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PRELIMINARY EVALUATION OF GROWTH AND YIELD PERFORMANCES OF SOME PEPPER (*Capsicum spp.*) VARIETIES IN AN ULTISOL

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ABSTRACT

A field trial was conducted at University of Uyo Teaching and Research Farm, Town Campus Annex, Uyo, Akwa Ibom State in the late cropping season of 2014 to evaluate the growth and yield performances of some pepper (*Capsicum spp.*) varieties in an ultisol. The experiment was laid out in a randomized complete block design with three replicates. Treatments were five pepper varieties (Tabasco, Trinidad, Scotch Bonnet, Aleppo and Cubanelle). Results indicated significant ($P < 0.05$) differences in growth and yield among the pepper varieties. Scotch Bonnet variety produced the highest number of leaves per plant (27.44, 58.53, 111.98 and 140.24 at 5, 7, 9 and 11 weeks after transplanting - WAT, respectively) while the least was from Trinidad variety (12.97, 35.45, 56.63 and 89.92 at 5, 7, 9 and 11 WAT, respectively). Aleppo variety had significantly ($P < 0.05$) taller plants by the 13th WAT (83.21cm) than other varieties. Scotch Bonnet had the widest leaf area at 9 WAT (40.71 cm²) while Trinidad had the widest at 7 and 11 WAT with 49.94 cm² and 42.27 cm², respectively. The number of fruits per plant and fresh fruit yield per hectare varied significantly ($P < 0.05$) among the varieties. The highest number of fruits per plant, fresh and dry fruit yields per hectare were from Aleppo variety (29.23, 16.57 and 9.51 t/ha) followed by Cubanelle variety (22.87, 14.96 and 7.08 t/ha, respectively) while Trinidad variety had the least (5.63, 2.82 and 1.31 t/ha). Fresh and dry fruit yields per hectare from Aleppo variety were higher than other varieties by 10- 83% and 26 -86 % respectively. Therefore, planting Aleppo and/or Cubanelle variety(ies) has high potentials for pepper production in an ultisol.

Keywords: Evaluation, pepper (*Capsicum spp.*), varieties, growth, yield, ultisol.

INTRODUCTION

Pepper (*Capsicum spp.*), a member of Solanaceae Family, is an important fruit vegetable in the world (Aliyu, 2000; Udoh et al., 2005). This is because it is consumed by human in various ways for its high nutritional, medicinal and economic value (Udoh et al., 2005) and is commonly used as condiments (Alabi, 2006). The non-pungent species are eaten raw in salad while the stronger flavoured types are popular in all kinds of cookery. The very hot varieties of pepper (Chillies) have a high content of the alkaloid capsaicin (C₁₈H₂₇O₃) which imparts the pungency or spicy taste. The pungent species is also used on seasoning sauces and soup and other dishes. Pepper like other vegetables crops contributes nutritiously with nutrient that may be lacking in other food material hence improve food intake (Grubben, 1997).

Due to its high demand, many people now engaged in its cultivation both at subsistent and commercial level, but the average production and yield in Nigeria is still very low (Andrew, 2002, Ikeh et al., 2012). Presently, its production is far below its demand and this lopsided relationship between demand and production emphasizes the need to investigate and subsequently develop strategies that can enhance pepper production. Besides, it remains a good source of income. In Ghana for instance, pepper is one of the leading vegetable crops noted for export (Nkansah et al., 2011). Bonsu et al. (2003) reported that its production is a good source of income for small producers or out growers and is significantly one of the foreign exchange earning vegetable crops in Ghana. Pepper is used daily in most homes and is playing positive role at the local and export markets. The Ghana Standard Board- GST (2004) classified the four commercial types of fresh hot peppers grown from *Capsicum annum* and *Capsicum frutescense* into two classes. The commercial types include the elongated-type (e.g. Legon 18), Cherry-type (e.g. Kpakpo shito), Bonnet shaped (e.g. Scotch bonnet) and Small elongated type (e.g., African bird's eye). Trial conducted in Ghana, revealed that yield in the forest zone was higher than those recorded in the Coastal Savanna zone indicating that environment has influence on pepper performance (Nkansah et al., 2011). Research findings have pointed to the fact that the use of adaptable variety/ies can boost pepper yield (Udoh et al., 2005; Ikeh et al., 2012). Consequently, this study was conducted to evaluate the growth and yield performances of some pepper (*Capsicum spp.*) varieties grown in an ultisol in Uyo, Southern Nigeria.

