Journal of Forestry Research and Management. Vol. 15(3).176-183; 2018, ISSN 0189-8418

www.jfrm.org.ng

Effects of *Gliricidia sepium* (Jacq.) Kunth ex Walp. and *Moringa oleifera* Lam leaf mulch on the yield of maize under different spacing regimes

***Akintan, C. I and Akintan, A. O**

Rain Forest Research Station, Ore, Ondo State: Forestry Research Institute of Nigeria

*cornial2000@gmail.com

ABSTRACT

Impoverished soil through such processes as soil erosion, leaching, microbial denitrification, volatilization and removal of nitrogen containing components can be ameliorated using legume for increased crop yield. This study was carried out to investigate the effect of *Gliricidia sepium* and *Moringa oleifera* leaf mulch at varied quantity on the yield of maize in a cut and carry agroforestry system. The experiment was laid out in Completely Randomized Design (CRD) with five treatments, each with three replicates. The treatments consisted of leaf mulches and spacing: 100g Gliricidia + 50cm^2, 50g Gliricidia + 50cm^2, 100g Moringa + 50cm^2, 50g Moringa + 50cm^2, and Maize at 50cm^2 control. Oba Super 2 maize seeds (two seeds per hole) were sown on the field; one week after sowing, the seedlings where thinned to one per stand. Leaves from three years old *Gliricidia sepium* and *Moringa oleifera* were applied as treatment mulch. The maize cobs were harvested when they were dried on the field and the grain yield was evaluated. Obtained data in this study was subjected to analysis of variance (ANOVA). There is significantly higher $(P \leq 0.05)$ yield of maize as affected by Gliricidia and Moringa leaf application. The highest yield was recorded in MM2(Maize at 50cm spacing/Moringa leaves at 100g) followed by MG2(Maize 50cm/Gliricidia leaves at 50g) then by MM1(Maize at 50cm spacing/Moringa leaves at 50g), then by MG1(Maize at 50cm/Gliricidia leaves at 50g, and M1(Maize at 50cm^2 sole) had the least maize yield.

Keywords: Moringa leaf mulch, Gliricidia leaf and maize yield

INTRODUCTION

The continual loss of nitrogen from the soil through such processes as soil erosion, leaching, microbial denitrification, volatilization and removal of nitrogen containing components constitute a major drain from the ecosystem and a significant source of soil impoverishment. Amelioration of soil fertility is an important component of interventions that guarantee increased crop yield (Ketong *et al.*, 2016). Increased interest in the management of nutrient and organic matter in relation to sustainability of agriculture and concerns over adverse effects of using inorganic fertilizers(high cost, non availability and environmental problems) have been identified through the ages in developing countries (Walpola *et al.*, 2009).

Legume has been recognized to be effective in soil fertility maintenance (Swarup, 1997). They could be either annual or perennial, but due to the seasonal availability of annual legumes and limited nutrients inputs, perennial legumes are preferred. An ideal perennial legume is one that grows fast and efficiently takes up and recycles available nutrient within the system thus shortening the time required to restore fertility.

Moringa oleifera a native to northern India (Panga, 2002), is a multipurpose tree species suitable for fuelwood, fodder, food, medicine and improvement of soil fertility. It typically grows in semi-dry, desert or tropical soil which is why it grows well in many countries that normally have dry soils (Parrotta, 2009). It can grow with very little moisture because its roots can store moisture for prolonged periods of time. Moringa can be planted by using the stem or by sowing the seeds. These properties makes the tree species a good candidate for intercropping systems (Ezekiel *et al.*, 2012).

Gliricidia sepium has high quality legume residue decompose and release nitrogen for plant use (Oyun *et al*., 2006). It is a clearly established suitable tree species for maintenance and improvement of soil fertility (Ezekiel *et al.*, 2012). Intercropping nitrogen fixing trees such as *Gliricidia sepium* with crops have been shown to improve the long-term efficiency of nutrient use and a positive nutrient balance in Malawi and Zambia (Mafongoya *et al.*, 2006; Akinnifesi *et al.*, 2007). So also is maize known as household accepted staple food.

