**EFFECTS OF SOIL AMENDMENTS ON GROWTH AND YIELD OF PEPPER (*Capsicum frutescens L.*) FRUITS**

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 ABSTRACT

 Research was conducted at Federal College of Agriculture, Akure between March to August 2010 and 2011 to evaluate the effects of organic and inorganic fertilizers on growth and yield of pepper fruits.Pepper fruit (*Capsicum frutescens*) Long Cayenne was procured at the seed section of department of Agronomy University of Ibadan and raised for six weeks in the green house before transplanting to the field at a spacing of 70 cm x 50 cm inter and intra row spacing respectively**.** The treatment imposed were poultry manure at 5 ton/ha, organomineral fertilizers at 3.0 tons/ha, liquid fertilizer at 1,400 litres/ha and the control. The treatments were laid out in a randomised complete block design replicated four times. Growth and yield indices such as plant height stem girth, fruit yield, number of fruits, number of leaves and number of branches was investigated. Results showed that there were significant increase (P>0.05) in the growth and yield parameters. Organomineral fertilizer gave the highest response, followed by Boost extra, Poultry manure and Control had the least in terms of improved growth and yield of *Capsicum frutescens*. For the Organomineral the number of leaves, plant height, stem girth and fruit yield ranged from 139 - 313, 22.28 – 56.70 cm, 2.25 –4.5cm2, 6.0-1.8, and 3.08 t ha-1 respectively while for the control 87 – 192, 20.35 – 49.80cm, 1.63 – 4.30cm2 , 3..0 – 14.0 and 1.01 t ha-1. The percentage increased in yield and growth parameters of Organomineral fertilizer compared to Control treatment are as follows: 38.7%, 12.2%, 14.0%, 22.2% and 16.9% respectively. Hence, the use of Organomineral Fertilizer to improve yield of pepper considerably cannot be over emphasized.

**Keyword:** Soil Amendment, Growth, Yield, pepper fruits, organic and Inorganic fertilizers

**INTRODUCTION**

Pepper (*Capsicum* sp.) is one of the most widely used spices in the world. Pepper production has increased in recent years worldwide. Nigeria is known to be one of the major producers of pepper in the world accounting for about 50% of the African production (Erinle, 1989). The implication of this is that we have a good soils and weather that can readily support the growth and production of pepper in Nigeria (Adigun, 2001). Pepper grown in Nigeria is in high demand because of its pungency and good flavor. It can readily be dried, ground and packaged for export. Exportation of pepper in Nigeria has once been reported as a lucrative business (Erinle, 1989, Adigun, 2001). Pepper consumption in Nigeria accounts for 40 percent of the total vegetable consumed per day (Erinle, 1989). A total of 100-200ha is being assigned to pepper production annually in Nigeria (Ado, 1988).

In 1983,FAO estimate of pepper production in Nigeria stood at 695,000 metric tons from total area of about 77,000ha. The major area for its production is the northern region between latitude 10oN and 12o301N. Pepper is utilized mostly for culinary purposes and seasonings. It also has medicinal uses, internally as a stimulant and carminative and externally as a counter- irritant (Tindal 1987, Grubben and Tahir,2004). Although, pepper is widely cultivated throughout Nigeria, yields obtained by peasant farmers are often very low (Adigun, 2001). Production constraints such as low soil fertility, weeds and diseases are the major problems. Comparatively, yield in the developing countries is about 10 – 30% of that in developed countries (Erinle, 1989; Grubben and Tahir, 2004). Pepper can be grown as a rain-fed crop or raised entirely under irrigation in areas with very low amount of rainfall. The moisture content of the soil and the prevailing temperature has important effects on the growth and yield of pepper. In general, the maximum growth and production of pepper occur between a temperature range of 18oC and 30oC (Grubben and Tahir, 2004).

Fertilizers are very important inputs in crop production when other inputs such as weed control, good land preparation and high yielding varieties were right. Crop yields can be doubled through balanced use of chemical fertilizers. In fact the effect can also be more when combined with organic fertilizers that provide slow release of other nutrients not supplied through chemical fertilizer sources (Akande *et al.*, 2008). The purpose of fertilizer use is to remove the limitation to crop growth that would be caused by an inadequate supply of nutrients in the soil (Alan, 1993).

