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INTERNATIONAL JOURNAL OF SCIENCES AND ENERGY RESEARCH, JANUARY, 2017, VOLUME 4 N0 1, ISBN 978-130965-0-6

Residual Effect of Applied Compost on growth and yield of Tomato (*Lycopersicon esculentum* Mill) under an Alfisol

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Abstract

A field experiment was carried out to determine the residual effect of compost applied to two tomato varieties (UC82B and BESKE) on growth and yield succeeded by same varieties in second season on an organic farm, Abeokuta. Three rates 0, 10 and 20 t/ha of compost were incorporated to the soil classified as kandiustalf before planting in the first season. The treatments were arranged in split-plot layout and randomized complete block design. The parameters considered were plant growth and yield. The results of this study showed that the residual effect of compost applied to tomato varieties affected the growth and fruit yield of succeeding tomato. Also, the results showed that preceding tomato varieties had no significant effect on succeeding tomato growth parameters like plant height, number of leaves, number of branches, leaf area and leaf area index. Application of 20t/ha of composts on preceding tomato varieties plots significantly increased number of fruits per plant, fruit weight, total fruit yield and earliness to fruiting of the succeeding tomato plant than where no compost was applied.

Keywords: Compost, Residual effect, Tomato varieties, organic agriculture

Introduction

Vegetables, which are food of plant origin, are usually herbaceous annuals or perennials whose consumable parts can be eaten raw or cooked, and serve as a source of vitamins, proteins and minerals. In their fresh form, they supply substantial water into the body and they are usually taken along with some bulky food materials that constitute most of our

diet in the tropics. They are the cheapest source of protein and palatable parts are leaves, stems, roots, fruits, seeds and bulbs (Akintoye, 2002). Typical examples of indigenous tropical vegetables are okra (*Abelmoschus escofanius*), hot pepper (*Capsicum spp)*, *Amaranthus spp*, Tomato (*Lycopersicum esculentum* Mill) (Tindall, 1983; Nonnecke, 1922).

Tomato is world's second most widely cultivated vegetable after potato and is grown for its edible fruits that can be eaten raw in salad, or cooked or peeled, or made into puree ketchup, soup or powder in canning industries (Villareal, 1980; Akintoye, 2002).

Tomato is claimed to originate from Peru and Bolivia where it spread to Europe by early Spaniards and slowly established in Mediterranean region and the rest of the world, including Nigeria. In West Africa, tomatoes are used as condiment for stews which are regular features of African meals and they are essentials vegetable stable in Nigeria, both for the fresh fruit market and the processed food industries (Akinsanya, 2002; Dupriez, 1989; Grubben *et al.*, 1977). To maximize its productivity, tomato seedlings require adequate soil aeration (well-drained soil), well organic matter rich soil, solar radiation, warm temperature and moderately night temperature (Villareal, 1980).

Compost application is one of the organic matter enrichment to the soil and potential source of organic matter and plant nutrients (mainly of animal and plant origins). According to Jody (2005), compost is a term describing a managed process of organic matter decomposition and recomposition. Its preparation requires noting the C/N ratio, monitoring the temperature so as to ensure pathogen reduction and decomposition process to be that of aerobic rather than anaerobic. It application thus supports and encourages the growth of earthworms, bacteria, fungi and other micro-organisms (Gail, 1996). The process of compost making is known to stabilise the volatile N of raw materials into large protein particle; thereby reduces losses. Consequently, the residual effects of increased nutrients and organic matter in the soil following compost application can Residual effect of applied compost application can maintain crop yield more than one growing season after application, and also increase crop yield beyond application year (Ginting *et al.,* 2003). Soil organic matter, total N and P level will be elevated for years

after compost application ceased (Mulgwira, 1979), In recent time, man has realized the environmental and health hazard related to the residual effects of inorganic fertilizers. This had prompted a need for the use of organic fertilizers. Apart from the effectiveness of organic fertilizers during the year of application on soil properties and crop yields, it improves the soil physical, chemical and biological properties as well as plant growth and yield beyond years of application.

However, the information on the influence of compost application on plant productivity under a classified soil is not only limited but inadequate. Thus, this project was conducted to investigate the residual effect of applied compost on growth and yield of tomato.

