PERFORMANCE OF LIGHT GREEN VEGETABLE IN A CLAY LOAMY SOIL OF UMUDIKE UNDER DIFFERENT TILLAGE AND SOIL MANAGEMENT SYSTEMS

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ABSTRACT

A field experiment was conducted on a clay loamy soil of Umudike, Nigeria to determine the performance of light green vegetable under four tillage treatments and soil management systems. The tillage treatments are ploughing alone, ploughing and harrowing, harrowing only and no-tillage. The soils were treated with poultry manure, cow manure and pig manure. One of the plots was left untreated. The parameters measured are leaf number, height and root proliferation. Results of these measurements were subjected to statistical analyses using the ANOVA model. Results show that harrowing alone and ploughing with harrowing gave the highest and equal leaf numbers of 70 each when treated with pig manure. Also, ploughing and harrowing treated with poultry manure gave leaf number of 70. Ploughing and harrowing with pig manure gave height of 76cm (the highest). This is followed by harrowing with pig manure (75cm). Harrowing with no treatment gave 5cm, (the least). On root proliferation, harrowing alone with pig manure gave the highest (45) while harrowing alone with no soil treatment gave the least number of 5. For all the parameters measured, tillage treatment was not significance at 0.05 level of confidence but soil treatment was. It is therefore recommended that the best combination for light green vegetable production in the clay loamy soil of Umudike is harrowing alone with pig manure.

KEYWORDS: Vegetable, tillage, soil management.

1. INTRODUCTION

Tillage is a process which mechanically modifies or manipulates the soil by cutting, pulverizing and inverting in order to provide conditions favourable to crop growth (Anazodo, 1986). It is a physical, chemical or biological process which manipulates the soil to optimize conditions for seed germination and seeding emergence and establishment (Lal, 1979). Tillage is an integral part of crop production system and usually account for a high proportion of total energy spent in crop production (Anazodo and Onwualu, 1988). Other benefits of tillage (Anazodo 1986, Abraham, 1984) are to: develop a good soil structure; destroy weeds which will compete with crops for moisture, nutrient and sunlight; reduce soil erosion; prepare land for irrigation; incorporate commercial fertilizer, lime or other soil amendments into the soil; destroy insects, their larvae, eggs and hide outs or breeding spaces and ensure adequate drainage.

Tillage types include conventional, reduced or minimum, conservation, zero, slot mulch, basin, contour, ridge, terrace, etc (Camp et al, 1980, Anazodo, 1989; Purdue, 2005; CT Survey, 2005). A number of researchers have worked on tillage to determine its effect on soil properties and crop performance. Some of these works include those of Lal, 1979a; Anazodo and Onwualu, 1988; Asoegwu, 1992; Urger, 1993; Onwualu and Watt, 1998; Ogunjiri, 1999; Yilgep and Yusuf, 2000; Anikwe et al, 2001; etc.

Vegetables in general contain higher moisture content than the solid part and usually have very high quantity of minerals and vitamins (Udeogaranya, 1987). Light green vegetable has its origin from America but can be seen to be grown in scattered locations in Mexico, Central America, India, Nepal, Africa and China (Putman and Oplinger, 1989). It is a short duration crop as it matures 2-4 weeks from nursery. It can therefore be grown for up to 12 times within a year without supplementary water. It has many important uses which includes as food for man, and animal, as industrial raw materials, and as a herb (Asoegwu et al, 1989). Green vegetables are very important because they are cheap sources of

minerals and vitamin C and contain 12 – 17% protein with high lysine, an essential amino acid (Putman and Oplinger, 1989).

Soils in the tropics are characterized by poor nutrient status, weak structural strength and presence of hard pan requiring some form of treatments, mechanical manipulation and careful selection of tillage device and tillage type. There is also scarcity and high cost of inorganic fertilizer in the country. In Umudike and the surrounding, vegetable is produced in commercial quantity both by the institutions, the staff and the villagers. There are also abundant wastes from poultry and livestock being reared by the institutions. The above conditions call for continued studies to develop systems that will bring about sustainable crop production.

The objective of this study is to determine the growth performance of light green vegetable under different tillage and soil treatment conditions.

2. MATERIALS AND METHODS

2.1 The Experimental Site

Umudike is a rural community in Ikwuano Area Council of Abia State, Nigeria. It is a very important town in Nigeria as it plays host to two international research organizations namely, National Root Crops Research Institute and Michael Okapra University of Agriculture. The experiment for this study was conducted at the research farm of the university. The soil is clayey loam tropical utisol located at Lat. 5^0 28^1N and Long. $7^0$$33^1$E.

2.2 Design of Experiment

The experiment was laid down on 4 x 4 Randomized Complete Block Design (RCBD). There were 16 plots replicated three times in the months of November 2007, March, 2008 and July, 2008 respectively. Each plot measured 10m x 3m ($30m^2$). There were four tillage treatments and 4 soil management systems. The tillage treatments were disc ploughing only; disc ploughing and disc harrowing once; disc harrowing only and then no tillage. The soils are treated with poultry manure, pig manure, cow manure and one plot was not treated to any manure. The treatments were assigned to the plots at random.

The manures were spread on the plots uniformly and allowed to stay for four days before incorporating them into the soil. After incorporation, four days were also allowed for decomposition before sowing. The seeds were drilled into the soil with a stick at a spacing of 70cm x 20cm by making a small hole. Average of seven seeds were placed in a hole. All the plots were subjected to the same moisture stress and weed control.

