Proceedings of 37th Annual Conference of the Horticultural Society of Nigeria (HORTSON) "OWO MADE 2019"
THEME: Horticultural Production: A Panacea for Sustainable Economic Growth and Development
MONDAY 18TH – FRIDAY 22ND NOVEMBER, 2019

Proximate Composition of Tomato Genotypes as Influenced by Different Nutrient Sources in Minna

Amao, P. A., Ibrahim, H, Abdulahi , B. and Saidu, A.
Department of Crop Production, School of Agriculture and Agricultural Technology,
Federal University of Technology, Minna.
Department of Soil Science and Land Management, School of Agriculture and Agricultural Technology,
Federal University of Technology, Minna.
peteramao87@yahoo.com, 08032310478

Abstract
The study evaluated the effect of different nutrient sources on nutritional quality of Tomato. The field experiment was carried out during 2018 cropping season at the Teaching and Research Farm, Federal University of Technology and laboratory analysis was carried out at the Department of Water Resources, Aquaculture and Fisheries Technology, School of Agriculture and Agricultural Technology, Minna. Fresh matured fruits of Tomato that have been subjected to four different nutrient sources were harvested and evaluated for proximate analysis. The experiment was a factorial experiment involving three tomato cultivars and four nutrient sources which was applied and replicated three times. The experimental design was a 3x4 factorial arranged in a randomized complete block design. Data collected were subjected to analysis of variance (ANOVA) to determine the effects of nutrient sources on tomato fruits proximate and significant means were separated by Duncan Multiple Range Test (DMRT) at (0.05) probability levels. The results showed that, nutrient sources significantly affected ($p< 0.05$) the nutrient quality of Tomato fruits. Application of Urea fertilizer at 300kg N/ha was significant than other nutrient sources on tomato fruit nutrients. Hence, 300kg N/ha of Urea fertilizer is adequate for Tomato fruits nutrient quality. UC 82B and Dan Zaria varieties showed higher values of all the proximate parameters when compared to Roma Savanna.

Introduction

Fruit vegetables have been found to be of great importance in the supply of necessary nutrients such as vitamins, essential amino acids and minerals in other to aid balanced diet. Tomato is a fleshy berry regarded as very popular perishable fruit as well as vegetable grown throughout the tropical and temperate regions of the world (Robinson, 1976). It is typically over 90% water and, once they are harvested they begin to undergo higher rates of respiration, resulting in moisture loss, quality deterioration and potential microbial spoilage. Harvesting itself separates the fruit or vegetable from its source of nutrients. In many cases, fresh tomato has a shelf life of only days before they are unsafe or undesirable for consumption. Worldwide production of fresh and processing tomato combined has been steadily increasing, with total annual production growing from 129 million tonnes in 2005 to 163 million tonnes in 2013 (FAO, 2016).

Tomato fruits are of high nutritional, medicinal and industrial values which have been found to be rich in protein, fat, minerals and vitamins (Akanbi *et al.*, 2006). Several agronomic practices such as herbicide, pesticides and fertilizer application have been found to affect the nutrient qualities of vegetables. Application of nitrogen fertilizer is usually ascribed with the building up of leaf tissues. Plant tissue; usually contain more nitrogen than any other nutrients. Nitrogen application is used to produce rapid vegetative growth of vegetables (Ojetayo *et al.*, 2011). It promotes luxuriant growth, increases number of leaves. It is also necessary for reproduction and promotes the uptake of phosphorus and potassium by plants. Since Tomato are consumed as fruit vegetable therefore there is need to analyze the fruit of the plant for their nutritional quality in order to ascertain their effect on the nutrient to human health, diet and document the best nutrient sources that will positively increase the nutritional values with no detrimental effect on nutritional quality.

