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Effect of Tillage Methods on the Growth and Yeild of Egg Plant (*Solanum macrocarpon*)

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Abstract: The experiments on the effects of different tillage method (Flat, Bed and Trench) on the yield of egg plant *(Solanum macrocarpon*) were conducted at School of Agriculture and Agricultural Technology (SAAT) Training and Research farm, Federal University of Technology Owerri, (FUTO), Imo State Nigeria. The result showed that plant heights of *Solanum macrocarpon* increased with age of the plant. The apices cutting technique helped to increase the number of branches per plant and the bed tillage method performed significantly better than the flat and trench methods in flower set , fruit set and development. However, tillage methods are location specific and vary with climate, soil type, and crop and management level.

Keywords: Tillage methods, effect of tillage, growth and yield, Solanum macrocarpon

1. Introduction

Solanum macrocarpon otherwise known as the African Eggplant or Gboma is of the *Solanaceae* family. It is a tropical biennial plant that is closely related to the eggplant; it grows to a height of 1-1.5 m and has an alternate leaf pattern with the blade width of 4—15 cm and a height of 10—30 cm. The shapes of the leaves are oval and lobed with a wavy margin. Both sides of the leaves are hairy with simple hairs [1]. Prickles may or may not be present on the leaves depending on the cultivar. When prickles are present they are found more along the midrib and lateral veins. The prickles are straight and can grow up to a length of 13 mm. The flowers have a diameter of 3—8 cm and are located on short stalked inflorescence that can contain 2 to 7 flowers [2]. The lower portion of the plant carries bisexual flowers while the upper portion contains male flowers. The flowers are 2-3.5 cm in length and usually have a purple or pale purple colour, on rare occasions there are white flowers. The fruits are round, the top and the bottom are flattened out and have grooved portions with a length of 5—7 cm and a width of 7—8 cm. The stalk of the fruit is 1—4 cm long and is either curved or erect. At a young stage the color of the fruit is green, ivory, or a purple and white color with dark stripes. When ripe, the fruit turns yellow or a yellow-brown. The fruit contains many seeds and it is partly covered by the calyx lobes. The seeds have a length of 3-4.5 mm, a width of 2-3.5 mm, and the shape is obivoid. *S. macrocarpon* has a large cultivar and varieties which grows in areas of high rainfall found in the tropical and humid regions of West and Central Africa, South East Asia, South America and the Caribbeans. Some cultivars can be found in the savanna and semi-arid region of Northern Ghana, Burkina Faso and their neighboring countries. [1] The cultivars grown there consist of plants with small leaves and fruit and the fruit cultivars are only able to grow in humid coastal areas [3]. *S. macrocarpon* can occasionally be found at higher altitudes but have a slower growth rate and are more robust as it reproduces mostly by self-pollination although out crossing occurs by bees and other insects but this occurs at low frequencies early in the morning [1]. The eggplant is an important vegetable/fruit in our economy, therefore, the experiment on effects of different tillage methods for the production of

eggplant was carried out with a view of understanding the best tillage method for the production of eggplant in Owerri Southeastern Nigeria..This will help increase its yield and attract more resource poor farmers to the production of this all important crop.

