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The Effects Of Siam Weed Mulch Rates On Some Soil Nutrient Elements And Maize Yield Performance In The Tropical Rainforest-Belt Of Southeastern Nigeria.

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Abstract

The effects of Siam weed (*Chromolaena odorata*) mulch rates on the chemical composition of soil and maize yield performance was investigated in a trial conducted at the Teaching and Research Farm of the Federal University of Science and Technology, Owerri, Nigeria. The experiment was conducted in the field with experimental layout based on a Randomized Complete Block Design (RCBD) with three replications. Five rates (0,3,6,9 and 12t/ha) of Siam weed mulch materials were used as treatment and maize seeds planted at a spacing of 100 X 75 cm were used for the trial. Soil samples were collected at 14, 28, 42 and 56 days after mulch application, bulked and analyzed to ascertain the chemical composition of the experimental soil. Data were also collected on ear weight, cob weight, 1,000 grain weight, cob yield and grain yield. The data were subjected to analysis of variance procedure and treatment means were separated using the least significant difference (LSD) method. Results revealed that Siam weed mulch rate significantly ($p<0.05$) increased soil nutrient element such as phosphorous (25.3 Mg/Kg), potassium (0.65 Cmol/Kg), Calcium (6.6 Cmol/Kg), and Magnesium (3.7 Cmol/Kg). Also, Siam weed mulch reduced soil acidity by increasing the soil pH up to 6.6. Results further revealed that Siam weed at 12t/ha significantly ($p<0.05$) increased maize cob and grain yields (171.7 Kg/ha and 288.3 Kg/hg) respectively. It was concluded that Siam weed is a suitable mulch material for maize cultivation.

Keywords: *Chromolaena odorata*, Maize yield, Mulch rate, Nutrients, Performance

1.0 Introduction

A major constraint to soil fertility maintenance in most developing countries of the humid tropics is associated with scarcity of inorganic fertilizer. The use of mulch materials from plant sources has been shown to minimize this problem (Igwillo, 2001). However, efficient application of mulch is limited by production and transportation problems. Hence, the need for an alternative, environmental friendly, and readily available source of mulch materials especially in maize production system.

Maize (*Zea mays* L.), is one of the most important crops in Nigeria, it is second most important after wheat. It is an important food, fodder, and industrial crop in the world (FAO, 2002). Maize is grown both commercially and at subsistence level by most farmers.

Siam weed (*Chromolaena odorata*), is a weed that grows luxuriantly in the tropics and can constitute menace to crop production in Nigeria. It has deep roots capable of extracting nutrients that have been leached into deeper soil layers (Obatolu and Agboola, 1993). Due to its ability to decompose rapidly, Siam weed has been employed in various trials as mulch material (Ojeniyi and Adetoro, 1993). Mulching is a traditional practice aimed at controlling soil temperature and heat scorching in addition to maintening a good soil physical condition by conserving soil moisture and enhancing water infiltration and stabilizing soil structure (Awodun and Ojeniyi, 1999). According to Igwillo (2001), mulching increased yield of crops such as yam and cocoyam. Agele *et al*., (1999), reported that mulching improves the performance of Tomato.

The type of mulch determines the impact on soil physical and chemical properties as well as crop yield (Awodun and Ojeniyi, 1999). The role of mulch materials in soil fertility maintenance has received

less research attention more so there is paucity of studies on effects of mulch materials on soil chemical (nutrient) composition (Adeniyan *et al*., 2008). This present study therefore aimed at investigating the possible effects of different rates of Siam weed mulch material on soil chemical composition and maize yield performance.

2.0 Materials and Method

The experiment was conducted during the cropping season of 2010 at the Teaching and Research Farm of the Federal University of Technology, Owerri, Nigeria. The climatic data of the area indicates that average annual rainfall, relative humidity and temperature were 2500mm, 75% and 27°C respectively (NIMET, 2009). Experimental field of 20 X 15m was cleared using conventional farm implements such as cutlass and hoe. The experimental layout was based on a randomized Complete Block Design (RCBD). Replicated three times. Five rates (0, 3,6, 9,12 t/ha) of Siam weed were applied as mulch treatment. Each treatment plot measured 4 X 3m. maize seeds (Farz, 27) collected from the National Cereals Research Institute, Amakama, Umuahia, Abia State was used for the experiment. The maize seeds were planted at a spacing of 100 X 75 cm at the rate of 2 seed per hole and later thinned to one seedling per stand. The Siam weed was applied as mulch at the various specified rates. Soil samples were collected from each treatment plot at 14, 28, 42, and 56 days after mulching, bulked, air-dried and analyzed for chemical contents such as organic carbon (OC), Nitrogeen (N), phosphorous (P), potassium (K), Calcium (Ca) and Magnesium (Mg). The Total Nitrogen was determined by the Micro-Kjeldhahl method, organic carbon by the Walkley and Black (1934) method and Phosphorous by colorimetry after Bray-1 extraction (Bray and Kurtz, 1945). Exchangeable K, Ca and Mg by flame analysis after extraction with 1N ammonium acetate and pH with a glass electrode in 1:1 soil water medium. The experimental setup was manually weeded by picking at forty days after planting. Data was collected on the following parameters; ear weight (g), cob weight (g), 1000 grain weight (g), cob yield (Kg/ha) and grain yield (Kg/ha)and were subjected to analysis of variance procedure and treatment means were separated using the Least Significant Difference (LSD) method as described by Onuh and Igwemma, (2000).