Research on the optimum fertilizer usage for the fruit yield is recently being explored. However, information on the effect of different nutrient sources on nutrient quality of the fruits is limited since little efforts have been made to document the effects of fertilizer on the nutrient component of tomato. Soil fertility is a major overriding constraint that affects all aspects of crop production (Mbah., 2006). In the past, inorganic fertilizer was advocated for crop production to ameliorate low inherent fertility in the soils in the tropics. In addition to being expensive and scares, the use of inorganic fertilizer has not been helpful in intensive agriculture because it is often associated with reduced crop yield, soil acidity and nutrient imbalance (Ojeniyi., 2000), (Ano and Agwu., 2005), (Agbede *et al.*, 2008). Aduayi *et al.*, (2002) noted that three major nutrient elements known to be deficient in most tropical soils due to intense pressure on land as a result of continuous cropping were N. P. and K. The amount of fertilizer introduced into the soil, no matter the type affects the amount of mineral nutrient available to the plants and the organic carbon content of the soil (Bijlisma and Lambers., 2000). Bush fallowing is one of the long aged system used as an efficient, balanced and sustainable agricultural methods for soil remediation, productivity and fertility restoration in the tropics (Ayoola and Adeniyan., 2006), but as a result of rapid increase in the population, the years of fallowing period have been reduced drastically from ten years to three years and this has had an adverse effect on the fertility restoration leading to low and poor crop yield. In developing economics like Nigeria where the population is on the increase, the balanced use of fertilizers becomes imperative to meet the food requirement of the nation Heru, 1996).

Materials and Methods

Fruits of three Tomato genotypes (UC 82B, Roma Savana and Dan Zaria) that were previously subjected to four different nutrient sources (Poultry dropping, Cow dung, Bio-organic and Urea) at 300 kg /ha planted in 2018 at the Teaching and Research Farm, Federal University of Technology and laboratory analysis at the Department of Water Resources, Aquaculture and Fisheries Technology, School of Agriculture and Agricultural Technology, Minna. At maturity growth stage the fruits were harvested from the field and rinsed with distilled water for proximate analysis experiment at the Department of Water Resources, Aquaculture and Fisheries Technology, School of Agriculture and Agricultural Technology, Minna. The field experimental design was a 3x4 factorial arranged in a randomized complete block design with four replications.

Proximate composition analysis of leave samples: Moisture, ash, crude protein, crude fiber, fats and nitrogen free extract of the fruits were determined by the standard official methods of analysis of the Association of Analytical Chemist (AOAC., 2000) in triplicate.

Results and Discussion

The effect of fertilization on the proximate composition of three genotypes of Tomato (UC 82b, Roma savanna and Dan Zaria) is shown in Table.

Moisture content

There were no significant differences ($p > 0.05$) in the moisture contents of the three tomato varieties among the different nutrient sources (Figure 1). This implied that the type and forms of nutrient sources had no significant effect on the moisture content of the tomato which ranged from 91.70 - 92.78% for UC 82B, 92.46 – 93.54% for Roma savanna and 91.70 – 92.78% for Dan Zaria. This indicates that the fresh tomato has higher moisture content (93.8±3.00) ($p<0.05$). Several factors could account for such a difference. Since the main purpose of canning is to preserve the quality content, then reducing the water reduces the risk of microbial growth. Also, to increase the solid content so that consumers can buy more solid matter. Geographical differences could be another factor. The moisture content of the fresh tomato is in conformity with the finding of Romain (2001) and Harry (1994).

Ash content

The ash content as an indicator of the approximate mineral concentration of substance, showed some levels of significant difference ($p \leq 0.05$) between the different nutrients sources used for each of the tomato varieties. The ash of UC 82B and Dan Zaria fertilized with urea and poultry droppings were not significantly different from each other but were significantly higher than those fertilized with cow dung, and bio-organic nutrient as well as the control. The control and cow dung fertilized tomatoes were not significantly different in their ash contents but were significantly higher than that fertilized with bio-organic nutrient. The ash of Roma savanna fertilized with urea and bio-organic nutrient were not significantly different from each other but were significantly higher than those of the other treatments which were not significant different from each other. The ash content of UC 82B ranged from 0.23 – 0.33% , Rama savanna ranged from 0.24 – 0.33% and Dan Zaria variety from 0.23 – 0.33% (Figure 2). The high water content might also contribute to the low level of ash (Abdullahi *et al*., 2016).

