INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 7, No. 1, p. 58-65, 2015

RESEARCH PAPER OPEN ACCESS

Effect of different doses of foliar fertilizer on yield and physiochemical characteristics of tomato (*Lycopersicon esculentum* Mill) cultivars under the agro climatic condition of Peshawar

Anwar Ali*, Ijaz Hussain, Humaira Gul, Shah Masoud, Ayub Khan, Fazli Wahab, Junaid Khan

[1]*Department of Agriculture, University of Haripur, Khyber Pakhtunkhwa, Pakistan*

[2]*Agriculture Research Institute (ARI) Tarnab, Peshawar, Pakistan*

Key words: Tomato, Foliar fertilizer doses, Physiochemical Characteristics and Yield.

http://dx.doi.org/10.12692/ijb/7.1.58-65 Article published on July 14, 2015

Abstract

To assess the effect different doses of foliar fertilizers on physic-chemical characteristics and yield of tomato was conducted at Agricultural Research Institute (ARI) Tarnab Peshawar KPK, Pakistan during 2013. The experiment was laid out in Randomized Complete Block Design (RCBD) having three replications. Data on the following parameters were recorded i.e. Plant height (cm), average fruit weight (g), number of fruits plant^{-1}, TSS, Ascorbic Acid and fruits yield (t/ha). Foliar application at the rate 1600ml/100L shows significant effect on plant height (101.60cm), Average fruits weight (88.17g), Ascorbic Acid (16.35mg/100g) TSS (4.73%) and yield (22.10 T.ha^{-1}) when compare to all the other treatments. Cultivars of tomato had also shows significant effect to foliar fertilizers in which maximum Average fruits weight (80.77g), Ascorbic Acid (16.53mg/100g) and yield (23.31 t.ha^{-1}) were recorded in Cv. Roma. Maximum Ascorbic Acid (17.14mg/100g), Average fruits weight (94.35g) and yield (25.14 t.ha^{-1}) were observed in Cv. Roma treated with 1600ml/100L significantly influence on all treatments and cultivars under study as compared to control. Therefore, foliar application is an appropriate way to feed the tomato crop to enhance growth, physiochemical characteristics and yield. It is concluded that Cv. Roma and foliar fertilizer (Foliar Gold) at the rate of (1200 ml/100 L) is most effective for obtaining maximum quality and yield of tomatoes under the agro-climatic conditions of Peshawar.

* **Corresponding Author:** Anwar Ali ✉ anwar_ali315@yahoo.com

Introduction

Tomato (*Lycoperscion esculantum* Mill) is belong family Solanaceae originated from Western and Southern America (Ali *et al*, 2012). Tomato is one of the most important paramount vegetable in world and next ranks to potato whereas as processing crops it ranks first in the world. Tomato is classified as an annual plant cultivated in warm season with the average optimum growing temperature range of 25°C to 29°C (Ejaz *et al*, 2011). Generally, its two crops are cultivated during spring and autumn seasons in Pakistan (Naz *et al*, 2011). Major production countries are China, U.S.A, India, Turkey, Egypt, Italy and Iran. In Pakistan, tomato is grown on an area of .0534 million hectares with an average production of .562 million Metric tons. The Khyber Pakhtunkhwa (KPK) Province shared an area of .0165 million hectares with 0.1618 million Metric tons production (Ali. *et al.,* 2013).

