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ORIGINAL RESEARCH ARTICLE

Effects of Varieties on the Growth and Yield of some Tomatoes [*Solanum esculentum* (L.)] in Mubi, Northern Guinea Savannah, Nigeria

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ABSTRACT

The study determined the effect of varieties on the growth and yield of some tomatoes in Mubi Northern Guinea Savannah Nigeria. Tomatoes were obtained from Mubi main market for the experiment. The experimental treatments consist of three different varieties of tomatoes viz; (Seria, UC, and UTC) respectively. The treatments were laid out in a Randomized Complete Block Design (RCBD) with three replications. The plot size was measured 3m x 3m with alley of 1m between replication and 1m between plots. Tomatoes seeds were sown directly into the soil by dibbling method Sowing was done by hand using hoe and after germination the seedlings were thinned to one per stand in a hole for better yield. The results of varieties on plant height showed a significant difference (P≤0.01) level of significance at 3, 6, and 9 WAS, UTC recorded the highest mean value (23.17) followed by Seria (14.47) with UC recording the least (9.76) at 3 WAS. Similarly, at 6 and 9 WAS UTC recorded the highest mean value of (60.69) and (78.52) followed by Seria at (78.08cm) at 9 WAS and (49.75cm) at 6 WAS where UC recorded the least at (41.02cm) and (61.16cm) at 6 and 9 WAS. The results obtained agree with the findings (lqtidar et al, 2006 and Keskar et al; 2011). The number of branches per plant at 3, 6 and 9 WAS, the results showed a significant of (P ≥ 0.01) differences at 3,6 and 9 WAS. UTC recorded the highest mean value (20.26), (14.66) seria at 9 WAS followed by UC (14.80) and (9.20) seria at 6 WAS.

Introduction

Foolad (2018), found that, tomato is the sixth most valuable crop in the world worth US$ 87.9 billion in 2017 and is grown in all soil types on a small scale for family use and commercial purposes. Tomato belongs to the *solanaceae* family and the genus *Solanum* which is a small genus within the large and diverse genera that consists approximately 90 genera (Singh, 2019) and is one of the most consumed vegetables in the world. Tomatoes can be eaten fresh or in processed forms such as sauce, ketchup, puree, paste, powder and soup (Battistuzzi, 2012). Tomato is also a crop which is globally grown, some in the open field others in the green house. Indeterminate varieties are usually grown in greenhouses (Stoleru, 2020). Tomatoes fruits exist in many shapes appearing large and round, oval or elongated, depending on the variety. The

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fruits may be orange, yellow or red when ripe, usually with numerous kidneys or peer shaped, hairy, light brown seeds (Tindall, 2018). Tomato is a warm season plant that requires temperature of about 20-27^{0}c for most cultivars. Excessive rainfall and high relative humidity can be harmful to it. A deep loamy soil well drained rich in organic material with a pH of 6.2 – 6.8 for optimum growth and development. It is a nutritious vegetable with increasing demand in Nigeria. As documented by United States Dietary Allowance (2008), tomato fruit provide 95% water of its edible portion and the remaining 5% compose of miscellaneous compound among which include carotenoids, ascorbic acids, alcohol, insoluble solids (proteins) cellulose, pectins, polysaccharides and inorganic compound which give the fruit its characteristic flavor and aroma. In addition, (Stoleru, 2020) revealed that tomatoes are among the food plants to which moderate level of anti-cancer activities is associated. It also contains Vitamin A which is a remedy for night blindness. The world's cultivation of tomato is put to about 4 million hectares of which 63,482 hectares are estimated to be cultivated. In Nigeria, FAO (2010) reported an estimated annual production of 1.7 million tones. However, this was still far below demand as there was an increasing demand from human consumption. However, most of the deficits were offset by importation. Despite a drive towards increased tomatoes production in Nigeria, an optimum production has not been realized by the farmers to meet its demand among consumers. Generally, tomato production in Nigeria has been low because of low yields obtained by small scale farmers resulting from the use of unimproved local varieties with low yielding capacity which often grown in mixtures and this may prevent exploitation of crop productive capacity, environmental hazards such as drought and incidence of pest and diseases, plant population including soil fertility decline and a host of other factors have also kept tomato yield output relatively low (Adekiya and Ojeniyi, 2012). Therefore, effect of varietal influence on the growth and yield of three tomato varieties need to be evaluated to replace the low yielding local varieties currently in use by farmers.

