Influence of soil and foliar application of fulvic acid on yield parameters of organically grown bell peppers (Capsicum annuum L.) under open-field conditions in Tennessee

Pinkky Kanabar  
*Tennessee State University*

Dilip Nandwani  
*Tennessee State University*

Follow this and additional works at: [https://digitalscholarship.tnstate.edu/rsp_students](https://digitalscholarship.tnstate.edu/rsp_students)

Part of the [Plant Sciences Commons](https://digitalscholarship.tnstate.edu/rsp_students) and the [Soil Science Commons](https://digitalscholarship.tnstate.edu/rsp_students)

**Recommended Citation**

[https://digitalscholarship.tnstate.edu/rsp_students/2](https://digitalscholarship.tnstate.edu/rsp_students/2)

This Article is brought to you for free and open access by the Research and Sponsored Programs at Digital Scholarship @ Tennessee State University. It has been accepted for inclusion in Student Research by an authorized administrator of Digital Scholarship @ Tennessee State University. For more information, please contact XGE@Tnstate.edu.
Influence of soil and foliar application of fulvic acid on yield parameters of organically grown bell peppers (Capsicum annuum L.) under open-field conditions in Tennessee

Pinkky Kanabar and Dilip Nandwani
Department of Agriculture and Environmental Sciences, Tennessee State University, TN

Abstract

Due to increased demand for healthier fresh produce by consumers, growers are seeking for environmental-friendly techniques to improve sustainability and profitability in organic vegetable production. The use of fulvic acid biostimulant coupled with different mode of application can contribute to enhanced plant growth and high-quality yield. A field experiment was conducted in a randomized complete block design with three replications at the organic farm of Tennessee State University in summer 2021. The influence of foliar and soil application of fulvic acid biostimulant on yield of organically grown bell peppers (Capsicum annuum L.) was investigated. Transplants were raised from organic seed of bell peppers var. Revolution F1 in a greenhouse and transferred in the field on plastic mulch with drip irrigation. Fulvic acid was applied as a soil drench to the plant root area and foliar spray on the leaf surface at different rates (0.3, 0.7, 1.4 l/oz gal) three times a week starting from two weeks after transplanting. Results indicate increased yield in response to foliar application of fulvic acid and showed significant differences (p < 0.05) among treatments. Foliar 0.7 l/oz gal led to highest yield (9.41 lb/plant) with subsequent increase in yield at 0.7 oz gal (9.21 lb/plant) and Foliar 1 l/oz gal (0.99 lb/plant) as compared to control and other treatments. Foliar 0.7 and 1 l/oz gal also led to highest number of fruits (30 fruits/plant). Soil concentration at 0.7 and 1 l/oz gal resulted in statistically significant mean fruit weight (0.33 lb). Fruit length and fruit diameter showed no significant difference in control and fulvic acid treatments. Preliminary trial suggests that foliar application of fulvic acid was effective and could be used to increase marketable yield in organic bell pepper production.

Introduction

Bell Pepper (Capsicum annuum L.) is an important cash crop, not only for its economic value but also for its blend of color, taste, and presence of nutritional antioxidants (Zheng and Hanusa, 2003). According to the U.S. Department of Agriculture (USDA, 2017 Census of Agriculture, there are 434 farms growing bell peppers in Tennessee on 255 acres (USDA, NASS, 2019). The number of operations growing bell peppers and the number of acres on bell pepper production in Tennessee increased by 280 percent and 8 percent, respectively, between 2012 and 2017. The potential for increased bell pepper production in Tennessee appears to be favorable. To enhance the quality and yield of sweet bell peppers, there have been increased use of synthetic fertilizers, pesticides, and hormones since many years. However, in recent years, there is a growing interest among consumers in high-quality vegetables and its production practices due to increased preference for safe food (Jannin et al., 2012). Organic agriculture is one of the production methods that is supportive of conserving the environment and aimed at using biological and mechanical methods (Ramesh and Rao, 2005). The use of plant biostimulant in the form of fulvic acid (FA) is an eco-friendly strategy to reduce the dependency on agrochemicals and fertilizers, and a novel approach to improve crop yield and increase nutrient uptake by plants (Ali et al., 2022). FA has low molecular weight, higher oxygen content, and contains functional groups such as phenolic, carbonyl and alcoholic groups which allows FA to chelate with anions and cations. The size of FA is relatively small, and therefore, it can easily penetrate root, stem, and leaves of the plant. On entering these plant parts, they transmit trace minerals directly from plant tissues to plant surfaces. The agronomic efficiency of fulvic acid is more than humic acid as a foliar spray, due to its high solubility at low pH media, a standard considered for foliar feeding (Jannin et al., 2019). The study is aimed to investigate the influence of soil and foliar application of fulvic acid biostimulant at various concentrations on yield parameters of organically grown bell peppers.

