

# Assessment of the impact of micro-meteorological conditions on plants growth

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*Received: / Accepted: / Published:*

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**Abstract:** Agrometeorology is an interdisciplinary science aimed at finding and understanding the impact of changing weather conditions on plant's growth and their abilities to adapt to changing conditions. In this communication, the effect of outdoor temperature and humidity on plant's performance (Okinawa Spinach) is studied. To the extent of the period of study (two months during summer 2016) the following results were obtained: Plants were more sensitive to diurnal values of temperature and humidity, the stability of the Okinawa spinach grown in campus is in agreement with the documented facts about the preference of this plant for climatic regions similar to the existing in South Florida, and the type of soil used in the pods slightly affected the measured values.

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**Keywords:** *Agrometeorology, temperature, humidity, chlorophyll level, soil moisture, plant physiology, plant adaptation.*

## Introduction

Global climate changes and the acceleration of urbanization all over world constitute serious problems for the health of soils, the microbiome inhabiting in them, and ultimately to the agriculture. Intensive agricultural practices have increased the use of industrial fertilizers, which in many cases remediate temporarily and affect in the long term the soil biochemistry.

Agriculture is one of the most important practices carried by humans since early moments of civilization [1,2]. Agricultural productivity depends on both the quality of soils and weather conditions around plantations. The study of the conditions that might contribute to the soil health, crop yields, as well as the conservation of the microbiome are of tremendous relevance nowadays. In this end, the type of soil where crops and plants grow, the level of humidity, the typical temperatures, and the level of insolation are the physical characteristics that determine the survival and productivity of plants and soils. The yield of the plant is closely related with the efficiency of the photosynthesis. Therefore, the amount of chlorophyll is a **proxy** or indicator of the plant performance. In order to guarantee a sustainable agricultural development a full understanding of the inter-relationships between the biogeochemistry of soils, weather conditions at the micro-scales, and plant physiology and adaptation to changing climates is needed.

In this communication, the assessment of the impact of the outdoor temperature and humidity around the organic garden is performed, with emphasis on Okinawa Spinach. An evaluation of the micrometeorological conditions using mobile sensors from Pasco and how they compare with meso-scales is done, using the automated weather station operated with Earth-Networks (Weatherbug). Such studies are aimed at evaluating the impact of micrometeorological conditions of the effectiveness of artisanal soil in growing Japanese lettuces.

## Experiments and Results

Okinawa Spinach is a dense, low growing plant to 70 cm high. Thriving in warm, wet conditions Okinawa Spinach does best in subtropical and tropical areas; it is sensitive to frost. It grows best in full sun to partial shade. It needs ample water; rich, fertile well-drained soil that is kept mulched and prefers a pH of between 6.1 and 6.5.

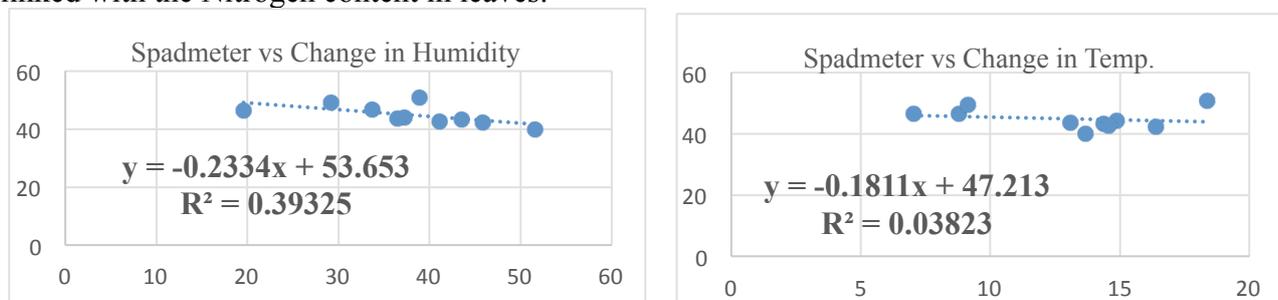


**Fig1:** Experimental set-up with 16 pots with Okinawa Spinach plants arranged under different conditions of insulation and with different soils.

A group of 16 pots with Okinawa spinach (*Gynura crepioides*) are placed outdoor in the botanical garden under different conditions of illumination and soil moisture. Meteorological conditions from the AWS – Weatherbug were recorded on a daily basis with 5 minutes resolution and extreme values included. These readings are representative of the overall weather conditions up to a radius of 5 miles around St. Thomas campus. On the other hand, mobile weather sensors from PASCO permitted the recording of

weather conditions around the plants. This way, a comparison between the mesoscale and microscale behaviors can be performed. Additionally, a mobile soil moisture sensor from PASCO is recording the variation of soil moisture of five randomly selected plants. Mobile chlorophyll sensor (spad-

meter SPA 502 Pro from Spectrum Technologies Inc.) is used to assess the chlorophyll levels in plants selected for this pilot study [3]. Plants are located in pots with different soils and different conditions of illumination. A higher spad value indicates higher chlorophyll content and then a healthier plant. It is linked with the Nitrogen content in leaves.



**Fig 2:** Changes in the measured SPAD values as functions of diurnal ranges of the temperature (left panel) and humidity (right panel) for the pot corresponding to case (d) shown above. As might be noticed, the Okinawa spinach is very tolerant to the diurnal changes in temperature, while it is slightly affected by diurnal changes in humidity.

## Conclusions

To the extent of the period of time when measurements were performed is concluded that: No substantial changes are observed with the variations in diurnal values of the temperature; plants are more sensitive to diurnal variations in humidity of the atmosphere; the stability of the Okinawa spinach grown in campus is in agreement with the documented facts about the preference of this plant for climatic regions similar to the existing in South Florida; and the type of soil used in the pods slightly affected the measured values.

## Acknowledgments

The original research summarized in the following was supported, in part; by U.S. Department of Education grant award P03C110190. We would like to thank Pia Marsh, Carlos Vazquez, Luis Cendan, and Pilar Maul for a received support while completing this project.

## Conflicts of Interest

The authors declare no conflict of interest.

## References and Notes

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