Reducing Crop Abiotic and Biotic Stress by Understanding Plant, Insect Population, Disease Incidence and Soil Water Variability Overlay Patterns

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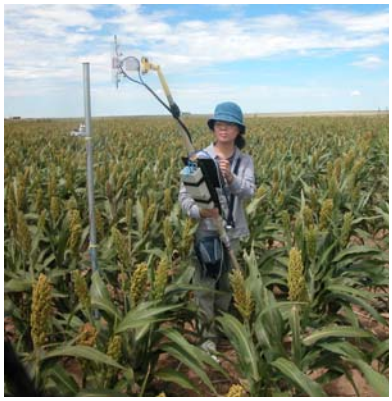
BACKGROUND

Crop growth and crop yield are affected by abiotic and biotic factors including weather (rain, heat and temperature), soil conditions (water, pH and nutrients), insect populations, disease incidence and management practices (cultivar, irrigation, fertilization and rotation). Crop growth conditions are vastly variable on the High Plains, and complex relations of these factors in the cropping systems have not been established.

There is a need of greater understanding of crop physiological responses to the abiotic and biotic factors for improving non-irrigated crop production for producers in the High Plains. Practical applications of remote sensing technology can lead to real-time, cost-effective methods to more efficiently manage crop physiological stresses in variable environments.



Hyperspectral measurement (left) and mast-mounted infrared thermometer system (right).

OBJECTIVES

- Assess spatial/temporal overlay patterns of soil/plant water dynamics, canopy infrared temperature, crop hyperspectral reflectance, insect populations, and disease incidence in the established grid.
- Develop dynamic models that use the type of information gathered to predict yield, plant growth, plant water use, and insect variations in space and time.
- Suggest efficient management strategies to reduce plant biotic and abiotic stresses.

RESULTS/BENEFITS

Our data show that sorghum grain yield was positively correlated with soil water content, and negatively correlated with canopy infrared temperature, greenbugs, corn leaf aphid, maize dwarf mosaic virus, and site elevation ($P < 0.05$). Semivariogram analysis showed that these variables were correlated in space within 30-48 meters. Differences in site characteristics suggest the need for further examination of the spatial influences of soil water, texture, and geographic features in the sorghum yield, insects, disease incidence, and canopy temperature overlay patterns for sorghum cropping management against chronic drought and high temperature.

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