Effect of Soil Sampling Point and Age at Harvest on the Growth and Dry Matter Yield of Two *Panicum maximum* Varieties

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ABSTRACT

The study was conducted in a greenhouse to evaluate the effect of soil sampling point and age at harvest on the growth and yield of two *P. maximum* varieties. The experiment design is a 3 x 3 x 2 factorial with 3 sampling points (Industrial site, Dump site, and Fadama) and 3 harvest ages (4, 8, and 12 weeks after planting [WAP]) and 2 Panicum varieties (Local and Ntchisi) making eighteen (18) treatments with 4 replications. The data collected were agronomic data which include plant height, number of leaves per plant, leaf length, number of tillers per pot, leaf width and leaf to stem ratio and the dry matter yield (DMY) was as well quantified.

Results indicated that the sampling sites, varieties, and age at harvest significantly ($P<0.05$) affected the growth as well as the yield. Plant height increased with increasing in age (63.63cm at 4 weeks, 111.18cm at 8 weeks, and 147.35cm at 12 weeks). The local variety was observed to be taller (129.62 cm), the number of tillers (4.58 tillers/stand) was better with the Ntchisi variety and at 12 WAP, the tillering ability was superior. The variety Ntchisi recorded a superior leaf-stem ratio. The dry matter yield at 12 WAP (15.66 g/pot) and dump site (16.56 g/pot) were better.

(Keywords: grasses, soil, tiller, varieties, yield)

INTRODUCTION

Panicum maximum is recognized an important fodder plant in the places where it is found naturally. It is generally known for its seed and leaf production and also its palatability to livestock. It is cultivated extensively as pasture and can be conserved as hay (Gibbs *et al*., 1990). It grows rapidly and occurs in abundance when grown on a well-drained fertile soil (Botha and Botha, 1996). The cultivars differ in their production potentials and herbage quality (Aganga and Tshwenyane, 2004).

Increase in population, industrialization, waste disposal, modern-day agricultural activities, and mining have significantly contributed to large contamination of soil over the last centuries (Singh and Jain, 2003). Plants that survive on soils that are contaminated with heavy metals have been observed to have reduced growth which is as an outcome of changes in biochemical and physiological processes in plants (Chatterjee and Chatterjee 2000, Oncel *et al*., 2000 and Oancea *et al*., 2005).

Prolonged decline in the growth of plants reduces yield which finally cause insecurity in both feed and food production to animals and man, respectively. When heavy metals exceed permissible limits, there tend to be adverse effects on the plant. Further, the indirect effect of heavy metals on the activities and growth of microorganisms in the soil may also show a decrease in growth of plants. Activities of enzymes that are important in plant metabolism may also be hindered as a result of heavy metal intrusion with microorganisms' activities in the soil. These direct and indirect toxic effects cause reduced plant growth which also causes death of the whole plant (Schaller and Diez, 1991).

Maturity is an important factor to be considered in the establishment and management of pasture. Cahill *et al*. (2014) showed that the biomass yield of constantly increase at the early stage until its optimum stage and gradually decrease in later season harvesting. The forage nutritive value and biomass yield are influenced by situations like

time of maturity, climatic condition, soil condition and preservation method. Moreover, if forage stay for long period of time, it will be considered as highly indigestible, low in forage quality and though high in quantity.

The aim of this study was to evaluate the effect of soil sampling point and age at harvest on the growth and yield of two *P. maximum* varieties.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the greenhouse of the College of Plant Science and the laboratory of the Department of Pasture and Range Management, College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State, Nigeria.

Experimental Design and Soil Collection

The study was a 3x2x2 factorial experiment in a completely randomized design comprising of three factors which are: 3 soil sampling points (i.e., industrial site, dump site and Fadama which was used as the control), 2 different varieties (*Panicum maximum* local and *Panicum maximum* Ntchisi) and age at harvest (4, 8, and 12 weeks after planting) which was replicated four times. 7kg of soil each was introduced into perforated plastic buckets which were used for planting.

Soils used for this study were collected from three different sites (cement factory in Ewekoro, dump site and Fadama where farming activities are common was used as the control) in Southwest Nigeria. Crown split of *Panicum maximum* local and Ntchisi were sourced from established plot of Pasture and Range unit of the Federal University of Agriculture, Abeokuta. Planting of the materials was done the same day of collection and was sown at the rate of two tillers per pot.