Tomato low yield on unit area is due to non-availability of suitable varieties and by adopting common cultural practices (Akinfasoye, 2011). Amongst cultural practices fertilization is one the most important to maximize the yield. Moreover, tomato had based on nutritional view points and all these nutrients is very important for human body for different diseases i.e. scurvy disease, skin problems and many more, Ejaz *et al*, 2011. Tomato yield is also affected by cultural practices and improper application micro and macro nutrients. (Williams and Harris, 1986). Organic and inorganic fertilizers were applied to crops. Organic manures had improve yield and yield components of tomato (Yafan and Barker, 2004). Inorganic fertilizers are also improving all aspect of growth and yield but due to high cost they are used in less quantity. Deficiently of micro and macro nutrient is directly affect quality of tomato fruits. . It is a well-established fact that macro or micro nutrients applied as foliar application become promptly available to crop plants Naz *et al*, 2012.The key functions of micronutrients are to assist the photosynthesis and the synthesis of chlorophyll in green plants. The elements e.g. nitrogen, boron, copper, and zinc are categorized as essential macro and micro-nutrients and these are required for proper plant growth, development and yield (Rub and Haq, 2012). Tomato crop demands heavy and sufficient amount of fertilizers for high yield (Naz *et al,* 2012). For improving tomato plant growth and development, both organic as well as inorganic manures are essential. It is now well established point that chemical fertilizers increase growth of plants directly. Generally, both macro and micro nutrients play an imperative role in quality tomato production. Tomato crop demands heavy and sufficient amount of fertilizers for high yield. For improving tomato plant growth and development, both organic as well as inorganic manures are essential and also disease resistance varieties. It is now well established point that chemical fertilizers increase growth of plants directly. Therefore, based on above facts, different supplementary dose of N, P_2O_5, K_2O, S, B, Mn, Cu, Zn, Mg and Fe with concentrations were used as foliar feeding to investigate their possible effects on growth, flowering, and yield of tomato crop and to identify best performing variety of tomato. To identify best achieve foliar fertilizer dose and variety of tomato for the agro climatic condition of Peshawar.

Materials and methods

The research study was conducted on silty clay soil at Agricultural Research Institute (ARI) Tarnab Peshawar KPK, Pakistan during 2013. The experiment was laid out in according to split plot design having 5 verities (Roma, Money Maker, Super Stone, Super Classic and Bambino) as main factor while foliar fertilizers ("Foliar Gold" consist of N 4%, P_2O_5 4%, K_2O 3%, S 2.5%, B 2%, Mn 0.25%, Cu 0.2%, Zn 0.10%,Mg 0,02% and Fe 0.004%) were applied in 5 various doses(control, 400ml/100L, 800ml/100L, 1200ml/100L and 1600ml/100L was considered as sub factor. Seeds were sown on seed beds in lines in 10 cm apart in last week of February 2013. Seedlings were transplanted to field in last week of March 2013. Plant to plant distance 60×60 and row to row distance 90×90cm was maintained. Foliar fertilizer doses were applied with sprayer three times (1st at 1st flowering time and 2nd was applied 10 days after 1st spray and 3rd spray was 20 days after 1st spray).

The physic-chemical characteristics of soil have been done by taking three simple from trail field which consist the following macro and micro nutrients.

Data collection

The important parameters encompassed in the research study were plant height (cm) (tallest shoot of five plants was measured from soil surface to the top point and average was calculated), Average fruits weight (g) (fruit weight of five fruits was measure with weight balance and average was calculated), Fruits plant^{-1} (at the time of each picking number of fruits was counted of five tag plants and mean was calculated), yield (ton/ha) (The total yield of each treatments was calculated by weighting the fruits picked in each plot in kg and converted yield ton/ha), Ascorbic acid (Vitamin C) and Titratable acidity was determined by standard method of AOAC 2012).

Statistical analysis

The data recorded on different parameters were subjected to the analysis of variance (ANOVA) technique to find out the difference between different treatments and their interactions. In cases where differences were found significant, means were compared for differences using least significant difference (LSD) test. Statistical computer software (statistix 8.1) was applied for computing both the ANOVA and LSD. All the assumptions were checked to ensure the statistical validity of analysis.

Results and discussion

Plant height

The data regarding plant height as affected by foliar fertilizer and cultivars are given in Table 2. The maximum plant height (101.60 cm) was recorded in 1600ml/100L treatment followed by (98.01cm) in 1200ml/100L. Minimum plant height (69.48cm) was noted in 0ml/100L (control). The maximum plant height (137.37cm) was observed in Cv. Money Maker followed by Cv. Super Stone (77.44 cm). The minimum plant height (76.42cm) was recorded in Cv. Roma .The interaction between foliar fertilizer and cultivars indicates that highest plant height (150.47cm) was recorded in Cv. Money Maker with the application of 1600ml/100L foliar fertilizer dose. Whereas the lowest plant height (56.76cm) was observed in control treatment of Cv. Super Classic. Plant height is a function of genetic as well as environmental conditions. Nitrogen and potash increase vegetative growth of plants (khan *et al.* 2014). The results are agreement with the findings of Davis *et al.* (2003) who reported similar results and increase in plant height.

Table 1. Physic-chemical analysis of soil.