Tomato productivity in Nigeria is rated very low at 1.5 to 14 tons per hectare compared to world average of 56 tons per hectare (FAO, 2014). The most common limiting factors to tomato productivity are pests and diseases, drought, soil erosion, and declining soil fertility across Nigeria (Birungi, 2020). Cultural practices associated with tomato growth and fruit developed have been investigated, but the findings are not conclusive. The situation is worst in developing countries such as Nigeria, where there is insufficient information on the cultural practice of some varieties of tomatoes. "Tomato (*Solanum (lycopersicum*) is a widely cultivated crop, and its yield and quality are significantly influenced by varietal differences. Despite the importance of tomato production, there is limited research on the comparative growth and yield performance tomato varieties under the same environmental conditions. This knowledge gap hinders the ability of farmers and gardeners to make informed decisions about which varieties to cultivate, leading to reduced yields and decreased productivity. For this reason, it is difficult to define the optimal development condition to maximize the production of tomatoes. To have more information, it would be of interest to give an insight on how agronomic and environmental factors affect some varieties. The research should be conducted to investigate the influence of varietal effect on the growth and yield of three tomatoe varieties.

The production of tomato could not meet up with the demand for food, industrial uses and

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export due to lack of proper cultural practices. There is a need to avail to the famers the best variety of tomatoes that will performance well. Tomato varieties exhibit distinct characteristics, and understanding their growth and yield of different tomato varieties under the same environmental conditions. So, by investigating the effect of varietal influence on the growth and yield of three tomato varieties, this will study will aim to address a significant knowledge gap, providing practical and scientific benefits that can impact tomato production and food security.

The objectives of the study are to; evaluate the effect of varieties on the growth and yield of tomatoes **(*Solanum esculentum* L.);** and determine the best varieties of tomatoes (*Solanum esculentum* L.) that can give maximum yield in study area.

Materials and Methods

Study Site

Field experiment was conducted at the Department of crop science, teaching and research farm, food and agricultural organization/tree crop programme (FAO/TCP) farm Faculty of Agriculture, Adamawa State University Mubi, Nigeria. Mubi located in the northern guinea savanna of Nigeria is situated between latitudes10˚11'N and10˚30'N of the Equator and between longitudes13˚10'E and 13˚30'E of the Greenwich Meridian and at altitude of 969m above Mean Sea Level (MSL). The mean rainfall is 900mm and a minimum temperature of 18^0C harmattan period and 40^0C as maximum in April (Adebayo, 2020).

Treatment and Experimental Design

The experiment design was laid out in a Randomized Completed Block Design (RCBD). The study was carried out in Mubi North Local Government Area. The treatments consist of three (3) tomatoe varieties viz: T1 (seria), T2 (UC) and T3 (UTC). The treatments were laid out in a Complete Block Design (RCBD) in three (3) replicates

Sources of Tomato Seed

Seria, UC and UTC seeds were bought from Mubi local market.

Table 1: Physico-Chemical Properties of the Experimental site before Cropping

Soil Sample	Sand	Silt	Clay	Textural classes	B.D g/cm³	P.D g/cm³	Porosity (%)
A	68.8	14.4	16.8	Sandy Loam	1.49	2.384	37.5
B	70.8	11.4	17.8	Sandy Loam	1.46	2.43	39.9177

Table 2: Soil Chemical Properties

Soil Sample	pH (1:2)	EC (ds/m)	Org.C (%)	Org.M (%)	TN (%)	Av- P (mg/kg)	Ca	Mg	Na	K	TEB	H	Al	TEA	ECEC	PBS (%)	ESP (%)
A	6.7	0.070	1.057	1.823	0.099	9.260	1.849	2.249	0.0883	0.555	4.736	0.576	1.508	1.508	6.244	85.672	1.322
B	6.80	0.09	0.54	0.93	0.05	8.74	8.80	1.20	0.78	0.23	11.01	0.74	1.13	1.87	12.88	88.72	6.09

