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RESEARCH NOTE: 1

INTERRELATIONSHIPS BETWEEN HERBAGE QUALITY ATTRIBUTES AND FORAGE YIELD IN FILEGRASS *(Genus Anthephora Schreb).*

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ABSTRACT

The interralationships between eight herbage quality parameters and forage yield were studied in 65 diplod and 2 polyploid genotypes of filesgrass. Of the six mineral elements assayed, only Mg showed a relationship with dry matter yield. Some of the attributes however correlated amongst themselves. The limiting effect of Mg content on forage yield was due to the highest utilisation of this element by larger and leafier plants. Breeding efforts should be geared towards the development of superior varieties of filegrass that would combine high yield and good herbage quality.

INTRODUCTION

The feeding value of herbage, estimated in terms of mineral elements contents and other quality parameters, is known to be the major hinderance to livestock production of milk and meat in the tropics (Allman and Hamilton. 1948; Whyte *et al.* 1959; Wilson and Brigstocke, 1981). While dry matter production of tropical grasses can be enhanced by simple cultural practices (e.g. fertilizer application), the improvement of quality is more difficult, and may involve elaborate genetic studies.

Anthephora ampulacea (a diploid) and *A. nigritana* (an allopolyploid) are currently used as livestock feed by local herdsmen in Nigeria (Mba, 1992). An autotetraploid form of *A. ampulacea* has recently been

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produced. (Ene-Obong and Mba, 1994). The present investigation was therefore designed to study the relationships among several quality attributes in both diploid and tetraploid filegrasses. Associationships were also studied between these attributes and forage yield. It could happen that selection for a quality attribute whose inheritance pattern is simple and clear-cut can lead to a successful correlated selection for final yield, which is usually under the control of several factors. Thus, breeding for advancement in one attribute could be linked directly or inversely to another attribute. In fact, Ahmad and Musty (1972) observed that association existed in a desirable direction between quality components and development traits related to tillering, flowering and maturity in *Agropyron cristatum* (L) Gaertn. In this work, correlation and regression analyses were used to study the relationships among percentage dry weight concentrations of nitrogen, phosphorus, potassium, calcium, magnesium, sodium, crude protein (CP) and the ratio $^{K}/(Ca + Mg)$, as well as between these attributes and final dry matter (DM) yield of whole plants per plot.

MATERIALS AND METHODS

The experimental materials were the natural diploids and the induced tetraploid of *Anthephora ampulacea* as well as the related allopolyploid. *A. nigritana.* There were 65 diploid genotypes made up of 8 ecotypes collected from there states (Benue, Enugu and Imo); 56 hybrids obtained from diallel crosses between these eight; and a single local collection from Nsukka. One single line each of *A. nigritana* (collected from Zaria) and the induced tetraploid were used. The trial was commenced in July 1988 with the transplanting of the 3-week old seedlings as single tillers, with a spacing 0.1m between plots and amongst the seedlings into 0.5 x 0.5m randomized plots at the Agricultural Farm of the University of Nigeria, Nsukka. This was set in a 3-replicate Randomized Complete Block Design. This arrangement gave a total of 16 plants stands per plot or 48 plants stand for the trial for each of the 67 genotypes. Fertilizer was applied once as single doses of N,P and K at rates equivalent to 200, 65.5 and 124.5kg per hectare, respectively. Weeding was done manually, three times between August and December, 1988, when this experiment was terminated.

The plants were assayed at 18 weeks after establishment, corresponding to sexual maturity, for mineral elements concentrations - N, P, K, Ca, Na -, CP and the ratio $^{K}/(Ca + Mg)$. Total content of N was determined by the Microkjeldahl method, Ca and Mg by titrimetric method using Erichrome-Black T and 0.01N EDTA; P concentration by simple colorimeter method, and K and Na by flame photometry (AOAC,

1970). Crude protein (CP) was computed as percentage NX6.25. These parameters were then correlated among themselves and with DM of total above ground yield of the plants. Partial correlation coefficients were also obtained and the path coefficients calculated were used in carrying out the path analyses.