Crude protein

The crude proteins content of the tomato were significantly different from each other ($p < 0.05$).The crude protein of UC 82B treated with poultry droppings was significantly higher than those of the other treatments and the control. While UC 82B treated with cow dung had significantly higher protein than the control, urea and bioorganic nutrient, which had the same protein content. Roma savanna treated with urea had protein content that was not significantly different from the control and both the control and urea treatments. Roma savanna proteins content that was not significantly higher than those treated with poultry droppings, bioorganic nutrient and cow dung, which were not significantly different from each other. The protein content of Dan Zaria treated with poultry droppings and cow dung were not significantly different from each other but were significantly higher than those treated with urea and bioorganic nutrient and the control. Dan Zaria planted on soil treated with urea and bioorganic nutrient as well as the control had crude proteins that was not significantly different from each other. The crude protein ranged from 3.5 – 4.87% for UC82B, 3.93 – 5.25% for Roma savanna and 3.5 – 4.87% for Dan Zaria (Figure 3). The high water content of fresh tomato might result in low level of protein (Abdullahi *et al*., 2016)

Crude fiber

The crude fiber of the samples generally ranged from 1.21 – 1.38% for UC 82b, 1.09 – 1.22% for Roma savanna and 1.21 – 1.38% for Dan Zaria (Figure 4).UC 82B and Dan Zaria crude fiber showed some levels of significant difference ($p < 0.05$) between the treatments while that of Roma savanna had no significant difference ($p > 0.05$). The crude fiber content of tomato treated with poultry droppings, bioorganic nutrient and cow dung were not significantly different from each other and also with the control but were all significantly higher than that treated with urea, which was significantly lower than the control. This could be because the high water content of the fresh tomato contributes to the low dry matter which contains the crude fiber (Abdullahi *et al.*, 2016).

Fat content

There were significant differences ($p< 0.05$) in the fat concentration of the varieties, UC 82B, Roma savanna and Dan Zaria, between the treatments. The fat content of the treated varieties ranged from 0.48 – 0.57% for UC 82b, 0.44 –0.58% for Rama savanna and 0.48 – 0.57% for Dan Zaria (Figure 5).

The fat contents of UC 82B and Dan Zaria treated with cow dung and poultry droppings were not significantly different from control and from each other but were significantly higher than those of bioorganic nutrient and urea, which were not significantly different from each other. The fat content of Roma savanna treated with bioorganic nutrient, poultry droppings and urea were not significantly different from each other but those of bioorganic nutrient and poultry dropping were significantly higher than those of cow dung and the control. The fat contents of Roma savanna treated with cow dung was not significantly different from that of urea but were significantly higher than the control.

Considering the percentage value of fat for fresh tomato, it was observed to have significant higher fat content. Several factors might result to such difference. The difference of processing mechanism involved in the processes of preservation might have a different effect on the fat content. Also geographical differences may also be a contributing factor for the difference (Abdullahi *et al.*, 2016).

Nitrogen Free Extract

There were significant differences in the mean NFE of each of the studied variety between the treatments ($p < 0.05$).

The NFE of the samples ranged from 1.19 – 2.31% for UC82b, 0.12 – 1.62 for Rama savanna and 1.19 – 2.31.

The NFE of UC 82B and Dan Zaria treated with bioorganic nutrient and the control were not significantly different from each other, but were significantly higher than those treated with urea, cow dung and poultry droppings. The NFE of UC 82B and Dan Zaria treated with urea was significantly higher than those of cow dung and poultry droppings, which were not significantly different from each other. The NFE of Roma savanna treated with poultry droppings was significantly higher than other treatments and the control. Roma savanna treated with urea and cow dung were not significantly different from each other but were significantly higher than those treated with bioorganic nutrient and the control. Bio-organic nutrient treated Roma savanna had NFE significantly lower than the control.

Conclusion

The results showed that nutrient sources significantly affected the nutrient quality of tomato fruits.

