This emphasizes the need for the forage program to provide as much of the nutrition as possible. The availability of organic feed sources must be determined.

Animal Health - The animal health program in an organic system must place more emphasis on prevention rather than treatment. Preventative vaccines are allowed and should be used. Sick animals must be treated even if treatment removes organic standing (which would require removal from the farm). Pasture rotation must be a significant segment of a parasite control program. Practices to reduce stress on the animals should be used. Some health remedies used in organic production are not proven or research based.

Genetics and Breeding - Bulls used for breeding do not have be managed organically. Artificial insemination is allowed, but of the use of synthetic hormones and antibiotics is prohibited. Bull selection should emphasize disease resistance and health traits. Organic production puts a premium on health traits. Breed for calving ease. Select for milk components if being paid on components. All bull

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CONTACT US!
Kristy M. Hill,
Extension Dairy Specialist
khill8@tennessee.edu
865-974-7289

Gary W. Rogers, Professor
and State Extension Dairy
Specialist
grogers2@tennessee.edu
865-974-7289

University of Tennessee
Department of Animal Science
114 McCord Hall
2640 Morgan Circle
Knoxville, TN 37996-4587

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proofs are derived from conventional systems and extensive data on bull performance in organic systems is not available. Crossbreeding is often recommended for grazing dairies, but production records for crossbred animals and new European breeds is limited.

Bio-security - There must be an emphasis on bio-security on an organic dairy. Water drainage from a conventional farm must be prevented from entering an organic farm. Buffers are required around field borders if the adjoining farm uses chemicals sprays. Buffers may also be needed along public roads if chemicals are used for roadside weed control. Fence contact with conventionally raised livestock is not allowed. Field equipment must be cleaned before entering an organic farm from a conventional farm.

Dairy Barn and Milking Equipment - Products used to clean and sanitize milking parlor and equipment must be approved by the organic certifying agency.

This information is a summary of information provided at "In-Service Training for Extension Agents on Organic Dairy Farming," June 7-9, 2006, Harrisonburg, Virginia, Virginia Cooperative Extension.

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