The main advantage of using legume for soil fertility is that compared to mineral fertilizers, they are usually available on or near the farm at very little or no cost other than labour costs of handling, transportation, or opportunity costs of land used for their production.

The aim of this study is to determine the effect of different levels of *Moringa oleifera* and *Gliricidia sepium* mulch on the yield of maize plants, compare the yield from Moringa and Gliricidia mulched plant with the intention of recommending Moringa leaves as mulch in semi-dry and desert zones.

MATERIALS AND METHOD

***Study area*:** The experiment was carried out at the Forest Reserve of Rainforest Research Station, Ore which lies between latitude 6.74^o N and 6.75^o N and longitude 4.86^o E and 4.87^o E. The experiment was carried out during a raining season. The soil of the study area is classified as basement complex rocks composed mainly of granite-gneiss, mica-schist and feldspathic rocks. The soils belong to Omotosho soil series (Esu *et al.*, 2014).

A land area of 12m *x* 31m was marked out. The layout consisted of 15 plots with each plot bearing different treatment.

The dimension for each plot was 2m x 5m with a 0.5m x 1m inter-plot boundary. Oba Super 2 maize seeds (two seeds per hole) were sown on the field at 60cm^2 and 50cm^2. One week after sowing, the seedlings where thinned to one per stand. Leaves from three years old *Gliricidia sepium* and *Moringa oleifera* were applied as treatment mulch. Pre-planting soil analysis was carried out in the experimental plot block. Mulch was applied 8 days after the maize were sown. The plots were weeded as at when due, maize harvested at maturity and yield calculated.

Design of experiment

The experiment was laid out in Completely Randomized Design (CRD) with five treatments, each with three replicates. The treatments consisted of leaf mulches: 100g Gliricidia + 50cm^2, 50g Gliricidia + 50cm^2, 100g Moringa + 50cm^2, 50g Moringa + 50cm^2, and Maize at 50cm^2 control.

Statistical analysis

Data obtained in this study was subjected to analysis of variance (ANOVA) to determine significant differences between maize yields. Least Significance Difference (LSD) was used to test significant differences (at 5% probability level) among the variables using the method described by Williams and Abdi, (2010).

RESULTS AND DISCUSSION

Soil status of the experimental site

Soil status of the experimental location before the experiment is presented in Table 1. Data obtained show that the soil is sandy loam in texture. The pH was found to be 6.8 indicating that the soil was near neutral and had low levels of residual nutrients with total nitrogen at 1.2g/kg, available P at 11.61mg/kg, organic carbon at 10.8g/kg and soil exchangeable acidity 0.15cmol/kg. The exchangeable bases were equally low and gave the following values, Ca (3.82 cmol/kg), Mg (1.65 cmol/kg), K (0.13 cmol/kg) and Na (0.05 cmol/kg). These values were considered adequate for crop germination (Ojeniyi and Adejobi, 2005) but cannot support high crop yields. There is therefore need for external nutrients supply to support good crop production.

Table 1: Pre-planting soil properties

Soil properties	Value
pH (1: 1H_20)	6.8
Soil exchangeable Acidity(E.A.)	0.15 cmol/kg
Organic carbon	10.8g/kg
Organic matter content	41.26g/kg
Total Nitrogen	1.2g/kg
Available phosphorus	11.61mg/kg
Exchangeable bases	
Ca^{2+}	3.82 cmol/kg
Mg^{2+}	1.65 cmol/kg
K^{+}	0.13 cmol/kg