Materials and Methods

The experimental field is located at Organic Agriculture Farm, University of Agriculture Abeokuta which is on latitude 7^0N 17' and longitude 3^0E 37'. The field experiment was carried between September and December 2005 to determine residual effect of applied compost on the growth and yield of the same tomato varieties (Beske and UC82B) previously grown on the same field after the first application of the compost (between March and June, 2005). Land preparation for the preceding tomato varieties was done by ploughing and harrowing. Compost was then applied at the rate of 0, 10 and 20 t/ha which was thoroughly mixed with the soil before the two varieties of tomato was transplanted. The crop residues of the tomato varieties were left to decay on the plot.

Land preparation for the succeeding crop was carried out by hoeing before transplanting. No compost was applied to the succeeding tomato. The two tomato varieties succeeding the preceding varieties (UC82B and BESKE) were transplanted accordingly. The spacing was 80 X 30cm with planting population of 56,000 plants per hectare.

Weed control took place twice at 3 and 7 weeks after transplanting using Africa hoe. Data were collected on weekly bases which started at five (5) weeks after transplanting. Those parameter collected on plant growth were plant height, number of leaves, number of branches and leaf length. Leaf area was determined by using these equations below:

Y= 0.156+1.986X (UC82B)

Y=-0.131+1.677X (BESKE)

where Y is the leaf area (cm^2) and X is the mid-rib length (cm).

The equation was derived from regression analysis between leaf area derived by graph paper tracing and mid-rib length. Mid-rib length of five leaves per plants in a plot was measured. The areas of 50 leaves of varying sizes were determined by graph paper tracing (Asif, 1977). Leaf area index (LAI) was equally determined by the equation below:

LAI = Leaf area (cm) [all plants/plot] / Plot area (cm^2)

At sixteen weeks after transplanting, plant fresh sample was taken by uprooting 2 plants per plot. The plant fresh weights were taken immediately by using weighing balance and the fresh weights were recorded. The samples were later transferred into the oven at 60°C for 48 hrs to determine the dry weight of the plant samples. For fruit yield character, parameter considered were days to first, 50, and 100% flowering, days to first harvest, number of fruits per plant, fruit weight, harvest duration, harvest frequency and total fruit yield. All data collected were subjected to analysis of variance (ANOVA) according to procedures outlined by Steel and Torrie (1960). The means were separated by the use of significant difference (LSD) test at 5% probability (Carmer and Swansun, 1971).

Results and Discussion

Table 1: Analytic Result of poultry manure used for the compost

Parameter assessed	Unit	Value	Rating
pH (H_2O)		7.4 ± 0.06	High
Total N	%	1.9 ± 0.06	Very high
Organic carbon	%	9.2 ± 0.04	Very high
Available phosphorous	mg/kg	1.7 ± 0.04	Very low
Exchangeable K	cmol/kg	0.7 ± 0.06	Medium
Exchangeable Ca	cmol/kg	1.7 ± 0.04	Low
Exchangeable Mg	cmol/kg	2.03 ± 0.06	Medium

Rating column were rated based on London (1991)

Table 2: Pre-planting and Post-Harvesting Soil analysis of the field

Parameters	Value	
	Pre planting soil Analysis	Post harvest soil Analysis after second planting
pH (H_2O)	6.04	5.19
Total Nitrogen, TN (g/Kg)	0.09	0.21
Potassium, K^+ (cmol/Kg)	0.42	0.92
Available Phosphorus, P (mg/Kg)	1.55	1.09
Sodium, Na^+ (cmol/Kg)	0.23	0.20
Magnesium, Mg^{2+} (cmol/Kg)	1.47	1.07
Calcium, Ca^{2+} (cmol/Kg)	2.35	1.98
Total Exchangeable Acidity, TEA (cmol/Kg)	0.17	0.13
Cation Exchangeable Capacity, CEC (cmol/Kg)	4.62	4.21
Organic Carbon, OC (%)	1.01	1.95
Base Saturation, BS (%)	96.1	94.2
Bulk density (g/cm^3)	1.63	1.54
Sand (g/Kg)	805	798
Clay (g/Kg)	80	82
Silt (g/Kg)	105	110
Texture	Loamy Sand	Loamy Sand
Porosity (%)	46	48
Permeability (cm/hr)	4.50	5.35

Presented in Table1 is the analytical result of the poultry manure used as compost materials. The pH of was slightly above neutral while the available phosphorous level was very low. The range of macro nutrient in the poultry material was Total N (TN) (1.9

± 0.06) > Available P (1.7 ± 0.04) >exchangeable K (0.7 ± 0.06). The rating of organic carbon (OC) in the manure was very high as well as TN.

