Nutritional Insights

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DROUGHT STRESSED CORN: HARVEST TIME, ENSILING CHARACTERISTICS AND FEEDING VALUE

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……Global Pioneer support helping solve local problems……

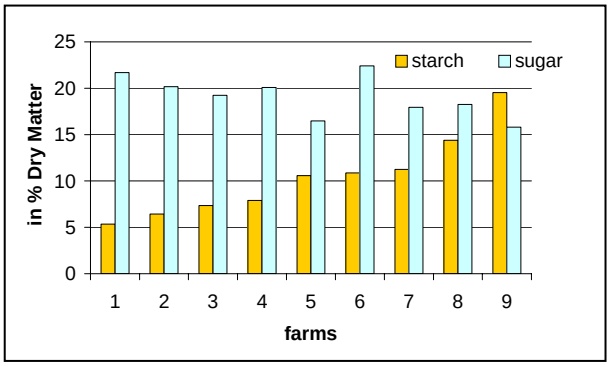
The development of the corn silage crop is quite advanced this year because of high temperatures and low rainfall experienced in many countries served by Pioneer.

Composition of drought stressed corn depends mostly on development of ears, which can be reduced especially when there was a water deficit at time of pollination. Sugars built up in the green parts of the plant may only be partly translocated into starch. The result of 1999 drought stressed corn from Germany show elevated sugar levels of 15-23% DM and correspondingly low starch concentrations of only 5-20% DM. The variation is large, depending of magnitude of damage. (see Fig.1).

TABLE 1: Composition and energy concentration of drought stressed corn silages. (data from harvest 1994 after Hertwig and Pickert 1999)

Cornfield	Dry Matter%	Crude Protein % Dm	Crude Fiber % Dm	NEL MJ/kg DM
No/little ear, stover mainly green	23	11,3	24,5	5,9
No/little ear, stover mainly strawy	46,6	8,2	29,7	5,5
Normal	34,3	8,3	20,0	6,5

FIGURE 1: Starch and sugar in 9 farms (Pioneer 1999)



Analysis from 1994 East German farms experiencing drought stressed corn silage with little or no ear and strawy stover showed low starch and low energy density (-15% from normal) and very high dry matter %. In fields with little or no ear and green stover it was found that energy density was not reduced as much (-10% from normal) due to high sugar levels in stover. When ears are missing, dry matter % is low even with the high sugar levels. Corn with poor ears and green stover are usually a result of water deficit during pollination that could vegetatively recover later because of subsequent rain. Corn with poor ears and strawy stover did not recover afterwards because of longer lasting drought conditions.

Drought can also lead to **elevated nitrate levels** especially in the lower part of the stem. During ensiling 40-60 % of nitrate will be degraded. Be especially cautious of silo gases. If feeding fresh green chop from the field, nitrate levels should be checked. It could be useful to harvest these plants at elevated cutting heights.

TABLE 2: Nitrate in forages (adapted from L. E. Chase und T. R. Overton, Cornell Univ. USA)

Nitrate Ion %	Nitrate Nitrogen ppm	Recommendations
< 0,44	<1000	Safe to feed under all conditions.
0,44 to 0,66	1000-1500	Safe to feed to non-pregnant animals. Limit use for pregnant animals to 50% of total ration on a DM basis.
0,66 to 0,88	1500-2000	Safely fed if limited to 50% of the total DM ration.
0,88 to 1,54	2000-3500	Feeds should be limited to 35-40% of the total DM in the ration. Feeds over 2000 ppm nitrate nitrogen should not be fed to pregnant animals.
1,54 to 1,76	3500-4000	Feeds should be limited to 25% of total DM in the ration. Do not feed to pregnant animals.
over 1,76	>4000	Feeds containing these levels are potentially toxic. DO NOT FEED.