3.0 Results

3.1 Soil Chemical Composition

Table 1 below shows the chemical composition of the experimental soil as influenced by Siam weed mulch rates. The plots that received 12t/ha of the Siam weed mulch contained 10.4% OC which was the highest mean value, although it was statistically at par with the lowest (7.5%) recorded from the control (un-mulched) plots. The highest (0.34%) total N was also recorded from plots that received 12t/ha of the Siam weed material and it was also

Table 1: Soil Chemical composition of experimental site as influence by Siam Weed Mulch Rate

Mulch Rates (t/ha)	OC (%)	N (%)	P (Mg/Kg)	K (Cmol/Kg)	Ca (Cmol/Kg)	Mg (Cmol/Kg)	pH (1:1 H_2O)
0(control)	7.5^{ab}	0.24^{ab}	9.6^{bc}	0.42^{b}	3.8^{c}	1.8^{ab}	5.5^{b}
3	8.5^{ab}	0.25^{ab}	11.8^{b}	0.57^{ab}	4.3^{bc}	1.9^{ab}	6.6^{a}
6	9.2^{ab}	0.29^{a}	16.4^{ab}	0.61^{a}	5.3^{b}	2.7^{a}	6.3^{ab}
9	9.6^{ab}	0.30^{a}	19.9^{ab}	0.62^{a}	5.8^{ab}	2.8^{a}	6.5^{a}
12	10.4^{s}	0.34^{a}	25.3^{a}	0.65^{a}	6.6^{a}	3.7^{a}	6.6^{a}
LSD	**4.2**	**0.13**	**11.53**	**0.11**	**1.15**	**2.2**	**0.81**

Means in the same column having the same letter(s) are not significantly different at $p<0.05$ according to LSD

Table 2: Maize Yield and Yield Components as influenced by Siam weed Mulch Rate

Mulch Rates (t/ha)	Ear weight (g)	Cob weight (g)	1,000 grain weight (g)	Cob yield (Kg/ha)	Grain yield (Kg/ha)
0 (control)	149.2^{c}	117.8^{c}	230.0^{bc}	98.2^{d}	191.6^{d}
3	177.6^{c}	141.7^{bc}	280.0^{b}	118.1^{cd}	233.3^{c}
6	196.0^{bc}	151.0^{b}	317.8^{a}	125.8^{c}	264.8^{b}
9	209.4^{b}	171.0^{ab}	346.0^{a}	142.8^{b}	288.3^{a}
12	244.3^{a}	206.0^{a}	337.7^{a}	171.7^{a}	281.4^{a}
LSD	**33.48**	**42.98**	**63.52**	**15.35**	**19.33**

Means in the same column having the same letter(s) are not significantly different at $p<0.05$ according to LSD

statistically at par with the least (0.24%) value obtained from the control. However, 25.3 Mg/Kg was the highest mean value of phosphorous recorded from the plots that received 12t/ha Siam weed mulch. This was statistically different ($p<0.05$) from the 9.6 Mg/Kg recorded from the control plot (See Table 1). The highest (0.65 Cmol/Kg) mean value of potassium was recorded from the plots that received 12t/ha of the Siam weed and this showed significant ($p<0.05$) difference from the 0.42 Cmol/Kg mean value of potassium recorded from the control plots. 6.6 and 3.7 Cmol/Kg were the highest mean values recorded from the 12t/ha Siam weed mulched plot for Ca and Mg respectively and these values were significantly ($p<0.05$) different from the least (3.8 and 1.8 Cmol/Kg) mean values recorded from the control plots (Table 1). The highest (6.6) pH value was recorded from the plots that received 3t/h and also from plot that received 12t/ha and this was significantly ($p<0.05$) different from the 5.5 ph value recorded from the control plots (Table 1).