Data Collection

Agronomy data were collected prior to harvesting. Plant height was determined by measuring from the base of the grass plants to the topmost part where the last leaf on the stem emerges, with the aid of a meter rule. Leaf length was also estimated by measuring the length of the leaf of the grass from the tip of the leaf to the ligule with the aid of meter rule. The width of the leaf of the plants was measured at widest point of the leaf using meter rule. Leaf and tiller number were determined by physical counting. In estimating the proportion of leaf to stem, a fresh sample of 500g weight from the grass per replicate was taken and separated into leaf and stem fractions and the proportion of each were calculated by weight as follows:

Dry matter content of leaf/stem = Weight of dry leaf or stem / Weight of fresh sample of leaf or stem x 100

Dry matter yield was determined by harvesting the grasses at 4, 8, and 12 weeks after planting. The above ground vegetative plant material was harvested from 5cm above ground level. The harvested grasses were weighed (fresh weight (FW)) and sub-sample of 500 g was oven dried at 65^{o}C till a constant dry weight (DW) was obtained for dry matter contents (DM). The percentage of dry matter contents (DM %) was calculated as DW/FW x 100. Dry matter yields (kg/ha) was calculated as DM % x FW. This was calculated in grammes per pot.

Statistical Analysis

Data collected were subjected to analysis of variance and means separated Tukey's HSD, the means were afterwards presented graphically.

RESULTS AND DISCUSSION

Figure 1 showed that the soil sampling point, variety and different age at harvest had significant influence ($p<0.05$) on the plant height of the grasses. Plant height was highest at 12 WAP (147.35cm) which was significantly similar to *Panicum maximum* local (129.62 cm) and soil from dumpsite (136.14cm). The increase observed in the plant height can be because of the extended harvest time (12WAP) which helped the plant to enhance development of root and efficient nutrient uptake (from the soil gotten from dumpsite) and allowing the plant to continue increase in height. Generally, plant height was consistent with plant maturity until the 12th week. This is similar with results been reported by Berihun (2005) and Simachew (2016). At four weeks after planting, plant height was least

(63.63cm). The plant height recorded for Fadama and industrial site had values 101.00cm and 85.02cm respectively which was significantly similar to the plant height of *Panicum maximum* Ntchisi and the plant harvested 8 WAP.

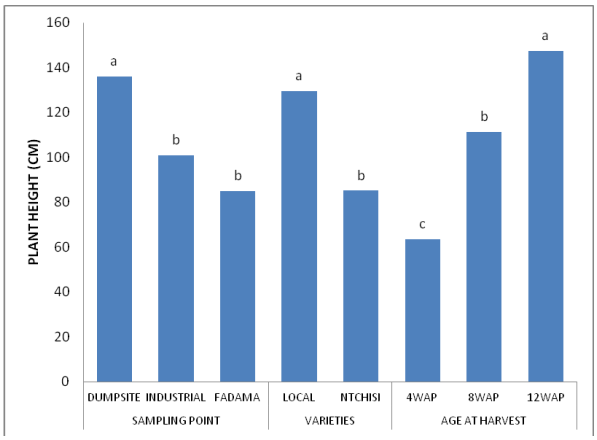

Figure 1: Effect of Soil Sampling Point and Age at Harvest on the Plant Height of Two *P. maximum* Varieties.

The soil sampling point, variety and age at harvest had a significantly influenced ($p< 0.05$) leaf length. Panicum varieties planted on dumpsite soil had the highest leaf length which was significantly similar to the Panicum Ntchisi and plant harvested at 8 and 12 weeks after planting (Figure 2). Fadama had the least value. The value obtained at 4WAP was significantly different ($p<0.05$) and lower compared to 68.43 cm and 68.18 cm obtained from plant harvested at 8 and 12 WAP respectively. This shows that leaf length increases with increasing age at harvest and its in line with Malede (2006) who also found that, leaf length of triticale grass was highly affected by the different stages of plant growth when the growth stages of plant advanced the leaf length was raised.

In Figure 3, soil sampling points, varieties and age at harvest significantly ($p<0.05$) influenced the leaf width of grasses. Dumpsite recorded the highest leaf width which was significantly similar to both Panicum local and Ntchisi harvested at 4, 8, and 12 WAP. Fadama recorded the lowest leaf width (2.75cm) which was similar to the industrial site (2.88 cm). Leaf width increased with increasing age at harvest which is similar to the record of Sema *et al* (2019) and Ahmed (2011) that there was significant difference in leaf width as plant progresses in age.

