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Full Length Research paper

Growth, fruit yield and nutritional quality of tomato varieties

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Experiments were conducted on a sandy loam soil at the Teaching and Research farm of the Faculty of Agricultural Sciences, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso (8°10N; 4°10E) between April and July, 2004 to evaluate the growth, fruit yield and quality of seven varieties of tomato in the Guinea Savannah zone of South West Nigeria. The varieties tested were, DT97/162A(R), DT97/215A, Tropical, Roma VF, UC82B, Ibadan local and Ogbomoso local. These were assigned randomly into three blocks each containing seven beds and fitted into randomized complete block design. Growth, yield, mineral content and quality attributes of tomato were assessed. The results showed that DT97/162A(R) gave the highest height whereas Ogbomoso local recorded the highest number of leaves at 6 weeks after transplanting. Higher fruit yield was recorded from UC82B, closely followed by Ibadan and Ogbomoso local. Although, there is inconsistence in the results of the nutritional compositions of tomato fruits, the local varieties (Ogbomoso and Ibadan Local) closely followed by UC82B recorded most of the nutritional values more than the other varieties. Therefore UC82B, Ibadan and Ogbomoso local in that descending order are better in terms of fruit yield and quality, and can be successfully grown in Ogbomoso, the Guinea Savannah zone of south west Nigeria.

Key words: *Lycopersicum lycopersicon,* varieties, growth, fruit yield, fruit quality.

INTRODUCTION

Vegetable production can be adopted as a strategy for improving livelihood and alleviating the nutritional status of the people. It is the answer to the perpetual problems of hunger and malnutrition in the country. Since in Nigeria, a lot of children suffer from vitamin "A" deficiency, a nutritional problem that can be reduced by regularly eating fruit and green leafy vegetables (South Pacific Foods, 1995).

Tomato is one of the most important vegetable crops grown all over Nigeria. It is the world's largest vegetable crop after potato and sweet potato but it tops the list of canned vegetables. In Nigeria, tomato is regarded as the most important vegetable after onions and pepper (Fawusi, 1978). It is an important condiment in most diets and a very cheap source of vitamins. It also contains a large quantity of water (%), calcium (%) and Niacin all of which are of great importance in the metabolic activities of man. Tomato is a good source of vitamins A, C and E and minerals that are very good for body and protect the body against diseases (Taylor, 1987).

Tomatoes are planted by an estimated 85% of the gardens each year. If well managed, tomato is highly productive (Denton and Swarup, 1983). Cropping of tomatoes during the wet and dry seasons contributes immensely to the national requirement but the bulk of production is from the dry season cropping particularly in southern states (Anon, 1989).

FAO (1983) estimated the national yield average to be 114 tones/ha. Compared with U.S.A and Taiwan, where yields as high as 175 and 178 tones per hectare respectively have been recorded (Bowen and Kratku, 1982), the yield of tomato in Nigeria is low, the average in Western part of the country being only about 5 tones per hectare and in growing areas of Northern Nigeria is 20 tones per hectare (Quinn, 1980; Adelana, 1978). One of the reasons for this low yield in Nigeria is poor fruit set resulting from temperatures that are generally above optimum range for good fruit set (Simon and Sobulo, 1974). Adelana (1975) also attributed poor tomato yield to non-development of flowers into fruits. He found that

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only 50% of the flowers produced developed into fruits. Thus sink size was a limiting factor to fruit production in tomato.

Tomato is currently a popular fruit vegetable in Nigeria, however, its production in Nigeria is low compared with those of the temperate zones due to differences in crop environmental conditions, lack of high yielding varieties and cultural practices applied to the crop on the field. The objective of this preliminary study was to examine the growth, fruit yield and quality of tomato varieties in Ogbomoso, the guinea savannah zone of south west Nigeria.