Characteristics	Values	Units
Textural class	silty clay	-
pH	8.6	-
Organic Matter	0.66	%
$CaCO_3$	14.41	%
Total Nitrogen	0.033	ppm%
Available phosphorus	21.86	ppm%
Available Potash	102	ppm%
Clay	31.4	%
Sand	6.6	%
Silt	62	%

Number of fruits plant^{-1}

The number of fruits plant^{-1} were significantly (P≤0.05) affected by foliar fertilizer and cultivars of tomato. The interactive effect of both was also significant shown in Table 3. The maximum number of fruits plant^{-1}(102.81) was recorded in 1600ml/100L treatment followed by (100.39) recorded in 1200ml/100L dose of foliar fertilizer. The minimum number of fruits plant^{-1} was observed (69.46) in Control followed by (91.26) 400ml/100l dose of foliar fertilizer. The highest number of fruits plant^{-1} (137.47) was observed in Cv. Money Maker followed by Cv.

Roma having (83.98) fruits plant^{-1}. Whereas lowest number of fruits plant^{-1} (78.90) was noted in Cv. Bambino followed by Cv. Super Stone having (79.49) number of fruits plant^{-1}. The interaction of foliar fertilizer doses and cultivar shows that maximum number of fruits plant^{-1} (144.65) was found in Cv. Money Maker treated with 800ml/100L followed by (143.69) fruits plant^{-1} recorded also in Cv. Money Maker in the application of 1200ml/100L foliar fertilizer dose. While minimum number of fruits plant^{-1} (55.54) was recorded in Cv. Bambino in control treatment followed by (55.80) number of fruits plant^{-1} recorded in Cv. Super Stone in control treatment. The result were conformity with Javaria *et al.*, (2012) who reported 130 fruits plant^{-1} and similarly increase in number of fruits plant^{-1}in tomato were increase with the increase with foliar application Ali, *et al.* 2013. While Rub and Ihsan, 2012 also supported the similarly results.

Table 2. Effect of different doses of foliar fertilizer on plant height of tomato cultivars.

Treatments	Cultivars					
	Roma	Money Maker	Super Stone	Super Classic	Bambino	Mean
0ml/100L	57.98	116.42	58.40	56.76	57.83	69.48d
400ml/100L	72.35	130.03	67.64	68.52	65.03	98.01ab
800mlL/100L	81.68	142.85	85.68	85.31	83.95	80.71c
1200mL/100L	82.67	147.10	86.27	86.67	87.35	95.89b
1600mL/100L	87.44	150.47	89.19	89.24	91.66	101.60a
Mean	76.42b	137.37a	77.44b	77.30b	77.16	

Mean is followed by same letter (s) do not differ significantly significant at 5% level of probability.
LSD value (P≤0.05) for the foliar doses = 3.61
LSD value (P≤0.05) for varieties = 3.61
LSD value (P≤0.05) for interaction = 8.07.

Table 3. Effect of different doses of foliar fertilizer on Number of fruits plant^{-1}of tomato cultivars.

Treatments	Cultivars					
	Roma	MoneMaker	Super Stone	Super Classic	Bambino	Mean
0ml/100L	62.38j	17.31b	55.80j	56.27j	55.54j	96.46d
400ml/100L	83.74fg	138.81a	72.44i	85.21e- g	76.10hi	91.26c
800mlL/100L	88.58c-f	144.65a	90.35c-f	86.54d-g	80.06gh	98.03d
1200mL/100L	90.33c-f	143.69a	87.27d-f	90.36c-f	90.31cf	100.39ab
1600mL/100L	94.87c	142.87a	91.60c-e	92.21ce	92.51c-f	102.81a
Mean	83.98b	137.47a	79.49cd	82.12bc	78.90d	

Mean is followed by same letter (s) do not differ significantly significant at 5% level of probability.
LSD value (P≤0.05) for the foliar doses = 3.17
LSD value (P≤0.05) for varieties = 3.17
LSD value (P≤0.05) for interaction = 7.08.

Average fruit weight

Table 4 regarding average fruit weight shows that the cultivars and foliar fertilizer doses has significant effect on average fruit weight while their interaction had non-significant effect on fruit weight. The maximum average fruit weight (88.17g) was observed in 1600ml/100L followed by (82.80g) average fruit weight in 1200ml/100L. Whereas lowest average fruit weight (59.79g) was founded in control followed by (71.31g) average fruit weight recorded in 400ml/100 dose of foliar fertilizer. While in cultivars the maximum average fruit weight (80.78g) was noted in

Cv. Roma followed by (79.05g) was noted in Cv. Bambino. The minimum fruits weight (65.70g) was found in Cv. Money maker followed by Cv. Super Stone having (77.23g) average fruit weight. The results were agreement with Rab and ihsan. (2012) and Javaria *et al.* (2012) who reported that average fruit weight, were increased with increased in N and potash level. So this is also might be due to increase in all essential nutrients availability to plant. Our results are in accordance with the findings of Iqbal *et al.* 2011.