Pre-planting and post harvesting soil analysis of the field used is as presented in Table 2. The acidity of the field reduces from 6.04 to 5.19 as well as total exchangeable acidity (0.17 to 0.13) after second season indicating a slightly acidic soil as result of cropping activities. Thus, some of the soil inherent attributes such as Bulk density (1.63g/cm^3 to 1.54 g/cm^3) and sand content (805 g/kg to 798 g/kg) measured were reduced form the initial value after second season but the potential of the soil as indicated by these parameters remain the same. However, there is increase in the value of the parameters like permeability (4.50cm/hr to 5.35cm/hr), porosity (46% to 48%), clay (80g/kg to 82g/kg), silt (105g/kg to 110g/kg) which was a result of cropping activities reflecting soil dynamics attribute.

The residual effects of compost on tomato varieties (UC82B and BESKE) plant height, number of leaves, number of branches, leaf area and leaf area index are presented in figure (fig.) 1, 2, 3, 4 and 5. The statistical analysis of the results showed that UC82B tomato variety had significant plant height, number of leaves; leaf area and leaf are index than BESKE tomato variety. However, 20t/ha UC82B tomato variety had significantly higher plant height, number of leaves, leaf area and leaf area index. The range of the plant growth as influenced by the residual effect of compost was 20t/ha UC82B tomato variety > 20t/ha Beske > 10t/ha UC82B tomato variety > 10t/ha Beske tomato variety tomato > 0t/ha Beske tomato variety > 0t/ha UC82B tomato variety.

However, the succeeding UC82B variety grows taller, produced more leaves, more branches, had greater leaves area and leaf area index. This probably due to the fact that preceding BESKE variety of tomato depleted the soil nutrients more than UC82B variety. Also, the statistical analysis of the results showed that the interactions between the compost rates applied to the preceding tomato variety had no significant effect on the succeeding tomato varieties plant height, numbers of leaves, number of branches and leaf area.

Residual effect of compost on shoot, root fresh and dry weight taken at 16 weeks after transplanting and days to flowering is presented in Table 3. The statistical analysis showed that the succeeding varieties had significant effect on shoot fresh weight. Application of 10 or 20 t/ha of compost applied to preceding tomato varieties enhanced shoot dry weight of the succeeding tomato variety. However, compost had no significant effect on root fresh and dry weight as well as days to flowering.

Residual effect of compost on yield characters is presented in table 4. The statistical analysis showed that compost applied to preceding tomato variety had no significant effect on succeeding tomato fruit/plant, fruit weight, total fruit yield, harvest duration and frequency. However, compost applied to preceding tomato varieties had significant effect on days to first harvest. Application of 10 or 20 t/ha of compost on the preceding tomato varieties influenced earliness to fruiting of the succeeding tomato varieties than where no compost was applied.