3.2 Ear Weight

There is significant difference ($p<0.05$) in the influence of Siam weed mulch rate on the ear weight of maize plant. The highest (244.3g) mean value of ear weight was obtained from the plots that received 12t/ha mulch rate and this was significantly ($p<0.05$) different from the 149.2g recorded from the control plots (Table 2).

3.3 Cob Weight

The cob weight was highest (206.0g) in the plots treated with 12t/ha Siam weed mulch rate and it was significantly ($p<0.05$) different from the 117.8g recorded from the control plots (See Table 2).

3.4 1,000 Grain Weight

The highest (346.0g) 1,000 grain weight was obtained from the plots that were mulched with 9t/ha Siam weed rate and it was statistically ($p<0.05$) different from the 230.0g obtained from the control plots (Table 2).

3.5 Yield

The yield of maize cob was highest (171.7Kg/ha) from the plots that received 12t/ha Siam weed mulch and it showed significant ($p<0.05$) difference from the lowest (98.2Kg/ha) mean cob yield obtained from the control (Table 2). In the same trend, the highest (288.3Kg/ha) mean grain yield was obtained from plots that received 9t/ha of Siam weed mulch rate and this was statistically at par with the 281.4Kg/ha mean grain yield recorded from plots that received 12t/ha Siam weed mulch rate. However, these values were significantly ($p<0.05$) different from the 191.6Kg/ha recorded from the control plots (Table 2).

4.0 Discussion

Results of the study showed that Siam weed rates were able to improve soil chemical characteristics such as phosphorous, potassium, calcium and magnesium. The extent of the effect increased with increase in the rate of application of the Siam weed mulch. However, characters such as organic carbon and nitrogen were not significantly influenced. Siam weed mulch rate also increase the soil pH which suggests that it has a liming effect on the soil, and can reduce acidity (Obatolu and Agboola, 1993).

Significant weight differences were observed in the weights of the maize ears and cob. This shows that Siam weed is a suitable mulch material for maize cultivation. Consequently the Siam weed mulch rates improved the cob and grain yield of maize. This improvement on the yield of maize can be attributed

to the ability of the Siam weed to improve soil chemical compositions which in turn led to improved yield performance of maize (Adeniyan *et al*., 2008).

5.0 Conclusion

Maize yield significantly increased with the increase in the rate of the Siam weed mulch application. Which was an indication of the potentials of Siam weed to improve soil nutrient status. Siam weed therefore, within the limit of the trial, is a suitable mulch material for maize cultivation.

References

Adeniyan, B.O., Ojeniyi, S.O. and Awodun, M.A. 2008, "Relative effect of weed mulch types on soil properties and yield of yam in Southwest Nigeria", Journal of Soil Nature **2**(3), 01-05.

Agele, S.O., Iremiren, G.O. and Ojeniyi, S.O. 1999, "Effects of plant density and mulching on the performance of late season Tomato (*Lycopersicon esculentum*) in Southern Nigeria", Journal of Agricultural Science Cambridge, **133**, 397-402.

Awodun, M.A. and Ojeniyi, S.O., 1999, "Use of weed mulches for improving, soil fertility and maize performance", Applied Tropical Agriculture **2**, 26-30.

Bray, R.H. and Kurtz, L.T., 1945, "Determinatio of total organic and available forms of phosphorous in soils", Soil Science, **59**, 45-59.

FAO, 2002, "World Agriculture: Towards 2015/2030", Summary report, Rome

Igwillo, S.N., 2001, "Effect of staking mulching and seed bed preparation on the field performance of two yam varieties grown off season", Nigeria Agriculture Journal, **32**, 129-139.

NIMET, 2009, "Nigeria Meterological Agency Annual Report", for 2009.

Obatolu, C.R. and Agboola, A.A., 1993, "The potential of Siam weed (*Chromolaena odorataI*) as source of organic matter for soils in the humid tropics", In: K. Mulongoy and R. Merclax (eds.) Soil Organic Matter Dynamics and Sustainability in Tropical Agriculture, John Wilym Chichester, pp 89-99.

Ojeniyi, S.O. and Adetoro, A.O., 1993, "Use of chromolaena mulch to improve yield of late season tomato. Nigerian Journal of Technical Education **10**,144-149.

Onuh, M.O and Igwemma, A.A., 2000, "Statistical Techniques for Business and Basic Sciences", Skill Mark Publishers Owerri, pp 341.

Walkley, A. and Blacky, I.A., 1934, "An experimentation of the deglajerff method of determining soil organic matter and proposed modification of the chronic acid titration method", Soil Science, **37**, 29-30.