MATERIALS AND METHODS

The study was carried out at the University of Uyo Teaching and Research Farm Town Campus Annex, during 2014 late farming season. Uyo is located at Latitude 5° 03' and 5° 27'N; Longitude 7° 27' and 7° 58'E and altitude, 38.1m above sea level). Uyo is in a rainforest zone which receives about 2700mm rainfall annually (Meteorological Garden, 2008). The rainfall pattern is binodal, with long (March - July) and short (September - November) rainy seasons separated by a short dry spell of uncertain length, usually during the month of August. The mean relative humidity is 78.8 %, atmospheric temperature is 30°C and the mean sunshine hours is 12 (Peters

et al., 1989). The soil belongs to the ultisol broad group and the land had been under fallow for about two years before the experiment.

The experiment was laid out in a randomized complete block design with three replicates. Treatments were five pepper varieties (Tabasco, Trinidad, Scotch Bonnet, Aleppo and Cubanelle). Each plot measured 4.5 m x 2.0 m while each replicate measured 28.5 m x 10 m. The inter-block and plot spacing were 2m and 1m, respectively. All plots were constructed into seedbeds (4.5 m x 2.0 m). The pepper seedlings were raised in polybags in the Department of Crop Science Screen House on varietal basis and the seedlings well nurtured until they were 50 days old before they were transplanted to the permanent field in the evening. One week prior to transplanting they were hardened up by exposing them to direct sunlight for 2-6 hours progressively. Only healthy and uniformly sized seedlings were transplanted in the evening at a spacing of 50 cm x 50 cm. Weeding was done manually at 3, 6, and 12 weeks after transplanting (WAT). Five plants were randomly tagged per plot for the determination of height, number of leaves per plant, leaf area (using Salau et al., 2008 method- $LA = 0.64 \times LW$, where L=length of the leaf and W=width of the leaf), number of branches per plant, number of days to 50% flowering, number of fruits per plant, fruit length and circumference as well as fresh and dry fruit yields (t/ha). Data collected were subjected to analysis of variance procedure and treatment means that indicated significant difference were compared using the Least Significance Difference at $P < 0.05$.

RESULTS

Soil characteristics of the experimental site (Table 1) showed that the soil was acidic with pH values of 6.0 and 6.3 at 0-15 and 15-30cm depths, respectively. The organic matter content was 1.50 and 1.03 % while nitrogen was 0.07 and 0.05 %, respectively. The sandy, clay and silt fractions were 76.40, 14.20 and 9.40% at 0-15 and 78.40, 14.20 and 7.40 % at 15-30cm soil depth, respectively. Based on the soil basic characteristics, the soil would require some amendments in order to sustain its fertility.

Pepper height and number of leaves per plant

Pepper height (Table 2) as influenced by varieties showed significant difference ($P < 0.05$). Aleppo was the tallest variety (27.44, 54.21, 68.44, 76.96 and 82.35cm at 5, 7, 9, 11 and 13 WAT respectively, followed by Scotch Bonnet (26.85, 54.77, 65.94 and 73.66cm at 5, 7, 9, 11 and 13 WAT) while Trinidad was the shortest variety (14.49, 23.70, 32.12, and 42.48cm.). The number of leaves of pepper per plant as influenced by varieties (Table 3) showed significant difference ($P < 0.05$). The number of leaves per plant in all the pepper varieties gradually increased in the number from 5 to 11 WAT but reduced at 13 WAT. Scotch Bonnet variety produced the highest number of leaves (45.69, 85.53, 113.98, and 140.24 at 5, 7, 9, and 11 WAT) but reduced to 124.24 at 13 WAT. The least number of leaves per plant was from Trinidad variety (12.97, 35.45, 55.63, 89.92 and 81.81 at 5, 7, 9, 11 and at 13 WAT).

