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5 June, 2017

TO WHOM IT MAY CONCERN

This is to certify that Dr. Shasthree Taduri, Assistant Professor, Department of Biotechnology, Kakatiya University, Warangal, Telangana State, India and UGC Raman Visiting Scientist at the Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS, USA has fruitfully spent his 12-month tenure at the Environmental Plant Physiology Laboratory, Department of Plant and Soil Science, Mississippi State University, MS USA from 7 July, 2016 to 11 June, 2017.

Dr. Shasthree Taduri was involved in experiments characterizing morpho-physiological traits under stressful environments on major crops such as sweetpotato, rice, and corn under sunlit plant growth chambers, sunlit-pot-culture facilities, greenhouse, and field settings. The outcome of these experiments have resulted several papers presented at regional and international meetings during the year. Few papers have been written and are in various stages of for publication in high reputed journals in this research area.

Dr. Shasthree Taduri has sincerely learnt important research methodologies related to stress induction, photosynthesis, growth and developmental parameters of crops using different tools and instruments. He also learned new ways of quantifying and developing stress-dependent response indices for various crop processes and cultivars.

In recognition of his good work done at laboratory, our physiological research findings on rice has been focused under State Spotlight of Mississippi State University web portal (http://www.msstate.edu/state-spotlight/2016/08/visiting-fellows/) and sweetpotato and corn work highlighted in the MAFES Discovers magazine, which are rare honor by themselves for innovative team research at Mississippi State University, MS. In addition, several abstracts and presentations were made at international and national meetings.

Dr. Taduri is a keen learner and sincere worker, and I fervently hope that the techniques which he has learnt during his intensive training at our laboratory will be immensely useful for further improving the standards of environmental plant physiology, physiological breeding, and trait quantification at his focal institute in India. In addition, we are in the process of developing collaborative research and teaching programs ween our institutions in the near future. If you have any questions, please feel free to ntact me at 662-325-9463 or e-mail me at: krreddy@pss.msstate.edu

Sincerely,

K. Raja Reddy
Research Professor and Mentor

DOI: 10.32615/ps.2019.137

PHOTOSYNTHETICA 58 (1): 37-44, 2020

# Ultraviolet (UV) B effects on growth and yield of three contrasting sweet potato cultivars

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## Abstract

Ground-level UV-B will stay at a high level in the next several decades and influence sweet potato growth and yield because of the remaining chlorofluorocarbons in the atmosphere. The study explored three UV-B (none, ambient, and elevated/projected) levels on three contrasting sweet potato cultivars (Beauregard, Hatteras, and Louisiana 1188) using sunlit plant growth chambers at Mississippi State University. The results showed that UV-B influenced three cultivars differently. Growth, photosynthetic rate, epidermal and leaf structure of Beauregard were negatively influenced under ambient and elevated UV-B. On the contrary, Hatteras was positively influenced, and Louisiana 1188 was influenced by elevated UV-B positively on leaf thickness and waxes content, but negatively on the vine length, dry mass, and leaf area. In summary, Beauregard, Louisiana 1188, and Hatteras were UV-B sensitive, moderately sensitive, and tolerant, respectively. Developing UV-B tolerant cultivars will benefit under both current and projected UV-B exposures.

*Additional key words*: combined response index; cultivar differences; gas exchange; *Ipomoea batatas*; leaf anatomy; water-use efficiency.

## Introduction

The solar UV-B radiation at ground level is mainly influenced by ozone in the stratosphere because it is where most ozone resides in and absorbs approximately all the UV-C (200–280 nm), most of UV-B (280–315 nm), and a small amount of UV-A (320–400 nm) radiation. It was estimated that the peak value of UV-B might triple in the U.S. in the next fifty years without the Montreal Protocol (McKenzie *et al*. 2011). However, despite the success of Montreal Protocol, the global averaged ozone concentration will not return to the 1980's level until the mid-century because of the remaining chlorofluorocarbons (CFCs) in the atmosphere (Björn and McKenzie 2008, McKenzie *et al*. 2011). Besides ozone, ground-level UV-B is also determined by solar angles, cloud cover, aerosols/pollution, and surface albedo, which change with location and time (Hideg *et al*. 2013).

