



## Enhancement of Growth and Yield Performance in Tomato (*Solanum lycopersicon* L) through Foliar Application of a Nutrient Supplement

B. A. Shobo<sup>1\*</sup>, J. G. Bodunde<sup>2</sup>, O. E. Akinboye<sup>1</sup>, T. A. Ayo-Bello<sup>3</sup>, O. J. Afodu<sup>3</sup>  
and L. C. Ndubusi-Ogbonna<sup>4</sup>

<sup>1</sup>Department of Agronomy and Landscape Design, Babcock University, Ilishan-Remo, Ogun State, Nigeria.

<sup>2</sup>Department of Horticulture, Federal University of Agriculture, Abeokuta, Nigeria.

<sup>3</sup>Department of Agricultural Economics and Extension, Babcock University, Ogun State, Nigeria.

<sup>4</sup>Department of Animal Science, Babcock University, Ilishan-Remo, Ogun State, Nigeria.

### Author's contribution

*This research was conducted with close collaboration among all authors. Authors BAS and JGB were involved in conception, design, formulation of protocol and writing the first draft of the manuscript. Authors OEA, TAAB, OJA and LCNO managed the literature searches, participated in statistical analysis and interpretation as well as reading through the manuscript. All authors also read and endorsed the final manuscript.*

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### ABSTRACT

Megagreen® is activated calcite of a worldwide granularity. It is an ecological foil fertilizer with a strong impact on plant resistance, it improves the fertility and health of plants resulting in an improvement of yield and plant quality. The experiment was carried out to examine the growth and yield performance of indeterminate (Ibadan Local) and determinate (UC 82-B) tomato varieties as influenced by a nutrient supplement (Megagreen®) applied as foliar spray at two weeks after

\*Corresponding author: E-mail: teetoad@yahoo.com;

transplanting tomato at different rates of 1.0, 2.0, 3.0 kg/ha with a control. The experiment was laid out in a split plot design with three replications and data collection commenced at two weeks after transplanting. Results showed that the two varieties were significantly different in growth and yield parameters. Rate of application significantly influenced plant height (except at 2 & 8 WAT), number of leaves (except at 6 WAT), number of branches at 2 WAT, days to flower, days to maturity, number of flowers and fruit yield. Application of Megagreen® at the rate of 3.0 kg/ha is recommended for fruit yield enhancement in tomato.

**Keywords:** Nutrients supplements; fruit yield; foliar application; application rate; tomato.

## 1. INTRODUCTION

Tomato (*Solanum lycopersicon*) belongs to the family Solanaceae. It is one of the most important commercial vegetables grown in the tropics and could be grown in green houses and outdoor fields. It is also considered the most widely grown vegetable crop in the world because of its economic impact on the growers and its nutritional quality by way of its richness in vitamins (A and C) and minerals [1].

One of the reasons for the increased production worldwide is the fact that the knowledge of improved management, and an ever increasing economic importance of the crop, has resulted in tomato cultivation now being extended to places and seasons that are ordinarily unsuitable for its productivity [2].

More than 90% of the vitamin C in human diets is supplied by fruits and vegetables (of which tomato is the most important) [3]. Tomato fruits contain high amount of ascorbic acid and lycopene [4]. The tomato is classified as a functional food, for having good levels of vitamins, minerals, and especially lycopene, a carotenoid pigment that provides red color and has antioxidant qualities [5].

Research has revealed that a low calcium level in the root is rarely a limiting factor for the vegetative growth of tomato [6]. Nevertheless, the calcium nutrition of tomato demands special attention because this nutrients is intimately involved in the occurrence of the physiological disorder, bottom and end rot (BER), which may considerably reduce fruit quality and market acceptability [7,8]. BER is caused by a local deficiency of Ca in the distal part of the fruit, which results in a disruption of tissue structure in that area [9].

