

# Harvesting and Feeding Drought-Stricken Corn Plants

*2008 Corn Silage and Forage Field Day*



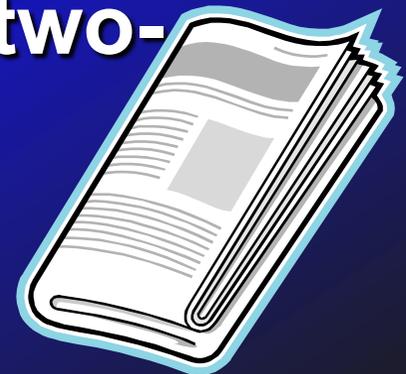
**Charles R. Staples**  
**University of Florida**



**WEST PALM BEACH, Florida, January 8, 2008**

**- The past two years have been the driest back-to-back calendar years in South Florida since rainfall recordkeeping began in 1932, meteorologists at the South Florida Water Management District confirmed today.**

**The combined two-year total is nearly two feet less than the historical district-wide average of 104.5 inches for a typical two-year period.**



# Irrigation of Corn Plants



# ***Scope of Presentation***

**Plant Development  
Affected by Drought**

**Harvesting and  
Ensiling  
Recommendations**



**Feeding Cautions**

# How Does Water Deficiency Influence Corn Plant Development?

Uptake of nutrients by plant is reduced

- Growth (yield) is reduced
- Loss of leaves due to wilting



# How Does Water Deficiency Influence Corn Plant Development?

**Uptake of nutrients by plant is reduced**

- **Growth (yield) is reduced**
- **Loss of leaves due to wilting**
- **Increased susceptibility to disease and insects**

# Common Corn Smut (*Ustilago maydis*)



# Eating Smut?

- **Fungus (smut) does not produce toxins**
- **Sheep fed smut-infested corn silage ate more silage dry matter and had equal digestibility compared to sheep fed smut-free corn silage.**



[newscoma.files.wordpress.com/2008/04/sheep\\_racing](http://newscoma.files.wordpress.com/2008/04/sheep_racing)

# Huitlacoche; aka Corn Smut aka Mexican Truffle



# **Influence of Water Deficiency on Corn Plant Development**

## **When did drought stress occur?**

- **Prior to pollination of ear (tasseling and silking)**
  - **Reduced length of ear**
  - **Reduced # of rows of kernels (10-12 leaf stage)**
  - **Reduced # of kernels per row (12-17 leaf stage)**
- **During pollination, may eliminate ear development**
- **After pollination of the ear**
  - **Aborted kernels**
  - **Poor kernel fill**



# Effect of Drought on Corn Yield

Stage of development	% corn yield reduction
Early vegetative	5 – 10
Tassel emergence	10 – 25
Silk emergence, pollen shedding	40 – 50
Blister	30 – 40
Dough	20 - 30

# Yield & Nutrient Content of Silage – Drought Prior to Pollination

Measure	Drought year	Normal year
DM yield, tons/acre	7.7	8.1
NDF, % of DM	41	49
Starch, % of DM	36	29
NDF digestibility, %	58	62
Milk (lb) per ton	3,400	3,280
Milk (lb) per acre	26,000	26,000

Lauer, Univ. of Wisconsin, 2003-06, Marshfield and Arlington growing sites (55 hybrids)

# Yield & Nutrient Content of Silage – Drought During Grain Filling

Measure	Drought year	Normal year
DM yield, tons/acre	4.9	7.1
NDF, % of DM	51	51
Starch, % of DM	20	29
NDF digestibility, %	60	64
Milk (lb) per ton	3,100	3,275
Milk (lb) per acre	14,750	23,250

Lauer, Univ. of Wisconsin, 2003-06, Chippewa Falls (50-53 hybrids) and Spooner (21-27 hybrids) growing sites

# Yield and Quality of Drought Stressed Corn Plants

## ➤ Silage

- If drought prevents pollination, expect to harvest 1 ton per foot of plant height, excluding the tassel, of 30% dry matter material
- Feed value is 65 to 95% of normal silage