MATERIALS AND METHODS

Experiments were conducted at the Teaching and Research Farms, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, ($8°10^1$N; $4°10^1$E). The climatic of Ogbomoso is mostly influenced by the North east trade wind and southwest trade wind. The former is cold with drying effect which starts from November to March while the later is warm and very moist. It starts from April to October. The area has maximum temperature of 33°C and the minimum temperature of 28°C. The humidity of this area is high (74%) all year round except in January when the dry wind blows from the north. Annual rainfall is over 1000 mm (Olaniyi, 2006). The land is a bit sloppy towards the stream; the soil was a well drained sandy loam which had been cropped previously for few years.

Prior to land preparation, soil samples (0 - 15 cm) were taken. The samples were taken randomly from 150 spots in the experimental site with an auger. Samples were bulked, air-dried, and ground to pass through a 2 mm sieve. The soil samples were analyzed for physico-chemical properties as follows: Soil particle size was determined by Bouyoucos method (Bouyoucos, 1962). Soil pH in H_2O (1:1) was determined using the custom laboratory apparatus (IITA, 1982). Soil organic carbon was determined by Walkley black modified method (Black, 1965). Available phosphorus and total nitrogen were determined separately by Technicon A All method (Technicon, 1975), while exchangeable Ca, Mg, K, Na and effective C.E.C in soils by use of atomic absorption spectrophotometer (Tel and Hargerty, 1984).

The tomato varieties used included five hybrid varieties (DT97162A(R), DT97/215A, Tropical, Roma VF, UC82B) and two local varieties (Ibadan Local and Ogbomoso Local), all obtained at the NIHORT and department of Agronomy, LAUTECH, Ogbomoso, Nigeria.

The nursery beds were prepared and watered regularly using a watering can and checked for seedling emergence which started on the 5th day after sowing. The nursery plots were mulched to avoid poor germination and prevent excessive heat. Transplanting of tomatoes seedling into their respective plots in the field took place four weeks after sowing (WAS) early in the morning after a heavy rainfall (Adelana, 1976).

N.P.K (15-15-15) fertilizer was applied at the rate of 120 kg/ha three weeks after transplanting (WATP) to boost the growth of the crops. The fertilizer was applied by ring placement into drills 5 cm deep and 7.5 cm away from the plant and covered with soil. Three weeding operations were carried out on the field at two weeks interval. Also, crop management includes spraying with cymbush at 2, 4 and 6 weeks after transplanting against defoliating pests (Vimala, 1978).

Data were collected on the growth parameters (number of leaves and plant height) number of flowers, number of fruits per plant, fruit weight per plant and fruit yield per hectare. The meter rulers was used for the measuring of the tomato plant height from base to the tip of the main shoots while the number of leaves were counted and recorded at 3 and 6 WATP. The numbers of flowers were counted and recorded at 50% flowering. The number of fruit per plant was counted while the fruit weight per plant and fruit yield per hectare were weighed and recorded at harvesting. The proximate analysis of the fruit was also assessed. Fruit samples were collected from each variety, and dried in an oven at 65°C till constant weight was obtained. The dried fruit samples were separately ground with a Wiley mill, and passed through a 0.5 mm sieve for tissue analysis. Total P was determined by the Vanadomolybdate method, K and Ca were determined by flame photometry and Mg and Fe were determined by atomic absorption spectrophotometer. Total N was analysed by the micro-Kjeldahl procedure as described by IITA (1982) and crude protein was obtained by multiplying the total N by a factor of 6.25. Concentrations of nutrient were expressed on the basis of percentage dry fruit material.

All data collected were subjected to the analysis of variance and significant means separated where appropriate by the least significant difference at 0.05 probability level.

Table 1. Chemical and physical properties of the soil of the experimental site.