### 1.1 Megagreen®

Megagreen® is an activated Calcite of a worldwide unique granularity. It is an ecological foil fertilizer with a strong impact on plant

resistance. Megagreen® improves the fertility and health of plants resulting in an improvement of yield and plant quality.

Due to the continuous process of disintegration of calcite, the atmosphere inside the leaf is enriched with carbon dioxide replicating the conditions of a CO<sub>2</sub> enriched greenhouse. Furthermore, an improved resistance against fungal diseases and certain varmint was observed. The increased calcium level results in a better organoleptic qualities of fruits and vegetables as well as prolonged storage periods. Megagreen® is often applied in solution (as a foliar application). The objectives of the experiment were to determine the effect of Megagreen® on the growth and fruit yield of two varieties of tomato and to determine the most appropriate rate of Megagreen® application. The principal constituents of Megagreen® are given as shown in Table 1.

**Table 1. Composition of Megagreen®**

Constituent	Quantity
CaCO <sub>3</sub> (Calcium carbonate)	95%
SiO <sub>2</sub> (Siliceous dioxide)	2%
MgO (Magnesium oxide)	1.5%
Fe (Iron)	8783 mg/kg
Mn (Manganese)	156 mg/kg
Selenium	0.24 mg/kg

Source: [10]

## 2. MATERIALS AND METHODS

The experiment was carried out at the research and teaching farm of University of Agriculture, Abeokuta, Ogun state, Nigeria (Longitude 30°25'E, Latitude 70°25' N) between August and December 2009. Two varieties of tomato, one indeterminate (Ibadan local) and the other determinate (UC 82-B) were used. These were raised in the screen house of the department of Horticulture, University of Agriculture, Abeokuta, Ogun State, Nigeria for the period of four weeks. The land was cleared, ploughed and harrowed. Beds for planting were manually prepared on the field. The experiment was laid out in a with split

plots design and treatments were replicated three times, tomato varieties: Ibadan Local, and UC 82-B was allotted to the main plot and rate of application of Megagreen®: 1.0 kg/ha, 2.0 kg/ha, 3.0 kg/ha and no Megagreen (control) were the sub-plot treatments. Transplanting was done to the field when seedlings were four weeks old, at a spacing of 0.5 m x 0.5 m intra and inter row, plot size was 1.0 m x 2.0 m. Foliar spraying of Megagreen® solution commenced two weeks after transplanting at the specified rates using a Knapsack sprayer after calibration. The calibration procedure was as follows;

- The quantity of water the knapsack will discharge in one minute was determined.
- It was assumed that each plant will use that quantity of water.
- The plant swort was measured i.e. the plant canopy width.
- The quantity of water that would be required for 1 hectare (10000 m<sup>2</sup>) was calculated.
- The quantity of water required by a plot was determined and multiplied by the number of plots for each rate.

Megagreen® is a purely mineral, non-toxic and non-polluting agent. It consists of activated calcite micro particles ranging from 0.1 to 0.2µm in size allowing them to permeate directly into the leaf.

Basal fertilizer application was done using NPK 15-15-15 at the rate of 125 kg/ha at one week after transplanting. Top-dressing followed using NPK 15-15-15 at the rate of 125 kg/ha at four weeks after transplanting to the field. Weeding was done manually as the need arose (at 3, 6 and 9 WAT). Five plants per plot were tagged for observations in each plot. Data collection started two weeks after transplanting. Stand count per

plot was taken at the commencement of harvest to aid in estimating the yield per plant.

Soil sample was taken from the experimental site before planting for laboratory analysis and the result is as shown on Table 2.

Note: From literature the level of exchangeable calcium in the experimental site is 5.28 mg/kg [11].

