

EFFECTS OF LOCATION ON FIBRE FRACTIONS AND AMINO ACIDS PROFILE OF TWO TROPICAL FORAGE LEGUMES IN UMUDIKE, RAINFOREST ZONE, NIGERIA

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ABSTRACT

An experiment was conducted to evaluate effect of location on fibre fractions and amino acids profile of two tropical legumes in Umudike, rainforest zone, Nigeria. The experiment comprises two factors namely; 4 locations and 2 leguminous species forming 4 x 2 factorial arrangement laid out in Completely randomized design (CRD) having 8 treatments, replicated three times. The locations are: Location 1- NDDC site, Location 2- Rubber plantation site, Location 3-Fish farm site, Location 4- Sambisa site and the legumes are *Centrosema pubescens* and *Calopogonium mucunoides*. There were significant ($P < 0.05$) difference on the values of fibre fractions of two legumes. Acid detergent fibre (ADF) showed that legume 1 (*Centrosema pubescens*) recorded the higher value of 44.45 % than that of legume 2 (*Calopogonium mucunoides*) with a value of 43.45 %. Similarly, cellulose content revealed that legume 1 (*Centrosema pubescens*) recorded the higher value of 35.56 % than that of legume 2 (*Calopogonium mucunoides*) with a value of 34.54 %. In the case of essential amino acids profile, the observed mean values indicated that leucine (0.808 to 0.945), valine (0.662 to 0.742), phenylalanine (0.566 to 0.713) and iso-leucine (0.536 to 0.613) acids are the most abundant essential amino acids present in the legumes. Others are present in moderate amounts except tryptophane which limited. Legume 1 had higher fibre than legume 2 and Legume 2 appears to favor the amino acids profile than legume 1. *Calopogonium mucunoides* is therefore recommended for feeding of livestock during dry season for optimum animal performance.

Keywords: Amino acids, fibre fractions, location, legumes and tropical.

INTRODUCTION

Livestock production faces threats from climate change and weather variability, especially in geographic regions where it is highly dependents on natural vegetation. At the onset of during dry season, grasses become relatively scarce and declined in nutritive quality and consequently resulted to poor animal performance in terms of their products and health status (Ingratubun *et al.*, 2000). During this period of scarcity, various means have been explored by ruminant producers to meet up with nutrient requirements of livestock. Although, each of these means, has its own limitations.

Among all, fodder bank perceived to be the best strategy to ensure provision of adequate feed resource where legumes are predominantly grown with optimum productivity during drought, when grasses would be majorly unavailable in the pasture field due to susceptibility to environmental stress such as extreme decline in moisture content and temperature rise. In this respect, legumes have been used to alleviate poor nutrition imposed by unavailability of many productive grass species to livestock, either by feeding solely or mixed with some more productive grass species. In addition, they also help in nitrogen fixation in the soil and improve nitrogen content of the soil (Wang Q *et al.*, 2018) thereby enriching soil nutrient for subsequent growing season (Andrew *et al.*, 2009).

In Umudike and its environs, two herbaceous forage legumes that found to be predominantly grown throughout the year, especially in the dry season are *Centrosema pubescens* and *Calopogonium mucunoides*. Therefore, this study was conducted to evaluate effects of location on fibre fractions and amino acid profile of two tropical leguminous species (*Centrosema pubescens* and *Calopogonium mucunoides*) in Umudike, rainforest zone of Nigeria.

MATERIALS AND METHODS

Experimental location

This research was conducted at the Pasture unit of the Teaching and Research farm of Michael Okpara University of Agriculture, Umudike located on latitude 05°29'N and longitude 07°33'E. Umudike is on an

elevation of 122 m above sea level and located in tropical rain-forest zone of Nigeria, which is characterized by annual rainfall of about 2177 mm; monthly ambient temperature ranges of 22-33°C and relative humidity of 50-95 % depending on the season.

Experimental design

The experiment comprises of two factors namely, location and leguminous species forming 4 x 2 factorial arrangement laid out in completely randomized design (CRD) having 8 treatments combination, replicated three times. The four locations are: Location 1- NDDC site, Location 2- Rubber plantation site, Location 3-Fish farm site, Location 4- Sambisa site and the selected legumes are *Centrosema pubescens* and *Calopogonium mucunoides*.