Plants are significantly influenced by UV-B radiation (Wargent and Jordan 2013). On the molecular level, UV-B radiation has damaging effects on the DNA, proteins, and membranes of plants because they are UV-sensitive targets (Jansen *et al*. 1998, Björn and McKenzie 2008, Prado *et al*. 2012). Approximately 20% of crops are sensitive to UV-B radiation regarding dry mass reduction (Teramura 1983). Previous studies had already covered soybean (Koti *et al*. 2007), cotton (Kakani *et al*. 2003), and maize (Singh *et al*. 2014, Wijewardana *et al*. 2016). For example, it was found

*Received* 27 July 2018, *accepted* 9 October 2019.
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*Abbreviations*: ADM – aboveground dry mass; BG – Beauregard; CA – calcium diacetate films; CFCs – chlorofluorocarbons; CRI – combined response index; DAP – days after transplanting; FAA – formaldehyde; $F_v'/F_m'$ – photochemical efficiency of PSII in the light; $g_s$ – stomatal conductance; HT – Hatteras; LA – leaf area; LA1188 – Louisiana 1188; LDM – leaf dry mass; $P_N$ – net photosynthetic rate; PVC – polyvinyl chloride; SDM – stem dry mass; SEM – scanning electron microscope; SPAR – soil-plant-atmosphere research; SRDM – storage root dry mass; SRFM – storage root fresh mass; SRN – storage root number; TDM – total dry mass; $E$ – transpiration rate; USI – UV-B sensitivity index; UV – ultraviolet; VL – longest vine length; VNN – longest vine node number; WUE – water-use efficiency; $\Phi_{PSII}$ – effective quantum yield of PSII photochemistry.
*Acknowledgments*: This research is supported by the US Department of Agriculture (USDA) UV-B Monitoring and Research Program, Colorado State University, and under USDA National Institute of Food and Agriculture Grant 2016-34263-25763 and NIFA-MIS 043040. We thank David Brand for his technical support and Chathurika Wijewardana, Firas Alsajri, Salah Jumaa, Naqeeb Hassas, and Ajaz Lone for their help during the experiment. We thank the Flatwoods Branch Experiment Station for providing sweet potato slips. This paper is from a thesis submitted to the Academic Faculty of Colorado State University in partial fulfillment of the requirements for the degree of Master of Science.

3.72
S1-1006

2020

agronomy

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# Morpho-Physiological Characterization of Diverse Rice Genotypes for Seedling Stage High- and Low-Temperature Tolerance

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**Abstract:** Extreme temperatures are considered one of the main constraints that limit the growth and development of rice. We elucidated the root and shoot developmental plasticity of 64 rice genotypes during early seedling establishment, using the sunlit plant growth chambers at 22/14 (low), 30/22 (optimum), and 38/30 °C (high) day/night temperatures. Low temperature severely inhibited 23 traits, such as shoot (68%), root (57%), and physiological (35%) attributes. On the contrary, the high temperature positively affected most of the shoot (48%) and root (31%) traits, except root diameter and root/shoot ratio, compared with the optimum. Alternatively, leaf chlorophyll fluorescence-associated parameters declined under low (34%) and high (8%) temperatures. A weak correlation between cumulative high-temperature response index (CHTRI) and cumulative low-temperature response index (CLTRI) indicates the operation of different low- and high-temperature tolerance mechanisms at the early seedling stage. Groups of distinct rice genotypes associated with low or high-temperature tolerance were selected based on CHTRI and CLTRI. The genotypes that commonly performed well under low and high temperatures (IR65600-81-5-2-3, CT18593-1-7-2-2-5, RU1504114, RU1504122, Bowman, and INIA Tacuari) will be valuable genetic resources for breeders in developing early-season high- and low-temperature-tolerant genotypes for a broad range of both tropical and temperate rice-growing environments.

**Keywords:** cold and heat temperature tolerance; early growth stage; rice; roots; cumulative stress response indices



**Citation:** Reddy, K.R.; Seghal, A.; Jumaa, S.; Bheemanahalli, R.; Kakar, N.; Redoña, E.D.; Wijewardana, C.; Alsajri, F.A.; Chastain, D.; Gao, W.; et al. Morpho-Physiological Characterization of Diverse Rice Genotypes for Seedling Stage High- and Low-Temperature Tolerance. *Agronomy* 2021, *11*, 112. https://doi.org/10.3390/agronomy11010112

Received: 21 December 2020
Accepted: 5 January 2021
Published: 8 January 2021



## 1. Introduction

Rice (*Oryza sativa* L.) is one of the major cereal crops grown under different agroecosystems. Globally, the harvested rice area had increased from 120.1 million ha in 1960 to 161.6 million ha in 2018. During this time, the average rice yield doubled from 1.84 to 4.51 tons $ha^{-1}$ (http://ricestat.irri.org:8080/wrsv3/entrypoint.htm). Rice is the staple food for 2.5 billion people globally, particularly in Asia; 1.7 billion people depend solely on rice for their livelihood [1,2]. Although rice is grown in different climatic regions (temperate, tropical, and subtropical), it is challenging to maintain rice productivity at a high level due to its higher sensitivity to unfavorable environmental conditions [3,4]. Crop production faces multiple challenges, with >50% of plant productivity often decreased by various abiotic stresses [5]. Similarly, rice productivity in most rice-growing areas suffers