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EFFECT OF BIO-STIMULANTS ON THE YIELD PERFORMANCE OF ORGANICALLY-GROWN EGGPLANT CULTIVARS IN THE U.S. VIRGIN ISLANDS

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Abstract: Crop bio-stimulants derived from commercial marine algae extracts have been known to improve yields in fruits and vegetable crops in conventional production system. Therefore, studies of biostimulants in organic management system are needed to determine their potential impact on yield. In organic management system ten cultivars of eggplant (Nubia, Fairy Tale, Dancer, Beatrice, Calliope, Orient Charm, Barbarella, Rosa Bianca, Machiaw and Shooting Stars) were selected to evaluate bio-stimulant effect. Ten cultivars of eggplant (*Solanum melongena* L.) were treated weekly with Stimplex® (5 mL/L) (liquid seaweed extract of *Ascophyllum nodosum*) and Biozest® (20 mL/L) crop bio-stimulants as foliar spray. Half of the plants in a row (5 plants) were sprayed weekly and the other half of the plants (5 plants) were untreated as a control. The organically managed, experimental design was a randomized complete block with 3 replications consisting of rows spaced 3' apart with plants spaced 2' between each plant within a row. Results showed that Stimplex® treated plants performed better than biozest treated plants. Marketable yields were higher in Stimplex® treated plants of Nubia (10.7%), Fairy Tale (42.5%), Dancer (31.9%), Beatrice (27.8%), Barbarella (13.9%), Machiaw (84.2%) and Shooting Stars (9.9%) than their respective untreated controls. Higher marketable yields were obtained in Biozest® treated plants of Nubia (35.8%), Beatrice (10.3%), Orient Charm (1%), Rosa Bianca (68.8), and Shooting Stars (55%) relative to their respective untreated controls. The remaining cultivars produced lower or non-significant yields. These results suggest that bio-stimulants may increase yields in eggplant. Additional research trials are needed to fully explain the effects of bio-stimulants in organically managed commercial production of eggplant.

Introduction

Eggplant (*S. melongena* L.) is a highly valued vegetable crop grown for fresh market in the Virgin Islands and the rest of the Caribbean (Palada *et.al.* 2000). The production of eggplant in the Virgin Islands increased from 19,495 lbs in 2002 to 37,163 lbs in 2007 (Census of Agriculture, 2009). The Government is encouraging locally grown produce to reduce the cost of imported food crops (Dominique 1990). Crop bio-stimulants derived from commercial marine algae extracts have been known to improve yields in fruits and vegetable crops in conventional production system. Therefore, studies of bio-stimulants in organic management system are needed to determine their potential impact on yield.

Studies show that organic management system have played a significant role in U.S. market expansion. The conversion of conventional farming to organic farming systems has been more extensive. U.S.-certified, organic-crop acreage more than doubled between 1992 and 1997, and doubled again between 1997 and 2001 for different crops (Greene and Kremen, 2003). According to the telephone survey by Food Marketing Institute (52 percent in 2004), (50 percent in 2003), and (53 percent in 2000) surveyed had purchased organic food. The Hartman Group study of 5000

consumers, "Organic food and Beverage Trends 2004" found that 66 percent of households purchased organic products. Furthermore, they reported that 56 percent of the people surveyed were buying the organic food because of the positive environmental impact from growing organic food (Shively, 2005).

Trial was conducted to evaluate the response of eggplant to the different chemical. An experiment was conducted on the eggplant responses to K fertilization on soil testing low in Mehlich-1 extractable K at live Oak, Fla, in the spring and fall of 1991. Fresh petiole-sap K critical concentration were 4500-5000 v/v before harvesting and 4000-4500 at the end of harvesting. Less than 3500 mg K/liter in fresh sap indicated K deficiency in the plant. Eggplant yielded 51.1 $t \cdot ha^{-1}$ with 94 kg K/ha fertilization in spring and 53.3 $t \cdot ha^{-1}$ with 60 kg K/ha in fall. Yield responses showed that the two sites differed in fertilization requirements (Hochmuth et al, 1993).

An experiment was conducted to evaluate the effect of tillage and insecticide treatment in growth and productivity of different cultivars (Ichiban, Little fingers, and Millionaire) of eggplant at Belleville, Illinois. Imidacloprid resulted in high total and early yield by controlling the damage from the flea beetle. The tillage method did not affect the eggplant productivity or the flea beetle effect. Cultivar performance was similar over the tillage method and insecticide treatment. Cultivar 'Millionaire' and 'Ichiban' provided higher marketable and total yield than 'Little Fingers' under same cultural practices (Range et al, 2010).

Materials and Methods

The experimental design was complete randomize block and four replication (Biozest® and Stimplex® treated) and a control for each cultivar. Biozest® and Stimplex® (8.75ml/gallon) and (46 ml/ gallon), respectively for two plots with 5 plants in each plot applied a day prior to transplanting eggplants into the field. Data on number of fruits, total yield, marketable yield, fruit weight, marketable fruits, and fruit size were recorded.

