

INTRODUCTION

- Tomato: Second-most valuable crop globally (FAOSTAT, 2017)
- Worldwide Production: China (31%), India (11%), The US (9%), Turkey (7%), Egypt(5%) (Heuvalink et al.,2020)
- The US production: 239 million cwt (12.14 Metric ton)
 - California contribution: 96% (USDA-ERS, 2020)
- Texas Tomato Production: Negligible contribution
 - > 80% demand supplied by imports from Mexico

PROBLEM STATEMENTS

- Extreme temperatures during spring-summer cropping period
- Lack of genetic materials adapted to high temperature exposures

OBJECTIVES

- Identify agronomically superior heat tolerant tomato genotypes in open field conditions
- Evaluate selective physio-biochemical traits determining tolerance or sensitivity of selected genotypes
- Establish correlations between morphological performance, physiological-biochemical response, and yield components in heat-stressed tomato plants

APPROACH



First Open Field Study

- Feb 2019 to July 2019
- RCBD (43 varieties, 3 blocks and 7 replications)
- Average marketable yield (six harvests)

Second Open Field Study

- Feb 2020 to July 2020
- RCBD (24 varieties, 4 blocks and 8 replications)
- Gas exchange measurements, SPAD, electrolyte leakage (EL), heat injury index (HII), leaf temperature (LT), chlorophyll fluorescence (CF): 51 and 86 DAT
- Average marketable yield (four harvests)

RESULTS AND DISCUSSION

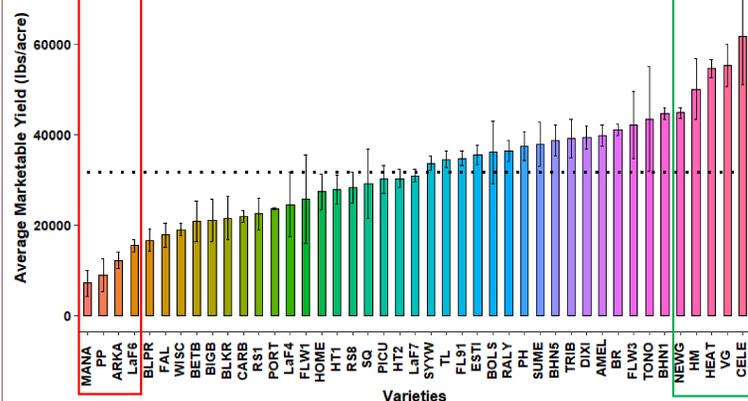


Figure 1: Average marketable yield (lbs/acre) of 43 tomato varieties obtained in the first open field study-2019.

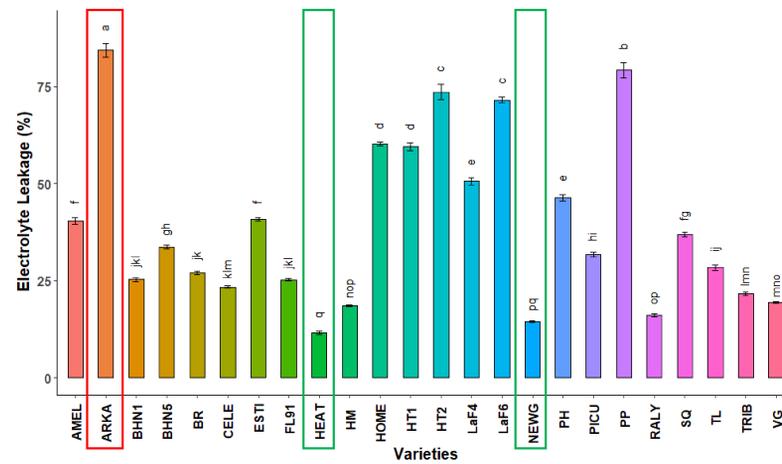


Figure 2: Average electrolyte leakage (%) of 24 varieties in the second open field study-2020.

