Management and Assessment of Ensiled Forages and High-Moisture Grain

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KEYWORDS

• Silage quality • Forage quality • Ensiled forage • Forage and grain crops
• Nutritional value • Fermentation • Digestibility • Evaluation

KEY POINTS

- Forage crop options affect dairy cow performance and health.
- Environmental growing conditions, more than seed genetic selection, determines the final forage quality fed to dairy cattle.
- Forage digestibility is influenced by growing conditions and length of time in silo storage.
- Harvest and ensiling management determines success of forage fermentation process and silage feeding value.
- On-farm tests and forage laboratory samples are available for determining forage quality of ensiled forages and grains.

FORAGE AND GRAIN CROPS ENSILED FOR DAIRY PRODUCTION

The diversity of geographies and growing environments dictate the types of ensiled forages that are used for dairy production. Feed cost represents the largest single expenditure on most livestock operations. The production of high-quality silages can help reduce the cost associated with feeding concentrates and supplements. For dairy producers, whole-plant corn, high-moisture corn, alfalfa, cereal, and a variety of grass species are the silages of most economic significance.

SPECIFIC FORAGE CROP HYBRIDS AND VARIETIES AND IMPACT OF THE GROWING ENVIRONMENT

Forage Production Considerations

- Decisions on forage product options based on genetic nutritional traits are important; however, environmental and management factors have the greatest influence on forage quality.

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- Corn silage quality at time of harvest is primarily influenced by harvest maturity, kernel processing (PROC), theoretical length of chop, and length of storage time in silos.
- Corn offers a diversity of feeding options, which include corn silage, high-moisture shelled corn, high-moisture ear corn (HMEC), snaplage (SNAP), dry corn (DC), and stalklage.
- Legume, grass, and cereal forage quality is contingent on stage of maturity at time of harvest and wilting time to achieve proper dry matter (DM) content at time of ensiling the crop.
- Temperature and moisture are 2 environmental variables during plant growth that highly influence forage quality of corn, legumes, grass, and cereal forage crops.

Forage categories

Plants are classified as C3 and C4 carbohydrate producers, and the primary difference is within plant cells in which photosynthesis for carbon fixation events occur. C3 plants are cooler season crops that have a longer growing season and higher water demands (**Table 1**). In contrast, C4 plants are warm season crops that are water efficient and drought tolerant. **Table 2** compares water usage requirements for several C3 with C4 crops; alfalfa is a C3 crop that has the highest water demand, whereas C4 sorghum crops use about one-third of the water required by alfalfa.[1]

Crop scientists monitor growth rates with calculators based on ambient temperature where using corn for example, growth starts at 7.2°C, maximizes at 22–30° C range, and ceases at 46°C. A Growing Degree Unit (GDU) calculation is used in the United States that is based on a linear relationship of growth to temperatures in the 10–30°C range. The GDU formula along with an example for corn is shown in **Table 3**. Using alfalfa in contrast, this crop starts growing at 5°C compared to corn at 10°C. Using the calculation for alfalfa and same daytime and night time temperature inputs as showing in the table, there would be 15.0 GDU accumulated for that day.[2]

Corn utilization as ensiled forage or grain

Corn is the predominant cereal crop grown throughout the world, because compared with all cereal crops, corn is unique in its ability to outyield the other crops on a ton/acre and nutrients/acre basis.[2] Corn growth and development are typically categorized by a staging system that divides plant development into vegetative (before flowering) and reproductive grain development (after flowering) stages. The reproductive stages are key growth periods for capturing crop harvest opportunities intended for (1) whole-plant corn silage (WPCS), (2) high moisture ear corn (HMEC) or snaplage (SNAP), high-moisture shelled corn (HMSC), and (4) dry corn (DC).

Table 1
Characteristics of cool and warm season grasses

Cool Season Grasses (C3)	Warm Season Grasses (C4)
Optimal growth at cooler temperature (70°F)	Optimal growth at higher temperature (95°F)
More digestible and higher in crude protein	Less digestible and lower in crude protein
Longer growing season	More drought tolerant
Higher water demands	More efficient at using water

Data from Teutsch C. Using mixtures of summer forages for improved forage yields in dry conditions. J Anim Sci 2013;91(E-Suppl 2)/J Dairy Sci 96(E-Suppl 1):406. [abstract 358].