Tomato Nursery Operations

Two nursery beds were raised 45cm × 45cm each, separated 1cm apart. 1kg of poultry droppings was spread on each beds and allowed to decompose for 14days. The seeds of the three varieties were sown by broadcasting method on each of the raised seed bed. All nursery management activities were strictly adhered to and the nursery duration took four weeks, before transplanting the tomatoe seedlings on the research field.

Transplanting of Tomatoes Seedlings

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The seedlings of the three varieties tomatoes were transplanted four weeks after broadcasting on already ploughed and harrowed. Transplanting was done early in the morning after a light shower of rainfall using the spacing of 60cm × 60cm.

Cultural Practices

Pest and Disease Control of Tomatoes: To control possible incidence of pest on disease associated with tomato, insecticide such as cypermethrin was applied at growth stages on weekly basis

Weed control

Hand weeding using hoe was done at three and six weeks after transplanting to control weeds competition for space, nutrient and sunlight required for photosynthesis.

Data Collection

Data were collected on the following parameters;

i. ***Plant height (cm):*** Five plants were tagged. Heights of the tagged plants were measured each from the base to tip of the stem using a meter scale at harvest. Number of branches: total number of primary branches of selected and tagged plants (five plant) in the treatment were counted at the time of last harvest or picking of fruits and the mean was recorded.

ii. ***Stem girth (mm):*** total number of primary stem of selected tagged plants under a treatment was counted at the time of last harvest or picking of fruits and the mean value was evaluated by selecting some plants randomly from treatment and at the time of last harvest. This was done by measuring the thickness of the stem at harvest.

iii. ***Days to 1st flowering:*** The number of days taken from date of sowing to date at which 1st of the plant population flowered was noted and then the average was determined.

iv. ***Days to 50% flowering:*** this is the period whereby 50% of the plant produce flowers

v. ***Fresh Fruits weight (FFW):*** The edible fruits weight in kg at tagged plants. Each treatment was recorded with the help of weighing balance. The total weight of fruits was divided from the tagged plants the number of fruits to obtain average fresh fruits weight by measuring the fruits weight of each plant in kg.

Statistical Analysis

Data obtained was subjected to the analysis of variance (ANOVA) and treatment mean was compared using the Ducan's Mutiple Range Test (DMRT) at 5%

Results and Discussion

Table 3: Effect of Varieties on Plants Height (cm), and Number of Branches at 3, 6 and 9 WAS in 2024 Cropping Season

Treatments	PH3	PH6	PH9	NB3	NB6	NB9
Seria	14.47^{b}	49.75^{b}	76.08^{ab}	4.93^{b}	9.20^{b}	14.66^{b}
UC	9.76^{c}	41.02^{bc}	61.16^{b}	3.46^{c}	14.80^{a}	11.66^{c}
UTC	UTC	23.17^{a}	60.69^{a}	78.57^{a}	7.20^{a}	20.26^{a}
P of F	0.011**	0.008**	0.003**	0.041*	0.002**	0.008**
SE	2.98	4.03	3.17	1.11	1.33	1.177

Keys: PH3: plant height at week 3, PH6: plant height at week 6, PH9: plant height at week 9, NB3: Number of branches at 3 weeks, NB6: Number of branches at 6 weeks, NB9: Number of branches at 9 weeks

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The results of varieties on plant height at 3, 6 and 9 weeks are presented on Table 3 above showed a significant difference (P≤0.01) level of significance at 3, 6, and 9 WAS, UTC recorded the highest mean value (23.17) followed by seria (14.47) UC recorded the least at (9.76) at 3 WAS. Similarly, at 6 and 9 WAS UTC recorded the highest mean value of (60.69) and (78.57) followed by Seria at (76.08cm) at 9 WAS and (49.75cm) at 6 WAS UC was recorded the least at (41.02cm) and (61.16cm) at 6 and 9 WAS. The plants number of branches at 3,6 and 9 WAS (Table 3). showed a significant (P≤ 0.01) differences at 3,4 and 9 WAS. UTC recorded a high mean value (20.26), (14.66) seria at 9 WAS followed by UC (14.80) and (9.20) seria at 6 WAS UC recorded the least with (3.46), respectively.

