Effect of Different Tillage Practices on the Growth and Yield of Sweet Potatoes (*Ipomoeo Batata L*) in Asaba, Delta State Nigeria.

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ABSTRACT

The research was carried out to determine the effect of different tillage practices on the growth and yield of sweet potatoes *(Ipomoeo batata L*) in Asaba, Delta State Nigeria. Field experiment was carried out at the teaching and research farm of Federal College of Education (Technical),Asaba, Delta State Nigeria. The experiment was laid out in a randomized complete block design (RCBD) made up of four treatments: T_o – control (ridge tillage), T_1 – Zero tillage, T_2 – Mound tillage, T_3 – Flat tillage and was replicated three times (4 x 3). Land area of 100m x 100m was cleared and divided into three to represent, replicates 1, 2 and 3. Random samples of five plants were tagged for data collection at four, six and eight weeks' intervals after germination of plants to measure the growth parameters, while yield was measured in kg using weighing scale. Data analysis was carried out using the statistical package of social science (SPSS) with general linear model procedure analysis of variance (ANOVA) to determine the treatment effect and Duncan Multiple Range Test was used for mean separation difference in mean were considered significant at an alpha level of 95% or higher ($p \leq 0.05$). Findings from the study revealed that tillage practices had significant effect ($p<0.05$) on the growth and yield of sweet potatoes. The study recommended the adoption of ridge tillage practices for increased growth and yield of sweet potatoes.

Keywords: Effect, Tillage, Practices, Growth, Yield and Sweet Potatoes.

INTRODUCTION

Tillage is the preparation of land for the purpose of growing crops. It is an operation that is carried out in crop production for the purpose of loosening the soil for easy penetration of plant roots. Tillage is seen by (Jari and Ogunrinde, 2014), as changing the soil condition with a tool for the benefit of Man. This is done after the land has been cleared and plant debris removed. Tillage is carried out for one or combination of the following purpose: seed bed preparation, weed control, incorporation of organic matter into the soil, soil and water conservation and improvement of the soil, physical condition (Jari and Ogurinde, 2014).

Tillage is also carried out to develop a desirable soil structure for seed bed and it is very important for crop establishment, growth and ultimate yield (Yaroson *et al,* 2019). There are different types or methods of tillage practices that can be adopted by farmers; They include; mounding, ridging, bed making, ploughing, harrowing, zero tillage among others. However, the choice of the type of tillage practice to adopt by a farmer is determined by the type of crop and the nature of the root of such crops. Deep rooted crops require

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heavy tillage operation to enable their roots penetrate into the soil while shallow rooted crops may require minimal or zero tillage because of the nature of their roots. Two cultural practices that can moderate the soil organic matter, sustain soil productivity and influence the growth and yield of sweet potato is appropriate tillage and application of organic manure (Agbede and Adekiya, 2019). Under different tillage practices, the growth and yield of sweet potatoes differs. According to Amobi (2023) in an experiment to determine the effect of tillage practices and fertilizer rate application on the growth and productivity of sweet potatoes in Anambra state, the study observed that tillage practices had significant effect ($p<0.05$) on growth and yield of sweet potatoes. However, the study indicated that ridges produced the highest in most growth and yield parameter measured. The study also recommended the adoption of tractor sized ridges for optimum sweet potatoes production.

According to Chagonda *et al,* (2014) in an experiment to determine the effect of tillage system and vine orientation on yield of sweet potato, observed that ridge recorded longer root length of 134.2mm over mound with 115.9 mm root length. Yaroson *et al,* (2019) in an experiment to determine the effect of different tillage practices on performance of potato *(Solanum tuberosum)* on the Jos Plateau recorded that ridged tillage recorded the highest yield of 8.6 kg followed by mound tillage, float tillage and zero tillage which has the lowest yield of 4.7 kg. They concluded that ridge as form of tillage could be the best practice for the growth and yield of potatoes.

According to Agbede and Adekiya (2011), higher growth and yield of sweet potatoes was obtained with conventional tillage. Furthermore, Agbede and Adekiya (2014) observed that the growth and yield of sweet potatoes were increased in this order; manual clearing, manual mounding, manual ridging, row tillage and conventional tillage with the highest yield obtained with conventional tillage. According to the observation of Dumbuya *et al* (2016) in the study to determine the growth and yield response of sweet potato to different tillage methods they reported that tillage practices had significant effect ($p<0.05$) on the number of leaves but had no significant ($p>0.0$) effect on the root yield of sweet potatoes but ridging method of tillage recorded better yield.