Table 4. Effect of different doses of foliar fertilizer on Average fruit weight of tomato cultivars.

	Cultivars					
Treatments	Roma	Money Maker	Super Stone	Super Classic	Bambino	Mean
0ml/100L	61.21	52.85	62.21	62.70	59.98	59.79d
400ml/100L	74.69	66.25	69.85	76.38	69.40	71.31c
800mlL/100L	85.53	67.47	77.85	78.56	88.31	79.55b
1200mL/100L	88.09	68.80	85.25	87.36	84.50	82.80b
1600mL/100L	94.35	73.11	90.99	89.31	93.07	88.17a
Mean	80.78a	65.70b	77.23a	78.86a	79.05a	

Mean is followed by same letter (s) do not differ significantly significant at 5% level of probability.

LSD value (P≤0.05) for the foliar doses = 4.82

LSD value (P≤0.05) for varieties = 4.82

LSD value (P≤0.05) for interaction = 10.77.

Ascorbic Acid (Vitamin C)

The data of Ascorbic acid (vitamin C) depicted in Table 5. Perusal of data showed that Ascorbic Acid was significantly (P≤0.05) affected by foliar fertilizer doses and cultivars but there interaction was non significant. The maximum (16.53 mg/100g) Ascorbic Acid was recorded in Cv. Roma followed by (16.27 mg/100g) Ascorbic Acid noted in Cv. Super Stone. Whereas minimum (13.70 mg/100g) Ascorbic Acid was observed in Cv. Super Classic followed by (14.54 mg/100g) Ascorbic Acid recorded in Cv. Bambino. The maximum (16.35 mg/100g) Ascorbic Acid was recorded in plant treated with (1600ml/100L) followed by (15.72 mg/100g) Ascorbic Acid recorded in plant treated with (1200ml/100L). While minimum (13.92 mg/100g) Ascorbic Acid was recorded in control followed by (14.93 mg/100g) Ascorbic Acid was recorded in fruits of plants treated with (400ml/100L) dose of foliar fertilizer. The results are in agreement with Javaria *et al.* 2012, who reported similar findings.

Table 5. Effect of different doses of foliar fertilizer on Ascorbic Acid of tomato cultivars.

	Cultivars					
Treatments	Roma	Money Maker	Super Stone	Super Classic	Bambino	Mean
0ml/100L	15.07	13.92	12.92	15.09	12.60	13.92d
400ml/100L	16.47	14.94	13.22	16.09	13.93	14.93c
800mlL/100L	16.96	15.49	13.61	16.42	14.83	15.46b
1200mL/100L	17.02	15.96	13.60	16.71	15.32	15.72b
1600mL/100L	17.13	16.41	15.17	17.05	15.98	16.35a
Mean	16.53a	15.34b	13.70d	16.27a	14.54c	

Mean is followed by same letter (s) do not differ significantly significant at 5% level of probability.

LSD value (P≤0.05) for the foliar doses = 0.35

LSD value (P≤0.05) for varieties = 0.35

LSD value (P≤0.05) for interaction = 0.78.

Total Soluble Solid (°BRIX)

The Total Soluble Solid were significantly (P≤0.05) affected by foliar fertilizer doses and cultivars of tomato. The interactive effect of both was also found significant (Table 6). Mean data shows that maximum TSS % (4.73) were recorded in plants treated with (1600ml/100 liter of water) of foliar fertilizer dose. Minimum (3.65) TSS % was recorded in control treatment followed by (4.13) TSS % recorded in plants treated with (400ml/liter of water). The mean of cultivar of tomato concern with TSS % shows that maximum (4.99) TSS % was recorded in Cv. Bambino. The mean of interaction of different doses of foliar fertilizer and cultivar of tomato concern with TSS % of tomato fruits shows that maximum (5.52) % of TSS was recorded in Cv. Super Stone treated with (1600ml/100 liter of water) of foliar fertilizer dose. Minimum (3.14) % of TSS was recorded in control treatment of Cv. Super Stone. The increased in TSS might be due to optimum availability of macro and micro nutrients to plant. The results were agreement with Fandi *et al.* 2010. They concluded that TSS increasing with increasing level of N, P and K. who reported that increase in level of NPK also increases the TSS in tomato fruits.