The results of the effect of varieties on the plant stem girth at 3,6, and 9 WAS showed that at 9 WAS Seria recorded the high mean value of (354.42 mm/plant) followed by UTC at (11.97 mm/plant) at 3 WAS, and (9.93 mm/plant) at 6 WAS while at 3,6 and 9 WAS UC recorded the least mean value at 3 WAS at (4.00 mm/plant) at (p ≥ 0.01) level of significance (Table 4). The effect of varieties on days to first and 50% flowering recorded that UC has the high mean value at DFF with (34.66) and (42.00) at DFPF and UTC recorded the least with (24.00) DFF and (28.33) DFPF with (P ≥ 0.01) level of significance.

Table 4: Effect of Varieties on Stem Girth (mm), Days to First and Fifty (50) % Flowering in 2024 Cropping Season

Treatments	SG3	SG6	SG9	DFF	DFPF
Seria	4.86^{b}	8.06^{b}	12.42^{a}	24.66^{b}	28.66^{b}
UC	4.00^{bc}	6.39^{c}	7.71^{c}	34.66^{a}	42.00^{a}
UTC	12.34^{a}	9.93^{a}	11.97^{b}	24.00^{bc}	28.33^{bc}
P of F	0.348^{NS}	0.009**	0.422^{NS}	0.001**	0.012**
SE	5.76	0.73	281.52	1.61	3.45

Keys: SG3: Stem Girth at 3 weeks, SG6: Stem Girth at 6 weeks, SG9: Stem Girth at 9 weeks, DFF: Days to first flowering, DFPF: Days to fifty percent flowering

Table 5: Effect of Varieties on Fruit Yield (Kg/ha^{-1}) in 2024 Cropping Season

Treatment	FY1	FY2	FY3	FY4	FY5	FY6	FY7
Seria	282.20^{a}	638.53^{a}	164.53^{a}	233.60^{a}	203.60^{a}	84.50^{c}	96.93^{c}
UC	120.00^{b}	148.66^{bc}	136.86^{b}	131.11^{c}	162.46^{c}	134.33^{b}	160.73^{b}
UTC	242.53^{ab}	162.46^{b}	135.66^{b}	188.53^{b}	196.13^{b}	147.13^{a}	208.26^{a}
P of F	0.145^{NS}	0.362^{NS}	0.587	0.001	0.004	0.371	0.008
SE	72.71	358.88	30.27	13.60	7.63	43.18	23.05

FY: Fruit Yield (Kg/ha^{-1})

The results of the effect of varieties on the fruits yield at FY2 and FY1, seria recorded the highest mean value of (638.53) and (282.20) respectively followed by UTC at (242.53) FY1 UC recorded the lowest at FY1 with 120.00 fruits yield.

Effect of Varieties on Plants Height, and Number of Branches at 3, 6 and 9 WAS

The result (Table 3) showed a significant difference (P≤0.01) level of significance at 3, 6, and 9 WAS, UTC recorded the highest mean value (23.17) followed by Seria (14.47) where UC recorded the least (9.76) at 3 WAS.

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Similarly, at 6 and 9 WAS UTC recorded the highest mean value of (60.69) and (78.52) followed by Seria at (78.08cm) at 9 WAS and (49.75cm) at 6 WAS with UC recording the least at (41.02cm) and (61.16cm) at 6 and 9 WAS. The results obtained agrees with the findings of (lqtidar *et al*, 2006 and Keskar *et al*; 2011). The plants number of branches showed a significant ($P \leq 0.01$) differences at 3,4 and 9 WAS. UTC recorded with the highest mean value of (20.26), (14.66) seria at 9 WAS followed by UC (14.80) and (9.20) seria at 6 WAS UC recorded the least with (3.46), respectively. The results obtained are in tandem with those of Singh (2020), Adekiya (2017) and Agbede (2008) who reported that application of poultry manure and the use of UTC tomato varieties gave the highest number of flowers per plant.