V1 = UC82B; V2 = BESKE

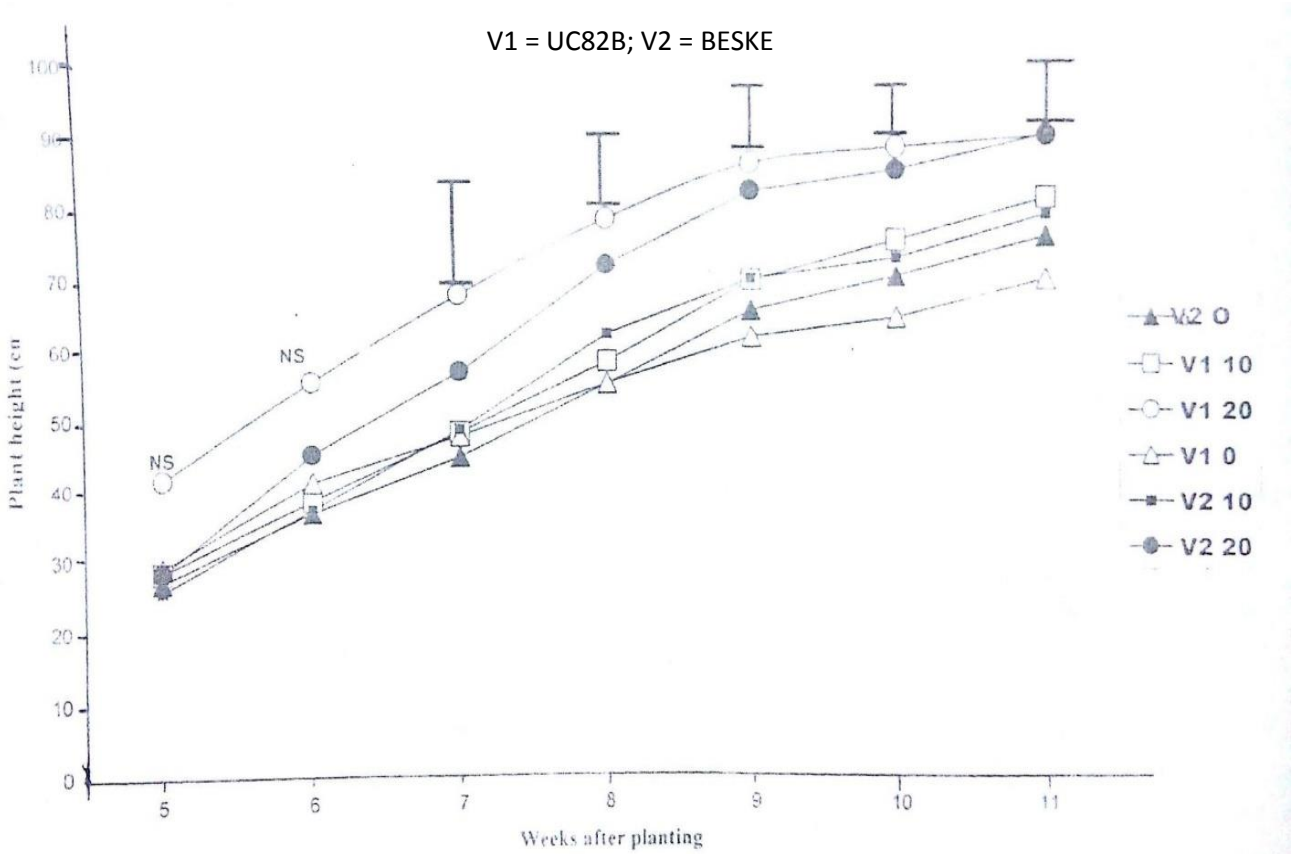


Fig 1: Residual effect of compost on plant height (cm)

