Effect of Nitrogen and Phosphorus Fertilizers on the Growth of *Senna Siamea*

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ABSTRACT

A field study was conducted to determine the effect of application of Nitrogen and phosphorus fertilizers and mixture of both fertilizers on the growth of Senna siamea. The result showed variation in growth and response to different fertilizer (KH_2Po_4, $KHNO_3$, KH_2PO_4 & $KHNO_3$) application on Senna siamea. There was significant improvement on the height and girth of Senna siamea by the application of $KHNO_3$ and KH_2PO_4 which resulted in taller plants. $KHNO_3$ application significantly ($P<0.05$) improved the leaf, stem and root dry weight of Senna siamea than combined KH_2PO_4 and $KHNO_3$. This suggests that the applications of $KHNO_3$ and KH_2PO_4 can enhance the growth of some economic crops.

KEYWORDS: Nitrogen fertilizer, Phosphorus fertilizer, Growth, *Senna siamea*

Introduction

The growth, development and the quality of some plants are affected by environment and cultivation practices as well as the processing and storage of plants tissues (Clark and Menary, 1980a, b). Among many plant growth factors, the nutritional requirements of the crop are considered to be the most important factor (Singh *etal.*, 1989). Nitrogen (N) and phosphorus (P) fertilizers play a vital role in enhancing crop yield. A high rate of nitrogen application increases leaf area development and increases overall crop assimilation thus contributing to increased seed yield (Bhardwaj and Kaushi, 1989). Patra *et al*., (1993) reported that straw mulching significantly affected the fertilizer nitrogen use efficiency and essential oil yield in Japanese mint (*Menthra arvensis* L.). Alkire and Simon (1996) and Piccaglia *et al.*, (1993) concluded that Nitrogen increases essential oil yield of peppermint by influencing a variety of growth parameters such as tillers per plant, the total plant dry weight and the Leaf Area index (LAI).

Senna siamea is a species introduced from Asia and commonly cultivated in fuel plantation and elsewhere in and around towns and villages. It is a tree up to 20m high branching low down, bark gray, fairly smooth leaves with a glabrous common stalk 20 -35cm long, 8 – 12 pairs of leaflets, 3.5 – 6cm long by 12 – 25mm broad, narrowly ecliptic to slightly lanceolate, rounded at the apex (sometimes with a notch at the tip) and with the midrib protecting, cunerate or rounded at the base glabrous, stalks of leaflets about 2mm length, glabrous lowers (at most season) lemon yellow about 3.5cm long, sepals greenish yellow the two outer ones smallest fruit (at most season) flat and straight 15 – 30cm long by 12mm broad, finely velvety when young becoming glabrous, hanging in clusters, eventually slitting often. All cropping is being widely tested in sub Saharan Africa for its potential to sustain adequate food production with low agricultural input, thus conserving the environment. Nitrogen fixing tress has been recommended for use in alley cropping because of their abilities to use atmospheric N_2 for growth (Kang *et al.*, 1985, Mulonogoy and Vander *et al.*, 1989). The purpose of this research was to evaluate the response of *senna siamea* to Nitrogen and Phosphorus fertilizers and with mixture of both fertilizers application to the growth of the plant.

Material and Methods

Senna siamea seeds used in this study were collected from a local cultivar at Mbiabong, Uyo Local Government Area, Akwa Ibom State and the study was conducted at the Biological Science Botanical Garden of the Akwa Ibom State College of Education, Afaha Nsit. Twelve rubber containers were filled with logs of topsoil and were watered to field capacity and left for 24 hours before seeds were sown. Seeds of *senna siamea* were scarified in hot water and planted in the rubber containers. At 64 DAP the seedlings were thinned to two per container. The containers were then randomly arranged for treatment in a complete randomized design. The treatments comprised of KH_2PO_4 for phosphorus fertilizer, $KHNO_3$ for Nitrogen fertilizer and a mixture of both while distilled water was used as a control treatment and each treatment was replicated three times.

On a weekly basis, each container was given 100ml of either $KHNO_3$ and KH_2PO_4 or a mixture of treatments. Seventy-one (71 DAP) days after planting and one week after the first treatment, the height and diameter of the seedling were measured using a meter rule and venier caliper respectively. At the end of 16 WAP, the plants were carefully up rooted after watering the soil thoroughly. The plants were separated into roots, stems and leaves and placed in envelops labeled according to their corresponding treatments. These were dried in the oven at 78^0C. The dry weight of these specimens were eventually determined using an electric weighing balance.

Table 1: Physical and Chemical Analysis of Experimental Soils

Soil Parameters	Values
Soil Ph	4.98
Organic matter (%)	1.22
Avail. P	37.5
Ca (Cmolkg^{-1})	2.2
K (Cmolkg^{-1})	1.00 – 10
Clay (%)	11.7
Silt (%)	10.7
Sand (%)	77.6
Total N (%)	0.13
Exc. Acidity (kg)	1.6cm/kg

Result and Discussion

The results showed variation in growth and response to different fertilizer KH_2PO_4, $KHNO_3$, KH_2PO_4 and $KHNO_3$) application on *senna siamea*. The height and girth of *senna siamea* was improved by $KHNO_3$ and KH_2PO_4 applications which resulted in taller plants (Figure 1). At 8 – 12 WAP there was no significance improvement but between 13 – 16 WAP there was significant improvement.

