Effects of Irrigation on Wheat Canopy Temperature and Yield

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INTRODUCTION

Traditionally in Kentucky, irrigation is unnecessary due to the high precipitation usually experienced in the state. However, with bouts of droughts becoming increasingly frequent in recent years, irrigation is serving as a backup method to ensure crop success for many producers. As a grain crop, wheat favors cooler temperatures with a higher yield generally being associated with a lower average canopy temperatures. The goal of this research project was to increase the overall yield by lowering the canopy temperature during grain fill. The specific objective was to determine whether canopy temperature and grain yield were affected by irrigation of 0.12" at noon on sunny days.

MATERIALS AND METHODS

The soft red winter wheat cultivar Pembroke 2016 was planted in late October 2017 under a lateral irrigation system at the University of Kentucky Research and Education Center in Princeton, Kentucky.

Plots were managed according to University of Kentucky recommendations[1].

There were four replications of two treatments: one with 0.12" water irrigated to it at noon every day if it was sunny, and the other received no irrigation.

Canopy temperature was measured with Decagon infrared thermometers. The thermometers were 14° half angle ultra narrow field of view mounted at a 60° angle at a height of 5 feet to measure an area of approximately 6' 11" by 19' 3". EM50 data loggers were used to collect and store canopy temperature once per minute from May 23rd to physiological maturity (Feekes 11.4) on June 11, as determined when the peduncle area closest to the wheat head had turned brown.

Grain was harvested June 11th and 12th with a Wintersteiger small plot combine equipped with a Harvest Master weighing system. Yield and test weight were determined and adjusted to 13.5% grain moisture.

Data was analyzed with SAS (version 9.4; PROC MIXED) to determine if differences in yield, test weight and canopy temperature existed.

REFERENCES

[1] Comprehensive Guide to Wheat Management in Kentucky http://www2.ca.uky.edu/agcomm/pubs/id/id125/id125.pdf

[2]Univ of KY Ag Weather Center http://weather.uky.edu/

ACKNOWLEDGMENTS

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WEATHER BACKGROUND

Figure 1: The precipitation received on April 27th- June 11th and the 30 year average for the same time frame.

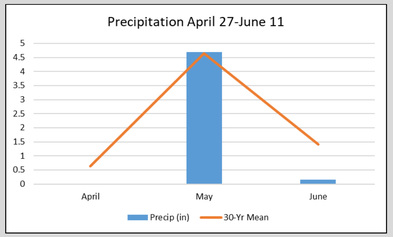
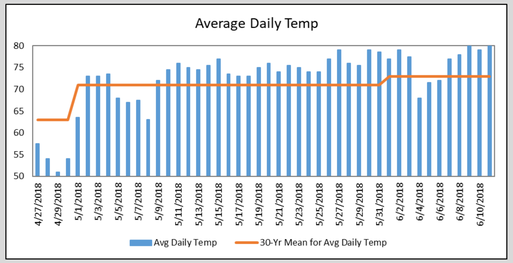


Figure 2: Daily temperature averaged for April 27th- June 11th and the 30 year mean.



- While precipitation for the month of May was similar to the 30 year averages, April and June were both comparatively dry when looking at the 30 year averages.
- Daily temperatures were largely greater than their 30 year averages in both May and July, in contrast to the much lower temperatures of April.

RESULTS

Figure 3: The average canopy temperature for the irrigated and non-irrigated treatments.

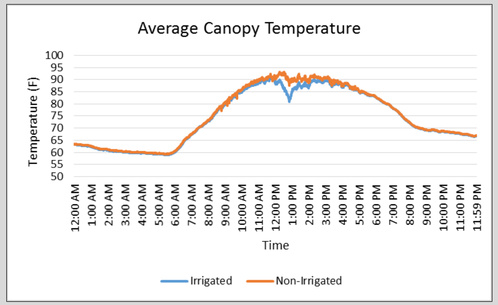
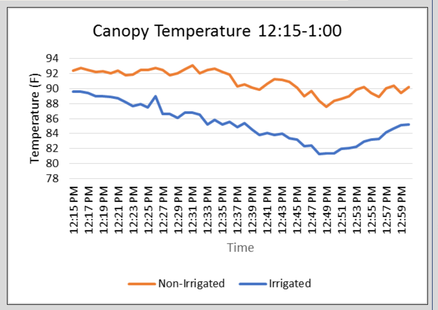


Figure 4: The averaged canopy temperature, comparing the irrigated and non-irrigated.



- Canopy temperature for the irrigated plots were significantly (*P*<0.05) lower beginning 15 min after the start of irrigation (12:15) and ending 15 min after the end (1:00).
- A constant decrease in temperature was observed as long as the irrigation was running.
- The range of significant canopy temperature differences between the irrigated and non-irrigated treatments was 3.1° F to 7.7° F.

- Canopy temperature decreased almost 8° F following application of 0.12" of water.

Table 1: Mean grain yield, test weight, and canopy temperature for the irrigated and non-irrigated treatments.

Treatment	Grain Yield (bu/A)	Test Weight (lb/bu)	Canopy Temperature[1]
Irrigated	67.1	49.2	85.3
UTC[2]	64.6	49.5	91
P - value	0.0163	0.4525	<0.0001

[1]Average of range from 12:15-1:00
[2]Untreated Control

- Yield increase of a small caliber was likely associated with the decrease in canopy temperature during grain fill.
- Yield increased by 2.5 bu/ac for the irrigated vs. the non-irrigated.
- Test weight between the irrigated and non-irrigated was not different.

CONCLUSIONS

We were able to decrease canopy temperatures and increase yield with as few as six irrigation events, which is likely due to an increased grain fill period as a result of the lowered canopy temperatures.

FUTURE WORK

Future work could include the analysis of the applicability to a producer, specifically whether similar results are realized with much larger pivot irrigation system and if it would be profitable.

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