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***Research Article***

# EFFECT OF SOIL TYPE ON THE GROWTH OF TOMATO

**Fagwalawa L.D., *Yahaya S.M. and Fatima Y.U.**
*Department of Biology, Kano University of Science and Technology, Wudil P. M. B, 3244*
**Author for Correspondence*

## ABSTRACT
The effect of different soil (loamy, compound, sandy and clay) on the vegetative growth of tomato has been evaluated. The seed germination showed that the germination percentage is higher in loamy soil followed by, compound, sandy and lastly clay soil which have 92.5%, 87.5% and 57.2% respectively. Statistical analysis (analysis of variance) showed significant differences depended on the types of soil used. However, the growth parameters taken as height, number of leaves fresh and dry weight was found to be higher in loamy soil, followed by compound soil then sandy and finally clay soil. Statistical analysis of these also indicates significant differences between the types of soil used. The analysis of the four soil sample showed that loamy soil was the best in term of mineral content; this was followed by compound soil, sandy and lastly clay soil.

***Keywords:*** *Germination, Plant Height, Soil Type, Tomato*

## INTRODUCTION
Tomato is a herbaceous plant that belongs to the family solanaceae. It is one of the important crops grown commercially in Northern Nigeria (Yahaya, 2010). Tomato can be produced in both rainy and dry season but require high light intensity, warm temperature not exceeding 21 degrees Celsius. (Quinn,1999). In Nigeria, tomato is highly produced in northern Sudan savannah zones between latitude 9 degrees and 12 degrees north. (Quinn, 1999). It was found that tomato does better under irrigation during dry season because of low incidence of pest and diseases also when there is too much rainfall it damages the leaves which results in killing the tomato (Walls, 2000).
Historically, tomato is said to originally originate from Mexico, it was introduced into Europe in the early 16 century and had spread to the Philippines through south America and to Malaysia. Tomato was introduced to West Africa port through Portuguese trader across the continent from Egypt. (Tindall, 1998), The expansion of tomato production in Nigeria has been accomplished by the establishment of numerous vegetable processing industries such as Cadbury Nigeria limited located in Lagos. The establishment of both private and government network of dams and irrigation facilities have greatly enhance the production of tomato in Nigeria (Quinn, 1999). Soil is the upper layer of the earth's crust upon which plant grows and depends upon for their nourishment. It most therefore receives primary attention. It is made up of mainly mineral particles resulting from weathering, disintegration and decomposition of rocks due to the action of several natural agencies such as heat, cold, frost, wind, rain etc. It also contains varying quantities of organic matter. Soil differ greatly in texture, chemical composition, colour etc depending upon the particles size of mineral component and the amount of organic matter present (Olaitan and Lonbin, 1996).

### *Economic Importance of Tomato*
Tomato is one of the most important vegetable, not only in Nigeria but the world in general; it is grown nearly in all home garden and large percentage of market garden, in most states of Nigeria (Muhammad and Abdulsalam, 2007; Yahaya, 2010).
Tomato is classified in the second group of nutrient and an appetizing vegetable used for soup. Tomato pulp or puree is made from raw tomato by separating liquid and fresh portion from seed and other component. It serves as a source of vitamin and mineral e.g. vitamin A, B and C for normal body function. It also supplies carbohydrate which gives energy (Walls, 2007). The seed of tomato contain about 24% oil which is used as salad oil and in manufacturing of margarine and soup. In addition to all these the extracted oil residual pressed cake is used as a life stock and fertilizer (Tindall, 2005) the

experiment was carried out with the aim of evaluating the effect of the four different types of soil on the vegetative south of formulae this can be achieved under the objectives of comparing the effects leading to finding the best soil and the least effective soil.

## MATERIALS AND METHODS

### *Experimental Site*

The research was conducted in the agricultural nursery farm of Kano University of Science and Technology Wudil located at latitude 11,8.2127$^0$ N and longitude 8,5$^o$ E of the Greenwich meridian. Its surrounded by Warawa Local Government to the East and North Gaya to the West Garko and Albasu to the South.

### *Seed Source*

The seeds of tomato used were obtained from international institute for tropical agriculture (IITA) the name of the seed used was tagged tomato UC80 Early variety.