Determination of fibre fraction and amino acid profile

In the late rainy season (early November of the year 2022) two predominant legume forages (*Centrosema pubescens* and *Calopogonium mucunoides*) were identified and selected from four different locations with varying altitude in Umudike natural vegetation. In each location, forage materials were harvested sub-samples weighing 500g were taken from forage legume components oven dried at 60°C until the samples were properly dried for the determination of fibre contents and amino acid profile. Samples were analyzed using near infra-red spectroscopy (NIRS) equipped with globally calibrated equations developed by ILRI from conventional analysis of proximate composition and fibre fractions (AOAC, 2000; Van Soest *et al.*, 1994). The NIRS instrument to be used is FOSS Forage Analyzer 2500 with software package WinISI II.

Statistical Analysis

The data collected were subjected to Analysis of Variance (ANOVA) in a completely randomized design (CRD) using SAS package and means were separated using Duncan Multiple Test Range (Duncan, 1955) at the 5 % probability level.

RESULTS AND DISCUSSION

The effect of location on fibre fractions of two tropical legumes in Umudike, rainforest zone of Nigeria is presented in Table 1. It was observed that location had no significant ($P > 0.05$) influence on fibre fractions of the two species. Meanwhile, there were significant ($P < 0.05$) difference on the mean values of fibre fractions of two legumes. Acid detergent fibre (ADF) showed that legume 1 (*Centrosema pubescens*) recorded the higher value of 44.45 % than that of legume 2 (*Calopogonium mucunoides*) with a value of 43.45 %. Similarly, cellulose content revealed that legume 1 (*Centrosema pubescens*) recorded the higher value of 35.56 % than that of legume 2 (*Calopogonium mucunoides*) with a value of 34.54 %. There is a close relationship between the crude fibre content and the nutritional value of the feed, and generally the higher the crude fibre content is, the lower the nutritional value. However, the ruminants have ability to digest and degrade fibre component within a certain limit with the aid of rumen microbes, this allows fibre to be a major determinant of ruminant GIT health. In other words, ruminant placed on dietary fibre perform better and healthier than those without fibre component (Khogare, 2012). In this study, the observation made was an indication that legume 1 (*Centrosema pubescens*) had the higher fibre fraction in terms of ADF and Cellulose than the legume 2. This could be attributed to stronger stem component of the legume 1 as observed in their morphology. Acid detergent fibre (ADF) being a parameter that determines the digestibility of forage material, this implies that legume 2 with lower ADF value have possibility of better digestibility than legume 1. The non-influence of location in the fibre fractions implies that any part of this study location could be used for effective forage legume production. The essential amino acids profile of two tropical legume species as affected by location in are shown in Table 2. There were significant ($P < 0.05$) differences in the mean values of the essential amino acids determined except methionine. The results showed that legume 2 (*Calopogonium mucunoides*) were higher than legume 1 (*Centrosema pubescens*) in all the essential amino acids recorded in this study. The observed mean values indicate that leucine (0.808 to 0.945), valine (0.662 to 0.742), phenylalanine (0.566 to 0.713) and iso-leucine (0.536 to 0.613) acids are the most abundant essential amino acids present in the legumes. The other amino acids are present in moderate amounts while tryptophane is the most limiting amino acid. However, the range of values obtained in this study is within the range reported by (Sreerama *et al.*, 2012) for legume forages. Amino acids are the building blocks of protein. The

nutritional quality of a protein is dependent upon many factors among which are: the effectiveness of the test protein in meeting the amino acid requirements of a particular function and the degree of retention of the component amino acids during processing and essential amino acid composition of the test protein.