Leaf area and stem girth

Pepper leaf area as influenced by varieties showed significant difference ($P < 0.05$) at all sampling periods (Table 4) but did not maintain a pattern. Scotch Bonnet variety produced the widest leaf area at 5 WAT (28.93cm²). At 7 and 9 WAT, Trinidad variety had the widest leaf area (49.94 and 41.37cm², respectively) while at 11 WAT, Aleppo variety had the widest leaf (45.11 and 40.39 cm² at 11, and 13 WAT. Cubanelle variety had the smallest (28.75, 29.25 and 35.60 and 30.86 cm², respectively at 7, 9, 11 and 13 WAT). Stem girth (Table 5) only varied significantly at 9, 11 and 13 WAT with Aleppo variety having the biggest stem girth (2.24 and 3.57 and 3.17cm respectively), while the smallest stem girth at 13 WAT was from Cubanelle variety (2.34cm).

Number of Branches per plant and some phenological characteristics

The number of branches per plant as influenced by varieties differed significantly ($P < 0.05$) (Table 6). Aleppo variety produced the highest number of branches (8.36, 19.81, 32.88, 36.97 and 39.48 at 5, 7, 9, 11 and 13 WAT, respectively). The least number of branches per plant was recorded in Trinidad pepper. The result of number of days to 50% flowering (Table 7) also varied significantly ($p < 0.05$). Aleppo variety was the first to attain 50% flowering (23.66 days after transplanting-DAT), emergence of first fruit (52.03 DAT), 50% fruiting (30.95 DAT), and 50% ripening (63.69 DAT) followed by Cubanelle (28.96, 33.68, 57.02 and 70.75 DAT, respectively). Tabasco variety took the longest number of days to attain 50% flowering (133.82), have first fruit emergence (180.33), 50% fruiting (149.03), and 50% ripening (171.03).

Yield and yield components

The number of fruits per plant (Table 8) as influenced by pepper varieties varied significantly ($P < 0.05$). Aleppo produced highest number of fruits per plant (29.23) while Trinidad had the least number of fruits per plant (5.63). Fruit length as influenced by pepper varieties (Table 8). Also varied significantly ($P < 0.05$) with Aleppo producing the longest fruits (7.73cm) followed by Cubanelle variety (7.16cm), while Tabasco had the shortest fruit (2.46 cm).

The effect of pepper varieties on fruit circumference (Table 8) also differed significantly ($p < 0.05$). Cubanelle variety produced fruits with the widest circumference (12.00 cm) followed by Scotch Bonnet (7.93 cm), while the smallest fruit circumference (2.78 cm) was from Tabasco variety. Aleppo produced the highest fresh (16.57 t ha⁻¹) and dry fruits (9.51 t ha⁻¹) and was followed by Cubanelle (14.96 and 7.08 t ha⁻¹) while Trinidad variety produced

the lowest fresh and dry fruits (2.82 and 1.31 t ha⁻¹). Fresh and dry fruit yields per hectare from Aleppo variety were higher than other varieties by 10- 83% and 26 -86 %, respectively.

DISCUSSION

Pepper varieties showed significant differences in growth and yield characteristics. The observed differences in growth and yield of the pepper varieties could be partly due to inherent genetic differences among them. Apparently, some varieties used their genetic potentials to take advantage of the environmental factors better than others probably in ability their ability to absorb and utilize moisture and nutrients. This view is in tandem with findings of earlier studies (Nkansah *et al.* 2011; Egharevba and Law-Ogbomo, 2007); El-Tohamy *et al.*, 2006; Alizadeh and Carapetian, 2006; Sana *et al.* ,2003; Gopal and Suryanarayan, 1998; Vos and Frinking ,1997; Mastro, 1995) where significant differences in plant heights in other crops were reported and due to differences in genetic and environmental conditions. Our results indicated significant variations in number of branches and this agrees with that of Sana *et al.* (2003) who reported similar findings in the number of branches in Canola cultivars and attributed the reasons to differences in genetic make-up.

The variations may also influence the yielding potentials of crop since varieties with good vigour, wider leaf area, more branches and bigger fruit size could produce more fruits than varieties with less vigour apparently due more to increased number of secondary and tertiary branches which are the locations for fruit bud formation (Faby, 1997; Orak and Ilker, 2004). From this study early and late maturing types were observed. Earliness or lateness in days to 50% flowering may be attributed to the plant's inherited characters, genetic capability, and even early acclimatization to the growing area as well as the ability of seedlings to withstand transplanting shock (Sana *et al.*, 2003; Hassan Wasiullah *et al.*, 2003). Alizadeh and Carapetian (2006) also indicated that early flowering is a lead and an escape mechanism in times of harsh environmental conditions especially at the reproductive stage and may impact positively on pricing (Demirsoy and Demirsoy, 2004). This study was conducted in the late season with less favourable conditions relative to the early season.