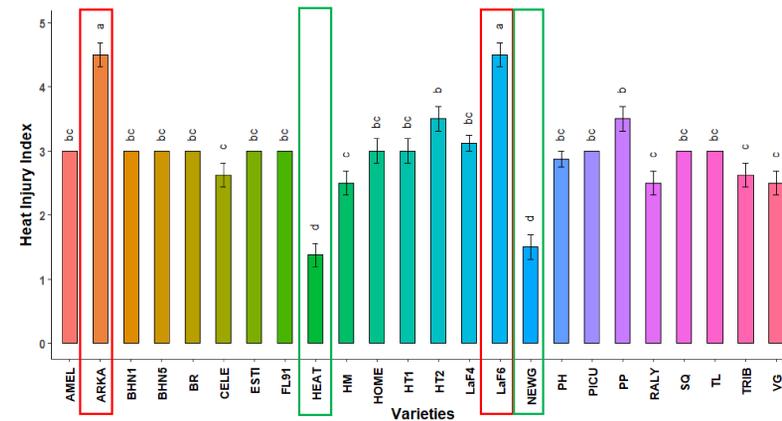


Figure 3: Average heat injury index (HII) of 24 varieties in the second open field study-2020.

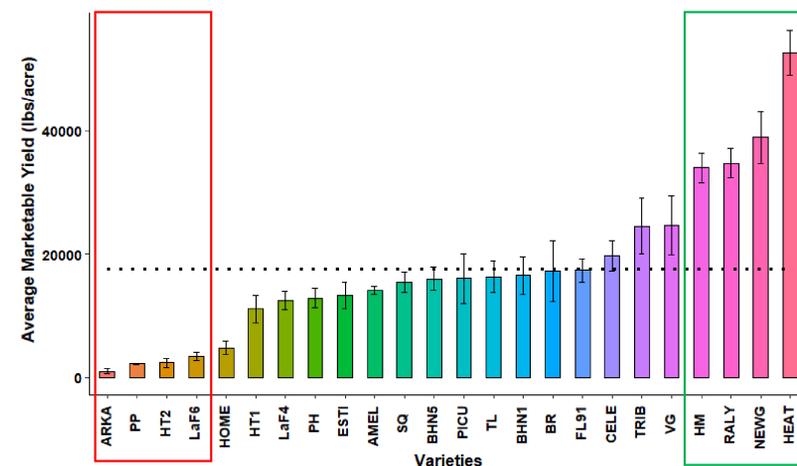


Figure 4: Average marketable yield (lbs/acre) of 24 tomato varieties obtained in the second open field study-2020.

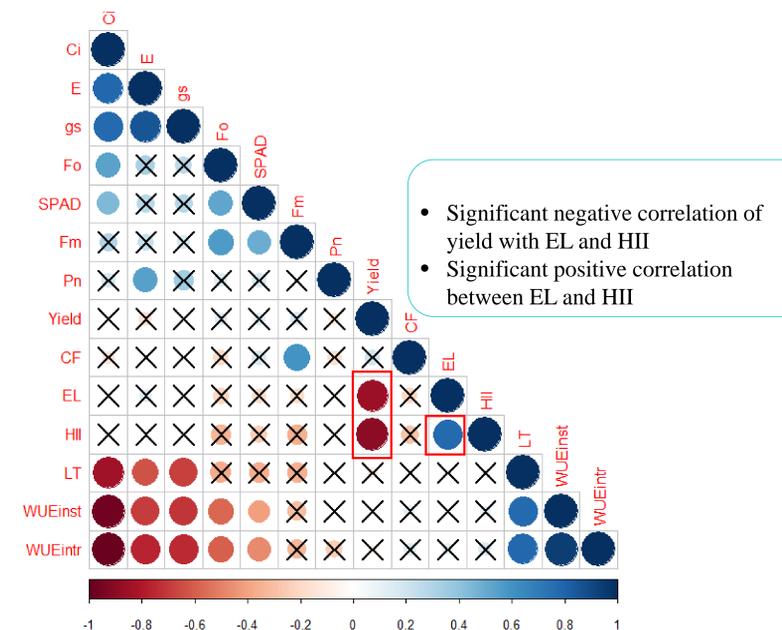


Figure 5: A correlogram showing correlation between the measured variables in the second open field study-2020.