### *Soils Sample Collection*

Soil sample were obtained from four different locations along the river bank of Wudil river and the samples were labeled as

A- Loamy soil

B- Sandy soil

C- Compound soil

D- Clay soil

### *Soil Analysis*

The soil analysis was conducted at the Biology Department Laboratory of Kano University of Science and Technology Wudil to determine its properties such as $P^H$ organic carbon percentage exchangeable cations e.g. calcium potassium, sodium etc. The soil test kit each dry soil sample was field into the barrel and a solution of the test was added, the plunger was insertedinto the barrel and was shook for 30 seconds the liquid was compressed into a test tube, the colour developer (N1 powder, K1 powder, P1 powder respectively) was added using a spoon than the test tube was caped and shake gently for 30 seconds. The colour was compared against the colour chart provided inside the manual test kit.

### *Experimental Design*

Thirty six pots were used each pot was placed at a distance of 250 cm from each other and the soil sample was filed into the pots before sowing. The seed was watered and each pot was labelled with the sample name. After watering the soil for a day, the seed of tomato was sown in the different pots and was allowed to start germinating. The pots were continuously watered using sprinklers daily for the first week then at interval of one day.

### *Germination*

Two weeks after sowing (2 WAS) the germinated seeds were transplanted. Each soil sample was replicated into eight (8) pots making 36 pots the seedling height and number of leaves were recorded the young plant was continuously watered and observed for a period of a month.

### *Data Collection*

### *Germination Time*

Day of germination was calculated from the time the seed wassown to the point of germination the number of seedlings germinated wasalso recorded and used to find percentage germination, the germination was calculated as:

$$\frac{\text{Number of seeds germinated}}{\text{Number of seed sown}} \times 100$$

***Plant Height***

Plant height was taken one week after transplanting at four days interval for one month from ground level to the apical shoot using measuring tape and thread. The thread was matched on the stem and later on the measuring tape to determine the height.

***Number of Leaves Per Plant***

The number of leaves per plant was also recorded one week after transplanting at interval of four days for total of four weeks.

***Data Analysis***

The data gotten were analyzed using ANOVA table (analysis of variance) to compare the sample result obtain and also a bar chart was used to show the result.

## RESULTS AND DISCUSSION

***Results***

The soil analysis revealed the following results sandy soil has the highest PH followed by loamy soil, the least which indicates acid conditions was observed in clay soil. Organic carbon and phosphorus were higher in the compound soil followed by loamy soil, the least were found in clay soil. Total nitrogen was also higher in the compound soil followed by loamy soil while the least was in the clay soil. The statistical analysis showed the F value (calculated) value to be higher than the table P. this shows significant difference between the effect of the soil. This was test at 5% level of probability P 0.05 (Table 1).

**Table 1: Shows the Result of Soil Analysis of Loamy, Sandy, Compound and Clay Soil**

| Properties % | Loamy Soil | Sandy Soil | Compound Soil | Clay Soil |
|---|---|---|---|---|
| pH | 6.1 | 6.2 | 5.9 | 5.3 |
| Organic Carbon | 0.66 | 0.21 | 0.77 | 0.18 |
| Total Nitrogen | 0.047 | 0.019 | 0.105 | 0.014 . |
| Available Phosphorus | 6.79 | 4.00 | 7.40 | 2.89 |
| Potassium | 0.22 | 0.10 | 0.16 | 0.17 |

***Germination Time***

The seeds of tomato sown on loamy soil, sandy soil and compound soil began to germinate four days after sowing (4 DAS) it was observed that out of four seeds planted on each soil types. Loamy soil has the highest number of germinating seeds and hence the percentage germination is higher in loamy soil followed by compound soil, then sandy soil and lastly clay soil. Also from the statistical data analysis the percentage germination was observed to be significant (Table 2).