$KHNO_3$ application significance ($P<0.05$) improved the girth of *senna siamea* than combined $KHNO_3$ and KH_2PO_4 caused wider girth at 8- 12 WAP (Figure 2). Fertilizers significantly ($P<0.05$) increased leaf, stem, root dry weight of *senna siamea.* The root dry weight responded more to $KHNO_3$ than KH_2PO_4. The effect to $KHNO_3$ application on leaf, stem and root dry weight was higher than combined KH_2PO_4 and $KHNO_3$ application (Figure 3).

Senna siamea responded best to KH_2PO_4 application. This is in agreement with the works of Sangige *et al* (1988) who reported that *senna siamea* respond most to phosphorus application. This response may be due to the fact the phosphorus availability to plants always plays a regulatory role resulting in viability of sufficient metabolites, which enhance growth (Smith and Graninazzi, 1993). This would depend on the ability lifetime of roots, and the amount of root per units shoat (Folise *et al.,* 1988). The higher capacity of *sienna siamea* treated with phosphate in this study to produce more root dry weight as shown at 16 weeks after planting, probably because large proportion of phosphate could be translocated to roots and nodules (Sandinda *et al.,* 1994).

There was little or no effect of nitrate and phosphate application on girth at the early stage of growth but as growth progressed nitrate improved the girth than phosphate (Figure 3). This implies that, nitrate application increases non-nitrogen fixing plant at their early stage of growth (Itta, 1995.)

The distribution of phosphate between shoot and roots was not caused by the ratio of dry matter production (Itta, 1995). The growth of *senna siamea*, root and leaf dry weight was slightly affected by combined $KNHO_3$ and KH_2PO_4 fertilization.

Conclusions

The application of nitrogen and phosphorus fertilizers significantly affected the growth of *senna siamea* for further investigation.

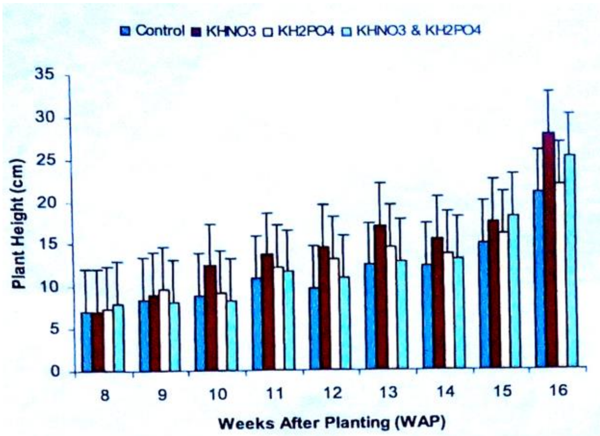

FIGURE 1: Effect of Nitrogen and Phosphorus fertilization on the height of *Senna siamea*

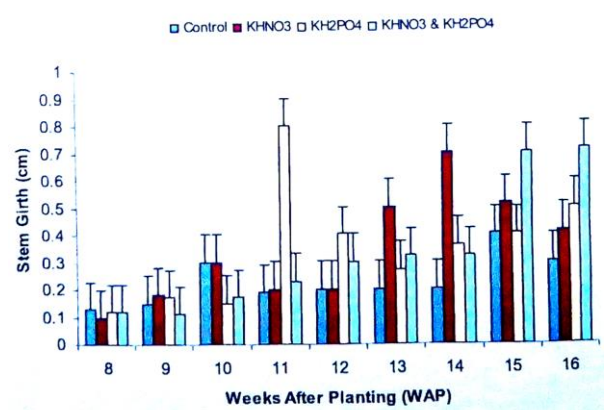

FIGURE 2: Effect of Nitrogen and Phosphorus fertilization on the stem Girth of *Senna siamea*

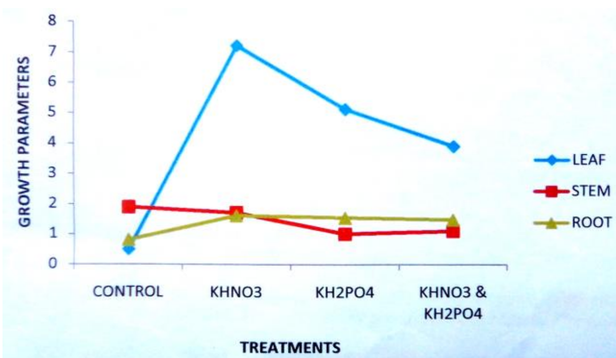

FIGURE 3: Effect of nitrogen and phosphorus fertilizer application on the leaf, root and Stem dry weight of *Senna siamea*

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