Proximate compositions showed several disparities with the different treatments. UC 82B, Roma Savanna and Dan Zaria) varieties responded well to all nutrient sources except for the control to produce significantly high percentage. Proximate analysis shows that organic fertilizer especially liquid fertilizer enhances the presence of most secondary metabolites while N fertilizer (Urea) encouraged better nutrients compared to other treatments at 300kg /ha. The use of organic fertilizers is essential to ensure the nutritional benefits of proximate to be effectively and efficiently harnessed. It can be seen that the proximate contents of the tomato fruits were significantly okay and can serve as good supplement for healthy living. Application of Urea fertilizer at 300kg N/ha^{-1} was significant than other nutrient sources on tomato fruit nutrients. Hence, 300kg N/ha^{-1} of Urea fertilizer is adequate for Tomato fruits nutrient quality.

References

Abdullahi I. I, Abdullahi N, Abdu A. M, Ibrahim A. S. (2016). Proximate, Mineral and Vitamin Analysis of Fresh and Canned Tomato. Bio-sci Biotech Res Asia 2016;13 (2). P 13754.

Aduayi, E. A, Chude, V.O, Adebusuyi, B.A. and Olayiwola, S.O. (2002).*Fertilizer use and management practices for crops in Nigeria.* Federal Fertilizer Department, Federal Ministry of Agriculture and Rural Development, Abuja Nigeria. p16.

Agbede, T. M. Ojeniyi, S. O. and Adeyemo A. J.(2008). *Effect of poultry manure on soil physical and chemical properties*, Agro I. (Ed.), pp. 1085-1121.*Methods of Soil Analysis Part 3* Chemical Methods. 2nd edition, SSA.

Akanbi W. B, Adebooye C. O, Togun A. O, Ogunrinde J. O, and Adeyeye S. A (2006). Growth, herbage and seed yield and quality of *Telfairia occidentalis* quality as influenced by cassava and mineral fertilizer. *World Journal of Agricultural Sciences*, 3(4): 508-516.

Ano, A. O. and Agwu.J. A. (2005). Effect of animal manures on selected soil chemical properties (1).*Nigerian Journal of Soil Analysis 15:14-19.*

AOAC, (2000). Official methods of analysis, Washington DC. *Association of official Analytical Chemist*. p 1058.

Ayoola, O. T. and Adeniyan, O. N (2006). Influence of poultry manure and NPK fertilizer on yield and yield components of crops under different cropping systems in South West Nigeria. *African Journal of Biotechnology*. 5 (15): 1386-1392.

Bijlsma, R.J and Lambers, H. (2000).A dynamic whole-plant model of integrated metabolism of nitrogen and carbon. *Journal of Plant and Soil*.220: 71-87.

FAO (2016) Food and Agriculture Organization of the United Nations. (2016). World Crops Production. Available at http://faostat3.fao.org /browse/ Q/QC/E.

Harry, W.J. (1994). Encyclopedia of Agricultural Science, volume V S-W. Index.; pp 337- 349.

Hera, C. (1996). Role of inorganic fertilizer and their management practices. Fertilizer Research. *International Journal of Soil Science*13: 63-81.

Mbah, C.N. (2006). Influence of organic wastes on plant *Telfairia occidentalis* growth parameters and nutrient uptake by maize (*Zea mays* L.). *Nigerian Journal of Soil Science* 16:104-108.

Ojeniyi, S.O (2000). Effects of goat manure on soil nutrients and okra yield in a rain forest area of Nigeria. *Applied Tropical Agriculture 5(1):7-12.*

Ojetayo A. E, Olaniyi J. O, Akanbi W. B, and Olabiyi T. I (2011). Effect of fertilizer types on the nutritional quality of cabbage varieties before and after storage. *Journal of Applied Biosciences*, 48:3322-3330.

Robinson, R.W. (1976). *Tomato Encyclopaedia of Food Agriculture and Nutrition*. Fourth edition. McGrow Hill Inc. New York.; 650-652.

Romain, H.R. (2001). Crop production in Tropical Africa. CIP Royal library Albert I, Brusssels.; pp 467-475.