Na^+	0.05 cmol/kg
ECEC	5.8cmol/kg
Textural class	Sandy loam

Effect of mulch on maize yield at 50cm spacing

Table 2: Maize yield from mulched maize at 50cm

Treatment	Yield(kg/ha)
M1(Maize at 50cm^2 control)	659e
MM1(Maize 50cm/Moringa(50g)	2037c
MM2(Maize 50cm/Moringa(100g)	2502a
MG1(Maize 50cm/Gliricidia(50g)	1662d
MG2(Maize 50cm/Gliricidia(100g)	2452b

Means with different letters in a column are significantly different $(P \leq 0.05)$

Maize yield as affected by leaf mulch application is significantly different at 5% probability level. The highest yield is recorded in order MM2 (Maize at 50cm spacing/Moringa leaves at 100g) greater than MG2 (Maize at 50cm spacing/Gliricidia leaves at 100g) greater than MM1(Maize at 50cm spacing/Moringa leaves at 50g) greater than MG1 (Maize at 50cm spacing/Gliricidia leaves at 50g) while M1(Maize at 50cm^2 sole) had the least.

This increase in yield could be attributed to provision of plant nutrient from the leaf mulch therefore justifying studies that Moringa can be used as a foliar spray to increase plant growth and as a green manure to improve soil fertility (Hiawatha, 2010). The findings of Ketong *et al.*, 2016 in a study on Influence of Moringa leaf and Fertiplus on soil pH and garden egg yield justifies that Moringa leaf has higher concentration of N, K, organic carbon, P, Mg and Organic carbon.

The effect of *M. oleifera* and G**.** *sepium* leaf mulch on the maize yield is as observed in table 2. It shows that application of *M. oleifera* leaves as mulch has better yield of maize when compared with maize at control and *G. sepium* mulched at same quantity and spacing.

Maize as influenced by mulch quantity shows that 100g applied mulch (Gliricidia and Moringa) has better yield than 50g mulch. This could be attributed to positive effects of improved water status as a result of reduced evaporation from the soil (Van Noordwijk and Kurniatun, 2000). This is supported by Uwah and Iwo (2011) whose research result showed that maize grew taller and faster under greater mulch levels subsequently due to increased soil moisture and adequate temperature which stimulated root development and growth. These results are also in consonance with IITA (1983), Bhatt *et al.*, (2006), Khurshid *et al.*, (2006) that mulching with crop residue at the rate of 4 and 6 t/ha not only affected both physical and chemical properties of the soil but also maintained good grain yield. Significant increase in yield of mulched plant than control is a manifestation of the positive effect of organic manures on soil properties that transformed into soil fertility and a confirmation of the high mineralizable nutrient composition of Moringa and Gliricidia manures.

CONCLUSION

This study has shown that *Moringa oleifera* leaf can add considerable amount of nitrogen to the soil as low input agriculture systems where the concerns over adverse effects of using inorganic fertilizers (high cost, non-availability and environmental problems) can be overcome. It is therefore recommended that Moringa plants be incorporated in farmer's field as scattered trees or alley farming technique.

REFERENCES

Akinnifesi, F.K., Makumba, G., Sileshi, W.G., Ajayi, O.C. and Mwete, D. (2007): Synergistic effect of inorganic N and P fertilizers and organic inputs from *Gliricidia sepium* on productivity of intercropped maize in southern Malawi. *Plant Soil* 2(94):203– 217.

Bhatt, R. and Khera, K. L. (2006): Effect of tillage and mode of straw mulch application on soil erosion in submontaneous tract of Punjab, India. *Soil and Tillage Res*., 88:107-115.

Esu, I.E. Akpan-Idiok, A.U., Otigbo, P.I., Aki, E.E. and Ofem, K.I. (2014): Characterization and Classification of Soils in Okitipupa Local Government Area, Ondo State, Nigeria. *International Journal of Soil Science*, 9: 22-36.