2.3 Field Measurements

The leaf number was obtained by counting the number of leaves on the most vigorous plant in each plot. The height was measured on the most vigorous plant using steel tape graduated in centimeters. Measurement was taken from the ground level to the apex. Root proliferation was obtained by uprooting 3 most vigorous plants in each plot, washing off the sand by dipping them in a bucket of water and then counting the roots.

2.4 Data Analysis

The field data were subjected to statistical analysis using the ANOVA model (Spiegel, 1985; Tanam and Babatunde, 1995).

3. RESULTS AND DISCUSSION

3.1 Leave Development

Table 1 presents the results obtained in the experiment for leaf development. From the table, no tillage with no manure recorded the least number of leaves (7). For the treated plots, no tillage with cow manure recorded the least leaf number of (20). The highest leaf number of 70 was obtained in the plots that were ploughed and harrowed once treated with poultry droppings, harrowed once treated with pig dung and ploughed and harrowed once treated with pig dung.

Table 1. Effects of different tillage methods and soil management systems on leaf development

Tillage	Poultry droppings	Pig dung	Cow dung	No- treatment
Ploughing	45	59	25	9
Harrowing	60	70	30	16
Ploughing/harrowing	70	70	25	16
No-tillage	50	65	20	7

3.2 Height Development

The values got by measuring the heights are shown in Table 2.The no tillage plot with no manure gave the lowest height of 4cm. Harrowing and ploughing once treated with pig dung gave the highest height of 76cm. This is followed by harrowing only treated with pig manure which gave 75cm. The least value among plots treated with manure was recorded with ploughing only treated with cow manure which gave a height of 10cm.

Table 2. Effects of different tillage methods and soil management systems on height development

Tillage	Poultry droppings	Pig dung	Cow dung	No- treatment
Ploughing	70	36	10	7
Harrowing	50	75	15	5
Ploughing/harrowing	72	76	61	9
No-tillage	35	40	19	4

3.3 Root Proliferation

For root proliferation (Table 3) harrowing only with pig manure gave the highest number of 45 roots followed by ploughing only which gave 36 roots when treated with poultry droppings. In all the evaluations, no tillage with no soil treatment gave the least results.

Table 3. Effects of different tillage methods and soil management systems on root development

Tillage	Poultry droppings	Pig dung	Cow dung	No-treatment
Ploughing	36	20	15	6
Harrowing	30	45	20	5
Ploughing/harrowing	35	25	20	5
No-tillage	30	32	18	6

3.4 Analysis of Variance for the Field Results

Results of the leave development, height development and root proliferation were subjected to further statistical analysis. The results show that for leaf development (Table 4 and 5) at 0.05 level of significant, tillage was not significant but soil management was. The same results were obtained for stem

development (Tables 6 and 7) and root proliferation (Tables 8 and 9)

Table 4. Data obtained for leaf development from RCBD

Tillage operation	Poultry dropping	Pig dung	Cow dung	No-treatment	Total
Ploughing	45	59	25	9	138
Harrowing	60	70	30	16	176
Ploughing/harrowing	70	70	25	16	181
No-tillage	50	65	20	7	142
Total	225	264	100	40	637

Table 5. ANOVA Table for leaf development for the RCBD

Source	SS	DF	MS	F-ratio
Tillage	372.72	3	125.24	2.79
Soil management	7795.70	3	2598.57	57.9**
Error	314.18	7	44.88	
Total	8485.60	15		

df = degree of freedom
** = Significant at P<= 5%, where P is the probability level

Table 6. Data obtained for stem development from RCBD

Tillage operation	Poultry dropping	Pig dung	Cow dung	No- treatment	Total
Ploughing	70	36	10	7	123
Harrowing	50	75	15	5	145
Ploughing/harrowing	72	76	61	9	218
No-tillage	35	40	19	4	98
Total	227	227	105	25	584

Table 7. ANOVA Table for stem development for the RCBD

Source	SS	Df	MS	F-ratio
Tillage	2004.65	3	666.22	1.001
Soil Management	763145	3	2453.82	3.69**
Error	2001.90	9	667.3	
Total	11368	15		

df = degree of freedom
** = Significant at P<= 5%, where P is the probability level

Table 8. Data obtained for root development from RCBD

Tillage operation	Poultry dropping	Pig dung	Cow dung	No- treatment	Total
Ploughing	36	20	15	6	77
Harrowing	30	45	20	5	100
Ploughing/harrowing	35	25	20	5	85
No-tillage	30	32	18	6	98
Total	131	122	73	22	384

Table 9: ANOVA Table for root development for the RCBD

Source	SS	Df	MS	F-ratio
Tillage	68.49	3	22.83	0.59
Soil Management	1859.48	3	654.66	16.77**
Error	273.18	9	39.03	
Total	2237.15	15		

df = degree of freedom
** = Significant at P>= 5%, where P is the probability level

4. CONCLUSION AND RECOMMENDATIONS

The following conclusions could be drawn from this research:

a. Tillage treatment alone is not significant in light green vegetable performance in Umudike environment
b. Soil treatment alone is significant in light green vegetable performance in Umudike environment.
c. No tillage system is not recommended for light green vegetable production in the study area.

It is therefore recommended that the treatment combination for light green vegetable production in Umudike soil is harrowing only with pig manure.

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