Materials and Methods

Study site and location: Certified Organic Farm at Tennessee State University, Nashville (Longitude 36° 10’ N, Latitude 86° 48’ W)

Study duration: April to October in 2021

Plant material and seed germination: Bell Pepper Variety – Pepper Revolution F1 (Untreated) were purchased from Harris Seeds. Seeds were soaked in fulvic acid (FULL-Power®, OMRI and GIM listed, Faust Bio-Agricultural Services Inc., BROAD, Oregon) at 0.8 fl oz/gallon for 72 hrs before sowing. Seeds were sowed in April in 0.25-inch deep biodegradable peat pots with one seed in each pot that consisted of a standard potting mix at air temperatures (71°F-80°F) day/night in a hoop house at the Organic Farm, (Certified Organic Farm, College Grove, Tennessee). After 4 weeks, seedlings were sprouted with 10 oz/gal foliar acid 3 times a week on Monday, Wednesday, and Friday, to reduce stress and enhance germination. Unseeded seedlings served as controls.

Experimental design: The experimental field was cleared, ploughed, harrowed, and divided into plots using plastic mulch. Soil was sandy loam with pH 6.5. The area of the experimental plot was 90’ X 50’ (0.1 acre) with total 270 pepper plant stands. The experiment was laid out in a randomized complete block design with nine treatments and three replicates for each treatment with a plant spacing of 18 inches and row spacing of 10 ft.

Treatments: Fulvic acid with no foliar acid application as control and fulvic acid at four concentrations (0.3, 0.7, 1.4 l/oz gal) was applied as a soil drench to the plant root area and foliar sprays on the leaf surface three times a week on Monday, Wednesday, and Friday, starting from two weeks after transplanting until flowering and fruit set stage.

Fruits were separated into three grades based on USDA standard as follows:• U.S. Fancy: diameter not less than 3” and length not less than 2.5”• U.S. No. 1: diameter not less than 2.5” and length not less than 2.5”• U.S. No. 2: diameter and length less than 2.5”

Fruits separated into three grades based on USDA standard as follows:

Insect, Pests, Disease and Physiological disorder

Based on visual observations, there were incidence of pest attack on few young pepper plants. Blossom-end rot (BER) and sunscald on pepper fruit was observed during the rapid vegetative growth and fruit setting as shown in Fig. 10. Southern stem rot was identified caused by B. floriformis colony on pepper plants and fruit. However, incidence of BER, sunscald and southern stem rot were below threshold level and caused no serious damage to the crops. Insecticide (Monterey T. B., Fresno, California, OMRI listed) and M-Pedeash, Growash, Yuma, Arizona, OMRI listed was applied two times during the initial stage of trial to control pests.

Conclusion

• Based statistical analysis, results indicated that bell pepper plants treated with fulvic acid exhibited significant increase in number of fruits as compared with control. Foliar application concentration at 0.7 fl oz/gal led to highest number of fruits as compared to control treatment.
• Foliar concentration at 0.7 fl oz/gal led to highest marketable yield with subsequent increase in yield at soil concentration 0.7 oz gal and foliar concentration 1 fl oz/gal compared to control treatment.
• Fulvic and soil application of fulvic acid showed significant difference in fruit weight as compared to control treatment. However, soil application of fulvic acid at 0.7 and 1 fl oz/gal resulted in statistically significant difference in fruit weight (0.33 lb) compared to foliar application applied at 0.3 and 1 fl oz/gal.
• Foliar and soil application of fulvic acid showed significant difference in fruit length and fruit diameter as compared with control treatment.

References


Acknowledgements

• We would like to thank TSU farm staff and organic agriculture research team for field assistance. This research is supported by TSU Cooperative Extension program (#2231199).