What is Unique About California Corn Silage?

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All over the world, dairy farmers plant corn silage as a source of digestible fiber and readily fermentable energy for their cattle. Twenty years ago, there were only 200,000 acres dedicated to corn silage in California. But parallel to the dairy industry growth, corn silage acreage has increased over time. In 2007, a total of 445,000 acres of corn silage were harvested in California (CDFA). Most corn silage is planted in the Central Valley where growing conditions are exceptionally good for corn: good quality and quantity of sunlight, fertile soils and available water for irrigation. Under these conditions, California dairy farmers are producing a very valuable forage crop. However, California corn silage differs from that grown in other cooler regions of the US. To understand what is unique about California corn silage, I will compare our corn silage with the corn silage produced in the second largest dairy state in the US, Wisconsin.

Corn silage statistics for the past three decades are presented in **Fig 1** for California (CDFA) and **Fig 2** for Wisconsin (USDA NASS-WI). Yields are approximately 10 tons more per acre in California than in Wisconsin. High yield hybrids with 115 days or more relative maturity can perform very well under California growing conditions, but not under cooler climates. In the West, corn plants are 10 to 15% taller (personal communication with senior researcher from a corn breeding company). While in Wisconsin corn silage production relies on rain, in California we have the advantage of timely managed crop irrigation. It is very important to have well-leveled fields, so irrigation water can travel quickly to the end of the field, minimizing the need for over irrigation. This is particular important when nutrient application is in the form of lagoon water (to ensure nutrients are homogenously distributed throughout the field). Good agronomic and irrigation management practices are the key to the consistent high yields over time.

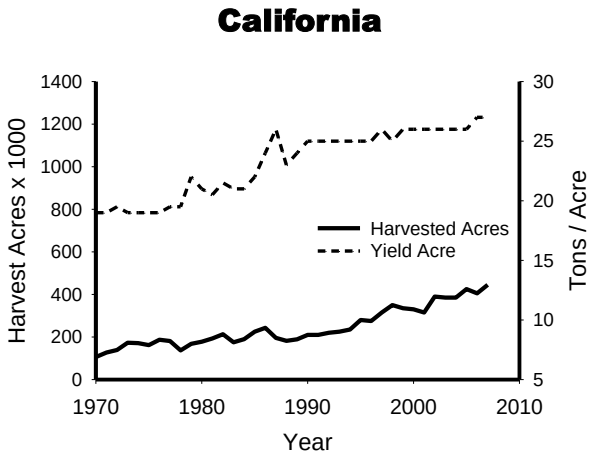

Fig 1. Acres harvested and tons per acres in California from 1970 to 2007 (source CDFA-2008).

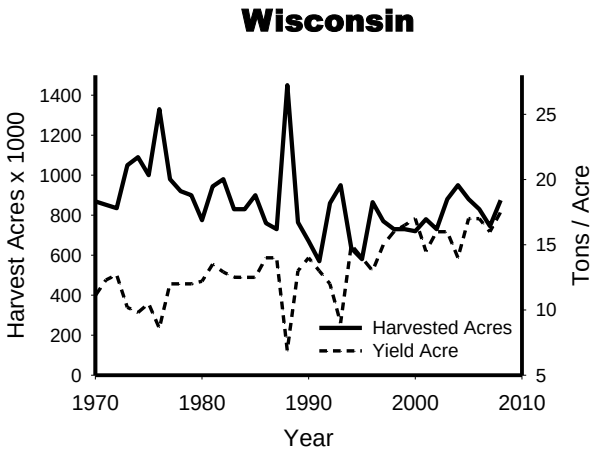

Fig 2. Acres harvested and tons per acres in Wisconsin from 1970 to 2008 (source USDA-NASS-WI).

Nutrient composition and lactic acid ratio of corn silage crop harvested in California and Wisconsin in 2009 is presented in **Table 1**. Fibers [Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF)] were determined by an in house laboratory method. Thus, absolute fiber values are not comparable with results from analytical labs following the Van Soest methodology. Nevertheless, we still can compare the relative values for ADF and NDF between California and Wisconsin. Overall, lignin and fiber (NDF and ADF) are higher in California corn silage. Similarly, pervious research showed higher lignin and NDF content when corn silage was grown in the Southern than in the Northern US regions (Sniffen et al., 1992). One possible explanation for higher ADF, NDF and lignin could be differences in ear to stover ratio. High yield hybrids, grown in favorable climate conditions, are tall and the stover may represent a larger portion of the whole corn plant.

Table 1. Nutrient composition and lactic acetic ratio of corn silage crop harvested in California and Wisconsin in 2009.

	California (n=131)		Wisconsin (n=205)	
	Mean	**SD**	**Mean**	**SD**
DM	31.6	4.7	34.1	5.3
ADF[1]	24.5	3.4	20.9	4.0
NDF[1]	44.6	4.7	40.4	5.5
Lignin	3.3	0.6	2.2	0.6
Protein	8.0	0.96	7.6	0.88
Ash	6.1	1.1	3.7	1.1
Lact:Acet	2.76	1.7	3.08	1.45

[1]ADF and NDF were no done following the Van Soest methodology.

In 2009, corn silage ashes averaged 6.1 % for California and 3.7 % for Wisconsin. High ashes indicate greater contamination from soil and soil microorganisms. In the Central Valley, spring and summers are very dry and that favors a dusty environment. There is no rain to wash the dirt off the plants. Moreover, at harvesting, choppers and trucks raise dust that ends in the crop being harvested. One of the implications of high ashes or dirt in corn silage is the faster wear out of harvesting equipment. During harvesting, knives need to be sharpened every hour for 10 minutes (personal communication with a local custom harvester). Also, knives need to be replaced every 20 days in spring and every 40 days during corn harvesting.

The temperature of the forage during ensiling may also affect the silage fermentation process and the quality of the corn silage. Ensiling involves microbes and enzymes and their biological activity is affected by temperature. Laboratory research studies, with mini silos (Kim and Adesogan, 2006), indicated that ensiling at 104 vs. 68 F results in:
- Higher pH (low pH inhibits undesirable microbial growth)
- Lower lactic to acetic acid ratio (it is desirable lactic:acetic greater or equal to 3)
- Higher DM losses.

Therefore, ensiling at high temperatures may have a detrimental effect on corn silage quality. Best management practices during silage making are advice to minimize potential losses associated with high temperatures at harvesting.

Genetics, climate and agronomic practices all have an impact on the quality and quantity of corn silage produced in Wisconsin and California. Dairy producers should understand regional differences in corn silage production to gain the most value from their crops.

Literature cited:

Sniffen C.J., J.D. O'Connor, P.J. Van Soest, D.G. Fox and J.B. Russell. 1992. A Net Carbohydrate and Protein System for Evaluating Cattle Diets: II. Carbohydrate and Protein Availability. *J. Anim. Sci.* 70:3562-3577.

Kim S.C. and A.T. Adesogan. 2006. Influence of Ensiling Temperature, Simulated Rainfall and Delayed Sealing on Fermentation Characteristics and Aerobic Stability of Corn Silage. *J. Dairy Sci.* 89:3122-3132.