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Effect of Organic Fertilizer Application on Forage Yield of Four Pasture Species as Affected in the Humid Tropics

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Abstract: Field experiments were conducted at the Teaching and research farm, Delta State University, Asaba Campus, Asaba between 2003 and 2005, to determine the effect of organic fertilizer (poultry droppings) on yield of species of forage crop and in their mixtures. The pastures who sown in plots measuring 5x5m in a split randomized complete block design with four replicates and soil fertilized at a rate of 0.5 t ha^{-1} and without soil fertility. The pastures were first harvested at 8 week after planting and a regular interval of 4 weeks there after. The result of the study showed that, the yield of sole crops and yield of 2 or more forage crop associations with organic fertilizer application was significantly higher ($p<0.05$) than with fertilizer applications. Also, the aggregates yield of 2 or more crop association was significantly higher ($p<0.05$) than their component sole crops in the same plot. The grain legume crop association produced diversify of pastures and higher yield both in quantity and quality. It was concluded that organic fertilizer is a possible replacement for organic fertilizer and a mixture of four forage crops association is recommended than sole or 2 or 3 crop association.

Key words: Organic fertilizer, forage yield, pasture

INTRODUCTION

Sustainability in ruminant animal production which in turn should ensure continued availability of animal protein for human consumption in the tropics is only achievable through adequate forage production. In the production of ruminants, forage crops play a vital role as a cheap and regular source of feeds. The use of inorganic fertilizer to encourage early and fast establishment of grasses has been reported[1]. Bamikole, Ezenwa and Akinsoyinu[2], reported the use of inorganic (calcium- Ammonium-Nitrate or N) fertilizer to improve the nutritional status and yield of grass pastures.

The Chinese however used organic waste fertilizer to maintain high level of soil fertility from the 16th century to date[3] while Alabi[4], reported that, organic fertilizer trails has resulted in the improvement of soil fertility. Organic manures increases soil aggregation, improves soil water holding capacity improves soil quality[5-7] and can be applied singly[8]. Olson and Paworth[9], has reported a positive effect on forage yield on the application of Hog organic manure. The sowing of legumes with other crops of non leguminous crops associated with the leguminous crops, improvement and maintenance of soil fertility[10,11]. Similarly Ojeifo[12] reported that, a mixture of grass and legumes gave higher yield than any of the components alone and give higher nutritive value and animal grazing on the grass-legume mixture needs minor supplement for optimum production. With recent increases in the cost of inorganic fertilizers in Nigeria, beyond the reach of most peasant livestock producers, there is likely to be a drastic reduction in the quality and quantity of forages over production through improvement of the nutrient status of the soil with leguminous forage crops species and the use of organic fertilizer. This study was therefore undertaken to evaluate the effects of organic fertilizer on yield of four pasture species and their mixture.

MATERIALS AND METHODS

Four pasture species, made up of three grass (*Panicum maximum andropogon gaynamus* and *Cynodon* IB.8) and one legume (*Calopogonium mucunides*) were harvested from grazing paddocks at Ozoro in Delta State, Nigerian and sown in the Delta State University teaching and Research Farm, Asaba, in Delta State. The experiment, which had a split in fermented poultry droppings at a rate of 0.5 t/ha. Each treatment combination was replicated 3 times treatments were sown on May 25th, 2003 repeated in May, 20th , 2004. The first

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harvest was carried out 8 weeks after transplanting and at intervals of 4 weeks thereafter. The cutting height was 10-18 cm above the ground level. The data were analyzed using statistical Analytical System[13] programme. Means showing significant differences were separated using Duncan's Multiple Range Test[14].

RESULTS AND DISCUSSION

Forage yields of sole crops without fertilizer application were significantly higher than in their mixtures. Also, yield declined significantly with increase in the number of forage crops associations. Yields of sole forage crops with organic fertilizer was significantly ($p<0.05$) higher than yields without fertilizer (Table 1) similarly yields in 2,3 or 4 forage crop associations with organic fertilizer applications were significantly ($p<0.05$) higher than without fertilizer application (Table 2- 5). This agrees with Bamikole[2] who reported higher yield with N fertilizer to improve the yield and quality of the pasture.