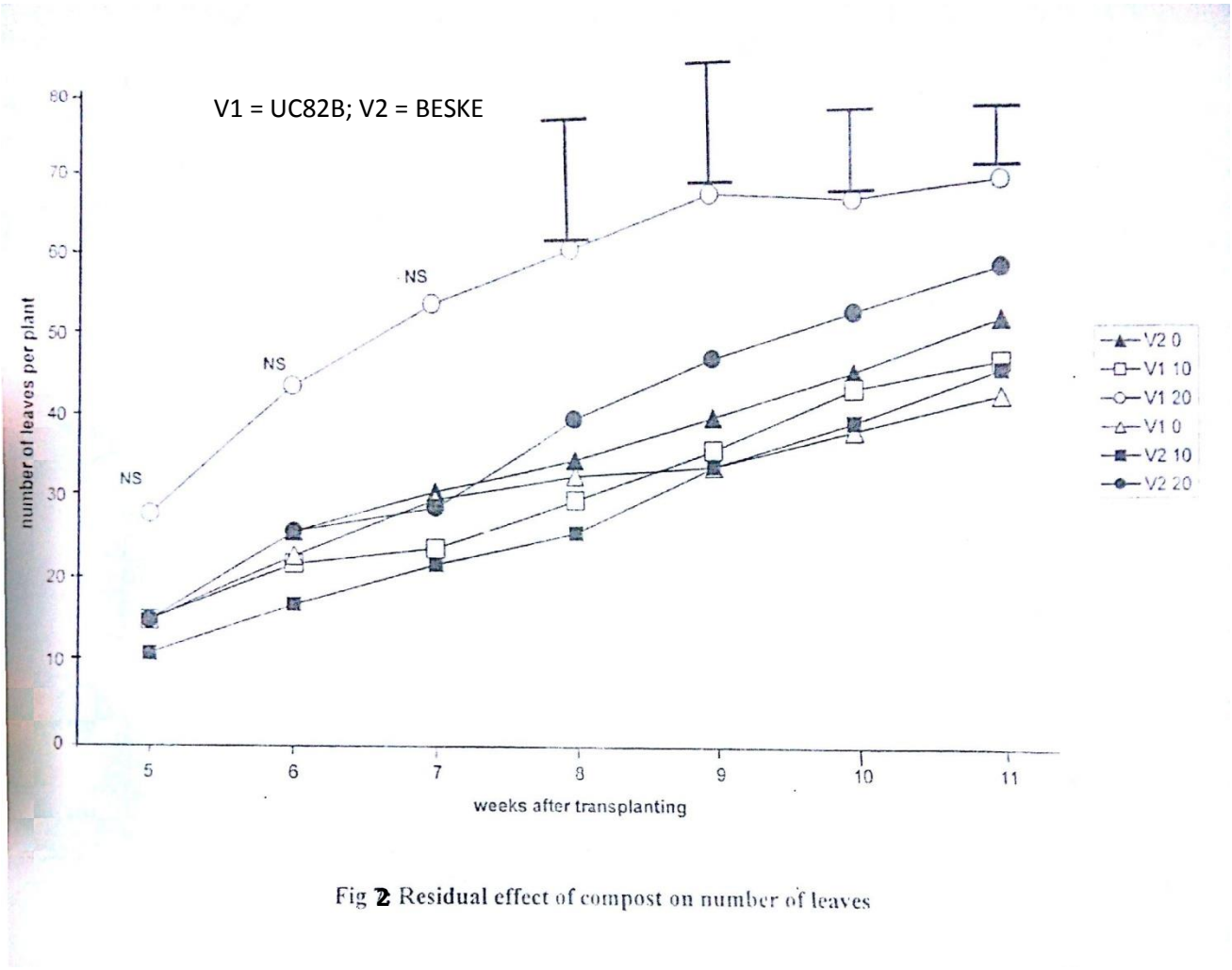


Fig 2 Residual effect of compost on number of leaves

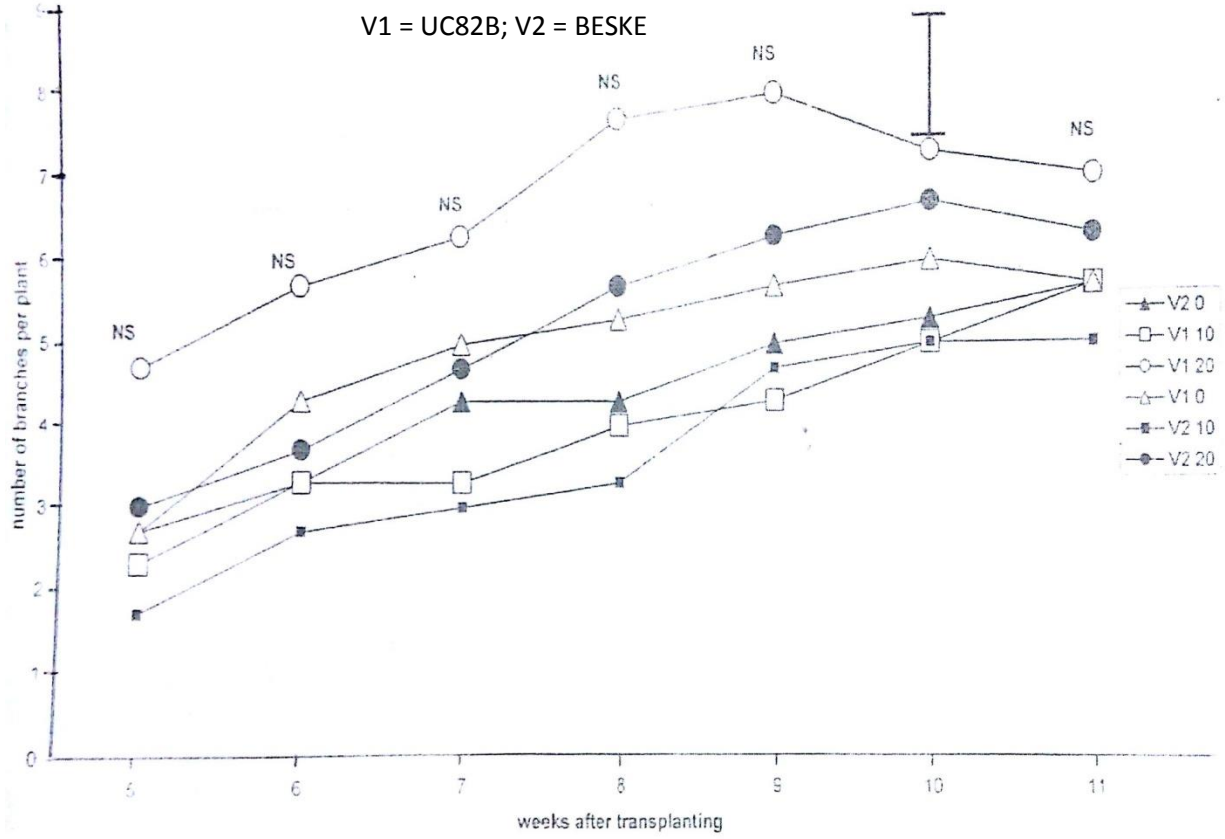


Fig **3**: Residual effect of compost on number of branches

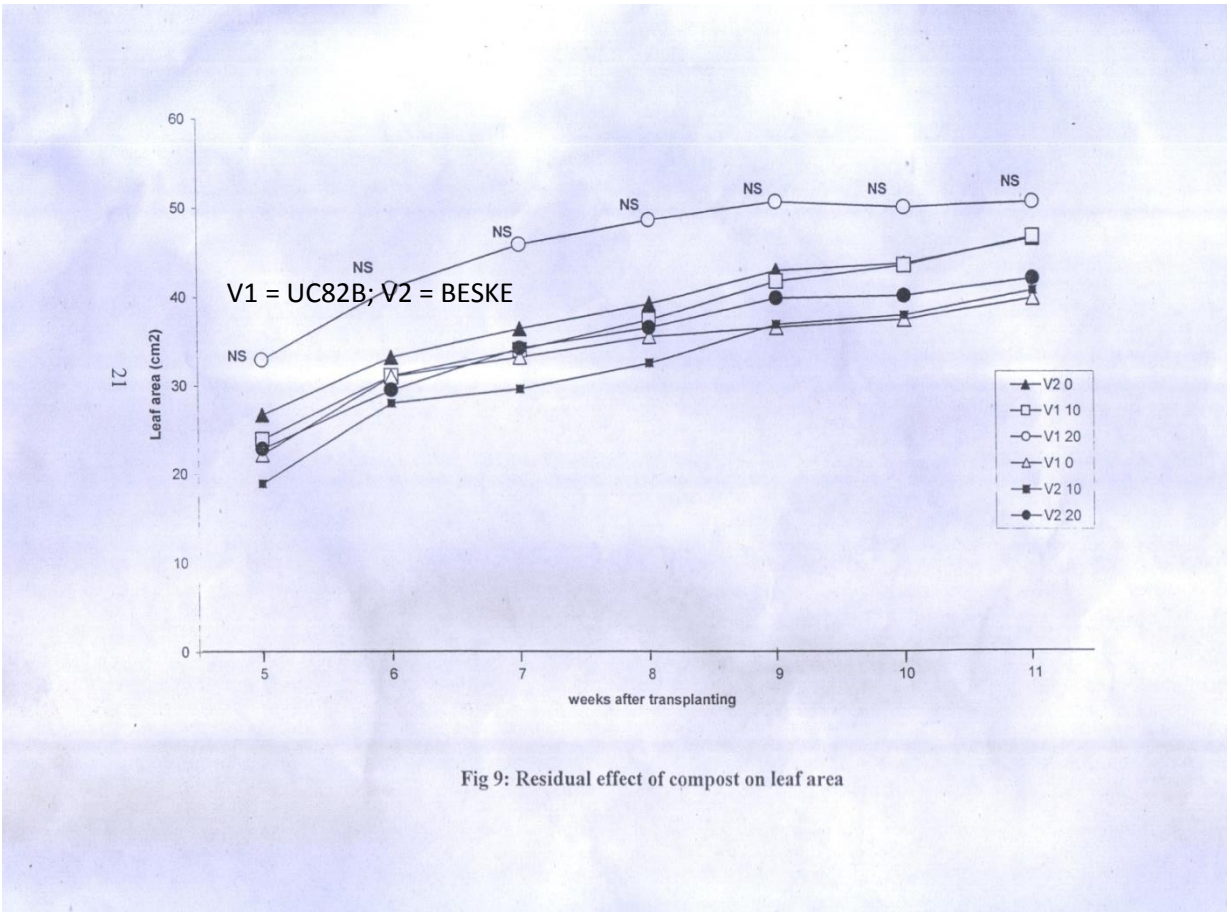


Fig 9: Residual effect of compost on leaf area

21

N

4

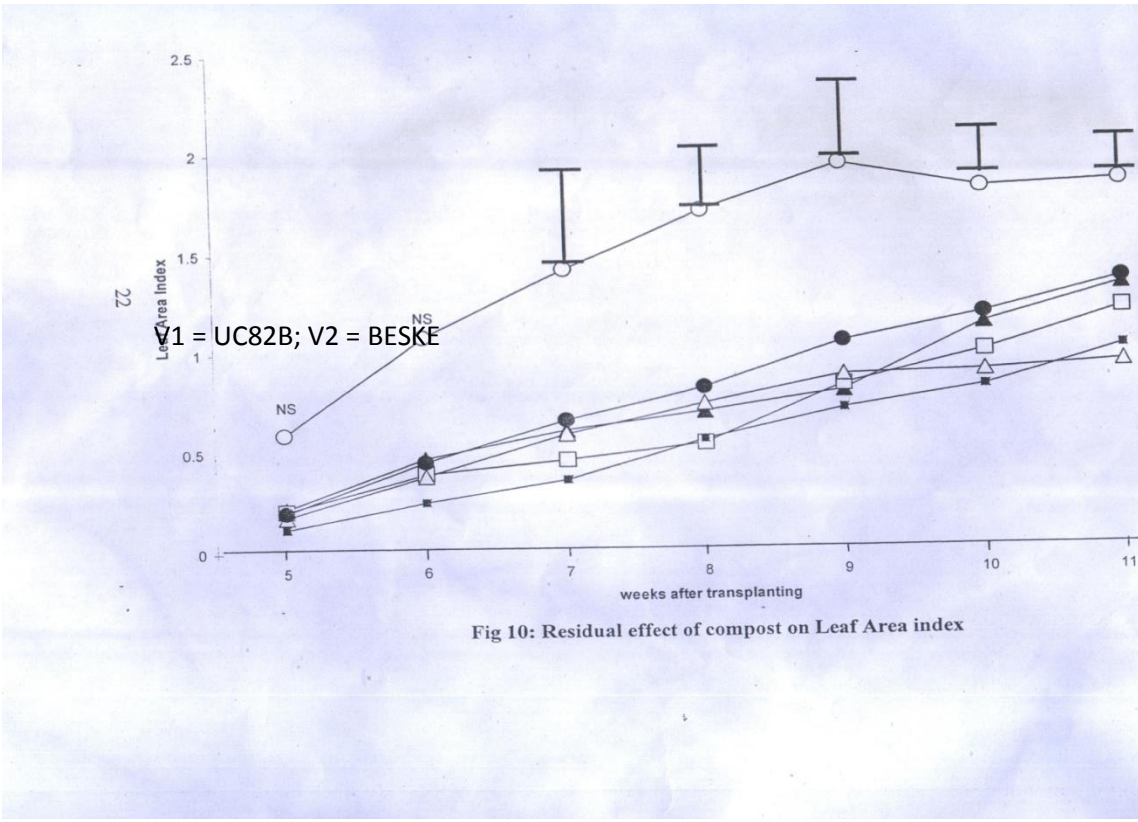


Fig 10: Residual effect of compost on Leaf Area index

22

N

5

Table 3: Residual effect of compost on shoot, root fresh and dry weight

Variety	Compost rate (t/ha)	Shoot weight (g)		Root weight (g)		Days to flowering		
