BELL PEPPER ROOTSTOCK RESPONSE TO *PHYTOPHTHORA CAPSICI* UNDER SALINITY STRESS

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Vegetable grafting is currently used as an eco-friendly technology to increase crop productivity and overcome several biotic and abiotic stress conditions that affect *Cucurbitaceae* and *Solanaceae* vegetable crops. In recent years, researchers with breeding programs and seed companies have selected rootstocks that are tolerant or resistant to specific pathogens affecting various vegetable crops, including bell pepper.

Fresh-market bell pepper is the second most important vegetable crop in Florida with a harvested area of 12,900 acres and a production value of $210 million in 2016 (USDA, 2017). Florida ranks second in bell pepper production in the USA, and in 2016 accounted for 27.8% of the national bell pepper harvested area and 27.4% of the national crop value (USDA, 2017). Nevertheless, every season the Florida bell pepper industry is threatened by the oomycete *Phytophthora capsici*, a key soil-borne plant pathogen known for its potential to cause major losses in Florida bell pepper crops (French-Monar et al. 2006). While major outbreaks of *P. capsici* have been associated with high rain fall, other factors affect the incidence of the disease. Among those, salinity stress seems to influence the severity of the disease. Seawater intrusion is not new to Florida, and irrigation with ground water characterized by moderate salinity levels combined with the increased adoption of drip irrigation systems can contribute to the development of salt stress conditions. Irrigation water salinity is a major concern, especially along the coastal areas of South Florida, where much of the bell pepper production takes place. Under such conditions, the interaction between pathogen and plant genotype, and the development of the disease may be influenced by salinity stress. It is possible that moderate salinity stress may stimulate plant defense mechanisms and enhance the plant response to the pathogen; or on the other hand, plants already weakened by salinity stress may be more susceptible to the pathogen. It is important to investigate whether using commercial rootstocks resistant to *P. capsici* for vegetable grafting enhances plant response to the combined biotic and abiotic stresses and maintains the resistance, assuring the control of the disease, or if salinity stress increases susceptibility of the crop to *P. capsici* even when using resistant rootstock genotypes.

To answer these questions, a greenhouse pot-study was conducted at the USDA-ARS U.S. Horticultural Research Laboratory in Fort Pierce, FL, with the objective of comparing the plant growth, yield, and stress response of different bell-pepper grafting combinations to *P. capsici* under no (0 mM of NaCl), moderate (30 mM of NaCl), and moderately high (60 mM of NaCl) salinity levels. ‘Blitz’ (Sakata) a

cultivar susceptible to *P. capsici* was selected as the scion. Non-grafted and self-grafted plants were compared with plants grafted onto 'Dorado' (Sakata) and 'Robusto' (Syngenta), two commercial bell pepper rootstocks resistant to *P. capsici*. Plants were grown in pots filled with a mix of sandy soil and perlite (50:50, v:v) and fertigated daily through a drip-irrigation system. Salinity treatments started 14 days after transplanting (DAT). Two weeks later, at 28 DAT, soil was inoculated with *P. capsici*.

At 21 days after salinity treatment initiation, the dry biomass of non-inoculated plants was not influenced by salinity treatments. Leaf fresh weight and leaf area decreased with increasing salt level. No differences were observed between grafting combinations, except for the root dry weight that was higher in plants grafted onto Dorado compared to all other grafting combinations. At 64 DAT, 50 days after salinity treatment started and 36 days after *P. capsici* inoculation, all three factors had an impact on plant growth, and a significant interaction was observed between all three factors for leaf area and a few other parameters (Fig. 1). At harvest, total fruit number and fruit fresh weight per plant were affected by salinity level and grafting combination, and a significant interaction was observed between grafting combination and the inoculation with or without *P. capsici* (Fig. 2). A significant interaction was observed between the three factors (Fig. 3) with regard to the incidence of disease. In inoculated soil, plants of Blitz non-grafted and self-grafted showed consistently higher incidence of Phytophthora blight compared to those grafted onto Dorado and Robusto. Moreover, plants grown under moderate salinity (30 mM of NaCl) had a higher disease incidence compared to those grown with 0 and 60 mM of NaCl.
In conclusion, irrigation with moderately saline water may increase the incidence of Phytophthora blight in susceptible cultivars of bell pepper, however, the use of commercial rootstocks resistant to *P. capsici* can assure the control of the disease either with no, moderate, or moderately high levels of salinity.

References

French-Monar, R.D., Jones, J.B. and Roberts, P.D., 2006. Characterization of Phytophthora capsici associated with roots of weeds on Florida vegetable farms. Plant Disease, 90(3), pp.345-350.