The increase in the dry matter yield of the fertilized forage pasture than the unfertilized ones could be adduced to the supply and uptake of adequate plant growth resources especially nitrate (no_3) from the poultry manure, which improved soil aggregation, soil fertility and improved the water holding capacity of the soil which of great biological importance to the tissues of the living plant. The retention of water in the soil would have probably helped to enhance water status in the plants. This could result in the freshness of the forage and pastures. This result confirms that organic manures incuses water infiltration, improves soil water holding capacity, soil aggregation and thus helping to maintain environment for optimum production. Similarly, Asadu, Ezeaku and Nnaji[7], reported that organic manures improves the soil physical chemical fertility and enhances crop performance.

The association of 2 or more forage crops produced lower individual yield than their corresponding sole crops. The consistent superior forage yields in sole crops than

Table 1: Forage Dry matter yield of four pastures under sole cropping (kg ha^{-1})

	Calopoganium mucunoides×10^3	*Panicum maximum*×10^3	*Andropogon gayanus*×10^3	*Cynodon* IB8×10^3	Mean
No fertilizer	1.84f	1.96e	2.05d	1.56f	1.85
Fertilizer	2.14c	2.64a	2.48b	2.01e	2.32
Mean	1.99	2.30	2.26	1.78	2.08

Table 2: Forage Dry matter yield of only *Colopogonium mucunoides* propagated along with other pasture sp. (kg ha^{-1})

	Calopoganium nucuniodes×10^3	*Calopogonium mucunoides*+ *Panicum maximum*×10^3	*Calopogonium mucunoides*+ *Andropogon gayanus*×10^3	*Calopogonium mucunoides Cynodon IB8* ×10^3	*Calopogonium mucunoides*+ *Cynodon IB8*+ *A.gayanus*×10^3	*Calopogonium mucunoides*+ *Cynodon IB8*+ *P.maximum* ×10^3	*Calopogonium mucunoides*+ *A. gayanus*+ *P. maximum* ×10^3	*Calopogonium mucunoides*+ *A. gayanus*+ *Cynodon.IB8* +*P. maximum*×10^3	Mean
No fertilizer	1.84b	1.04de	1.28d	1.48cd	0.79e	0.88e	0.68f	0.62f	1.85
Fertilizer	2.14a	1.24d	1.76ab	1.52c	1.81e	0.92de	0.81e	0.78e	2.32
Mean	1.99	1.14	1.52	1.50	1.30	0.90	0.74	0.70	2.08

Table 3: Forage Dry matter yield of only *Panicum maximum* propagated along with other pasture sp. (kg ha^{-1})

	P .maximum x10^3	*P .maximum*+ *A.gayanus* ×10^3	*P .maximum*+ *Cynodon. IB8*x10^3	*P .maximum*+ *C. mucunoides* ×10^3	*P .maximum*+ *A.gayanus*+ *Cynodon. IB8*+ *C. mucunoide*×10^3	*P .maximum*+ *C.IB8*+*A. gayanus*×10^3	*P .maximum*+ *A. gayanus*+ *C.mucunoides* ×10^3	*P .maximum*+ *A. gayanus*+ *C.mucunoides* +*Cynodon.IB8*×10^3	Mean
No fertilizer	1.96e	1.21hi	1.26h	1.30h	1.10j	1.00j	0.96j	0.81k	120
Fertilizer	2.64a	2.30b	2.14c	2.10d	1.8bef	1.68f	1.50g	1.40gh	1.95
Mean	2.30	1.75	1.70	1.70	1.48	1.34	1.23	1.10	1.57

Table 4: Forage Dry matter yield of only *Andropogon gayanus* propagated along with other pastures sp. (kg ha^{-1})