Table 6. TSS as affected by different foliar fertilizer does and cultivar of tomato.

Treatments	Cultivars					
	Roma	Money Maker	Super Stone	Super Classic	Bambino	Mean
0ml/100L	3.18 l	3.20l	4.17hi	3.14 l	4.61e-g	3.65d
400ml/100L	3.65 jk	3.46kl	4.36f-i	4.20g-i	4.95c-e	4.13c
800mlL/100L	4.13 hi	3.63jk	4.74d-f	4.25g-I	5.20a-d	4.37b
1200mL/100L	4.15 hi	4.03ij	5.40ab	4.74d-f	5.1733a-c	4.70a
1600mL/100L	4.36 f-I	4.20g-I	5.52a	4.50f-h	5.07b-d	4.73a
Mean	3.90c	3.70d	4.83a	4.17b	4.99a	

Mean is followed by same letter (s) do not differ significantly significant at 5% level of probability.

LSD value (P≤0.05) for the foliar doses = 0.19

LSD value (P≤0.05) for varieties = 0.19

LSD value (P≤0.05) for interaction = 0.43.

Table 7. Effect of different doses of foliar fertilizer on yield (t/ha) of tomato cultivars.

Treatments	Cultivars					
	Roma	Money Maker	Super Stone	Super Classic	Bambino	Mean
0ml/100L	18.81e-	16.73jk	16.09k	17.42i-k	17.17i-k	17.24c
400ml/100L	j22.37b-c	17.42i-k	18.31f-k	20.10c-h	18.04g-k	19.25b
800mlL/100L	25.14a	18.44f-k	21.56cd	19.13d-j	21.32c-e	21.12a
1200mL/100L	25.07a	17.91h-k	22.10bc	19.43d-I	20.47c-h	21.00a
1600mL/100L	25.14a	19.13d-j	20.77c-f	20.57c-g	24.61ab	22.10a
Mean	23.31a	17.98c	19.76b	19.33b	20.32b	

Mean is followed by same letter (s) do not differ significantly significant at 5% level of probability.

LSD value (P≤0.05) for the foliar doses = 1.16

LSD value (P≤0.05) for varieties = 1.16

LSD value (P≤0.05) for interaction = 2.59.

Yield (T/ha)

The data regarding yield (t/ha) show that foliar fertilizer and varieties has significant effect on yield while interaction has also significant effect, (Table 7). The maximum yield (23.31 t/ha**)** was recorded in Cv. Roma fallowed by (20.32 t/ha) yield in Cv. Bambino. While the lowest (17.98 t/ha) yield was recorded in Cv. Money Maker fallowed by (19.33 t/ha) yield was recorded in Cv. Super Classic. The maximum yield (22.10 t/ha) was recorded in plant treated with 1600ml/100L fallowed by (21.00 t/ha) yield on 1200ml/100L of foliar fertilizer dose. While the

lowest (17.25 t/ha) yield was recorded in control treatment fallowed by (19.25 t/ha) yield in 400ml/100L treatment. The interaction of foliar fertilizer doses and tomato cultivar shows that maximum yield (25.14 t/ha) was recorded in Cv. Roma on 1600ml/100L followed by (25.14 t/ha) recorded in Cv. Roma on 800mL/100L of foliar fertilizer dose. While minimum yield was observed (16.09 t/ha) in Cv. Super Stone in control treatment followed by (16.73 t/ha) was recorded in Cv. Money maker in control treatment. The maximum yield in tomato might be due to availability of essential nutrients to plants. Our finding are in agreement with those of Ali *et al.* 2013 who reported that the yield of tomato increased with increasing level of foliar fertilizer of some macro and micro nutrients. Javeria *et al.* 2012 also supported our findings.