**Table 2. Pre-planting soil analysis of the experimental site**

Parameters	Value
K	4.62 mg/kg
Na	5.21 mg/kg
pH	5.58
Total phosphate	4.3 ppm
Total nitrogen	3.64 mg/kg
Organic matter	10.43%
Organic carbon	5.99%
Exchangeable anion	0.2 mg/kg
Sand	90%
Clay	7%
Silt	3%

### 3. RESULTS AND DISCUSSION

Application of Megagreen® could increase tomato plant height although not significantly (Table 3), the two tomato varieties responded differently to Megagreen® application as shown in Table 3 that Beske plants were taller than UC 82-B, which can be attributed to the genetic differences of the two varieties. The rate of Megagreen® influenced the height in significantly taller plants as produced at application rate of 3.0 kg/ha (Table 3). The positive effect of Megagreen® on tomato plant height suggests that Megagreen® has constituents that can affect the parameter.

**Table 3. Plant height of tomato at 2 – 8 weeks after transplanting as influenced by variety and rates of Megagreen application**

	2 WAT	4 WAT	6 WAT	8 WAT
<b>Variety</b>				
Ibadan Local	16.4	24.76	51.37	74.67
UC82B	13.39	19.67	34.63	52.96
LSD (0.05)	1.87	3.24	7.15	7.27
<b>Rates of application</b>				
1.0 kg/ha	14.78	21.05	42.19	66.23
2.0 kg/ha	14.91	22.02	38.72	63.11
3.0 kg/ha	16.01	23.95	49.98	65.95
Control	14.52	21.84	41.09	59.97
LSD (0.05)	1.55	2.82	6.54	NS

Note: Values are treatments means per plot

It is evident from results obtained in Table 4 that application of Megagreen® significantly increased the number of leaves of tomato plant. Just as in plant height, the two tomato varieties responded differently in the production of leaves and this is equally attributable to inherent differences in the varieties. From the observation rates of Megagreen® application had no significant influence on leaf production in tomato, although higher number of leaves were produced where Megagreen® was applied at the rate of 3.0 kg/ha (Table 4). This suggests that Megagreen® application at the rate of 3.0 kg/ha would influence the number of leaves on tomato plants for both determinate and indeterminate varieties. Thus, Megagreen® application at an appropriate rate may result in a more efficient and higher photosynthesis for dry matter production in tomato.

Just like the other two vegetative parameters, the two tomato varieties responded differently to the number of branches as influenced by Megagreen® application. This confirms the

inherent differences between the two varieties in vegetative growth. Rate of Megagreen® application seems to be irrelevant in terms of number of branches as there was no significant difference between the different numbers of application. Application of Megagreen® at the rate of 2.0 kg/ha seems to be sufficient for tomato in terms of number of branches (Table 5).

Almost following the superiority observed in the vegetative traits of the indeterminate variety, it also started flowering early and attained 50% flowering as well as maturity earlier than the determinate variety (Table 6). The interaction of variety and rate of application showed a significant difference between the two varieties and Ibadan local attained days to 50% flowering early when Megagreen® was applied at the rate of 1.0 kg/ha followed by 3.0 kg/ha (Table 7). The results obtained in this study in Table 6 indicate that Megagreen® could induce earliness to flower in tomato, for this purpose it however has to be applied at the rate of 3.0 kg/ha to induce earliness to fruit maturity.

**Table 4. Number of leaves of tomato at 2 – 8 weeks after transplanting as influenced by variety and rates of Megagreen application**

	2 WAT	4 WAT	6 WAT	8 WAT
<b>Variety</b>				
Ibadan Local	4.20	9.59	34.65	62.56
UC82B	3.39	5.23	10.68	27.56
LSD (0.05)	0.50	2.01	6.25	8.79
<b>Rates of application</b>				
1.0 kg/ha	3.86	6.70	20.86	52.61
2.0 kg/ha	3.86	7.10	22.46	38.50
3.0 kg/ha	3.69	7.98	26.26	49.94
Control	3.77	7.88	21.02	39.17
LSD (0.05)	NS	NS	NS	NS

*Note: Values are treatments means per plot*

**Table 5. Number of branches of tomato at 2 – 8 weeks after transplanting as influenced by variety and rates of Megagreen application**