This study was conducted at the Albert A. Sheen campus of the University of the Virgin Islands Agricultural Experiment Station in fall season of 2012. The soil was sandy loam with 2% organic matter and pH 8.0. Seeds of cultivars ca. Nubia, Fairy Tale, Dancer, Beatrice, Calliope, Orient Charm, Barbarella, Rosa Bianca, Machiaw and Shooting Stars were obtained from Johnny Selected Seeds Co., NY and planted in seed trays (Styrofoam, 72 wells each). Trays were filled with pro-mix (Sun Grow Horticulture Canada Ltd.) and kept in the greenhouse for germination.

The field was rototilled and disk/harrowed. Twine was used to mark out the plots and colored flags (blue and orange) used to identify and differentiate the plots for the treated and the control. Seedlings were transplanted in the field approximately week after germination. Plots consisted of three rows spaced 4' apart, with 12 plants per row spaced 2' between the plants within a row using a drip system. The experimental design was randomized complete blocks, with 3 replications. Data collected from ten plants (#2-11) from centre row on maturity, number of fruits, total yield, marketable yield, and fruit size, fruit weight, marketable fruits. Fields were scouted and monitored for insect pests and diseases by Extension entomologist periodically. A complete fertilizer 20-20-20 was applied during the experiment through drip irrigation system (fertigation), weekly or as needed.

Plants of ten cultivars of eggplant (*Solanum melongena* L.) treated weekly with Stimplex® (5 mL/L) (liquid seaweed extract of *Ascophyllum nodosum*) and Biozest® (20 mL/L) crop bio-stimulants as foliar spray. Complete randomized block design with three replicates in each cultivar used. A total of 30 plots (three of each cultivar) were used, where each plot consists of three rows.

The left rows were treated with Stimplex® and right ones were treated with Biozest® while the center rows were considered as untreated or control-data rows in each plot. Stimplex® and Biozest® were applied 2 days prior to transplanting with a backpack sprayer. A total of 108 plants (36 plants/plot) of each cultivar were transplanted and watered after transplanting.

Collection of Data

Data was collected on the yield produced by all ten eggplant cultivars. Fruits were harvested when mature and measured, weighed, and graded. Marketable fruit weights will be considered to be at least 2.3 kg. The marketable yield (number of fruits and average fruit weight) was determined.

Experimental Design and Statistical Analysis

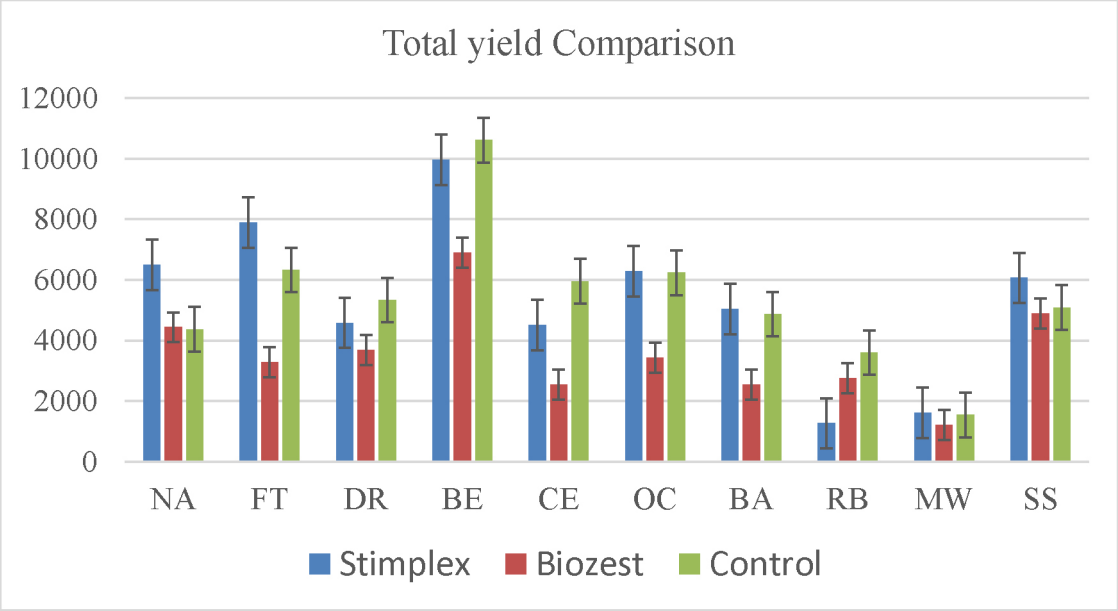
Experimental plot arranged in a randomized complete block design with three replications of each cultivar as explained in Materials and Methods. Each set of experimental data were analyzed using one way analysis of variance. There are separate analyses of weights, quality, yield and weed count. Treatment means were compared using Fisher's protected LSD tests at $P < 0.05$ for significance.