Parameters	Values
pH in H_2O	6.53
pH in Kcl	5.98
Total N (%)	0.63
Available P (mg/kg)	6.99
Exchangeable cations (mg/g)	
Ca2+	1.96
Mg2+	1.71
K+	0.44
Na+	0.10
Al3+	0.02
Exchangeable acidity (meq/100 g)	
Organic Carbon	2/74
CEC	4.2
Acidity	0.05
Mn	6.41
Fe (ppm)	21.14
Cu	1.63
Zn	3.47
Physical characteristics	
Sand (%)	79.2
Silt (%)	15.4
Clay (%)	5.4
Textural class	sandy loam

RESULTS AND DISCUSSION

Soil analysis

The result of the soil analysis is shown in Table 1. The

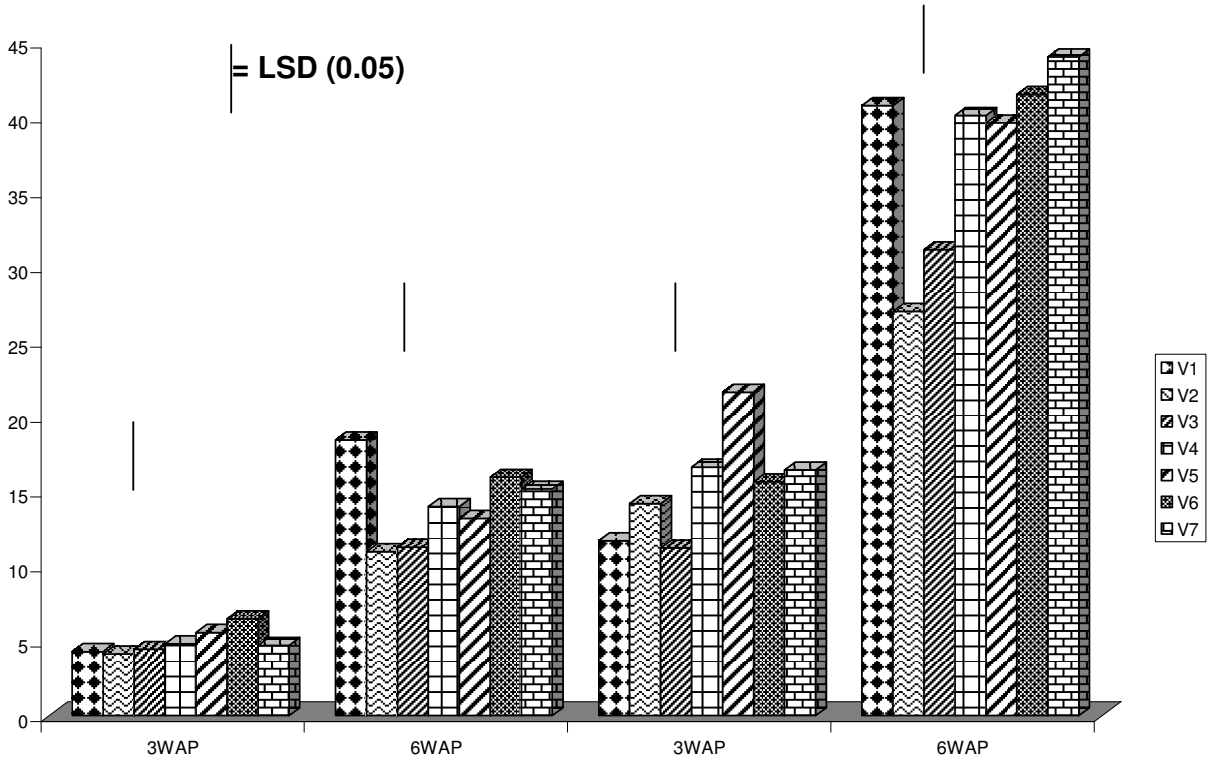

Figure 1. Plant height (cm) and leaf number of different tomato varieties.

pre-cropping soil analysis showed that the soil is sandy loam with organic matter and good moisture retaining properties. Most of its chemical nutrient elements are below the critical values (Adeoye and Agboola, 1985), which call for the application of soil amendment like inorganic fertilizer. The pH of 6.5 is within the range of pH considered suitable for vegetables (Tindal, 1983) in which tomato belong.