**Table 2: Percentage Germination of Tomato Seeds in Four Different Soil Type (4 DAS)**

| Soil Types | Number of Seed Sown | Number of Seeds Germinated | % Germinated |
|---|---|---|---|
| Loamy Soil | 40 Seeds | 37 | 92.5 |
| Sandy Soil | 40 Seeds | 31 | 77.5 |
| Compound Soil | 40 Seeds | 35 | 87.5 |
| Clay Soil | 40 Seeds | 25 | 57.5 |

***Plant Height***

The plant height was taken several days after transplanting at four days interval the result was found to be higher in loamy soil followed bycompound soil then sandy soil and lastly clay soil the height was taken from the tag plant from which the average result was obtained (Table 3)**.**

**Table 3: Plant Height (cm) at Four Days Interval in cm (4 DAS)**

| DAYS | LOAMY SOIL | SANDY SOIL | COMPOUND SOIL | CLAY SOIL |
|---|---|---|---|---|
| 7 DAS | 16.54 | 13.80 | 10.70 | 7.20 |
| 11 DAS | 17.50 | 14.70 | 11.50 | 7.70 |
| 15 DAS | 20.20 | 17.00 | 13.10 | 8.40 |
| 19 DAS | 23.40 | 20.80 | 17.00 | 9.30 |
| 23 DAS | 28.00 | 23.30 | 20.40 | 10.50 |
| TOTAL | 105.64 | 76.10 | 60.70 | 43.10 |
| MEAN | 21.128 | 15.120 | 12.140 | 8.620 |
| SE+ | 2.09 | 1.83 | 1.43 | 0.59 |

***Number of Leaf***

The number of leaf was taken just like in the height at four daysinterval, the number was found to be greater in loamy soil followed by compound soil, sandy soil and lastly clay soil the mean number of leaf was calculated as average of the number taken from the tag plant (Table 4).

**Table 4: Mean Number of Leaves per Plant at Interval**

| DAYS | LOAMY SOIL | SANDY SOIL | COMPOUND SOIL | CLAY SOIL |
|---|---|---|---|---|
| 7 DAS | 14.86 | 14.25 | 8.63 | 7.00 |
| 11 DAS | 19.50 | 18.86 | 12.86 | 7.75 |
| 15 DAS | 20.00 | 25.50 | 18.36 | 8.36 |
| 19 DAS | 29.75 | 29.13 | 23.13 | 8.86 |
| 23 DAS | 36.75 | 35.50 | 28.75 | 10.25 • |
| TOTAL | 125.86 | 123.24 | 91.73 | 42.22 |
| MEAN | 25.172 | 24.646 | 18.346 | 8.44 |
| SE+ | 3.83 | 3.74 | 3.50 | 0.85 |

***Discussion***

***Germination***

Out of the forty (40) seeds planted on each soil type, it was observed that thirty-seven seeds germinated from loamy soil thirty one from sandy soil thirty five from compound soil and twenty three seeds germinated from clay soil (37, 31, 35 and 23) hence the percentage germination is higher in loamy soil with 92.50% followed by compound soil with 87.50% and sandy soil with 77.5% and lastly clay soil with 57.5%. This percentage germination was later confirmed through statistical analysis carried out and hence shown significant differences on the soil used. This is because loamy soil has the best soil structure which readily influenced by the characteristics such as percolation and cation exchange capacity is higher than the other soil types used.

The growth plant height observed in plant sown in loamy soil is in conformity with the literature of Rice (2000) who reported that the moment required for growth and development of tomato include potassium (K) nitrogen (N)phosphorus (P) magnesium (mg) calcium (ca) as reports were found to be higher in loamy soil, Charles (1992) also reported that well drained soils with a good moisture retaining capacity and a relatively high level of organic matter with slightly low acid are the best for growing tomato. This further supports the findings as it showed that loamy soil and compound soil were the best in the mentioned characteristics.

The result for number of leaves was similar to plant height. It was found to be greater in loamy soil, followed by compound soil, sandy soil and lastly clay soil, plant on loamy soil and compound soil have better growth and development because they have the required nutrients. Moreover, there are not water logged and likewise are well aerated. Tindall (1998) reported that the amount of air present between the particles of soil directly affect soil fertility. Tomato requires an adequate supply of oxygen for respiration ad therefore for growth. Badly drained soils are often deficient in this respect and are accordingly unsuitable for tomato cropping. The poor growth and development of the tomato planted on clay soil could be explained from the fact that clay soil has a fine texture suggesting clumpy structure, poor aeration, water logging which result in low root development and penetration. Tindall (1998) reported that higher amount of water present between the soil particles not only determine the supply to the plant but

also affect the availability of minerals to the root system of the tomato regarding growth and development.

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