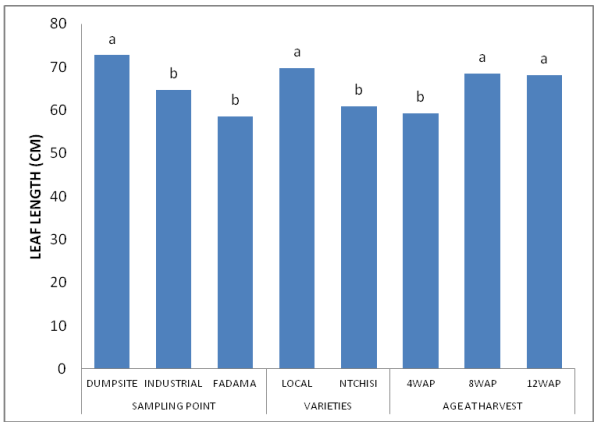

Figure 2: Effect of Soil Sampling Point and Age at Harvest on the Leaf Length of Two *P. maximum* varieties.

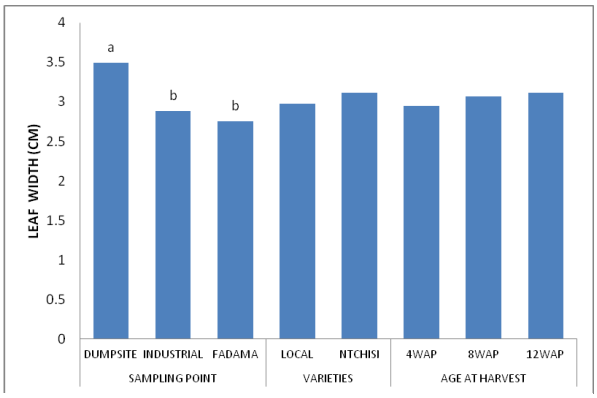

Figure 3: Effect of Soil Sampling Point and Age at Harvest on the Leaf Width of Two *P. maximum* Varieties.

Figure 4 shows that soil sampling point and age at harvest significantly influenced ($p<0.05$) the leaf number obtained from both *Panicum maximum* varieties. Plant harvested 8WAP had the highest number of leaf which was significantly similar to the soils from each sampling points and Panicum local. The plant harvested at four and twelve weeks was significantly similar to the Panicum local. Number of leaves was highest at 8 weeks. This may be due to increase in plant height, tillers, and the larger nodes number that also produce larger number of leaves. The results of this study agreed with Simachew (2016) and Berihun (2005).

Figure 5 shows that soil sampling point and age at harvest significantly influenced ($p<0.05$) the number of tillers of the two *P. maximum* varieties. Panicum planted on the dumpsite recorded the

highest number of tillers and it is significantly similar to the values recorded for panicum local and the plants harvested 12 weeks after planting. The tiller numbers for the industrial site and Fadama had similar significant difference with the plant harvested at four and eight weeks after planting. Number of tillers increased with increasing age at harvest. This is as a result of new shoot development leading to a higher number of tillers. The current result was confirmed by reported Mehiret (2008).

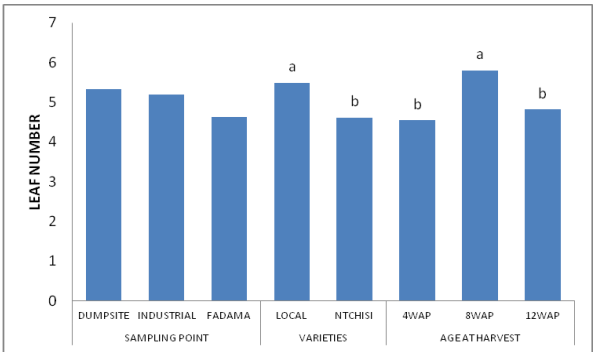

Figure 4: Effect of Soil Sampling Point and Age at Harvest on the Leaf Number of Two *P. maximum* Varieties.

