

**ENHANCEMENT OF GROWTH AND YIELD PERFORMANCE IN
TOMATO (*Solanum lycopersicum* L) THROUGH FOLIAR
APPLICATION OF A NUTRIENT SUPPLEMENT**

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 transplanting tomato at different rates of 1.0, 2.0, 3.0kg/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 & 8WAT), number of leaves (except at 6WAT), number of branches at 2WAT, 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.

INTRODUCTION

Tomato (*Solanum lycopersicum*) 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].

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.

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. Due to the continuous process of disintegration of calcite, the atmosphere inside the leaf is enriched with carbon dioxide replicating the conditions of a CO₂ enriched greenhouse. Furthermore, an improved resistance against fungal diseases and certain varmint was observed. Due to the increased calcium level, better organoleptic qualities of fruits and vegetables as well as prolonged storage periods were noted. 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.

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72 **Table 1: Composition of Megagreen®**

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

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74 Source: [10].

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76 **MATERIALS AND METHODS**

77 The experiment was carried out at the research and teaching farm of University of
 78 Agriculture, Abeokuta, Ogun state, Nigeria (Longitude 30°25'E, Latitude 70°25' N) between
 79 August and December 2009. Two varieties of tomato, one indeterminate (Ibadan local) and
 80 the other determinate (UC 82-B) were used. These were raised in the screen house of the
 81 department of Horticulture, University of Agriculture, Abeokuta, Ogun State, Nigeria for the
 82 period of four weeks. The land was cleared, ploughed and harrowed. Beds for planting were
 83 manually prepared on the field. The experiment was laid out in a with split plots design and
 84 treatments were replicated three times, tomato varieties: Ibadan Local, and UC 82-B was
 85 allotted to the main plot and rate of application of Megagreen®: 1.0kg/ha, 2.0kg/ha, 3.0kg/ha
 86 and no Megagreen (control) were the sub-plot treatments. Transplanting was done to the field
 87 when seedlings were four weeks old, at a spacing of 0.5m x 0.5m intra and inter row, plot
 88 size was 1.0m x 2.0m. Foliar spraying of Megagreen® solution commenced two weeks after
 89 transplanting at the specified rates using a Knapsack sprayer after calibration. The calibration
 90 procedure was as follows;

- 91 • 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 (10000m²) was calculated
- The quantity of water required by a plot was determined and multiplied by the number of plots for each rate.

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 125kg/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.

Table 2: Pre-planting Soil Analysis of the Experimental site

<i>Parameters</i>	<i>Value</i>
K	4.62mg/kg
Na	5.21mg/kg
pH	5.58
Total Phosphate	4.3ppm
Total Nitrogen	3.64mg/kg
Organic matter	10.43%
Organic Carbon	5.99%
Exchangeable anion	0.2mg/kg
Sand	90%
Clay	7%
Silt	3%
Exchangeable Ca	5.28mg/kg [11]

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® application influenced the height in significantly taller plants as produced at application rate of 3.0kg/ha (Table 3). The positive effect of Megagreen® on tomato plant height suggests that Megagreen® has constituents that can affect the parameter.

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 3.0kg/ha (Table 4). This suggests that Megagreen® application at the rate of 3.0kg/ha influenced 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 2.0kg/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 1.0kg/ha followed by 3.0kg/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 3.0kg/ha to induce earliness to fruit maturity.

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 3.0kg/ha while the determinate variety had the highest number of flowers when application was at the rate of 2.0kg/ha (Table 8). Megagreen® applied at the rate of 3.0kg/ha would be required for enhanced fruit yield.

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 8WAT. 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 3.0kg/ha. For high fruit yield, Megagreen® at the rate of 3.0kg/ha is recommended.

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
Variety				
Ibadan Local	16.4	24.76	51.37	
UC82B	13.39	19.67	34.63	
LSD (0.05)	1.87	3.24	7.15	
Rates of Application				
1.0 kg/ha	14.78	21.05	42.19	
2.0 kg/ha	14.91	22.02	38.72	

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

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				
Variety				
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
Rates of Application				
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
Variety				
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
Rates of Application				
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

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 st flower	Days to 50% flower	Days to Maturity	Fruit Yield (t/ha)
Variety				
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
Rates of Application				
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: Interactive effect of Variety and Rate of Application on Number of Days to 50% Flowering in two Tomato Varieties.

<u>Variety</u>	<u>Rate (Kg/ha)</u>	<u>Days to 50% Flowering</u>
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: Interactive effect of Variety and Rate of Application on Number of Flowers in two Tomato Varieties.

<u>Variety</u>	<u>Rate (Kg/ha)</u>	<u>Number of Flowers</u>		
		6 WAT	7 WAT	8WAT
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

REFERENCES

- Villareal, R. (1980) Tomatoes in the Tropics. West View, 1 Boulder, Colorado, U.S.A. Pp. 78.
- Bodunde J. G, Erinle I. D, Enitan, G. G. and Aman, E. B. (1993). Recommendation for the release of four hect tomato varieties. Paper approved by the Professional and Academic board, IFAR, ABU, ZARRIA, Nigeria. Pp 54-55.
- Vallejo F, Tomas-Barberan FA, Garcia-Viguera C (2002). Potential bioactive compounds in health promotion from broccoli cultivars grown in Spain. J. Sci. Food Agric. 82:1293-1297
- Tindall, H. D. (1983): Vegetable in the tropics. Macmillan Press, London. Pp 354 – 359
- Alvarenga, M.A.R. *Tomate: Produção em Campo, em Casa-de-Vegetação e em Hidroponia*; UFLA: Lavras, MG, Brazil, 2004.
- Del Amor FM, Marcelis LFM (2006). Differential effect of transpiration and Ca supply on growth and Ca concentration of tomato plants. Scientia Horticulturae 111, 17-23.
- Ho LC, Belda R, Brown M, Andrews J, Adams P (1993) Uptake and transport of calcium and the possible causes of blossom-end rot in tomato. Journal of Experimental Botany 44, 509-518.
- Granttan SR, Grieve CM (1999) Salinity-mineral relations in horticultural crops. Scientia Horticulturae 78, 127-157.
- Adams P (2002) Nutritional control in hydroponics. In: Savvas D, Passam HC (Eds) Hydroponics Production of Vegetables and Ornamentals, Embryo Publications, Athens, Greece, pp211-261.
- Gmbh(2004). www. Megamin-gmbh.de

251 11. Akinwa O. A. (2016) Storability, nutrient quality and shelf life of cucumber (*Cucumis*
252 *sativum* L) fruit as influenced by variety and fruit waxing. Unpublished M.Agric
253 thesis submitted to the Department of Horticulture, Federal University of
254 Agriculture Abeokuta.
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