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Effects of Drought Stress on Corn Production

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Corn grain and forage yields are reduced throughout most of South Dakota. This publication discusses 1) drought stress effects on corn yield potential, 2) how to estimate potential grain yields prior to harvest, and 3) alternate uses for drought stressed corn.

Research from Wisconsin indicates grain yield reductions might be expected from a short, severe stress period of 7 to 10 days as indicated below. Should the stress period be longer, then greater grain yield reductions can occur.

Growth Stage	Final Yield Decrease/ Day of Severe Stress %/day
10-Leaf	1 - 2
15-Leaf	2 - 4
Tassel/Silk	5 -15
Blister	3 - 6
Milk	3 - 5
Dough	3 - 4
Dent	2 - 3
Maturity	0

The greatest damage from heat and moisture stress occurs during the pollination and fertilization period which starts a few days after the tassels appear.

Shortly after the emerged tassels open and begin to shed pollen, the silks from the potential corn ear start to emerge and are receptive to the pollen. Once the silks receive the pollen, fertilization occurs and the ultimate formation of the kernels begins.

This period (tasseling to complete silk emergence) is considered to be the most critical time for corn yield because these are the most susceptible growth stages for yield reduction. Later rainfall will not correct damage done during this period. As indicated in the table, yield reductions of 5-15% can occur for each day of severe stress.

The pollination-fertilization period in nonstressed corn generally lasts about 8 days. Tassels emerge and begin to shed pollen 2 days before the first silks emerge. Once the silks emerge, pollination-fertilization begins and lasts about 6 days until all the silks have emerged and pollen shedding ends.

In contrast, in stressed corn the pollen begins to shed but silk emergence is delayed 3 or 4 days. Tassels also stop shedding earlier. Consequently, the pollination-fertilization period is much shorter, sometimes only 1 to 2 days compared to the 6 for non-stressed corn. In fact, pollen shedding may stop before all of the silks have emerged. A blank ear will result.

Because of the drought, some producers need an easy way to estimate potential yield to see whether harvesting the crop for grain is warranted. A common method is:

1) Determine the number of ears in 1/1000th of an acre.

The length of row needed to obtain a sample of this size is dependent upon row spacing.

Measure out 26 feet one inch for 20-inch rows 18 feet 8 inches for 28-inch rows 17 feet 5 inches for 30-inch rows 14 feet 6 inches for 36-inch rows 13 feet 9 inches for 38-inch rows 13 feet one inch for 40-inch rows. Use this number in step 3.

2) Within the sample area, randomly select three ears and count the number of kernel rows and kernels per row from each ear. If kernels near the tip are less than half size, then omit them from the count.

Average the number of kernel rows and kernels per row for the three ears selected. Use these numbers in step 3.

3) Multiply the number of ears from the sample area (1/1000th of an acre) X average number of kernel rows X average number of kernels per row X 0.01116. This will give you bushels per acre at 155% moisture.

4) Repeat steps 1-3 at several locations in the field and average those values to give you an estimate of yield potential.

The actual yield estimate obtained will vary according to test weight and kernel size. The accuracy of the estimate may be somewhat improved by increasing the number of sample locations within a field. Keep in mind that this is a rough estimate.

Should badly "fired" corn be chopped before it gets worse?

Even though many of the lower leaves may be brown, whole plant moisture content will still probably be 75-90%. This is too wet for proper silage fermentation.

Whole-plant moisture content should be tested before ensuing drought-stressed corn. Plant moisture content should be in the range of 55 to 70% for acceptable silage fermentation. Wait until this moisture range is reached before chopping.

Does drought-stressed corn accumulate nitrates?

Nitrates will accumulate in the stalk and leaves. Nitrate levels will be highest in corn plants stressed during pollination. Green-chopped forage will be the highest in nitrates.

Do not allow green-chopped forage to sit in wagons to heat. Chop only amounts that cattle will consume within a few hours. Ensiling will reduce nitrate levels 25 to 50%. Allow at least 3 weeks after ensiling before feeding the forage.

Have the corn tested for nitrate content. Station Biochemistry at SDSU will analyze forages for nitrates at a charge of $5.50 per sample.