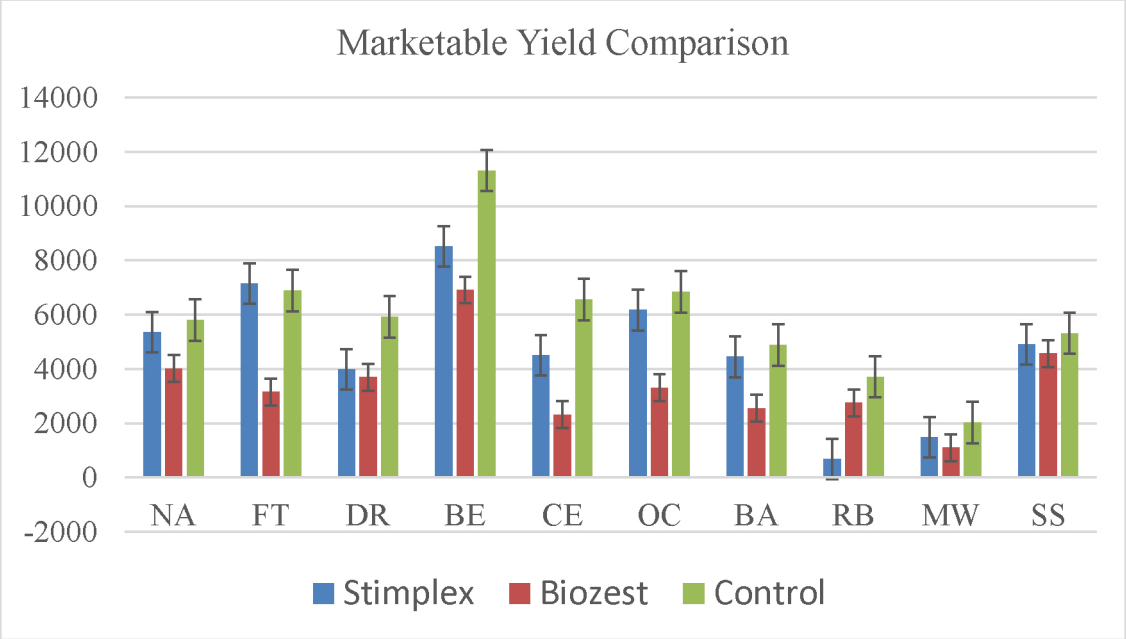
Table 1. Fruit weight (g) of eggplant varieties treated with biostimulants and control (untreated)

Varieties	**Stimplex**	**Biozest**	**Control**
Nubia (NA)	319.72	112.55	341.05
Fairy Tale (FT)	42.42	49.70	44.30
Dancer (DR)	217.22	214.08	216.38
Beatrice (BE)	319.32	242.80	262.40
Calliope (CE)	160.03	162.46	208.66
Orient Charm (OC)	127.58	123.27	131.91
Barbarella (BA)	211.01	229.38	281.08
Rosa Bianca (RB)	336.4	549.1	528.53
Machiaw (MW)	104.25	124.99	104.28
Shooting Stars (SS)	149.70	167.13	153.03

Results and Discussion

Increment in fruit yield, number of fruits and fruit weight was observed in Stimplex® and Biozest® treated plots. In Stimplex® treated plots, higher yields were produced in cultivars Fairy Tale 42.1%, and Machiaw 59.33% but lower yields in Calliope (40.01%) were produced relative to their respective controls (untreated cultivars). Cultivars treated with Biozest®, Rosa Bianca 68.85%, and Shooting Stars 58.09% produced higher yield and lower in Calliope by 70% than untreated. Yields were significantly higher in all ten cultivars grown in Stimplex® treated plots. 'Nubia' produced highest yield (427.47kg/ha) and lowest in 'Calliope' (187.33kg/ha). The number of average marketable fruits was higher (55.20%) in Stimplex® treated plants compared to untreated plants (control) in Machiaw. Total fruit number was also higher (41.77%). Fruit weight was highest in Biozest® treated plants (549.1 gm) in comparison to untreated control plants in Rosa Bianca cultivar.





Conclusion

Stimplex® results were more suitable than the Biozest® for each cultivar in eggplant in the USVI study. High total yield, marketable yield with greater fruit size were observed in Stimplex® treated cultivars such as Nubia (10.7%), Fairy Tale (42.5%), Dancer (31.9%), Beatrice (27.8%), Barbarella (13.9%), Machiaw (84.2%) and Shooting Stars (9.9%) than control. Higher marketable yields were obtained in Biozest® treated plants of Nubia (35.8%), Beatrice (10.3%), Orient Charm (1%), Rosa Bianca (68.8), and Shooting Stars (55%) relative to their respective

untreated controls. Cultivars produced lower or non-significant yields in remainder of cultivars. These results suggests Stimplex® out performs Biozest® and is economical and suitable as a Bio-stimulant for eggplant production in the US Virgin Islands, however, further study is needed before adopting this practice.

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