The significant differences in fruit yield in the pepper varieties as found in this study agree with the findings of other researchers (Izge *et al.*, 2007; Hassan Wasiullah *et al.*, 2003; Hassan *et al.*, 2001; Sana *et al.*, 2003; Khoshnazar *et al.*, 2000; Tsegaye *et al.*, 2007) who reported similar differences in other crops and ascribed it to genetic and environmental factors. In addition, during fruit growth, the fruit vary in size and this is said to be determined by the cultivar and by cell elongation during anthesis and post-anthesis (Bosland and Votava, 2000).

Table 1: Physico-chemical characteristics of the experimental site before planting

| Characteristics | Soil depth (cm) | |
|--------------------------------|-----------------|-------------|
| | 0-15 | 15-30 |
| Sand (%) | 76.40 | 78.40 |
| Silt (%) | 9.40 | 7.40 |
| Clay (%) | 14.20 | 14.20 |
| Textural class | Loamy sandy | Loamy sandy |
| pH | 6.0 | 6.3 |
| EC (ds/m) | 0.072 | 0.053 |
| Organic Matter (%) | 1.5 | 1.03 |
| Total Nitrogen (%) | 0.07 | 0.05 |
| Available phosphorus (mg/kg) | 31.97 | 29.97 |
| Exchangeable Ca (cmol/kg) | 4.20 | 3.81 |
| Exchangeable Mg (cmol/kg) | 1.6 | 1.5 |
| Exchangeable Na (cmol/kg) | 0.05 | 0.06 |
| Exchangeable K (cmol/kg) | 0.12 | 0.13 |
| Exchangeable Acidity (cmol/kg) | 2.58 | 5.04 |
| ECEC (cmol/kg) | 7.13 | 10.15 |
| Base saturation (%) | 70.46 | 52.24 |

EC = Electrical Conductivity, ECEC = Effective Cation Exchange Capacity

CONCLUSION

Aleppo and Cubanelle varieties were outstanding in growth performances. The highest number of fruits per plant and fresh and dry fruit yields per hectare were from Aleppo variety followed by Cubanelle variety while Trinidad variety had the least. Fresh and dry fruit yields per hectare from Aleppo variety were higher than other varieties by 10- 83% and 26 -86 %, respectively. Therefore, planting Aleppo and/or Cubanelle variety(ies) has high potentials for pepper production in an ultisol.