U.S. Department of Agriculture (USDA). 2017. Vegetable annual summary. U.S. Dept. Agr., National Agricultural Statistics Service, Washington, DC.

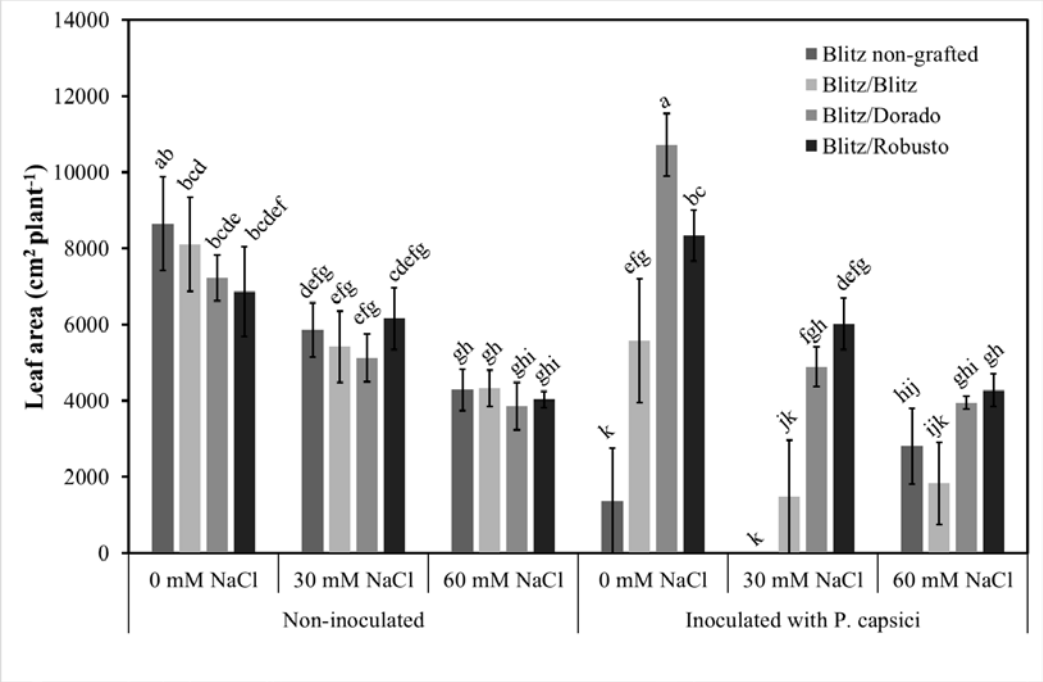

Fig. 1 Leaf area of bell pepper (*Capsicum annum* L.) plants cv 'Blitz' non-grafted (Blitz), self-grafted (Blitz/Blitz), or grafted onto 'Dorado' (Blitz/Dorado) and 'Robusto' (Blitz/Robusto), in response to no- (0 mM of NaCl), moderate- (30 mM of NaCl), and moderately high (60 mM of NaCl) salinity stress in soil inoculated (15 mL of zoospore suspension containing approximately 15,000 zoospores) or without *Phytophthora capsici*.