2. Materials and Methods

2.1. Location

The experiments was conducted at School of Agriculture and Agricultural Technology (SAAT) Training and Research farm, Federal University of Technology Owerri, (FUTO),Imo State Nigeria, located between latitude 5^0 23 / N and longitude 6^0 59 / E, at an altitude of 55m. The area has minimum and maximum temperatures of 27^0C -32^0C respectively and characterized by more than 2,500mm annual rainfall and 89%-93% relative humidity [4]. The soils of Owerri belong to the soil mapping unit number 431 that is Amakama-Orji-Oguta soil association [5] and derived from classification the coastal plain sands [6]. The ripped eggplant fruits used was bought from Imo ADP, Owerri Imo State and processed. The seeds were sowed in the nursery first, from where the resulting seedlings were transplanted to the experimental field. The area was cleared of secondary forest and the debris packed. Marking out was done and the different tillage methods prepared. A randomized complete block design (RCBD) was used with three treatments. The treatments were beds, small trenches and flat, there where 6 replications and the treatment were randomly allocated to the different plots using the piece of paper method. The total area used for the experiment was 10x17m = 170 m^2 , each plot measured 2 x3m with a 0.5m gap between plots and 1.0m gap between blocks and guard area of 1.0m round the experimental area. After the tillage methods were prepared the seedlings were transplanted in the evening at a spacing of 0.5 x 0.5m. The seedlings were planted at a depth of 2cm. Dry grasses were used for mulching to avoid excessive evaporation of water from the soil due to intensity of the sun. The crops were watered regularly in the morning and evening after they were transplanted to the field. The apices or apexes of the stems and branches of all the seedlings were cut off two weeks after planting in the field. This technique was applied in order to stimulate the young plants to branch profusely and bear more fruits on additional branches. Weeding was done with hoe at 2, 4, and 6 weeks after transplanting and manure was applied at the rate of 10,000$kg^{-1.}$ Data were collected on the following parameters: Plant heights (cm), Number of leaves, Number of branches and number of mature fruits.

2.2. Plant Heights

In each treatment, four plants were randomly selected and measurements of the heights were taken from the basal end of the plant to the apex of the last leaf. The plant heights were obtained using a measuring tape. The mean heights were recorded per replicate and treatment and were also subjected to statistical analysis

2.3. Number of Leaves

The leaves of four randomly selected plants in each plot were physically counted and the mean numbers recorded and subjected to statistical analysis

2.4. Number of Branches

After the apices of the stems of the plants were cut off, the number of the branches that grew out was physically counted from four randomly chosen plants on each plot and the average number recorded and subjected to statistical analysis.

2.5. Number of Flower

The numbers of flowers at four randomly selected plants in each plot were physically counted and the average numbers recorded and then subjected to statistical analysis.

2.6. Number of Fruits

At maturity and fruits were ready for harvest, four randomly selected plants with matured fruits were collected and the mean numbers recorded for each plot and subjected to statistical analysis.

2.7. Fresh Weight of Fruits

Crops were harvested eight weeks (8 weeks) after planting in the field. This was because the species is an early maturing variety. The mature fruits were handpicked from the branches in order to make very good assessment of the difference in field of the plants owing to the treatments they received, the weight of the fruits after harvesting were recorded with the aid of a saltare balance and mean weight recorded for each plot and subjected to statistical analysis. First weight of mature fruits reading were taken randomly from four samples of the test crop *(S. macrocapan*) in each replicate at 2 weeks, 4 weeks, 6 weeks and 8 weeks after planting. All data collected were statistically analyzed for each crop using the procedure analyzed [7] and presented by [8] for RCBD and significant mean differences detected using Fishers least significance test [F — LSD] at 5% probability.

3. Results and Discussion

Table 1. *Effects of tillage method on the average number of leaves of Solanum Macrocarpon at 2, 4, 6 and 8 weeks after planting.*

Treatments (Tillage method)	Number of weeks			
	2	4	6	8
Flat	4.33	10.67	16.67	18.17
Bed	4.50	11.50	18.50	22.87
Trench	4.33	9.57	17.17	18.67
$LSD_{0.05}$	NS	NS	NS	2.36

The results in table 1 showed that there were not statistically significantly different (p = 0.05) in the mean number of leaves *Solanum macrocarpon* at 2, 4 and 6 weeks after planting. However, at 8 weeks after planting, there were

significant differences among the three different tillage methods in mean number of leaves of *Solanum macrocarpon*, Bed has the highest mean number of leaves (22.87) and least was flat method (18.4).

Table 2. *Effect of tillage method on the average number of branches of Solanum macrocarpon at 2, 4, 6 and 8 weeks after planting.*

Treatments (Tillage methods)	Number of weeks			
	2	4	6	8
Flat	1.33	2.33	4.83	6.50
Bed	1.17	2.67	5.83	8.50
Trench	1.17	2.33	5.33	6.83
$LSD_{0.05}$	NS	NS	0.71	1.20

The results Table 2 showed that at 2 and 4 weeks after planting, showed no significant differences. At 6 weeks after planting, there were significant differences in the mean number of branches. The highest mean numbers of branches were recorded for bed followed by trench while flat recorded the least. The trend at 8 weeks after planting showed that bed (8.50) gave the highest mean number of branches for the *Solanum macrocarpon* followed by trench (.6.83) and flat (6.50) respectively. This could be attributed to the well pulverized seed beds that helped better aeration, water infiltration, water retention and nutrient uptake.