	2 WAT	4 WAT	6 WAT	8 WAT
<b>Variety</b>				
Ibadan Local	0.42	2.49	6.07	8.33
UC82B	0.23	0.47	2.08	3.83
LSD (0.05)	0.20	0.76	1.11	1.17
<b>Rates of application</b>				
1.0 kg/ha	0.06	1.46	3.32	5.44
2.0 kg/ha	0.36	1.44	4.43	6.42
3.0 kg/ha	0.25	1.39	4.54	6.31
Control	0.22	1.63	4.01	6.17
LSD (0.05)	0.20	NS	NS	NS

*Note: Values are treatments means per plot*

Megagreen® influence on number of flowers made it to be important in the overall yield production. Ibadan Local had a high fruit yield although the unit fruit weight was not different from that of UC 82-B, this is probably due to the overall high number of fruits produced by Ibadan Local. The interaction of variety and rate of application showed that the indeterminate variety had the highest number of flowers when Megagreen® was applied at the rate of 3.0 kg/ha while the determinate variety had the highest number of flowers when application was at the rate of 2.0 kg/ha (Table 8). Megagreen® applied at the rate of 3.0 kg/ha would be required for enhanced fruit yield.

**Table 6. Number of days to first and 50% flowering, maturity, unit fruit weight and fruit yield as influenced by variety and rates of Megagreen application**

	Days to 1 <sup>st</sup> flower	Days to 50% flower	Days to maturity	Fruit yield (t/ha)
<b>Variety</b>				
Ibadan Local	38.39	42.17	63.36	17.39
UC82B	42.00	46.06	80.81	5.28
LSD (0.05)	2.60	2.23	5.58	4.34
<b>Rates of application</b>				
1.0 kg/ha	40.22	41.67	77.28	7.56
2.0 kg/ha	41.00	43.44	73.61	8.06
3.0 kg/ha	37.11	43.11	66.22	16.28
Control	42.44	48.22	71.22	13.28
LSD (0.05)	2.15	1.69	6.00	4.36

*Note: Values are treatments means per plot*

**Table 7. Effect of variety x rate of application interaction on number of days to 50% flowering in two tomato varieties**

Variety	Rate (Kg/ha)	Days to 50% flowering
Ibadan Local	1.0	40.44
	2.0	43.33
	3.0	42.00
	Control	42.89
UC 82-B	1.0	42.88
	2.0	43.55
	3.0	44.22
	Control	53.56
LSD (0.05)		1.99

*Note: Values are treatments means per plot*

**Table 8. Effect of variety x rate of application interaction on number of flowers in two tomato varieties**

Variety	Rate (Kg/ha)	Number of flowers		
		6 WAT	7 WAT	8 WAT
Ibadan Local	1.0	3.11	4.00	11.00
	2.0	5.33	6.78	13.78
	3.0	7.44	9.22	16.11
	Control	5.78	6.78	13.44
UC 82-B	1.0	3.11	3.78	11.44
	2.0	3.22	5.67	13.44
	3.0	2.89	4.00	12.56
	Control	2.11	3.89	9.33
LSD (0.05)		1.99	1.99	1.99

*Note: Values are treatments means per plot*

#### 4. CONCLUSION

Application of Megagreen® significantly affected the two tomato varieties in terms of vegetative, yield and yield characters. For all the vegetative parameters, Ibadan Local responded better than UC 82-B except for the number of branches at 2WAT and the leaf area at 8 WAT. Ibadan Local responded better to Megagreen® application than UC 82-B in terms of total fruit yield, Ibadan Local attained days to first flowering, days to maturity and Days to 50% flowering earlier than UC 82-B and therefore had a higher fruit yield. For Both varieties, fruit yield was highest when Megagreen® was applied at the rate of 3.0 kg/ha. For high fruit yield, megagreen® at the rate of 3.0 kg/ha is recommended.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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