		Fresh	Dry	Fresh	Dry	1st	50%	100%

	0	104.0	16.4	14.2	3.3	72	90	103
UC82B	10	97.2	15.4	14.0	2.9	70	89	103
	20	136.6	26.2	21.2	4.6	71	86	99
Mean		112.6	19.3	16.5	3.6	71	88	102
	0	137.8	18.8	12.2	2.0	83	98	109
BESKE	10	157.0	21.3	29.7	3.6	84	99	109
	20	200.5	30.5	22.5	4.3	77	91	105
Mean		165.1	23.6	21.5	3.3	81	96	108
	LSD5%							
	Variety	19.4	NS	NS	NS	NS	NS	NS
	Rate	NS	6.2	NS	NS	NS	NS	NS
	V x R	NS	NS	NS	NS	NS	NS	NS

WAT= Weeks after Transplanting

Conclusion and Recommendation

The results of this study showed that the preceding two tomato varieties (UC82B and BESKE) had no significant effect on the same succeeding tomato varieties growth and yield. Compost application at the rate of 20 t/ha to the two tomato varieties enhanced better performance in growth and yield. The statistical analysis of the results also showed that residual effect of compost applied to the preceding tomato varieties enhanced the growth and yield of the same succeeding tomato varieties with the application of compost at 20 t/ha preformed better.