RESULTS AND DISCUSSION

The linear correlation matrix of eight forage quality parameter is shown in Table 1. The only significant association between these attributes and forage yield was the negative relationship ($P<0.05$) with Mg content of the swards. This also had a significant linear slope ($P<0.05$, Table 2). This relationship was even more pronounced after fixing the effects of the other parameters, resulting in highly significant partial correlation and regression coefficients ($P<0.01$, Table 2). Some of the relationships between the feed value parameters themselves were also significant. Nitrogen was negatively related with Na ($P<0.05$). Similarly, Phosphorus concentration was positively associated with Na ($P<0.01$); K with the ratio $^{K}/(Ca + Mg)$ ($P<0.001$) while Na was negatively correlated with CP ($P<0.05$).

The results therefore showed that none of the attributes studied had a significant direct positive contributory effect on the final DM yield of the swards, rather Mg concentration, with a negative R^2 value of 0.068 (Table 2) was probably a limiting factor to DM yield. The negative correlation between Mg and forage yield could be due to the fact that more Mg is used by the larger and leafier plants since the same level was available to all the plants.

Table 1: Correlation coefficients among mineral element concentrations, some quality attributes and dry matter yield.

Minerals and herbage quality attributes	Phospo-rous (P)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	K/(Ca + Mg)	Crude Protein(CP)	Dry matter
	ppm			%				g
Nitrogen (N) %	-0.022	-0.001	0.048	-0.083	-0.271*	0.010	0.999***	0.006
Phosphorus (P) ppm		-0.216	0.182	-0.018	0.315**	-0.231	-0.022	0.145
Potassium (K) %			-0.028	0.108	0.004	0.972***	-0.002	-0.098
Calcium (Ca) %				-0.031	-0.064	-0.212	0.048	0.047
Magnesium (Mg) %					-0.008	0.026	-0.083	-0.261*
Sodium (Na) %						0.027	-0.275*	-0.060
K/(Ca + Mg)							0.010	-0.102
Crude Protein (CP)								0.001
DM (g)								

Significant (P< 0.05); highly significant (P<0.01); ***very highly significant (P<0.001).*

Table 2: Means intercepts and slopes of simple and multiple regression lines and partial correlation coefficients of mineral element concentrations and some quality attributes on dry matter yield of whole plant.

Minerals and some quality attributes	Mean	Simple regression		Multiple regression	Partial correlation	R^2 - coefficient of determination
		intercepts (a)	slope (b)	slope (b)	coefficients	
Nitrogen (N)%	1.092	71.666	0.678	538.434	0.168	0.00003
Phosphorus (P) ppm	3.881	60.697	3.017	4.100	0.189	0.02104
Potassium (K) %	1.057	74.595	-2.071	31.101	0.182	0.00969
Calcium (Ca) %	1.263	68.750	2.896	-17.885	-0.161	-0.00226
Magnesium (Mg) %	0.623	88.850	-26.382*	-39.079***	-0.318**	-0.06812
Sodium (Na) %	0.035	73.318	-26.309	-59.107	-0.129	-0.00357
K/(Ca + Mg)	0.584	74.689	-3.909	-59.080	-0.187	-0.01043
Crude Protein (CP)	6.832	72.299	0.157	-88.223	-0.169	0.00000
DM of whole plant per plot (g)	72.407	-	-	-	-	-

**Significant (P<0.05); ** Highly significant (P<0.01).*

The present study was aimed at exploring the possibility of the use of correlated responses between quality and yield traits in filegrasses as a selection criterion. The levels of mineral elements contents of forage is critical in the nutritional status of the livestock fed on it. Improvements in biomass production of the forage, usually estimated by the DM, should be accompanied by quality parameters of acceptable standards. Breeding therefore should be targeted at producing varieties of tropical herbage grasses that combine high yields and superior quality feed values, the latter having been identified as the constraint to organised pasture management in the tropics (Whyte *et al.*, 1959).

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