Growth parameters

The plant height increased as the plant aged (Figure 1). There were statistically significant differences among the varietals treatments. However, variety Ibadan Local had higher mean plant height while variety DT97/215A recorded the least values. The mean number of leaves of tomato varieties is presented on Figure 2. The number of leaves increased as the plant mature or ages. The statistical analysis showed significant difference amount the varietals treatments except at 6 WAT. The highest number of leaves was recorded from variety DT97/162A(R) while DT97/215A had the least value. The tomato plants growth patterns shows an initial slow growth in the nursery and the accelerated or exponential growth as observed in the field after the normal slow establishment of the plant after transplanting. This result agreed with the findings of other researchers (Olaniyi and Fagbayide, 1999; Fogg, 1967), who found that the plant showed growth in height beginning rather slowly, increasing to a maximum then slow down again so that the graph obtained by plotting height against time is like an oblique 'S' in shape.

Yield and yield components of different tomato varieties

The number of flowers, number of fruits, fruit weight per plant and total fruit yield per hectares of tomato varieties used is presented on Figure 2. Although, there was no significant difference for the number of flowers among the varieties, higher value was recorded for Roma VF while DT97/215A gave the least value. The fruit yield per plant and total fruit yield were statistically significant among the varieties. The highest values were recorded from UC82B while DT97/215A gave the least values. The low marketable yield obtained for some tomato varieties used might be due to non-development of flowers into fruits as about 50% of the flowers developed into fruits. Most of the flowers were dried up and fell off or they might form tiny fruits which shriveled up and fall off without further development. This may be due to their genetic composition. Adelana (1975) discovered that only 50% of the flowers produced developed into fruits, thus sink size was a limiting factor to fruit production in tomato. The poor fruit set may be as a result of high temperatures that are not conducive for good fruit set (Simon and Sobulo,

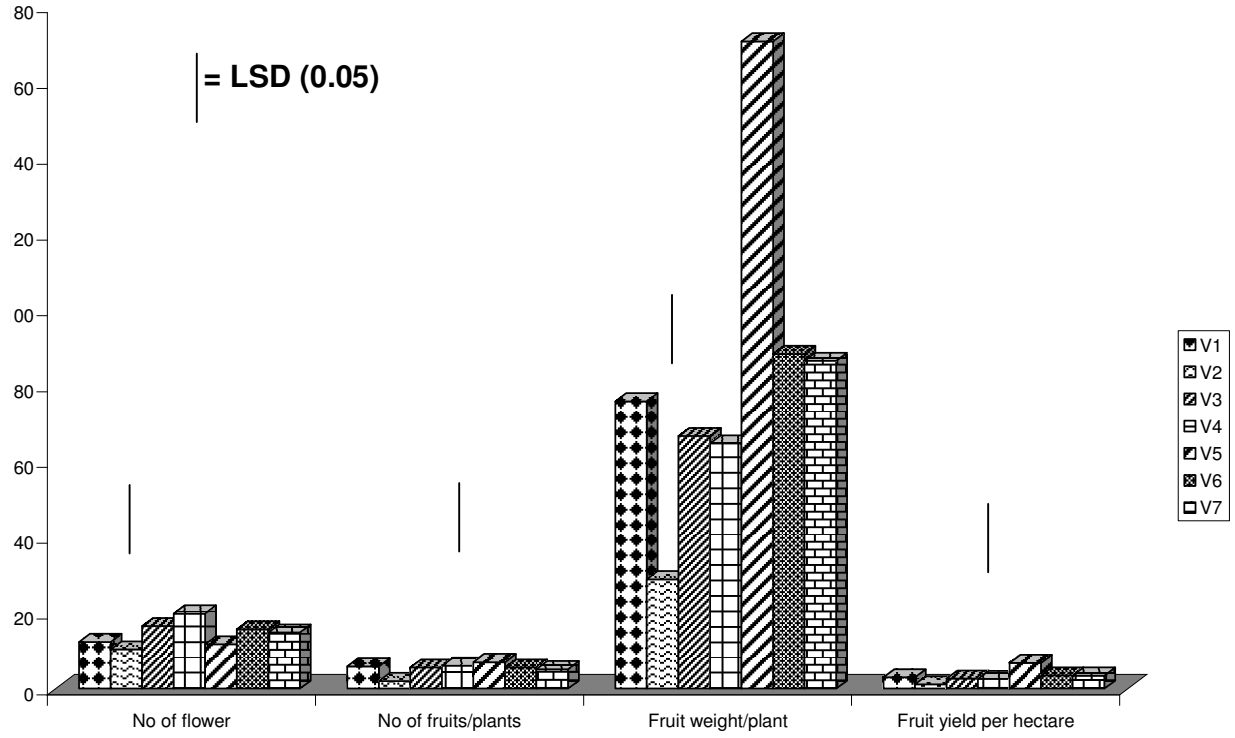

Figure 2. Yield and yield components of different tomato varieties.