Table 4.1: Effect of location on fibre fractions (%) of two tropical legume species in Umudike, rainforest zone of Nigeria

Factors	NDF DM	ADF DM	ADL DM	Cellulose	Hemicellulose
Location 1	53.65	45.64	8.965	36.67	8.02
Location 2	54.98	45.58	9.352	36.23	9.40
Location 3	53.87	41.63	8.367	33.26	12.24
Location 4	53.05	42.94	8.875	34.06	10.11
SEM	0.951	0.894	0.283	0.765	0.877
LEGUME 1	53.95	44.45 ^a	8.871	35.56 ^a	9.50
LEGUME 2	53.83	43.45 ^b	8.909	34.54 ^b	10.38
SEM	0.672	0.632	0.200	0.541	0.620
P-Value					
Legume*Location	NS	*	NS	*	NS

a,b: means on the same column with different superscripts are significantly different (P<0.05)

SEM: Standard error of mean

NS: Non-Significant (P>0.05)

*: Significant (P<0.05)

Location 1: NDDC Hostel; Location 2: Rubber Plantation; Location 3: Fish Farm; Location 4: Sambisa

Legume 1 (*Centrosema pubescens*); Legume 2 (*Calopogonium mucunoides*)

NDF DM: neutral detergent fibre dry matter; ADF DM: acid detergent fibre dry matter; ADL DM: acid detergent lignin dry matter

Table 4.2: Effects of location on essential amino acids profile of two tropical legume species in Umudike, rainforest zone of Nigeria

Factors	Histidine	Threonine	Valine	Methionine	Lysine	Isoleucine	Leucine	Phenylalalanine	Tryptophane
Location 1	0.146	0.469	0.687	0.156	0.562	0.553	0.787	0.565	0.088 ^{ab}
Location 2	0.149	0.499	0.669	0.163	0.497	0.555	0.858	0.605	0.081 ^b
Location 3	0.206	0.549	0.732	0.183	0.559	0.595	0.938	0.707	0.127 ^a
Location 4	0.175	0.506	0.718	0.165	0.545	0.593	0.922	0.679	0.119 ^{ab}
SEM	0.0161	0.0268	0.0248	0.0099	0.0450	0.0249	0.0512	0.0382	0.0107
Legume 1	0.138 ^b	0.4712 ^b	0.662 ^b	0.158	0.487 ^b	0.536 ^b	0.808 ^b	0.566 ^b	0.087 ^b
Legume 2	0.199 ^a	0.5409 ^a	0.742 ^a	0.175	0.595 ^a	0.613 ^a	0.945 ^a	0.713 ^a	0.120 ^a
SEM	0.0114	0.0190	0.0175	0.0070	0.0319	0.0176	0.0362	0.0270	0.0076
P-VALUE									
Location* legume	*	NS	NS	NS	NS	NS	NS	*	*

a,b: means on the same column with different superscripts are significantly different (P<0.05)

SEM: Standard error of mean

NS: Non-Significant (P>0.05)

*: Significant (P<0.05)

Location 1: NDDC Hostel; Location 2: Rubber Plantation; Location 3: Fish Farm; Location 4: Sambisa

Legume 1 (*Centrosema pubescens*); Legume 2 (*Calopogonium mucunoides*)

Conversely, location had no significant ($P>0.05$) effect on the essential amino acid contents of the two tropical legume species, indicating that generally, the major proteins are influenced by legume species. This is an indication that plant species harvested in the environment with the similar micro climate possibly possess protein in the same quantity. This could be attributed to access to soil nutrients in the similar proportion and its uptake occur at equal rate.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Having considered the outcomes of this study, the following conclusions were made:

For the fibre fractions, only legume species had significant influence on the parameters determined, where legume 1 recorded the higher ADF and cellulose than legume 2. Thus, legume 2 is preferable to legume 1 in livestock feeding.

In the case of amino acids profile, location did not affect all the parameters determined except tryptophane, where the legumes harvested from location 3 recorded the highest value.

Meanwhile, legume species significantly affected essential amino acids except methionine. Legume 2 appears to favor the essential amino acids profile than legume 1.

Recommendations

Calopogonium mucunoides having observed to possess lesser fibre contents and higher amino acids profile here by recommended to be utilized in feeding of livestock during dry season for optimum animal performance. It could also be explored in feeding rabbits and non-ruminants which is greatly produced in rainforest zone of Nigeria.

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