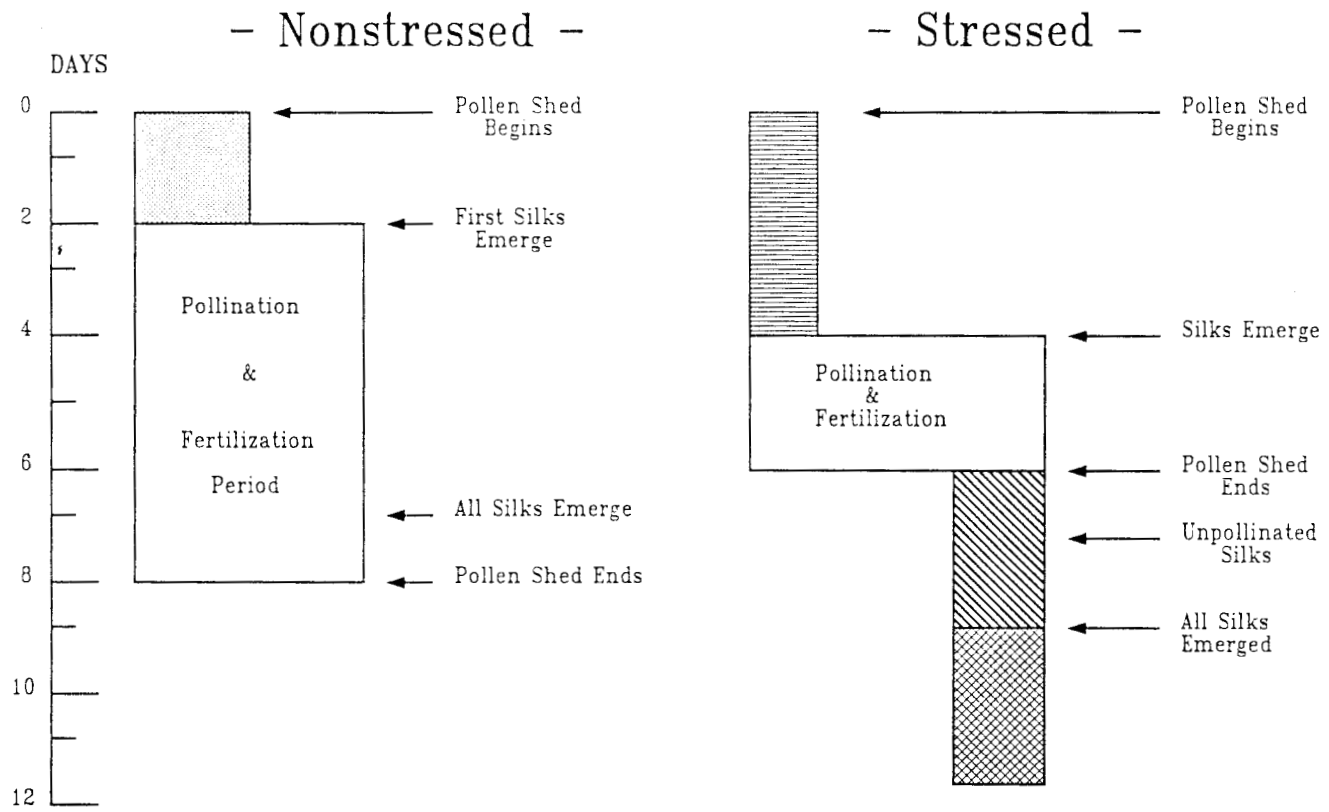
When collecting material for analysis, take as representative a sample as possible. Combine material from several parts of the field. Place samples in air-tight containers to prevent loss of moisture and mail to: Station Biochemistry, Oscar Olson Biochemistry Labs, South Dakota State University, Box 2170, Brookings, SD 57007.

What is the feeding value of drought-stressed corn?

Drought-stressed corn silage that contains no grain will typically have 75 to 95% of the feed value of normal silage.

Energy values will be lower, crude protein values will be similar, and fiber values will be lower in drought-stressed corn. Have the silage tested for quality to determine its feeding value.

Illustration of Corn Pollination – Fertilization Period When Exposed to Nonstressed Vs Stressed Conditions



What is the potential silage yield of corn having little or no grain?

For moisture-stressed corn, about one ton of 30% dry matter silage per acre can be obtained for each 5 bushels of grain per acre. If a grain yield of 50 bu/A is expected, about 10 tons/A of 30% dry matter silage will be produced.

If no grain is expected, silage yields can be estimated using plant height. For each foot of plant height about one ton of 30% dry matter silage can be obtained. On this basis, corn that is 4 feet high will produce about 41/A of 30% dry matter silage.

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