COMPATIBILITY OF *STYLOSANTHES HAMATA* AND *STYLOSANTHES CAPITATA* IN MIXED PASTURES IN THE SUBHUMID ZONE OF NIGERIA

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ABSTRACT

The forage productivity of sole plots of *Stylosanthes capitata* and *Stylosanthes hamata* in comparison with various proportional mixtures of the two legumes and their effect on soil properties and subsequent maize yield were studied in subhumid Nigeria. Dry matter (DM) yields in the mixtures were higher than in the sole stands, with the mixtures of *S. hamata* and *S. capitata* reaching 11959 to 14822 kg/ha over a three year period. Total nitrogen and/or organic carbon concentrations in the soil following the three years of legume were higher in the mixtures than in the sole stands, and this resulted in higher maize yields. Though having nodulation problems in monoculture, *S. capitata* could be utilized as a component in mixtures of complementary legumes. The beneficial effects of such mixtures for both forage and crop production and their potential for crop-livestock production systems are discussed.

KEYWORDS

Stylosanthes capitata, *Stylosanthes hamata*, legume mixtures, crop-livestock interactions, maize, soil, organic carbon, nitrogen

INTRODUCTION

Livestock production in subhumid Nigeria is limited by inadequate feed, in particular during the dry season; likewise the low fertility of the savanna soils is a severe constraint to forage and crop production. The introduction of forage legumes into the farming systems is thought to be an appropriate way to boost both animal and crop production (Humphreys, 1991; Mohamed Saleem and Fisher, 1993; Tarawali and Mohamed Saleem, 1995). *Stylosanthes capitata*, identified in similar environments in South America as a highly productive, drought and disease tolerant species with adaptation to low fertility soils (Thomas et al., 1987), had been evaluated for its potential in subhumid west Africa. Results showed that this legume failed to nodulate in preliminary trials. However, observations made on abandoned plots in the same area revealed that several years after introduction *S. capitata* nodulated and produced higher yields than *S. hamata*, the most widely used forage legume in subhumid Nigeria (Tarawali et al., 1996). An experiment was therefore initiated to study the potential of *S. capitata* and *S. hamata* in various mixtures on forage and subsequent crop yields.

MATERIAL AND METHODS

At the beginning of the 1990 wet season, twenty, 2m x 3m plots were sown with both *S. capitata* and *S. hamata* at a seed rate of 10 kg/ha each. Four to six weeks after planting plant populations were thinned to 100 seedlings/m^2, in the following combinations: a) 100% *S. capitata*; b) 75% *S. capitata*/25% *S. hamata*; c) 50% *S. capitata*/ 50% *S. hamata*; d) 25% *S. capitata*/75% *S. hamata*. e) 100% *S. hamata*. The five treatments were arranged in a randomized complete block design with four replicates. Plots were kept weed free and were fertilized with 150 kg/ha single superphosphate (SSP) at planting and 100 kg/ha SSP in subsequent years. Forage parameters were studied for the first three years. At the end of each wet season two 0.25m^2 quadrats per plot were cut to assess dry matter productivity and samples were taken for crude protein determination. In 1993 plots were cropped with maize to obtain information on the effect of various proportions of the two legumes on cereal production (for details on methodology, see Tarawali, 1994). The maize did not receive any nitrogen (N) fertilizer, but a basal dressing of 60 kg/ha potassium and phosphorus each were applied as muriate of potash and SSP, respectively. Prior to planting of maize, soil samples were taken for the determination of total nitrogen (Kjeldahl) and organic carbon (Walkley-Black).

RESULTS

Total forage dry matter yields in the mixtures were higher than in the sole stands (Table 1), with *S. capitata* increasing its contribution over time. Total soil nitrogen concentrations were higher in plots following three years of *S. capitata/ S. hamata* mixtures than *S. capitata* sole stands. Organic carbon concentrations were higher in the two mixtures than plots preceded by either sole *S. capitata* or *S. hamata*. Maize yields were correspondingly higher following the mixtures than either of the sole legume stands.

DISCUSSION

The experiment showed the beneficial effects of legume mixtures not only on forage production but also on subsequent crop yield. The higher soil nitrogen and/or organic carbon levels in the mixtures compared to the sole stands resulted in increased crop yield. The improvement in soil characteristics in the mixtures over the sole stands reflected the higher total forage legume yields in the mixtures as the nitrogen contribution to a succeeding crop depends on the vigour of the legume stands (Jones et al., 1991). Soil parameters and resulting maize yields were lowest in the *S. capitata* sole stands, confirming the nodulation problems of this species when grown as a sole legume. However, the higher soil nitrogen, organic carbon and resulting maize yields in the mixtures than in either of the sole stands suggest the complementarity of *S. capitata* and *S. hamata.* Thus, though not recommended for sole legume pastures, *S. capitata,* could be used in mixtures with other complementary legume species such as *S. hamata*, *Centrosema brasilianum* and/or *C. pubescens*. The positive effect of legume mixtures on forage production (Peters et al., 1997) and on subsequent crop production indicate the potential of mixtures of complementary legumes in crop-livestock systems. Further studies are needed on the mechanisms of nitrogen fixation in such mixed legume stands.

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Table 1
Effect of different proportions of *Stylosanthes capitata* and *Stylosanthes hamata* on forage yields (total of three years), soil properties and subsequent maize production

Proportion *S. capitata/S. hamata*	Forage yield (1990-1992) kg/ha	Maize yield (1993) kg/ha	total soil nitrogen g/kg	organic carbon g/kg
100 / 0 %	10209	303	0.15	8.57
75 / 25 %	14822	587	0.19	9.85
50 / 50 %	12925	492	0.22	11.56
25 / 75 %	11959	509	0.23	10.48
0 / 100 %	10495	460	0.20	9.53