Effects of Intensity and Frequency of Early Season Defoliation on Corn Grain Yield

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Abstract

Multiple biotic and abiotic events can results in early season defoliation of corn (*Zea mays* L.) plants. The recovery from, and resulting impact of this defoliation depends on the timing, severity, and frequency. Our objective was to evaluate the effect of clipping plants at approximately 2.5 cm above the soil beginning at V3 and continuing for three weeks. Studies were conducted in 2011, 2012 and 2013 at Kentland Farm near Blacksburg, VA. Treatments were imposed with a string trimmer at one, two, or three times weekly in a full factorial arrangement with timing of V3, one and two weeks later, with four replications in a randomized complete block design. Plot size was 4, 76 cm rows by 5 m long. At maturity, all ears were counted and harvested from 3 m of row from the center two rows in each plot and weighed. A representative six-ear subsample was then shelled and grain test weight and moisture determined. Ears ha^{-1}, kernels ear^{-1}, kernel weight and cob weight were likewise determined on shelled samples. Defoliation during the first week (V3) even on multiple days had little effect on grain yield. By the second week, multiple defoliation timings decreased yield more than a single event. Defoliation during week three (V6) resulted in the greatest yield loss.

Materials and Methods

- In early May of each year corn was planted directly into recently killed cereal winter cover crop using a Wintersteiger Plot King no-till plot planter at a population of 69,000 seeds ha^{-1}.
- The area was divided into plots that were 4, 76 cm rows wide and 5 m long.
- Treatments were imposed in a randomized complete block design with four replications.
- Beginning at the V3 stage and for the two following weeks a string trimmer was used to trim corn plants to a height of approximately 2 cm either once, twice or three times per week creating a factorial arrangement of treatments. The string trimmer created a non-uniform or “ragged” defoliation that would be more similar to most natural damage than incising the plants with a razor.
- Production practices, other than the treatments outlined above followed Virginia Cooperative Extension recommendations.
- At maturity, corn was hand-harvested from 3 m of the center two rows of each plot. The number of plants and harvested ears was also recorded form this harvested area. All harvested ears were weighed and a representative six-ear subsample selected. Subsamples were oved-dried at 40°C until the grain reached approximately 150 g kg^{-1} moisture. The six-ear subsamples were then shelled, grain weighed, and grain moisture and test weight determined via a DICKEY-john GAC 2500 (DICKEY-john, Auburn, IL). Yields are reported on a consistent 155 g kg^{-1} moisture basis.
- Analysis of variance was conducted using Proc GLIMMIX in SAS with replication considered a random effect and defoliation timing and frequency as fixed effects. Treatment mean separations were performed using Tukey’s test with significant fixed at p<0.05.

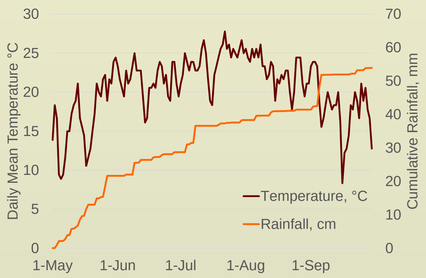
Materials and Methods (cont.)

Treatments

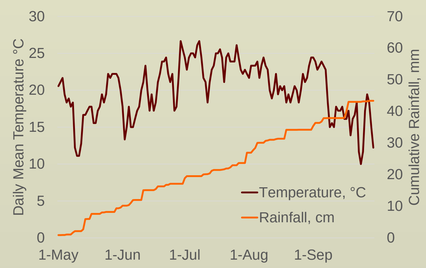
Frequency	Timing: Week 1 (V3)	Week 2 (V4-5)	Week 3 (V6)
Once week^{-1}	1	0	0
Once week^{-1}	0	1	0
Once week^{-1}	0	0	1
Once week^{-1}	1	1	0
Once week^{-1}	1	0	1
Once week^{-1}	0	1	1
Once week^{-1}	1	1	1
Once week^{-1}	0	0	0
2X week^{-1}	1	0	0
2X week^{-1}	0	1	0
2X week^{-1}	0	0	1
2X week^{-1}	1	1	0
2X week^{-1}	1	0	1
2X week^{-1}	0	1	1
2X week^{-1}	1	1	1
2X week^{-1}	0	0	0