# Recommendations for Harvest of Corn Silage During a Drought

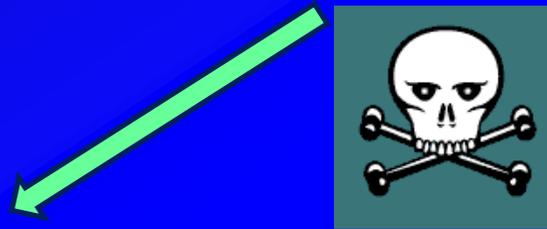
- Harvest at proper moisture (30 to 35% DM)
- If too dry, need to increase packing in silo
  - shorter TLC, possibly 0.5 inch w/o processor
  - add water (~6 gallons/TON per 1% increase in DM) - difficult to do
- Sugars stored in stalk instead of grain so silage may be more susceptible to aerobic spoilage upon opening if unused sugars are present.

# Plants Can Accumulate Nitrates

- **Plants accumulate N in  $\text{NO}_3$  (Nitrate) form rather than convert it to a protein form**
- **Environmental conditions conducive to nitrate formation**
  - **Rain after a period of drought**
  - **Cloudy weather**
  - **Heavy N fertilization**

# Plant Nitrates Pose Toxicity Risk to Cows

In the cow,  $\text{NO}_3$  (nitrate)  $\longrightarrow$   $\text{NO}_2$  (nitrite)  $\longrightarrow$   $\text{NH}_3$  (ammonia)



- Reduces oxygen-carrying capacity of blood
- Rapid or difficult breathing
- Staggering, weakness, death
- Chocolate-colored blood
- Abortion

# Reducing Risk of Nitrate Toxicity

- **Bacterial fermentation during ensiling converts 25 to 50% of nitrates to bacterial protein so risk is reduced**
- **Don't green-chop or graze droughty corn plants**
- **Analyze for nitrates at commercial lab ~\$6-9**

# Nitrates and Feeding Recommendations

<b>Nitrate, ppm</b>	<b>Feeding recommendation</b>
<b>Less than 4,400</b>	<b>Safe</b>
<b>4,400 – 8,800</b>	<b>Limit to 50% of diet DM</b>
<b>8,800 to 17,600</b>	<b>Limit to 25% of diet DM</b>
<b>More than 17,600</b>	<b>Do not Feed!</b>

**To convert ppm to %, divide by 10,000**

**To convert nitrate to nitrate-Nitrogen, multiply nitrate value by 0.227**

# Reducing Risk of Nitrate Toxicity

- Bacterial fermentation during ensiling converts ~50% of nitrates to bacterial protein so risk is reduced
- Don't green-chop or graze droughty corn plants
- Analyze for nitrates at commercial lab ~\$6-9
- Consider harvesting higher on stalk?  
Nitrates accumulate in lower stalk and leaf portion of the plants