	A. gaynanus ×10^3	*A.gayanus*+ *Cynodon .IB8*×10^3	*A. gayanus*+ *C.mucunoides* ×10^3	*A. gayanus*+ *P .maximum* ×10^3	A.*gayanus*+ *Cynadon IB8*+*C.mucu-noides*×10^3	*A.gayanus*+ *P .maximum*+ *Cynadon. IB8*×10^3	*A. gayanus*+ *P. maximum*+ *C. mucunoides* x10^3	*A. gayanus*+ *P .maximum C. mucunoides*+ *Cynadon .IB8*×10^3	Mean
No fertilizer	2.05b	1.69c	1.71c	1.21e	1.12e	1.04e	0.60f	0.60g	1.26
Fertilizer	2.26	1.88	1.83	1.31	1.46	1.20	0.80	0.73	1.62
Mean	2.26	1.88	1.83	1.31	1.46	1.20	0.80	0.73	1.44

Table 5: Forage Dry matter yield of only *Cynodon* IB8 propagated along with other pastures spp. (kg ha^{-1})

	Cynodon.IB8 ×10^3	*Cynodon.IB8*+ *A.gayanus* ×10^3	*Cynodon.IB8*+ *C..mucunoides* ×10^3	*Cynodon.IB8*+ *P .maximum* ×10^3	*Cynodon.IB8*+ *C.mucunoides A. gayanus*×10^3	*Cynodon.IB8*+ *A. gayanus*+ *P .maximum*×10^3	*Cynodon.IB8*+ *P. maximum A. gayanus*×10^3	*Cynodon.IB8*+ *P .maximum A. gayanus*+ *C. mucunoides*×10^3	Mean
No fertilizer	1.56d	1.36ef	1.41e	1.26f	1.24f	1.04f	1.10h	0.81k	1.22
Fertilizer	2.01a	1.86b	1.68c	1.31ef	1.21f	1.23f	1.14g	1.04I	1.43
Mean	1.78	1.61	1.54	1.28	1.22	1.13	1.12	0.92	1.32

in their mixtures can be adduced to intra specific competition for growth resources in space and time among forage crops in the mixtures. This yields differences agree with Gondwe[15], who observed higher yields in sole crops than in their mixtures. Amongst the forage crops, *Panicum maximum* was most tolerant in the association.

The planting of grass- legume mixture produced a diversity of pastures, increased the quantity and quality of the forages than either grasses or legumes alone. Also, legumes in the grass-legumes mixture fixes atmosphere N, which benefits the association crop. Although N fixed was not measured, the association of legumes-grass performed well in he pasture. This supports Agboola and Fayemi[10-12], whom reported excretion of N to the associated crop, performance of non-leguminous associated with a leguminous crop, improvement of soil fertility and improvement in the quality and quantity of the forages.

Further, Ojeifo[12] stressed that, a mixture of grass-legume give higher yield than any of components along, reduces management cost by frequency of weeding and animal grazing continuously in such crop mixture needs minor supplementary feeding.

In most developing countries, especially in the humid tropics, where the cost of inorganic (chemical) fertilizer are exorbitant beyond the reach of farmers and the need for fertilizer in any agro-economy system for forage and pasture crops production could come from organic sources.

Since the organic waste comes from poultry droppings, farm yard manure, gabbages from municipal waste e.t.c. which are almost constituting a menaces in most places in the humid tropics. Also, nitrogen fixing leguminous plant can be grown with pastures to serve as a biological agent for N to the soil and to the associated crop. This biological fixing of N accounts for about 65% of total N utilized in Agriculture[16]. It would be important in pasture and forage crop production which its understanding will be useful in sustainable pasture and forage crop production.

A system with low individual yield in pastures but higher associates (commutative) yield in the mixtures will hold higher benefit to the ruminants and the peasant livestock producer, in addition to variability and heterogeneity of the pasture. The inclusion of *calopogonium mucunoides*, a legumes will improve the soil fertility and the pasture. Further, the addition of organic fertilizer to the pasture improves the soil fertility status (although not measured), with subsequent higher productivity of the pastures as against no fertilizer application to the other pastures.

CONCLUSION

The pastures with organic fertilizer application is a possible replacement for inorganic fertilizer and a mixture of four pastures is recommended than sole 1,2, or 3 pasture crop associations.

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