Weather

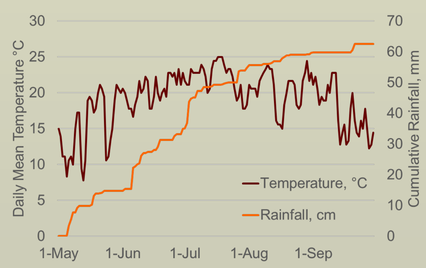
2011



2012



2013



Results

Week 1

Week 2

Week 3, trimmed

Week 3, check

June 27

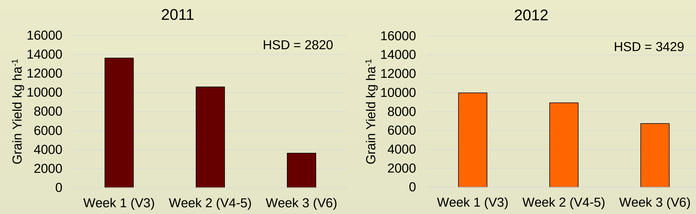
July 20

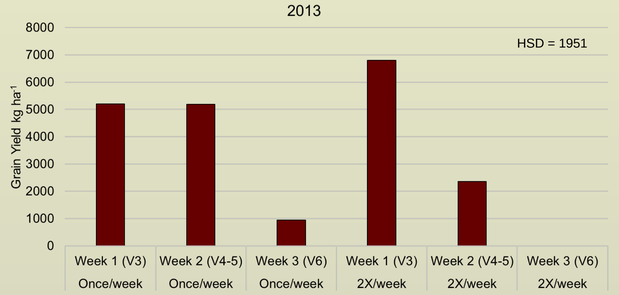
Results (cont.)

Effect of Early Defoliation on Ears ha^{-1}, Harvest

Frequency	Timing: Week 1 (V3)	Week 2 (V4-5)	Week 3 (V6)	2011 Ears ha^{-1}	2012 Ears ha^{-1}	2013 Ears ha^{-1}
Once week^{-1}	1	0	0	68860	52362	37299
Once week^{-1}	0	1	0	67784	54873	44472
Once week^{-1}	0	0	1	12911	13449	20801
Once week^{-1}	1	1	0	68860	61866	38016
Once week^{-1}	1	0	1	29533	42499	20084
Once week^{-1}	0	1	1	35506	39809	7890
Once week^{-1}	1	1	1	29050	40347	17932
Once week^{-1}	0	0	0	78543	30126	49493
2X week^{-1}	1	0	0	66708	31202	48058
2X week^{-1}	0	1	0	69936	23133	26540
2X week^{-1}	0	0	1	5145	12373	0
2X week^{-1}	1	1	0	45189	31202	17215
2X week^{-1}	1	0	1	15795	22057	2695
2X week^{-1}	0	1	1	0	41603	0
2X week^{-1}	1	1	1	10388	27974	0
2X week^{-1}	0	0	0	76391	50031	43037
HSD (0.10)				ns	21560	11577

Effect of Early Defoliation on Grain Yield





Summary

- Temperatures and rainfall were generally favorable for corn growth in all three seasons.
- Using a string trimmer to impose defoliation proved an effective method to simulate damage to corn foliage.
- Trimming plants to a 2 cm height at V3 had limited lasting effect on corn stand, growth or grain yield.
- Trimming twice per week at V3-V4 state also had little effect on yield potential.
- Trimming plants once during week 2 (V4-V5) had little effect on plants ha^{-1}, final ear numbers or grain yield.
- Trimming plants twice during week 2 (V4-V5) began to have an additive effect with reduced stand and yield, especially in 2013.
- Trimming plants during week 3 (V6) resulted in grain yield decreases in all years, but with greater effect in 2011 and 2013.
- Trimming plants at 2 cm more than once during week 3 (V6) resulted in near complete loss of the stand.