## Stalk $\text{NO}_3$ , ppm

➤ Upper 1/3 = 678

➤ Middle 1/3 = 3,557

➤ Lower 1/3 = 24,471

**Whole Plant = 4,333**

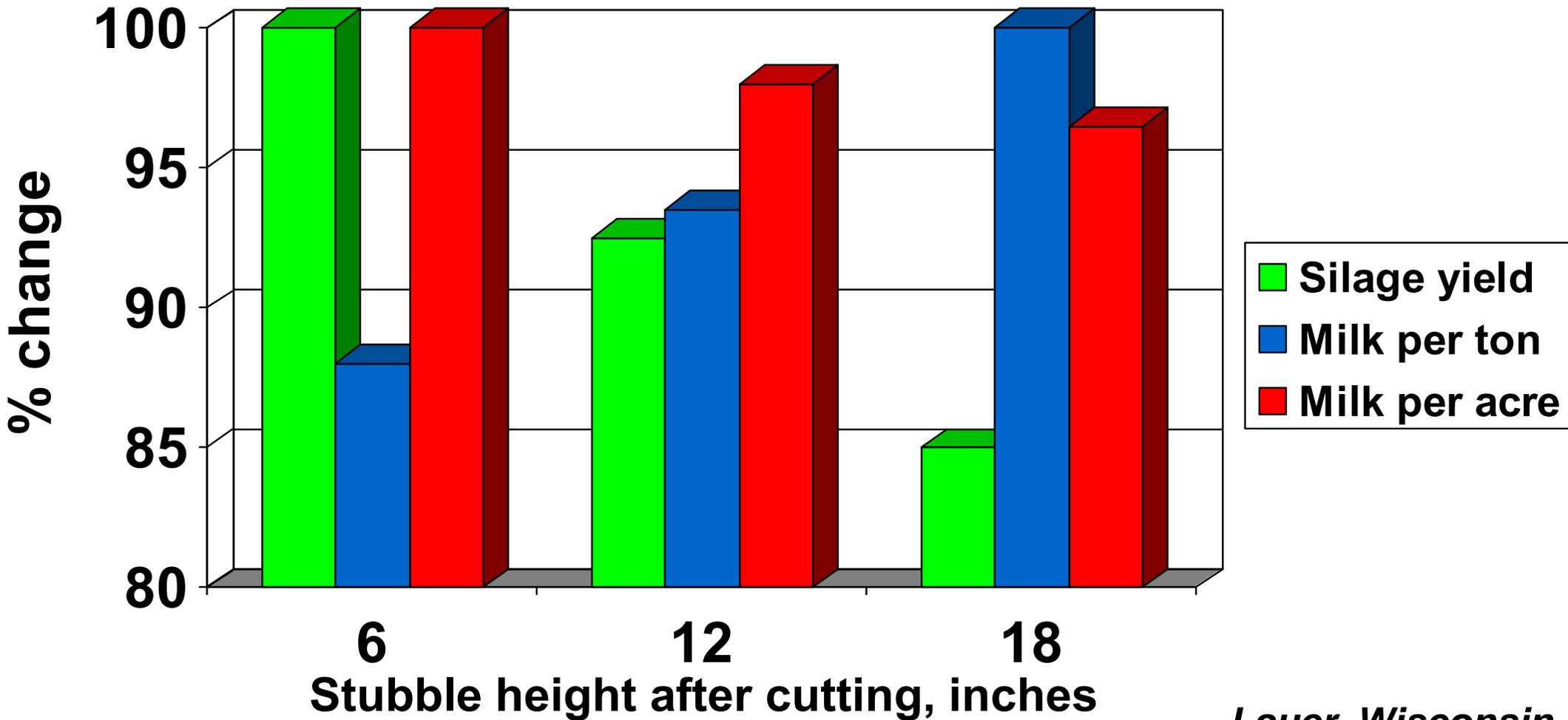


## $\text{NO}_3$ , ppm

➤ Leaf: 284

➤ Ear: 75

# Effect of Cutting Height of Corn Plants on Silage Yield and Quality



*Lauer, Wisconsin*









# Nitrates and Diphenylamine Test

Nitrate, ppm	% of stalks turning blue
0 to 2,500	46%
2,500 – 6,000	67%
6,000 to 10,000	86%
10,000 to 15,000	95%
> 15,000	100%

**61% false positives**  
**11% false negatives**

# Feeding Precautions

- **Plants with few ears have a greater portion of N in ruminally soluble form**
  - **Keep diet N at ~50% ruminally degradable N**



# Feeding Precautions

- **Plants with few ears have a greater portion of N in ruminally soluble form**
  - **Keep diet N at ~50% ruminally degradable N**
- **Don't overfeed nitrates (less than 0.44% of dietary DM)**
- **Don't underfeed starch (24-26% of diet DM)**
- **Have NDF tested for digestibility to better estimate NEL**

# Summary

- **Effect of drought on corn plant development is most negative at pollination and during grain filling**
- **Smut probably does not pose a health problem to cows**

# Summary

- **Ensilage corn plants at 30 to 35% DM**
- **Analyze silage before feeding for**
  - **Nitrates**
  - **Protein and soluble protein**
  - **Starch**
  - **Digestible NDF**