Table 1: Effect of different nutrients sources on the proximate composition of Tomato genotypes UC 82b, Roma savanna and Dan Zaria

Parameter	Treatment	UC 82 b	Roma savana	Dan Zaria
MC (%)	Control	92.01 ± 2.12a	92.46 ± 2.56a	92.01 ± 1.06a
	Urea	92.78 ± 2.52a	92.54 ± 1.76a	92.78 ± 3.21a
	Poultry droppings	91.70 ± 2.44a	92.49 ± 2.40a	91.70 ± 2.65a
	Bio-organic nutrient	92.18 ± 2.18a	93.54 ± 2.70a	92.18 ± 3.73a
	Cow dung	92.20 ± 2.24a	93.05 ± 4.30a	92.20 ± 1.06a
ASH (%)	Control	0.28 ± 0.01b	0.24 ± 0.01b	0.28 ± 0.00b
	Urea	0.33 ± 0.01a	0.33 ± 0.01a	0.33 ± 0.01a
	Poultry droppings	0.33 ± 0.01a	0.25 ± 0.01b	0.33 ± 0.01a
	Bio-organic nutrient	0.23 ± 0.01c	0.31 ± 0.01a	0.23 ± 0.01c
	Cow dung	0.28 ± 0.01b	0.24 ± 0.01b	0.28 ± 0.00b
CP (%)	Control	3.50 ± 0.08c	5.25 ± 0.15a	3.50 ± 0.04b
	Urea	3.50 ± 0.09c	4.81 ± 0.09a	3.50 ± 0.12b
	Poultry droppings	4.87 ± 0.13a	3.93 ± 0.10b	4.87 ± 0.14a
	Bio-organic nutrient	3.50 ± 0.08c	4.25 ± 0.12b	3.50 ± 0.14b
	Cow dung	4.37 ± 0.11b	4.37 ± 0.20b	4.37 ± 0.05a
CF (%)	Control	1.33 ± 0.03a	1.22 ± 0.03a	1.33 ± 0.02a
	Urea	1.21 ± 0.03b	1.09 ± 0.02a	1.21 ± 0.04b
	Poultry droppings	1.37 ± 0.04a	1.13 ± 0.03a	1.37 ± 0.04a
	Bio-organic nutrient	1.35 ± 0.03a	1.20 ± 0.03a	1.35 ± 0.05a
	Cow dung	1.38 ± 0.03a	1.17 ± 0.05a	1.38 ± 0.02a
FATS (%)	Control	0.57 ± 0.01a	0.44 ± 0.01c	0.57 ± 0.01a
	Urea	0.49 ± 0.01b	0.54 ± 0.01ab	0.49 ± 0.02b
	Poultry droppings	0.54 ± 0.01a	0.58 ± 0.02a	0.54 ± 0.02a
	Bio-organic nutrient	0.48 ± 0.01b	0.58 ± 0.02a	0.48 ± 0.02b
	Cow dung	0.56 ± 0.01a	0.50 ± 0.02b	0.56 ± 0.01a
NFE (%)	Control	2.31 ± 0.05a	0.39 ± 0.01c	2.31 ± 0.03a
	Urea	1.69 ± 0.05b	0.69 ± 0.01b	1.69 ± 0.06b
	Poultry droppings	1.19 ± 0.03c	1.62 ± 0.04a	1.19 ± 0.03c
	Bio-organic nutrient	2.26 ± 0.05a	0.12 ± 0.00d	2.26 ± 0.09a
	Cow dung	1.21 ± 0.03c	0.67 ± 0.03b	1.21 ± 0.01c

Means are ± Standard error
Means on the sample column for each parameter followed by different letters are significantly different ($p \leq 0.05$)