Ezekiel, E., Shabani, A.O.C., Mathew, A.M. and Yonika, M.N. (2012): Effect of spacing and cutting management on survival, growth and biomass production of *Moringa oleifera* intercropped with maize on-station at Gairoin land plateau and Ruvu, Coast region – Tanzania; *Greener Journal of Agricultural Sciences*, 3 (4): 254-26.

Hiawatha, B.H. (2010): All Things Moringa: The Story of an Amazing Tree of Life, www.allthingsmoringa.com

IITA (1983): *Maize production under no-tillage system*. International Institute of Tropical Agriculture Research Highlight p30-31, Ibadan, Nigeria.

Kekong, M.A., Ojikpong, T.O. and Attoe, E.E. (2016): Influence of Moringa Leaf and Fertiplus on soil pH and garden egg yield in Obubra Rainforest zone of Nigeria. *Nigerian Journal of Soil Science*, 6: 27-35 ISSN-1597-4488

Khurshid, K., Iqbal, M., Arif, M.S. and Nawaz, A. (2006): Effect of tillage and mulch on soil physical properties and growth of maize. *International Journal of Agriculture and Biology*, 8(5):593-596.

Mafongoya, P.L., Bationo, A., Kihara, J. and Waswa, B.S. (2006): Appropriate technologies to replenish soil fertility in southern Africa, *Nutrient Cycling in Agroecosystems*, 76:137–151.

Ojeniyi, S.O. and Adejobi, K.B. (2005): Comparative effect of poultry manure and NPK fertilizer on growth, yield and nutrients content of sweet potato (*Ipomea batatas)*: Proceedings of Conference of the Agricultural Society of Nigeria, held at University of Benin, Benin City, Nigeria; October, 9-13, 2005. Pp 115-118.

Oyun, M.B., Kadeba, O. and Aletor, V.A. (2006): Nitrogen Release Patterns of Mixed *Gliricidia sepium* and *Acacia auriculiformis* leaves as Influenced by Polyphenol, Lignin and Nitrogen contents. *Journal of Applied Science*, 6(10): 2217-2223.

Panga, J.T. (2002): Effect of processing on nutritional quality of *Moringa oleifera* leaves and pods. MSc. Dissertation, SUA, Tanzania. 81pp.

Parrotta, J.A. (2009): *Moringa oleifera* Lam., 1785; WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim ISBN: 978-3-527-32141-4

Sanchez, P.A., Shepherd, K.D. Sonle, M.J., Place, F.M. Buresh, R.J. Izac, A.M., Mokwunye, A.U., Kwesiga, F.R., Nderitu, C.G. and Woome, P.L. (1997): Soil fertility replenishment in Africa: an investment in natural resource capital. In: Buresh, R.J., P.A. Sanchez & F. Calhoun (Editors) *Replenishing Soil Fertility in Africa*. Soil Science Society of America, Special Publication Number 51, Madison, Wisconsin. pp 1-46.

Swarup, A. (1997): Effect of presubmergence and green manuring(*Sesbania aculeate*) on nutrition and yield of wetland rice(*Oryza sativa* L.) on a sardic soil. *Biology and fertility of soil*, 5: 203-208.

Uwah, D.F. and Iwo, G.A. (2011): Effectiveness of organic mulch on the productivity of maize (*Zea mays* L.) and weed growth. *The Journal of Animal and Plant Sciences*, 21(3): 525-530.

Van Noordwijk, M. and Kurniatun, H. (2000): Tree-Soil-Crop Interactions, International Centre for Research in Agroforestry Southeast Asian Regional Research Programme

Walpola, B.C., Aruna Kumara, K.K.I.U, Senanayake, A.P. and Wanniarachchi, S.D. (2009): The effect of particle size on microbial respiration; *Bangladesh Journal of Agricultural Research*, 34(3): 343-350. ISSN 0258-7122.

Williams, M.J. and Abdi, H. (2010): Fisher's Least Significant Difference (LSD) Test, Neil Salkind (Ed.), Encyclopaedia of Research Design. Thousand Oaks, CA: Sage.