Recommendations

The same plots can be used to grow the same tomato varieties in the subsequent year at the rate of 20 t/ha. This indicates that less fertilization will be required to attain maximum productivity with efficient use of resources.

References

Akinsanya M.A., (1994); Effect of method of transplanting on the establishment growth Yield of tomato, Project report presented to University of Agriculture, Abeokuta.

Akintoye, H. A. (2002). Evaluations of growth and yield performance of tomato lines grown at two planting dates in the South Western Nigeria, Proceedings of the Annual .Conference of HORTSON held under the theme "Horticulture for Sustainable Environment and Economic Empowerment". HIHORT, Idi - Isin, Ibadan, 14n - 17n May, 2002, pp. 150-153.

Asif, M. I, (1977). Estimation of leaf area in okra. Tropical Agriculture (Trinidad) 54:192

Carmer and Swanson, (1971) Principle and procedure of statistics. McGraw-Hill Book Company. New York, NY.

Denton, O.A. and Swarup, V., (1988). Tomato cultivation and its potential in Nigeria. A NIHORT Ibadan occasional paper No. 10. Dupriez, H., P. D. Leener, B. Organic Meara and H. D. Tindall (1989). African Gardens and Orchards: Growing vegetables and Fruit, Published by Macmillan Education LTD London & Basingstoke, ISBN 0-333- 49076 -, pp. 170-171 and 244-245.

Gail Feenstra (1996). "Sustainable Agriculture Research and Education Programme" Journal of Sustainable Agriculture University of California, USA MP3001. vol.5: pp. 11-25.

Ginting, D; Kessavalou A., Eghball B. and Doran J. W; (2003). "Greenhouse gas Emissions and Soil Indicators four years after manure and compost Applications" J. Environ. Qual. 32:23-32.

Grubben, G. J. H., H. D. Tindall and J. T. Williams (1977). Tropical Vegetables and their Genetic Resources. Published by International Board for Genetic Resources, FAO, UN,Rome 00100, Italy, and pp. 28-29.ISBN. Jody P., (2005); Journal on Soil Biology and Humus Farming Volume 13 No 5 systems:

Komolafe M.F, Adegbola A.A, Are L.A and Ashaye T.I,(1980). "Agriculture Sciences for The transition phase and long-term viability Midwest Organic and Sustainable Education Service". West African Schools and Colleges Second Edition. Pp: 101-103.

Lan, Y.Q., H U, Q.Y. and Xue, J.H. (1996). Effect of humic acid and solution pH on dispersion of Na-and Ca-soil clays. Pedosphere. 6 (4): 349-354.

Morganand, C. (1975). Effect of Blossoming on fruit and earliness in tomato. Journal Bol. 31:107-118.

Mulgwira, L. M. (1979). Residual effects of dairy manure on millet and rye forage and soil properties. J. Environ. Qual. 8: 251-255.

Nonnecke ,Ib. Libner, (1922); Vegetable Production, Macmillan Press.

Nottidge, D. 0., Ojeniyi S. 0. and Asawalum D. 0., 2005. "Comparative Effect of Plant Residues and NPK Fertilizer on Nutrient Status and yield of Maize (Zea mays L.) In a Humid Ultisol". Nigerian Journal of Soil Science. 15: 1-7.

Phillips J.A,(!959); Agriculture and Ecology in Africa, Faber and Faber, London. Press, United Kingdom.

Rice, R. P., Rice L. W. and Tindall H. D. (1991). Fruit and Vegetable production in Warm Climates. Published by Macmillan Education LTD., London and Basingstoke,

Rodale J.I (2002). Advantage of Compost Fanning. PAY DIRT; Farming and Gardening •with Composts. Small Farms Journal, S. A, CH. 2.9

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