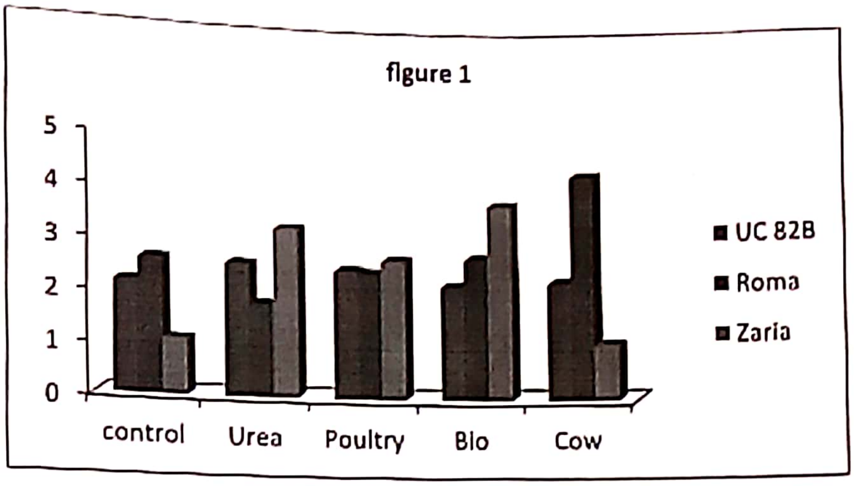

Figure 1: Effect of different nutrient sources on moisture content of three tomato varieties.

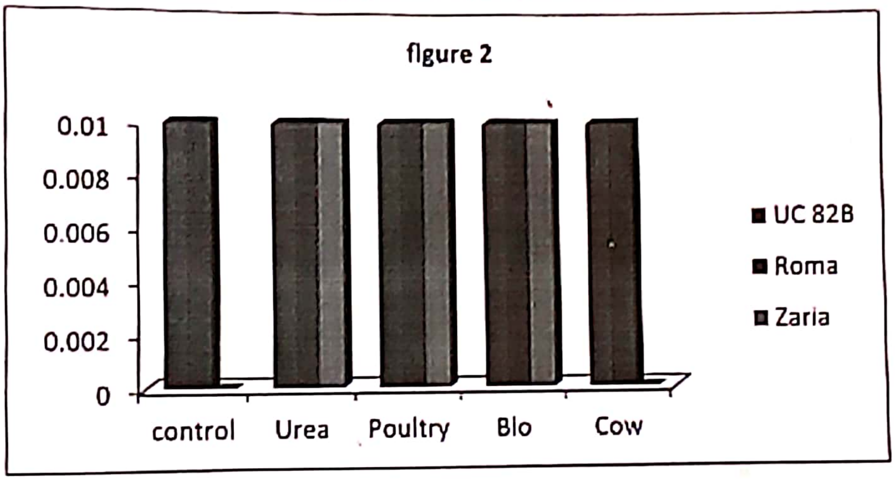

Figure 2: Effect of different nutrient sources on ash content of three tomato varieties

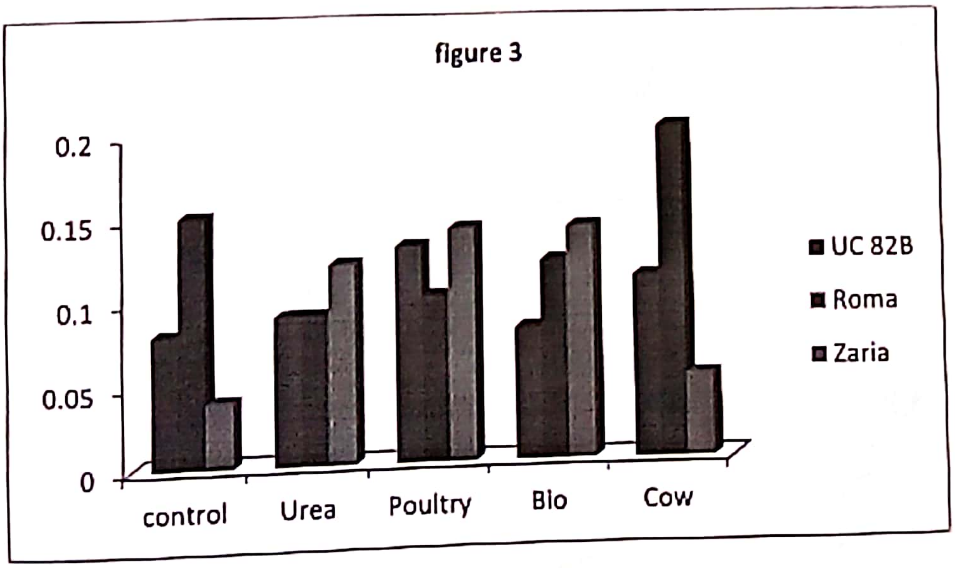

Figure 3: Effect of different nutrient sources on crude protein of three tomato varieties.