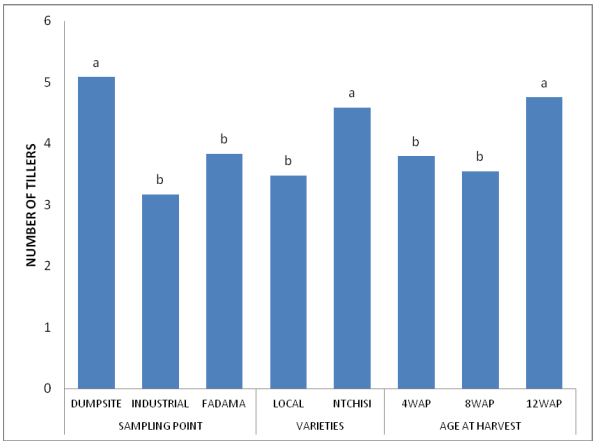

Figure 5: Effect of Soil Sampling Point and Age at Harvest on the Number of Tillers of Two *P. maximum* Varieties.

Soil sampling and age at harvest significantly affected ($p<0.05$) the leaf to stem ratio of *P. maximum* varieties. At 4 weeks after planting, leaf to stem ratio was highest (2.05) and it did not differ significantly with the three locations (industrial site, dumpsite and Fadama) and *P. maximum* Ntchisi. Leaf to stem ratio at 8 weeks was lowest (1.17) and did not differ significantly to the *P. maximum* local and the plant harvested 12 weeks after planting. This could be due to the reason that old leaves fall down when a plant gets older and older, thereby reducing the number of leaves and making the leaf to stem ratio smaller. The present finding agreed with the finding of Malede (2006) and Berihun (2005).

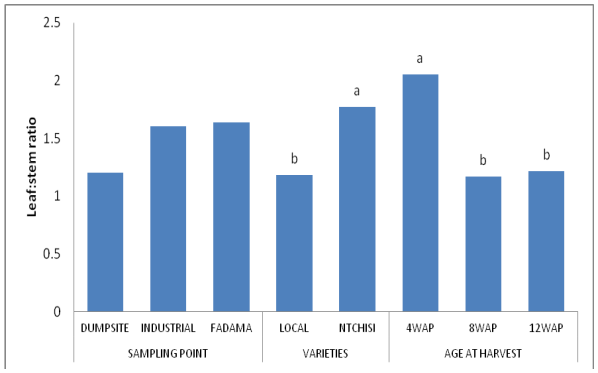

Figure 6: Effect of Soil Sampling Point and Age at Harvest on the Leaf:Stem Ratio of Two *P. maximum* Varieties.

The soil sampling points and age at harvest had significant influence ($p<0.05$) on the yield of the two *P. maximum* varieties (Figure 7). The increase in dry matter yield with advance in harvest age was due to increase in the structural carbohydrate and reduction in the moisture content of the grass. This was in line with the finding of Mehiret (2008) who explained that the increment in dry matter yield was due to longer time on the growing season before harvest and amount of cell wall materials deposited as a result of the increased age.

Dumpsite recorded the highest yield to be 16.56 g/pot which was significantly similar to the yield for Panicum local and the plant harvested 12 weeks after planting. Plant harvested four weeks after planting had the least value to be 4.03 g/pot. The plants from industrial site and fadama were significantly similar to Panicum local and the plant harvested 8 WAP.

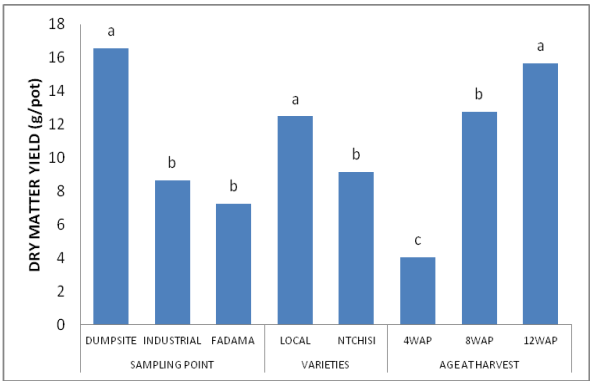

Figure 7: Effect of Soil Sampling Point and Age at Harvest on the Dry Matter Yield of Two *P. maximum* Varieties.

CONCLUSION

From the result of this study, it can be concluded that soil sampling sites, varieties and age at harvest affected the plant height, leaf length, tiller number, leaf width, leaf to stem ratio and also the yield. Plants harvested 12 weeks had the highest plant height, tiller number, leaf width, and dry matter yield while leaf to stem ratio was highest at 4 weeks. *Panicum maximum* local had the highest yield and the soil gotten from dumpsite recorded the highest yield too.

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