However, there are some organic materials and soil conditioners used to improve soil physical and chemical condition and yields. They serve as growth regulator, stimulating hormones or biostimulant (Akande *et al*., 2008). They are also fertilizers additives. Growth regulator in form of organic compound that is widely used to improve production and quality of agricultural crops. It also helps the crop to maximize absorption of nutrient elements from the soil. Organic compounds which contain hormone have been found to play important role in the vegetative growth and reproduction of many crops including pepper (Onofeghara,1981). The effect of these compounds on the crops may be positive or negative depending on the concentration applied. Several studies have been reported on the use of organic compounds to enhanced crop production. Akande and Adediran (2004) reported positive responses of okra and tomato to complimentary use of terralyt plus with mineral fertilizer. Adediran et al. (2005) reported a greenhouse and field studies conducted on the effect of organic root plus (biostimulant) on nutrient content, growth and yield of tomato (*Lycopersicon lycopersicum* Mill). Complimentary application of organic root plus with mineral fertilizer promoted both the vegetative growth, root development and fruit yield of tomato, therefore this study aim at investigating the effect of soil amendment on growth and yield of pepprer fruit.

**Materials and Methods**

The experiment was carried out at the experimental site of Federal College of Agriculture, Akure, Ondo State, Latitude 7° 16N and Longitude 5° 14 E in the rainforest vegetation of Nigeria. The town is characterized by a bimodal rainfall pattern with a long rainy season, which usually starts in the late March while the short rainy season extends from September to early November after a short dry spell in August. The soil is sandy clay loam, skeletal, kaolinite, isohyperthermic oxic paleustalf (Alfisol). Soil Survey Staff (1999). The annual rainfall in Akure varies from 1100 - 1300mm with moderate relative humidity. The temperature of the site varies from 27oC – 32o C during the period of the study.

 Thirty core soil samples were collected randomly from 0 - 15 cm depth on the site using soil auger, mixed thoroughly, bulked, air dried and sieved to pass through a 2 mm sieve for chemical analysis. The soil pH (1:1 soil/water) and (1:2 soil/0.01M CaCl2) solution was determined using a glass calomel electrode system while organic matter was determined by the wet oxidation chromic acid digestion method (Walkley, A. and Black, I.A. (1934). The total nitrogen was determined by the microkjedahl method (AOC, 1990) while available soil phosphorus was extracted by the Bray P1 extractant, measured by the blue colouration on spectronic 20 at 882 Um (Murphy, J. and Riley, J.P. (1962). The soil K, Ca, Mg and Na were extracted using neutral normal NH4OAc at soil: solution ratio 1:10. The extract of K, Ca and Na were read on flame photometer while Mg was determined with an atomic absorption spectrophotometer. Jackson, M.L. (1958).The exchangeable acidity (H+ and Al3+) were determined using 0.01M HCl extracts and titrated with 0.1M NaOH. McLean, E.O. (1965) while the micronutrients (Mn, Cu, Fe and Zn) were extracted with 0.1M HCl and read on Perkin Elmer atomic absorption spectrophotometer. The mechanical analysis of the soil was done by the hydrometer method Bouycous, J. (1951).

The site was ploughed and harrowed and divided into plots, each plot size was 4m x 4m, the plot was laid out in a randomized complete block design replicated four times. Cured poultry manure was collected from organic fertilizer unit of the college. Organo-mineral fertilizer and Boost extra additives were purchased from Agro chemical industry. The treatment imposed were poultry manure at 5 ton/ha, organomineral fertilizers at 3.0 tons/ha, liquid fertilizer at 1,400 litres/ha and the control. The treatments were applied two weeks after transplanting. Growth and yield indices such as plant height, stem girth, fruit yield, number of fruits and number of leaves were measure every week. At fruit maturity, ripe fruits when reddish in colour were harvested at 5 days interval and weighed to obtain fresh fruit weight. Data generated were subjected to statistical analysis of variance (SAS, 1994) and means were separated using least significant difference (LSD).

**RESULTS**

 The result of the physical and chemical analysis of the soil used prior to the commencement of the experiment presented in Table 1. The soil available phosphorus, the exchangeable bases and CEC were very low (Agboola, A. A. and Corey, R.B .1973) the soil is sandy loam with pH slightly acidic. The organic matter, organic carbon and total nitrogen of the soil were relatively low. From the result, it can be deduced that the soil is low in fertility and therefore, there is need for fertilizers application to boost crop production.

 The effect of poultry manure, organic mineral fertilizer and Boost extra were shown in table 2. At sixth weeks after transplanting, pepper plants treated with organomineral fertilizer had the highest plant height (38.37cm) followed by Boost extra (35.25cm) while poultry manure had a plant height of 34.75cm and control 34.00cm. At twelve weeks after transplanting, treatment with organomineral had a significantly higher plant height of 56.70cm followed by Boost extra (52.80cm) while poultry manure had a plant height of 54.81cm and control 49.80cm. The control treatment had the least value compared to others and this could be as a result of growing of crops continually on the same piece of land which had led to soil nutrient depletion and low fertility status of the soil. This observation was supported by Wang et al (1999) who worked on critical levels for soil pH in sedimentary soil Southwest Nigeria and report that extensive cultivation and continuous use of the same piece of land without fertilization resulted into sharp decline in soil pH and poor soil nutrient status.