Sweet potato is a dicotyledonous plant and a storage root crop with herbaceous tuber. It is among the world's most important food crops, because of its nutritional values and higher yields (Mwanja, Goler and Gugu, 2017). Sweet potato is one of the major root crops grown in Nigeria where it is commonly consumed in boiled, fried or roasted form Anene–okeakwa *et al,* (2022). The planting material can be tubers or stem cuttings (vine). Stem cuttings (vines) are mostly preferred because they are cheaper to produce and also free from soil borne diseases. Stem cuttings 20 – 45cm long is planted 10 – 30cm apart. Planting can be done on mound of 60cm (Okonmah and Eruotor, 2012).

Good ground preparation is required for increased growth and yield of potatoes. Farmers adopt different tillage practices in the cultivation of sweet potatoes, some plant after disc ploughing without harrowing. Others disc plough and harrow before planting, some make mounds or ridges while others plant on flat ground (zero tillage) (Yaroson *et al,* 2019). However most sweet potato farmers adopt different types of tillage practices without the proper knowledge of their effects on the growth and yield of sweet potatoes. This study therefore was carried out to determine the effect of different tillage practices on the growth and yield of sweet potatoes in Asaba Delta State Nigeria. Specifically, the study has as aim to:

1. Determine the effect of different tillage practices on growth parameters of sweet potatoes.
2. Evaluate the effect of different tillage practices on yield of sweet potatoes.
3. Ascertain the tillage practice that produced the best tuber size and number of sweet potato.

Statement of Problems

The growing food insecurity in Nigeria calls for an urgent step towards redirecting different cultural practice

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in crop production so as to determine the best that can deliver maximum yield. Sweet potatoes production in Asaba Delta State Nigeria, cannot meet the demand of the growing population of the city Anene–Okeakwa *et al,* (2022), there is low production of the crop by few farmers who engages in cultivation of the crop. There is knowledge gap on the right size of mound or ridges for sweet potato cultivation, wrong tillage practices, prolong root penetration and tuber formation. Most farmers in Asaba adopts different tillage practices for sweet potatoes production with a little or no knowledge of their effect on yield of the crop.

Significance of the Study

The study identified the most suitable tillage practice the gave maximum yield of sweet potatoes in the area of study (ridge tillage) and recommended that farmers in the area of study should adopt it..

MATERIAL AND METHODS

The research was carried out in the teaching and research farm of Federal College of Education (Technical) Asaba, Delta State Nigeria. Asaba is located at latitude 06^{o} 25^{1} N and longitude 06^{o} 49^{1} E of equator. The location lines in the tropical rainforest zone and characterized by rainfall periods between April and October. The mean rainfall ranges from 1500 mm – 1849 mm with the mean temperature of 23.40^{o}c. (Anene-Okeakwa *et al,* 2021). The experiment was laid out in a randomized complete block design (RCBD) made up of four treatments:

T_0 – control (ridge tillage), T_1 – Zero tillage, T_2 – Mound tillage, T_3 – Flat tillage and were replicated three times (4 x 3). Land area of 100 m x 100 m was cleared and divided into three to represent, replicates 1, 2 and 3. Random samples of five plants was tagged for data collection at four, six and eight weeks' interval after germination of plants. The following growth parameters and yield were measured:

1. Number of Leaves: The leaves were counted per plant and then per plots
2. Leaf Area: This was carried out by measuring the width and length using meter rule than multiplying them. Leaf area = leaf width x leaf length x 0.5 (cm^2)
3. Plant height: This was measured from the base of the plant to the tip using meter rule.
4. Number of stem: This was obtained by physical count.
5. Number of tubers per stand; This was achieved by counting the number of tubers obtained from each stand.
6. Plant weight this was obtained by measuring the weight of the tubers in kg.

Data Analysis

This was carried out using the statistical package of social science (SPSS) with general linear model procedure analysis of variance (ANOVA) to determine the treatment effect and Duncan Multiple Range Test was used for mean separation difference in mean were considered significant at an alpha levels of 95% or higher ($P \leq 0.05$).

RESULTS

Table 1: Effect of Different Tillage Practices on Plant Growth at 4WAP

Treatment	No of leaves	Leaf area	Plant height	No of stem
T0-ridge (control)	157.56	146.87	210.11	4.56
T1- zero tillage	91.44	96.28	87.61	2.56
T2- mound	127.00	83.29	153.44	4.44

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T3-flat tillage	108.22	89.38	156.22	4.22
Mean	121.06	103.96	151.85	3.95
LSD (0.05)	2.74***	14.65	3.28	0.43

Result from table 1 showed that tillage practices had high significant effect ($p<0.05$) on the number of leaves. Ridge (T0) recorded the highest mean rating of 157.56 for number of leaves while flat tillage (T3) had the lowest mean rating of 108.22. Leaf area obtained the highest mean rating of 146.87 at T0, and the lowest at of 83.29 at T2. Plant height increased with the mean rating of 210.11 at T0 while T1 (zero tillage) recorded the lowest mean rating of 87.61 for plant height. Highest mean rating for number of stem was 4.56 obtained at T0 while the lowest was 2.56 obtained at T1.