When should drought stressed corn be harvested? Corn silage with little ear development should be harvested when no further quality and yield development can be expected. Fields with some ear development and green leaves around and above the ear can still increase in yield and quality, because they can continue to deliver assimilates to the ear. Once those leaves start to turn dry, the corn should be harvested. Because of the poor ear development, the dry matter will be lower than typical corn silage, around 22-26%, depending on sugar level in stover. Depending upon hybrid genetics a red color at the stem can be a sign of stress due to the inability of the plant to translocate sugars from the stover.

The silage quality of drought stressed corn depends on dry matter and sugar level. Strawy stover is difficult to compact and therefore could be more prone to heating at feed out. It is important to chop this material short and compact well (>230 kg dry matter / m3). Green corn silage with dry matters lower than 28 % tend to produce effluent, and are especially prone when levels go below 25% dry matter. The problem can partly be solved with layers of absorbent material such as straw. High sugar levels in low ear corn often leads to high residual sugar in corn silage. Research has shown that this high residual sugar may lead to increased yeast activity and heating during the feeding period.

In both, strawy high dry matter corn silage as well as green low dry matter corn silage there is a risk of heating at ensiling and again at feed out. The best defense against heating and yeast/mold development is to compaction tightly, strive for high feedout rates and use a research proven Pioneer® brand Inoculant.

TABLE 3: decision aid for harvest time of drought stressed corn

	No Ear	Little Ear	Good Ear
hardly green leaves	harvest immediately	harvest immediately	harvest immediately
green leaves at or above ear	harvest, when you see red color at stem	harvest, when you see red color at stem	normal harvest
Most leaves are green	harvest, when you see red color at stem	harvest, when you see red color at stem	normal harvest

CORN "WHOLE PLANT VISUAL MOISTURE"

A "visual reference " of whole plant moisture of corn taken for silage
Pat Branick, North Central (Northern Wisconsin) FSA

These pictures, taken August 20, 2003 near Hixton, WI., represent plants analyzed for moisture levels. Corn was growing on sandy loam soils. Less than ½ inch of rain has fallen since the 2nd week of July. . Kernel development was milk stage. The photos taken were of plants rapidly drying down. Photos were not taken of the green plants also sampled.

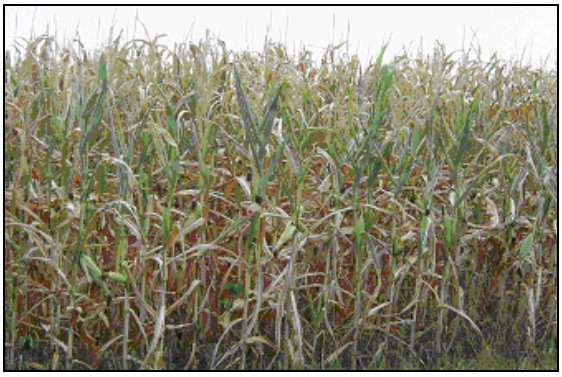
Whole plant moisture = 70.4% (30-inch rows)

Moisture determination by Dairyland Labs in Arcadia, Wisconsin

Moisture levels will be highly variable in these fields. Two samples analyzed, each sample consisting of three plants taken side by side.

Sample #1: moisture = 69.2% (15-inch rows)

Sample #2: moisture = 63.2%



This picture represents visual appearance from the road. Much of the lower half of the plant has fired. The leaves above the ear are rolled. Some leaves above the ear are beginning to fire.

Moisture readings were taken from plants in the lower lying areas of the field that were still "grass green". Green plants moisture = 74.8%.

Samples a grower brought in tested:

Dry appearing corn tested = 67.2% (Dry sample looked similar to photos above.)

Green appearing corn tested = 77.1% (Grass green in appearance)

This red coloring is due to the pigment anthocyanin that is more visible when sugars accumulate in the stover because the kernel photosynthetic sink is unavailable (e.g. poor pollination). It is similar to early season purpling seen under cold stress

It is normally expressed in some genotypes. The percentage that show this in a normal fall is typically below 25%. 37D25, 37R71 are examples of Pioneer hybrids that show this purpling of the stalk in fall.