Table 3. Proximate analysis of tomato varieties.

Variety	% Protein	% Fat	% Fibre	Mg/100g Vit. C	% Ca	% Mg	% K	% P	Ppm Fe
DT97/162A(R)	28.65	3.66	6.07	0.33	0.247	0.117	0.068	0.413	21.41
DT97/215.A	33.34	3.51	6.52	0.28	0.275	0.145	0.084	0.382	22.55
Tropical	32.18	4.22	6.93	0.29	0.302	0.183	0.138	0.404	27.60
Roma VF	26.10	4.08	6.48	0.22	0.376	0.222	0.148	0.445	19.25
UC82B	25.98	3.67	7.33	0.24	0.257	0.123	0.173	0.426	15.36
Ibadan local	29.34	3.86	7.42	0.21	0.329	0.185	0.135	0.573	31.55
Ogbomosolocal	42.55	3.72	6.94	0.19	0.383	0.214	0.157	0.455	31.09
LSD 0.05	0.0O7	ns	Ns	0.02	0.003	0.001	0.001	0.002	0.64
CV	0.23	385.54	133.91	5.11	0.494	0.223	0.448	0.232	1.45

Mg; Magnesium, P; Phosphorus, K; Potassium, Ca; Calcium, Fe; Iron.

1974).The varietals differences in growth and yield might be attributed to the differences in ecological distribution of the tomato varieties (Olaniyi, 2007).

The variation in yield may also be due to genetic differences among the varieties since they were grown under the same environ-mental conditions (Olaniyi and Fagbayide, 1999). The low yield recorded in this study compared with that of the temperate region is in con-formity with the finding of Adelana (1978), who reported about 5 and 20 tones per hectare as the average yield in the main tomato growing areas of Southern and Northern Nigeria, respectively.

Proximate analysis of tomato fruits

The results of the fruits proximate analysis of tomato varieties are presented on Table 2. The percent protein, vitamin C, Calcium, Magnesium, Potassium, Phosphorus and Iron contents of tomato fruits showed significant differences among the varieties. There is inconsistence in the nutritional values obtained in this study for the tomato varieties used. The local varieties (Ogbomoso and Ibadan Local) closely followed by UC82B recorded some of the nutritional values more than the other varieties.

The outstanding values of the tomato as a source of

special nutrient needed in the diet are indicated by the nutritive values. All the seven tomato varieties are good sources of quality and mineral elements. The variation in the nutritive values of different varieties of tomato used in this study might be due to d the environmental effect in which they are grown. Also, distribution of minerals needed for human health in the edible portions of plants can be affected by cultural production methods (Russo, 1996). Tomato production is currently on the increase in Nigeria partly in recognition of its food values as a source of essentially body building proteins, vitamins and mineral (Vilareal, 1980). Protein helps in the building up of new cells in the body and enhances growth. Fat in the diet serves as a source of energy in the body of a man. Calcium aids the formation of bones, while Fe in the diet serves as a source of blood formation to the body of a man (South pacific foods, 1995).

In conclusion, despite environmental and other yield constraints encountered by these varieties during the growth period, UC82B closely followed by Ibadan and Ogbomoso Local still gave the highest growth, marketable and good quality fruit yield performance. This suggests that UC82B tomato variety has ability to tolerate the environmental hazards and other yield constraints encountered during the growth periods than the remaining six varieties under investigation. Therefore, UC82B, Ibadan and Ogbomoso Local in that descending order can be recommended as the best tomato varieties in Ogbomoso, the Guinea Savannah zone of south west Nigeria.

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