Table 2: Effect of Different Tillage Practices on Plant Growth AT 6WAP

Treatment	**No of leaves**	**Leaf area**	**Plant height**	**No of stem**
T0-ridge	331.33	63.64	302.33	7.00
T1- zero tillage	91.22	96.32	87.50	2.33
T2- mound	126.89	84.80	153.67	4.33
T3-flat tillage	109.33	88.40	156.56	4.11
Mean	164.69	84.29	175.02	4.44
LSD(0.05)	6.89***	3.48	3.54	0.43

Result on table 2 revealed that ridge (T0) had high significant effect ($p<0.05$) on the number of leaves, with the highest mean rating of 331.33 while zero tillage (T1) recorded the lowest mean rating of 91.22. Leaf area recorded the highest mean rating of 96.32 at the practice of zero tillage (T1) while the lowest mean rating of 63.64 was obtained at T0. Ridge (T0) gave the highest mean rating of 302.33 for plant height while the lowest mean rating of 87.50 was obtained at the practice of zero tillage. Highest mean rating for number of stem was 7.0 obtained at the practice of T0 tillage (ridge) while the lowest was 2.33 recorded at T1 (zero tillage)

Table3: Effect of Different Tillage Practices at 8WAP Planting

Treatment	**No of leaves**	**Leaf area**	**Plant height**	**No of stem**
T0 -ridge	335.44	64.40	304.11	7.11
T1- zero tillage	166.78	52.66	208.22	6.44
T2- mound	200.33	53.41	206.67	6.56
T3- flat tillage	269.78	78.54	203.89	6.5
Mean	243.08	62.25	230.72	6.5
LSD (0.05)	17.55	0.91***	3.34***	0.40

Findings from table 3 showed that tillage practices had high significant effect ($p<0.05$) on leaf area and plant height. The highest mean rating for number of leaves was obtained at the practice of ridging (T0), while the lowest mean rating of 166.78 was obtained at T1 (zero tillage). Flat tillage (T3) recorded the highest mean rating of 78.54 for leaf area while the lowest was 52.66 obtained at the practice of zero tillage (T1). Highest mean rating for plant height of 304.11 was observed at T0 (ridge) while the lowest was 203.89 obtained at T3 (flat tillage). The highest mean rating for number of stem was 7.11 recorded at T0 (ridge), while the lowest was 6.44 obtained at T1 (zero tillage).

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Table 4: Effect of Different Tillage Practices on Yield of Potatoes

Treatment	Number of tubers	Weight of tubers (kg)
T0 – ridge	1.44	2.22
T1- zero tillage	1.00	0.52
T2- mound	1.33	0.88
T3- flat tillage	1.44	0.63
Mean	1.30	1.06
LSD (0.05)	0.22**	1.97

Result in table 4 indicated that tillage practices had high significant effect ($p<0.05$) on number of tubers. However T0 (ridge) and T3 (flat tillage) practices gave the highest mean rating of 1.44 for number of tubers, while the lowest of 1.0 was obtained at T1 (zero tillage). The highest mean rating for weight of tubers was 2.22 obtained at T0 (ridge), while the lowest was 0.52 obtained atT1 (zero tillage)

DISCUSSION

Findings from the study indicated that tillage practices had high significant effects ($p<0.05$) on number of leaves at 4 and 6 weeks after planting, this agreed with the findings of Dumbuya *et al*, (2016). While leaf area and plant height were significantly influenced ($p<0.05$) by tillage practices at 8 weeks after planting. Ridge tillage practices increased the number of leaves, leaf area, plant height, and number of stem at 4WAP, at 6WAP ridge tillage recorded better performance for plant height and number of stem while it also increased number of leaves and plant height at 8WAP. These agreed with the findings of Amobi (2023), Chagonda *et al* (2014) and Dumbuya *et al* (2016). The practice of zero tillage also increased number of leaves and leaf area at 6 WAP while zero and flat tillage increased leaf area at 8WAP. Findings on the yield of sweet potatoes revealed that tillage practices had high significant effect ($p<0.05$) on the number of tubers. Ridge and flat tillage gave a better performance for number of tubers with the mean rating of 1.44 while ridge tillage gave a better plant weight with the mean rating of 2.22. This agreed with the findings of Yaroson *et al*, (2019) who observed that ridge tillage practice increased the growth and yield of sweet potatoes.

CONCLUSION AND RECOMMENDATIONS

The study was carried out to determine the effect of tillage practices on the growth and yield of sweet potatoes in Asaba Delta State Nigeria. The results showed that tillage practices had high significant effect ($p<0.05$) on growth and yield of sweet potatoes. Also the use of ridge tillage practice recorded better growth and yield. Based on the findings of the study the use of ridge tillage practice is recommended for increased growth and yield of sweet potatoes in Asaba Delta State Nigeria.

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