Effect of Fertilizer Level and Intercropping with Bambara Nut (*Vigna subterranea*) on the Growth and Herbage Yield of Maize

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Introduction

The low fertility status of most tropical soils has hindered maize production as maize has a strong exhausting effect on the soil. It has been generally observed that maize fails to produce good grain in plots without adequate nutrients (Adediran and Banjoko 2003). Legumes generally are able to fix nitrogen to the soil which the companion crop could benefit from, but usually the nitrogen fixed occurs in insufficient quantities for marginally nitrogen sensitive crops such as maize and hence the required use of fertilizers. Inorganic fertilizers exert strong influences on plant growth, development and yield (Stefano *et al.* 2004). The use of legumes in mixed cropping systems is one of the traditional soil-fertility maintenance strategies. Legume-cereal intercropping often increases the quantity and quality of residues, which could improve livestock production considerably in addition to benefits in soil fertility but may decrease the yield of the companion cereal crop (Nandi and Haque 1986). Although the beneficial effects of intercropping legumes have been demonstrated by intercropping cereals with a few legumes such as cowpea, lablab, soybean etc, the same cannot be said for all legumes. This study aims at investigating the effect of fertilizer levels and intercropping with bambara nut (*Vigna subterranean* L.Verdc) on the growth and yield of maize for use as forage.

Materials and methods

The experiment was conducted at the teaching and research farm of Abia State University Umuahia Campus between the months of May and October, 2012. The routine soil analysis of 0-30cm depth (Mylavapus and Kennelley, 2002) showed that it had pH (H2O) 5.88, total nitrogen (%) 0.11, organic carbon (%) 0.34, available phosphorus (mg/kg) 17.20, exchangeable Ca (cmol/kg) 1.20, exchangeable Mg (cmol/kg) 1.20, clay (%) 9.40, silt (%) 16.80 and sand (%) 73.80. The trial was laid down in a randomized complete block design. The treatments included three NPK fertilizer rates either in sole or intercropped system viz: bambara-maize 600 kg/ha (BM600), bambara-maize 400 kg/ha (BM400), bambara-maize 0 kg/ha (BMNF), sole maize 600 kg/ha (SM600), sole maize 400 kg/ha (SM400) and sole maize 0 kg/ha (SMNF) of NPK compound fertilizer. Three seeds of maize variety Oba Super 2 sourced from the National Seed Store Umudike were sowed on the field at a spacing of 50 x 50 cm. The application of NPK 15:15:15 fertilizer was carried out 4 weeks after planting. Six plants were randomly selected per plot for determination of growth parameters. The growth parameters assessed included plant height (cm), stem girth (cm), number of leaves, leaf area per plant and total dry matter (kg/ha). Data were subjected to analysis of variance using SPSS version 17 and means were separated and compared using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Effect of fertilizer level and intercropping with bambara on the growth indices of maize are shown in Table 1. There were significant differences in means of all the parameters investigated at week 7. The zero fertilizer treatments, BMNF and SMNF had similar (P<0.05) values across all the parameters and their values were significantly lower than the values recorded for the other treatments. The highest value of 11.00 for number of leaves was recorded for BM 400 and this value was statistically similar to those recorded for SM 600, SM 400 and BM 600. BM 400, SM 400, SM 600 and BM 600 all had recorded similar values for plant height. Values for this parameter ranged from 82.10cm for BMNF to 150.00cm for SM400. Stem girth ranged from 6.01cm for SMNF to 8.00 cm for SM600. Keating and Carberry (1993) reported that from 7 to 10 weeks after sowing, plant competition ensured, resulting in significant differences in vegetative parameters such as plant height, number of leaves per plant and plant girth. Omar and Abou-Bakr (1995) reported that parameters such as plant height, number of tillers/plant, dry weight, leaf area/plant, leaf area index (LAI), flag leaf area and specific leaf weight significantly increases by application of mineral fertilizer. Leaf/Stem ratio was not affected by fertilizer level and intercropping. The range for this parameter was from 0.43 for SM400 to 0.49 for BM600. The values for dry to green leaf ratio showed that the

Table 1. Effect of Fertilizer levels and intercropping on the growth indices of maize at 7 and 9 weeks after planting (7 WAP and 9 WAP). Means on the same row with different letters are significantly different (P<0.05).

Treatment	Plant height		Stem girth		No. of Leaves		Dry/Green leaf ratio	Leaf/Stem ratio	Yield (t/Ha)
	7 WAP	9 WAP	7 WAP	9 WAP	7 WAP	9 WAP			
BM600	121.5 b	167.2 ab	7.12 abc	6.54	10.0 ab	13.4	0.85 ab	0.49	1.01 bc
BM400	132.3 b	229.3 a	7.33 abc	6.91	11.0 a	13.1	1.20 ab	0.43	1.33 ab
BMNF	82.1 c	162.3 b	6.32 bc	5.21	8.9 b	13.4	1.23 ab	0.44	0.59 cd
SM600	135.3 ab	176.1 ab	8.00 a	7.49	10.8 a	13.2	0.83 b	0.46	1.84 a
SM400	150.0 a	198.1 ab	7.77 ab	7.09	10.8 a	13.5	1.07 ab	0.43	1.33 ab
SMNF	92.1 c	138.7 b	6.01 c	5.02	8.5 b	13.5	1.26 a	0.47	0.37 d

highest value indicating more dry leaves was recorded for SMNF while the lowest value was recorded for SM600. The range was from 0.83 to 1.26. The dry to green leaf ratio will reflect on the quality of the forage and also on overall crop yield. This is so because only photosynthetically active leaves contribute to the production of soluble sugars. It was also observed that at SM600 had a significantly higher (P<0.05) value for herbage yield than BM600. This could be as a result of some competition that existed between the plants in the intercropped plot at this fertilizer level. SM400 and BM400 had the same value for this parameter possibly indicating no deleterious effect intercropping the two crops at this fertilizer level.

Conclusion

This study demonstrated the roles of nitrogen and intercropping on growth and development of maize in a maize/bambara as sole crops and maize/bambara intercropping in the humid agro-ecology of Nigeria. The results obtained in this study showed that the use of NPK 15:15:15 fertilizer improved maize plant growth and development. It was observed that planting at both fertilizer levels investigated in this study competed in their effects on plant growth and development suggesting that it may not be necessary and cost effective using NPK 15:15:15 fertilizer at levels greater than 400 kg/ha.

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