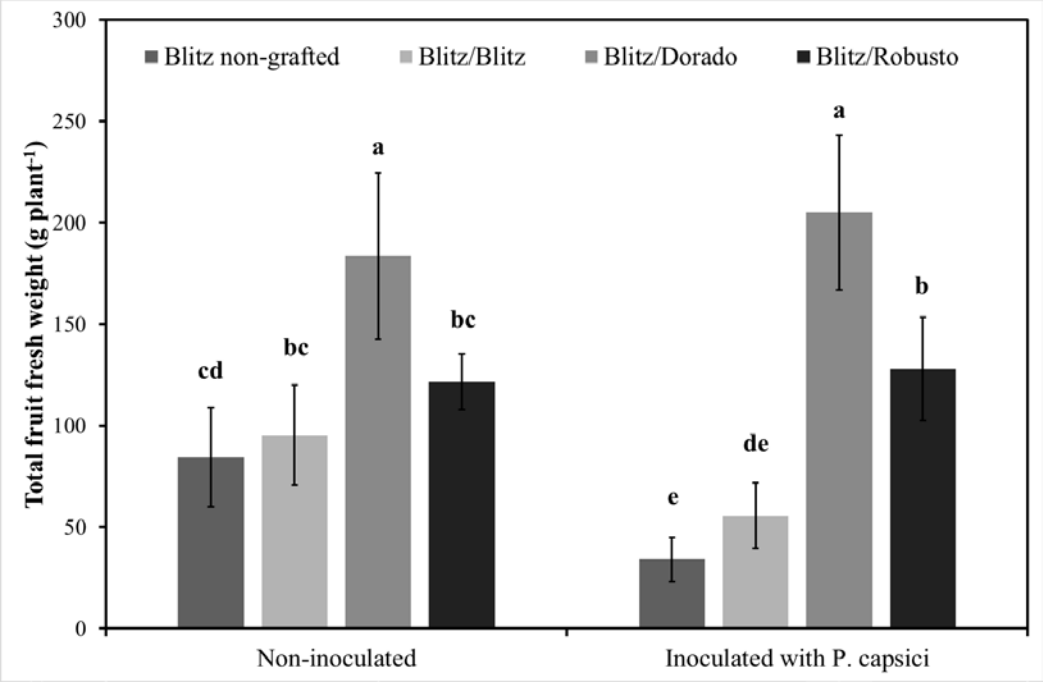

Fig. 2. Total fruit fresh weight of bell pepper (*Capsicum annum* L.) plants cv 'Blitz' non-grafted (Blitz), self-grafted (Blitz/Blitz), or grafted onto 'Dorado' (Blitz/Dorado) and 'Robusto' (Blitz/Robusto) grown in soil inoculated (15 mL of zoospore suspension containing approximately 15,000 zoospores) or without *Phytophthora capsici*.

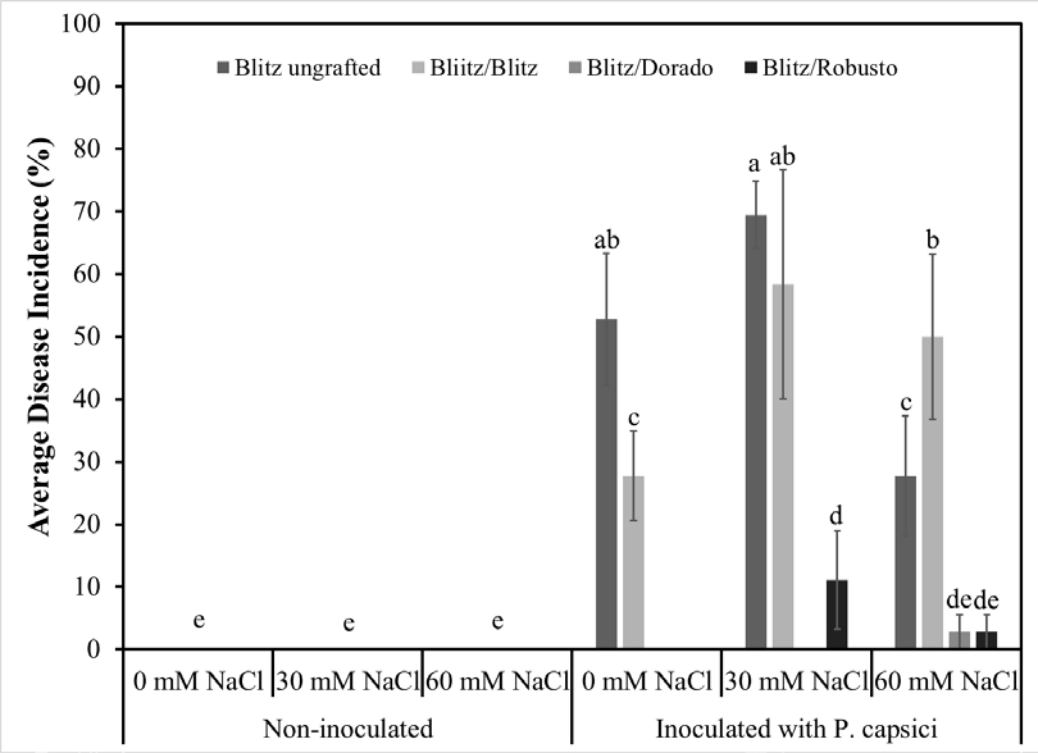

Fig. 3. Phytophthora blight Average Disease Incidence of bell pepper (*Capsicum annum* L.) plants cv 'Blitz' non-grafted (Blitz), self-grafted (Blitz/Blitz), or grafted onto the commercial rootstocks 'Dorado' (Blitz/Dorado) and 'Robusto' (Blitz/Robusto), grown in soil inoculated with *Phytophthora capsici* (15 mL of zoospore suspension containing approximately 15,000 zoospores) 28 days after transplanting and grown with nutrient solution containing 0, 30, and 60 mM of NaCl, starting at 14 days after transplanting.