Effect of Varieties on Stem Girth, Days to First and Fifty (50) % Flowering

The results of the effect of varieties on the plant stem girth (Table 4) shows that at 3,6, and 9 WAS showed that at 9 WAS Seria recorded the highest mean value of (354.42 mm/plant) followed by UTC at (11.97 mm/plant) at 3 WAS, and (9.93 mm/plant) at 6 WAS while at 3,6 and 9 WAS UC recorded the least mean value at 3 WAS with (4.00 mm/plant) at ($p \geq 0.01$) level of significance (Table at 4.2) This observation was corroborated with the findings of (Bache and Heathcoat, 1996, Adediran, 2003), that both UC, UTC and Seria increased. The effect of varieties on days to first and 50% flowering recorded that UC has highest mean value at DFF with (34.66) and (42.00) at DFPF and UTC recorded the least mean of (24.00) DFF and (28.33) DFPF with ($P \geq 0.01$) level of significance.

Effect of Varieties on Fruit Yield

The results of the effect of varieties on the fruits yield at FY2 and FY1 (Table 5) shows that seria recorded the highest mean value of (638.53) and (282.20) respectively followed by UTC at (242.53) FY1 where UC recorded the lowest at FY1 with 120.00 fruits yield. Highly significant difference was recorded on leaf area on FY2. This results agrees with the findings of the following researchers Ramachandra and Thimmaraju 1983; Ehigiator, 1990; Singh and Whitehead, 1996; Egharevba and Ogbe, 2002 Olaniyi, 2007; Jombo *et al*; 2012)..

Conclusion

The study determines the effect of varieties on the growth and yield of some tomatoes in Mubi Northern Guinea Savannah Nigeria. Seeds of tomatoes were obtained from Mubi main market. The experimental treatments consisted of three different varieties of tomatoes viz; (Seria, UC, and UTC) respectively. The treatments were laid out in a Randomized Complete Block Design (RCBD) with three replications. The plots size was measured 3m x 3m with alley of 1m between replication and 1m between plots. Tomatoe seeds were sown directly to the soil by dibbling method Sowing was done by hand using hoe and after germination the seedlings were thinned to one per stand to set required population for better yield. The results of varieties on plant height showed a significant difference ($P \leq 0.01$) level of significance at 3, 6, and 9 WAS, UTC recorded the highest mean value (23.17) followed by Seria (14.47) where UC recorded the least at (9.76) at 3 WAS. Similarly, at 6 and 9 WAS UTC recorded the highest mean value of (60.69) and (78.52) followed by Seria at (78.08cm) at 9 WAS and (49.75cm) at 6 WAS with UC recording the least at (41.02cm) and (61.16cm) at 6 and 9 WAS. The results obtained agree with the findings of (lqtidar *et al*, 2006 and Keskar *et al*; 2011). Results of plants number of branches at 3,6 and 9 WAS showed at the results showed a

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significant of (P ≥ 0.01) differences at 3,4 and 9 WAS. UTC recorded the highest mean value (20.26), (14.66) seria at 9 WAS followed by UC (14.80) and (9.20) seria at 6 WAS.

Based on the above findings of experiment, it can be concluded that the use of Seria, UC and UTC that recorded significant differences between the different varieties on the yield of tomatoes and even their combination can be beneficial to farmers. It is therefore recommended that farmers may opt for any of the three varieties of tomatoes for a better productivity.

Recommendations

Based on the findings of this study, it may be recommended that it would be advisable to farmers to use any of the three varieties of tomatoes so that better yields may be achieved with moderate application of fertilizer. This should be encouraged to forestall vegetative growth at the expense of seed formation and for maximum growth and yield of tomato in the study area.

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