REFERENCES

- Alabi, D. A. 2006. Effects of fertilizer phosphorus and poultry droppings treatments on growth and nutrient components of pepper (*Capsicum annum* L.). *African Journals Biotechnology* 5: 671-677.
- Aliyu, L. 2000. The Effect of Organic and Mineral Fertilizer on Growth Yield and Composition of Pepper (*Capsicum annum* L.) *Biology Agriculture Horticulture*. 18: 29-36.
- Alizadeh, K. and Carapetian, J. 2006. Genetic variation in a safflower germplasm grown in rainfed cold drylands. *J. Agron.*, 5: 50-52.
- Andrew, D. 2002. *Dangerous Tastes*. Berkeley. University of California Press.
- Bonsu, K.O., E.O. Owusu, G.O. Nkansah, E. Oppong-Konadu and H. Adu-Dapaah, 2003. Morphological characterisation of hot pepper (*Capsicum* sp.) Germplasm in Ghana. *Ghana J. Horticulture*, 2: 17-23.
- Bosland, P.W. and Votava, E. 2000. *Peppers, Vegetables and Spices*. CABI Publishing, New York, 204pp.
- Demirsoy, H. and Demirsoy, L. 2004. Characteristics of some local sweet cherry cultivars from homeland. *J. Agron.*, 3: 88-89.
- Grubben, G. I. H. 1977. *Tropical Vegetables and their Genetic Resources*. International Board for Plant Genetic Race Courses FAO, Rome.
- GST (Ghana Standard Board) 2004. *Fresh fruits and vegetables: Specification for fresh hot pepper*. Ghana Standard Board, Ref. No. GS 604, pp: 1-4.
- Egharevba, R.K.A. and Law-Ogbomo, K.E. 2007. Comparative effects of two nitrogen sources on the growth and yield of roselle (*Hibiscus sabdariffa*) in the rainforest region: A case study of Benin City, Edo State, Nigeria. *J. Agron.*, 6: 142-146
- El-Tohamy, W.A., Ghoname A.A. and Abou-Hussein, S.D. 2006. Improvement of pepper growth and productivity in sandy soil by different fertilization treatments under protected cultivation. *J. Applied Sci. Res.*, 2: 8-12.
- Faby, R., 1997. The productivity of graded Elsanta frigo plants from different origin. *Acta Horticulturae*, 439: 449-456.
- Gopal, R.B. and Suryanarayan, R.M. 1998. Effect of organic manures and nitrogen levels on soil available nutrients status in maize-soybean cropping system. *J. Ind. Soc. Soil Sci.*, 46: 474-476.
- Hassan Wasiullah, M., Javed I. and Mohammad, I. 2003. Evaluation of wheat varieties under the agro-climatic condition of barani agricultural research station, Kohat. *J. Agron.*, 2: 8-12.
- Hassan, M., Ilyas, M. Wasiullah, M. and Khan, M. 2001. Performance of wheat varieties in Barani areas of Kohat Division. *Pak. J. Biol. Sci.*, 4: 114-115.
- Ikeh, A. O., Ndaeyo, N. U., Uduak, I. G., Iwo, G. A., Ugbe, L. A., Udoh, E. I. and Effiong G. S. 2012. Growth and yield responses of pepper (*Capsicum frutescens* L.) to varied poultry manure rates in Uyo, southeastern Nigeria. *ARPJ Journal of Agricultural and Biological Science*, 7, (9): 735 – 742.
- Izge, A.U., Kadams A.M. and Sajo, A.A. 2007. Agronomic performance of selected cultivars of pearl millet (*Pennisetum glaucum* L.R.Br.) and their hybrids in North-Eastern Nigeria. *J. Agron.*, 6: 344-349.
- Khoshnazar, P.R., Ahmadi, M.R. and Ghanadha, M.R. 2000. A study of adaptation and yield capacity of rapeseed (*Brassica napus* L.) cultivars and lines. *Iran. J. Agric. Sci.*, 31: 341-352.
- Mastro, G. 1995. Rape. Metapontum area. *Inform. Agrario*, 51: 26-27.
- Meteorological Garden 2008. Department of Geography and Regional Planning, University of Uyo, Uyo, Nigeria.
- Nkansah, G.O. Ayarna A. and Gbokie, T.J. 2011. Morphological and Yield Evaluation of Some Capsicum Pepper Lines in Two Agro-Ecological Zones of Ghana. *Journal of Agronomy*, 10: 84-91.
- Orak, A. and Ilker, N. 2004. Agronomic and morphological characters of some common vetch (*Vicia sativa* L.) genotypes under trakya region conditions. *J. Agron.*, 3: 72-75.
- Peters, S. W., Usoro, E. J., Obot, U. W. and Okpon, S. N. (eds). 1989, Akwa Ibom State: Physical Background, Soil and land Use and Ecological Problems. A *Technical Report of the Task Force on Soils and Land Use Survey in Akwa Ibom State Nigeria*. pp. 198-191.
- Salau, A. W., Olasanta, F. O. and Olariacle, G. A. 2008. Rapid leaf area estimation in Capsicum (*Capsicum Spp*) Nigeria. *Journal on Horticultural Science*. 13(1):56-73.
- Sana, M., Ali, A. Malik, M.A. Saleem M.F. and Rafiq, M. 2003. Comparative yield potential and oil contents of different canola cultivars (*Brassica napus* L.). *J. Agron.*, 2: 1-7.
- Isegaye, E., Dechassa N. and Sastry, E.V.D. 2007. Genetic variability for yield and other agronomic traits in sweet potato. *J. Agron.*, 6: 94-99.
- Udoh, D. J. Ndon, B. A., Asuquo, P. E. and Ndaeyo, N. U. 2005. *Crop Production Techniques for the Tropics*. Concept Publications Limited, Lagos, Nigeria. 263pp.
- Vos, J.G.M. and Frinking, H.D. 1997. Nitrogen fertilization as a component of integrated crop management of hot pepper (*Capsicum* spp.) under tropical lowland conditions. *Int. J. Pest Manage*, 43: 1-10.