Table 3. *Effect of tillage method on plant height of Solanum macrocarpon at 2, 4, 6 and 8 weeks.*

Treatment(Tillage method)	Number of weeks			
	2	4	6	8
Flat	16.17	23.17	31.63	40.33
Bed	19.68	29.27	41.72	53.68
Trench	16.67	27.37	35.47	43.33
$LSD_{0.05}$	NS	3.26	4.13	4.23

The result showed that plant heights of *Solanum macrocarpon* increased with age of the plant. The result also showed that at 2 weeks after planting, there were no significant differences in the heights of *Solanum macrocarpon* among the different tillage methods used. At 4 weeks after planting, the crops planted on bed were not significantly different (29.27) from those planted in trench (27.37) but was statistically significantly different from those planted on flat (23.17).However, at 6 and 8WAP, the bed method had significantly taller plants than those on flat and trench. This could be as a result of nutrient release which is fast in pulverized soils than in unpulverized ones

Table 4. *Effects of tillage method on the number of flowers of Solanum macrocarpon at 6 and 8 weeks after planting.*

Tillage methods	Number of weeks	
	6	8
Flat	10.67	5.33
Bed	12.83	5.67
Trench	10.50	5.45
$LSD_{0.05}$	2.01	NS

Field observations showed that flowering started from the sixth week after planting. The result showed that at 6 weeks after planting, there was significant difference (12.83) in the number of flowers of *Solanum macrocarpon* for the crops on bed. This was followed by flat method (10.67) and trench method (10.50). It was further observed that as the weeks go by, the number of flowers decreased. Flowers increased at 6 weeks after planting and decreasing at 8 weeks after planting and there were no significant difference among the different tillage methods.

Table 5. *Effects of tillage method on the mean number and fresh weight of matured fruits of Solanum macrocarpon at 6 and 8 weeks after planting.*

WAP Tillage ethods	6	8	Mean weight of matured fruits
Flat	1.25	6.33	46.22
Bed	1.77	8.85	89.40
Trench	1.47	6.50	61.50
$LSD_{0.05}$	NS	0.94	6.87

WAP - weeks after planting

The results Table 5 showed the effect of tillage method on the mean number of matured fruits at 6 and 8 weeks after planting and also the weight of matured fruits harvested at maturity .The results showed that the mean number of matured fruits of *Solanum macrocarpon* were not statistically different. However, at 8 weeks after planting, we observed that the number of matured fruits increased and the plants on the bed had higher mean number of fruits (8.85) than trench and flat (6.50 and 6.33) respectively. The fruits on bed had higher mean weight of fruits, were bigger in size and were statistically significantly different from those of flat and trench respectively.

4. Discussion

Generally, the plants on bed did better than those on flat and trench, in plant height, number of leaves, fruit size and weight. The apices cutting technique helped to increase the number of branches per plant. As the branches grew out of the plant, the number of leaves per plant also increased. The experiment showed that branching is an index of leaf proliferation in the production of *Solanum macrocarpon* and also, helps in production of more flowers, fruit set and development. The bed method did better than the flat and trench methods within the period of Solanum production because a well prepared seedbed encourages moisture reserve [9], quick nutrient release and also improves soil drainage which helped the *Solanum macrocarpon* to grow well and taller than the other methods [10].

5. Conclusion

Tillage can either enhance or destroy good soil tilth. It is true that bed preparation breaks up clods and loosens the topsoil, but the stirring action helps to stimulate the microbial breakdown of beneficial soil organic matter. However, seedbed preparation is very location specific and varies with climate, soil type, crop and management level .One has to be careful in over tilling the soil to avoid the negative consequences. The trench and flat however, has their own

advantages and disadvantages and may overtime be more productive than an over tilled soil and bed tillage method had the advantage of releasing nutrients faster than the flat and trench tillage methods.

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