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EFFECT OF BIOSTIMULANTS ON THE YIELD PERFORMANCE OF ORGANICALLY-GROWN OKRA CULTIVARS IN THE U.S. VIRGIN ISLANDS

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Abstract: Okra is one of the widely grown vegetable for the commercial market in the United States Virgin Islands and the rest of the Caribbean. Plant biostimulants or agricultural biostimulants include diverse substances and microorganisms that are derived from commercial marine algae extracts, enhance plant growth of fruits and vegetables. Plants of eight cultivars of okra (Abelmoschus esculentus) treated weekly with Stimplex® (5 ml/L) liquid seaweed extract of (Ascophyllum nodosum) and Biozest® (100 mL/5L) crop biostimulants as foliar spray to assess yields under the effect of biostimulants. Half of the plants in a row (5plants) sprayed weekly and half of the plants (5plants) were untreated control. Eight cultivars of okra ca. Clemson Spineless 80, Red Burgundy, Clemson Spineless, Jambalaya, Red Velvet, Annie Oakley II, Perkins Mammoth and Chant were investigated. The experimental design was a randomized complete block with 3 replications consisted of rows spaced 3’ apart and spaced 2’ between the plants within a row. Plots were managed with organic cultural practices. Results showed that Biozest® treated plants of most of the cultivars responded positively. Marketable yields were higher in Biozest® treated plants of Clemson Spineless 80 (0.5%), Annie Oakley II (27.9%), Perkins Mammoth (49%), Jambalaya (41.2%), Chant (16%) and Red Burgundy (60%) than untreated control. Higher marketable yields were obtained in Stimplex® treated plants of Jambalaya (62%), Red Burgundy (58%) and Perkins Mammoth (30%), than untreated control. Cultivars produced lower or non-significant yields in Clemson Spineless 80, Clemson Spineless, Red Velvet, Annie Oakley II and Chant. The results show that biostimulants may increase yields in okra, however, further research trials are needed to fully explain the effects of biostimulants in commercial production.

Keywords: Vegetables, Crop biostimulant, Organic, Production, Yield

Introduction

Okra is a versatile warm-season best known vegetable crop produced in southern region of United States. Okra is grown commercially in Georgia, South Carolina, Tennessee, Alabama, Texas, California, and Florida. Most southern states cultivate enough okra to make available for local demand. There are ≈15,000 acres of land (6,000 ha) of okra produced annually in the United States. It is a highly nutritive value and easy to cultivate vegetable crop. These varieties perform differently under the diverse conditions or nutrition. Tender green pods are consumed as a vegetable and used as a thickening agent in the soups. Well drained soil with organic matter soil is suitable for production of okra. This can be achieved by applying animal manures or incorporating green manure crops (Colditz and Barber, 1975). Moreover, the biostimulants adds
to the better growth and development of okra in organic management system. There are number of varieties of okra available in the market for commercial production in organic crop management.

The biostimulant federation defined biostimulants as “materials, including microorganisms, that are applied to plant, seed, soil or other growing media that may improve the plant’s capability to assimilate useful nutrients, or deliver benefits to plant development” (Calvo et. al. 2014). Marine bioactive elements extracted from seaweed like Stimplex and biozest are currently used in organic farming, in order to avoid extreme application of fertilizers and improving the uptake through the roots or leaves. So, number of characteristically determined products are utilized as development promoters or biostimulants on vegetables, regardless of the fact that their components of activity are not still now totally illuminated. Among them, seaweed products are embedded as permissible organic (natural) manures (Trinchera et. al. 2014). Stimplex is one of biostimulant derived from the seaweed extracts. Stimplex is best used in drip irrigation for fertigation and applied after the 2 weeks of emergence and then after every 1 week until end of blooming in okra crop. Effects of the biostimulants have been testified to increase the production, upsurge the efficiency of nutrient use and resistance to various factors and biotic abiotic stress. Study conducted on pepper (Capsicum annum L.) to explore the effect of natural biostimulants on yield and quality parameters of fruits and they got significant results in terms of yield and other parameters. There was increase observed in the pigment content of leave with the application of biostimulant results in the higher total and marketable yields of treated pepper cultivars as compared to their controls. The results indicated that natural biostimulants had a synergistic effect on the vitamin C and total phenolic contents in pepper fruits. The antioxidant activities were also noticeably higher ($P < 0.05$) in treated plants excluding the phenolic content (Paradikovic et al. 2011). Thus the use of biostimulants is considered as good approach to increase the overall production of the crop.

**Materials and Method**

Eight cultivars of okra ca. Clemson Spineless 80, Red Burgundy, Clemson Spineless, Jambalaya, Red Velvet, Annie Oakley II, Perkins Mammoth and Chant were investigated. The experimental design was a complete randomized block with three replications. The trial was conducted from 7 October, 2013 through 27 November, 2013. Crops were grown using National Organic Program (NOP) standards and permitted practices. Seeds were planted in 72-cell trays containing farmer produced organic compost at the University of the Virgin Islands on St. Croix, greenhouse reared, and transplanted into the field 21 days after germination. There were 36 plants per plot for each variety for a total of 864 plants in the field. Data was collected from ten plants in the center row of each plot. The tender pods of okra plant are harvested after every two days and the data of total yield, total number of fruits per plant has been calculated. After the complete period of crop production the data was compiled and analyzed by using SAS and the significant results were calculated.

**Results and Discussion**

Significant results were observed from the application of the biostimulants in okra. As shown in figure 1 Average marketable yield for Clemson spineless 80, chant, Red burgundy, Annie Oakley and Perkins mammoth is higher in the biozest treated plants and Clemson spineless and red velvet have higher average marketable yield with the stimplex treatment. On the other hand,
in case of average yield per plant the effect of both stimulants on varieties Clemson spineless, Clemson spineless 80 and red velvet were not significant. However, in other varieties on an average biozest treated plants performed well in terms of average yield per plant. We did not find any significant differences in the average fruit weight of the okra varieties in stimplex, biozest and control plants (Table 1).

Figure 1. Average marketable yield.

Figure 2. Average yield per plant.
Table 1. Fruit weight of okra varieties treated with biostimulants and control.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Fruit (pod) Weight (gm)</th>
<th>Stimplex</th>
<th>Biozest</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clemson Spineless</td>
<td>15.536</td>
<td>16.158</td>
<td>16.586</td>
<td></td>
</tr>
<tr>
<td>Annie Oakley II</td>
<td>14.027</td>
<td>14.874</td>
<td>15.206</td>
<td></td>
</tr>
<tr>
<td>Jambalaya</td>
<td>14.027</td>
<td>12.859</td>
<td>12.407</td>
<td></td>
</tr>
<tr>
<td>Red Burgundy</td>
<td>11.947</td>
<td>10.621</td>
<td>11.229</td>
<td></td>
</tr>
<tr>
<td>Clemson Spineless 80</td>
<td>17.327</td>
<td>17.414</td>
<td>16.083</td>
<td></td>
</tr>
<tr>
<td>Chant</td>
<td>16.421</td>
<td>19.502</td>
<td>18.159</td>
<td></td>
</tr>
<tr>
<td>Red Velvet</td>
<td>15.617</td>
<td>16.687</td>
<td>18.419</td>
<td></td>
</tr>
<tr>
<td>Perkins Mammoth</td>
<td>15.617</td>
<td>15.004</td>
<td>14.515</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

Most of the varieties of okra performed well under the treatment of biostimulants and positive effect of stimplex or biozest for crop enhancement in organic vegetable production system observed. Since these are the results from the one year trial, therefore, further research is needed to explain the complete benefits or the effects of the biostimulants and commercial production of crop.

References