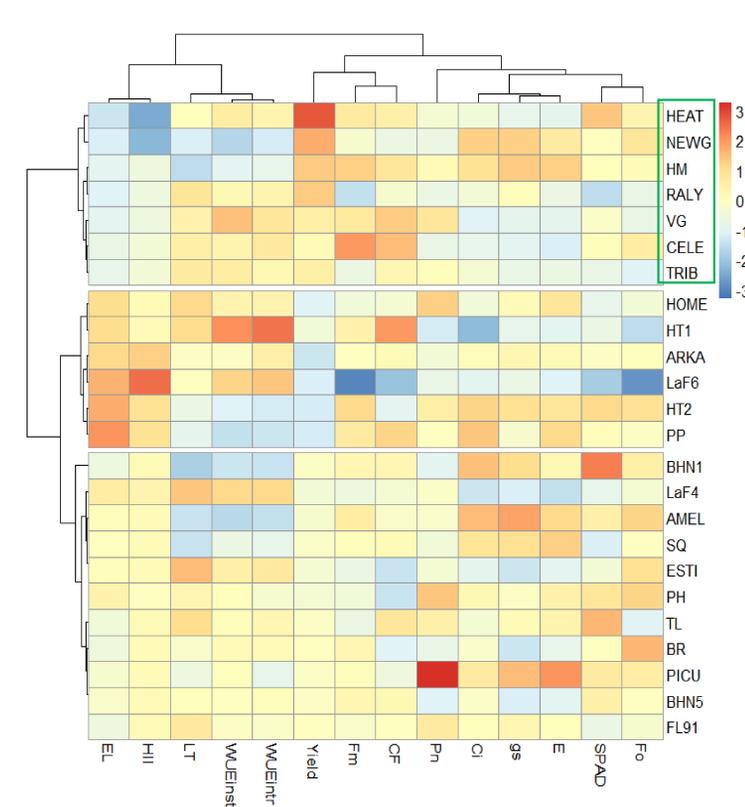
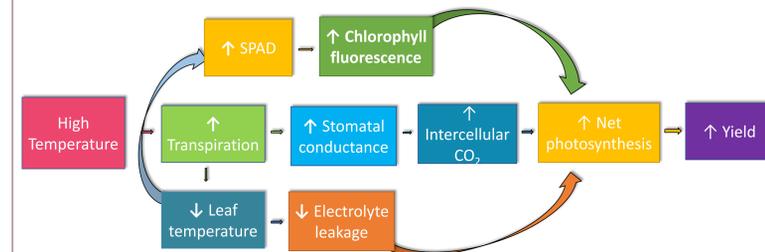


Figure 6: A heatmap and clustering of varieties based on the scaled values of the measured variables obtained under second open field conditions.

- Varieties with high electrolyte leakage and heat injury index had lower yield, and vice-versa
- Varieties clustered clearly based on EL, HII and yield
- Heat tolerant varieties: low leaf temperature → unaltered membrane stability → low electrolyte leakage → unaffected PSII functionality → high yield

CONCLUSION

- The most effective methods: Electrolyte leakage(EL) and visual injury symptoms (Heat Injury Index)
- Heat-tolerant varieties: Heat Master, New Girl, HM-1823, Rally, Valley Girl, Celebrity, and Tribeca
- Mechanism of heat-tolerance observed:



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- Heuvelink, E., Okello, R. C., Peet, M., Giovannoni, J. J., & Dorais, M. (2020). 7 Tomato. *The Physiology of Vegetable Crops*, 138.
- USDA ERS. (2020). Vegetable and pulses outlook (table 5).

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TAMU SEED GRANT

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