Conclusion and recommendation

Based on the results of study it is concluded that foliar fertilizer of micro and macro nutrients improve growth, quality and maximization of tomato yield. The deficiencies of micro and macro nutrients are impeding the crops yield around the globe; therefore, the endowment of these essential nutrients not only fulfills the nutritional requirements of tomato crop but is also helpful in increasing the growth, flowering, and yield of tomato. Among various treatment 1200ml/100L is more effective in increasing plant height, fruit weight, TSS and yield of tomato. Whereas with in cultivars Roma resulted in significantly superior performance compared to other. So Roma variety and 1200ml/100L of foliar fertilizer dose is recommended for the agro climatic of Peshawar Pakistan.

Reference

Akinfasoye, Akindele J, Dotun JO, Emmanuel OA. 2011. Phenotypic Relationship among Agronomic Characters of Commercial Tomato (Lycopersicum esculentum) Hybrids. American-Eurasian Journal of Agronomy **4(1),** 17-22.

Ali S, Hafiz UJ, Rana N, Irfan AS, Muhmmad SN, Muhmmad ZS, Dawood AS, Muhammad. AN. 2013 Foliar application of some macro and micro nutrients improves tomato growth, flowering and yield. International journal of bioscinces **3(10),** 280-287. http://dx.doi.org/10.12692/ijb/3.10.28087.

Ali W, Jilani MS, Naeem N, Waseem K, Khan J, Ahmad MJ, Ghazanfarullah. (2012) Evaluation of different hybrids of tomato under the climatic conditions of Peshawar. Sarhad Journal of Agriculture **28(2),** 207–212.

Aman S, Rab A. 2013. Response of tomato to nitrogen levels with or without humic acid. Sarhad Journal of Agriculture **29(2),** 181- 186.

Davis JM, Sanders DC, Nelson PV, Lengnick L, Sperry WJ. 2003. Boron improves growth, yield, quality, and nutrients contents of tomato. Journal of American Society for Horticultural Science **128(3),** 441–446.

Ejaz M, Rehman SU, Waqas R, Manan A, Imran M, Bukhari MA. 2011. Combined efficacy of macro-nutrients and micro-nutrients as a foliar application on growth and yield of tomato grown by vegetable forcing. International Journal for Agro Veterinary and Medical Sciences **5(3),** 327–335.

FAO STATE. Www.Research.cip.cgiar.org/confluence/display/wpa/Pakistan.

Javaria S, Khan MQ, Bakhsh I. 2012. Effect of potassium on chemical and sensory attributes of tomato Fruit. The journal of animal & plant sciences **22(4),** 1081-1085.

Javaria S, Khan MQ, Rahman UH, Bakhsh I. 2012. Response of tomato (*Lycopersicon Esculentum L.*) yield and post harvest life to potash levels. Sarhad Journal of Agriculture **28(2),** 227-235.

Mehdizadeh M, Darbandi EI, Naseri-Rad H, Tobeh A. 2013. Growth and yield of tomato as

influenced by different organic fertilizers. International Journal of Agronomy and Plant Production **4(4),** 734–738.
Available online at http://www.ijappjournal.com

Naz RMM, Muhammad S, Hamid A, Bibi F. 2012. Effect of boron on the flowering and fruiting of tomato, Sarhad Journal of Agriculture **28(1),** 37–40.

Naz F, Haq IU, Asghar S, Shah AS, Rahman A, (2011) Studies on growth, yield and nutritional composition of different tomato cultivars in Battal Valley of District Mansehra, Khyber Pakhtunkhwa, Pakistan. Sarhad Journal of Agriculture **27(4),** 569–571.

Oikeh SO, Asiegbu JE. 1993. Growth and yield responses of tomatoes to sources and rates of organic manures in ferralitic soils. Bio resource Technology, **45(1),** 21–25.
http://dx.doi.org/10.1016/0960-8524(93)90138-2

RAB A, Ihsan UH. 2012. Foliar application of calcium chloride and borax influences plant growth, yield, and quality of tomato (*Lycopersicon esculentum* Mill) fruit. Turkish Journal of Agriculture and Forestry **36,** 695-701.
http://dx.doi:10.3906/tar-1112-7

Singh HM, Tiwari JK. 2013. Impact of micronutrient spray on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill). HortFlora Research Spectrum **2(1),** 87–89.

Williams LB, Harris G. 1986. Fertilizer marketing in Nigeria. Fertilizer International **225,** 45–49.

Yafan H, Barker AV. 2004. Effect of composts and their combinations with other materials and their combinations with other materials on nutrient accumulation in tomato leaves. Communication in Soil Science and Plant Analysis **35(19–20),** 2809–2823.