 The effect of organomineral, poultry manure, boost extra were shown in table 4. At twelve weeks of transplanting treatment with organomineral had stem girth of 4.50qcm2, treatment with Boost extra had 4.38cm2 while poultry manure had 4.30cm2 , and control had 4.00cm2. This observation agreed with the work of Adediran *et al* (2003) who worked on effect of organic waste and method of composting compost and yield two vegetable crops and concluded that organic manures released their nutrient slowly but regularly and it improved the soil physical properties for good tilts and structure.

 The effect of organomineral, boost extra, poultry manure, and control were shown in table 5. At second week of transplanting, treatment with organomineral had 55.0 number of leaves, poultry manure had 41.0, while Boost extra had 60.0 and control had 40.0. At six weeks after transplanting, treatment with organomineral had 252.0 number leaves, poultry manure had 179.0 while Boost extra had 224.0 and control had 132.0 .

At twelve weeks of transplanting, treatment with organo mineral had 313.0 numbers of leaves, Poultry manure had 250.0. Treatment with Boost had 288.0 and control had 192.0

 There were significant increase (P<0.05) in the yield parameters among the treatment used. Table 6, showed the effect of organomineral, boost extra, poultry manure, and control on pepper fruit yield. Treatment with organomineral fertilizer gave the highest yield response (3.7t/ha), followed by Boost extra (2.8t/ha), poultry manure (2.1t/ha) and the control (1.0t/ha)

**CONCLUSION**

The significant increase in growth and yield of pepper plant treated with organomineral fertilizer compared to other treatment could be attributed to the combined effect of organic materials amended with mineral fertilizer to improve and speed up the release of nutrient for plant use. This was followed by boost extra which is in liquid form hence releases nutrient rapidly for plant but had no positive effect on soil structure and organic matter content of the soil. The poultry manure treatment was significantly low due to the slow release of the nutrient to plant.

**Table 1. Physical and chemical properties of the soil prior to cropping.**

|  |  |
| --- | --- |
| Properties  | Values |
| pH Ca (cmol kg-1) Mg (cmol kg-1) Na (cmol kg-1) K (cmol kg-1) CEC (cmol kg-1) Zn (mg kg-1)Available P (mg kg-1) Organic C (%) Organic matter (%) Total N (%) Sand (%) Silt (%) Clay (%) | 6.21.180.960.341.063.905.406.80.861.540.87641917 |

**Table 2**. **Effect of soil amendment on plant height of pepper plant**

Weeks After Transplanting Organo mineral Boost Extra Poultry Manure Control

 (WAT) (cm) (cm) (cm) (cm)

2 22.28 21.08 19.30 20.35

4 26.65 32.38 27.88 25.13

6 35.25 38.75 34.75 34.00

8 45.85 49.20 44.93 44.85

10 51.63 52.85 48.30 48.10

12 56.70 54.81 52.80 49.80

 LSD 1.03

**Table 3**. **Effect of soil amendment on stem girth of pepper plant**

Week After Transplanting Organo mineral Boost Extra Poutlry Manure Control

 (WAT) (cm2) (cm2) (cm2) (cm2)

2 2.25 2.05 1.73 1.63

4 2.40 3.40 3.00 2.78

6 3.15 3.48 3.49 2.85

8 3.90 3.93 3.90 3.15

10 4.40 4.33 4.28 3.80

12 4.50 4.38 4.30 4.00

 LSD 0.10

**Table 4**. **Effect of soil amendment on number of branches of pepper plant**

Week After Transplanting Organo mineral Boost Extra Poutlry Manure Control

 (WAT)

2 6.0 5.0 4.0 3.0

4 8.0 7.0 6.0 6.0

6 12.0 10.0 9.0 8.0

8 15.0 12.0 11.0 11.0

10 17.0 14.0 13.0 12.0

12 18.0 17.0 15.0 14.0

LSD 0.5

**Table 5**. **Effect of Soil Amendment on Leaves of Pepper Plant**

Week After Transplanting Organo mineral Boost Extra Poutlry Manure Control

 (WAT)

2 139.0 105.0 95.0 87.0

4 202.0 189.0 164.0 122.0

6 252.0 224.0 179.0 132.0

8 269.0 241.0 199.0 158.0

10 292.0 264.0 244.0 169.0

12 313.0 288.0 250.0 192.0

**LSD 0.30**

**Table 6 : Fruit Yield (t/ha)**

**Treatment t/ha**

Organo mineral 3.7a

Poutlry Manure 2.8c

Boost Extra 2.1b

Control 1.0d

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