GROWTH RESPONSE OF WEST AFRICAN DWARF GOATS FED *Chromolaena odorata* LEAF MEAL

J. A. Odedire & G. A. Olusegun-Bakare
Department of Animal Sciences, Obafemi Awolowo University, Ile-Ife, 220005, Nigeria
Corresponding author: oadeolu1@gmail.com

ABSTRACT
This study investigated the performance of West African Dwarf (WAD) goats offered *Chromolaena odorata* leaf meal (COLM) as supplement to a guinea grass – based diet. Sun –dried *Chromolaena odorata* leaves were milled and incorporated into a compounded ruminant concentrate diet. Twenty growing WAD goats, aged 5 - 7 months of both sexes, were randomly allotted to four concentrate diets containing graded levels of sun –dried processed COLM at 0, 10, 20 and 30% to make Diets 1, 2, 3 and 4 respectively. Results obtained indicate that goats on Diet 1 gave the best performance in terms of average daily gain (35.95 g/day) and feed conversion ratio (6.93), which was closely followed by goats on Diet 2 (25.0 g/day and 9.12 respectively). The study showed that COLM at 10 % level of inclusion possesses adequate nutritive value to support good growth of West African Dwarf goats without any deleterious effect.

Keywords: COLM, guinea grass, performance, WAD Goats

INTRODUCTION
Diets of small ruminants, such as goats and sheep, in the tropical regions of Africa have been reported to be deficient in protein (Becholie *et al.*, 2005), especially during the periods of drought and as such period, leguminous trees and shrubs provide a suitable source to offset the observed deficit. The recurrent world food crisis has been reported to inform the need to improve the use of local feed resources such as leguminous fodder trees and shrubs for animal nutrition (Alonso-Díaz *et al*., 2010). As such, Animal nutritionists are now focusing on the development of cost effective ways to maximize available feeds and innovatively broaden feed resource base through identification, evaluation and utilization of the many potential wild forages (Lanyasunya *et al*., 2005). *Chromolaena odorata*, a fast growing and invasive multipurpose wild shrub, has the potential of filling the nutritional gap for this class of ruminants. Recent researches on *Chromolaena odorata* has shifted from its eradication as an unwanted plant, to its utilization as a feed resource for livestock (Bamikole *et al*.,2004; Aro *et al.*, 2009; Igboh *et al.*, 2009). However, the use of *Chromolaena odorata* leaf meal in livestock production has been largely constrained by its unpalatable nature when fed fresh to farm animals. Hence, the need for processing the leaves into a more receptive and palatable form, in order to enhance its use in livestock feeding. The aim of this study therefore, was to assess the growth response of WAD goats fed sun – dried *Chromolaena odorata*.

MATERIALS AND METHODS
The experiment was conducted at the Sheep and Goat unit of the Obafemi Awolowo University Teaching and Research Farm, between March and July, 2016. Fresh leaves of *Chromolaena odorata* were harvested and processed into leaf meal by sun – drying. This was done by exposing the freshly harvested *C. odorata* leaves to the radiation effect of the sun, on a clean dry concrete slab for 72 hours. Preliminary investigations about processing methods (air – drying, oven – drying and sun – drying) had revealed sun – drying as the best, as the radiation effect significantly reduced the anti – nutritive contents of *C. odorata*, compared to the other two processing methods. The sun – dried C. odorata was subsequently ground using a hammer mill, to become *Chromolaena odorata* leaf meal (COLM). The COLM was incorporated into a typical ruminant concentrate diet in graded levels of 10, 20 and 30%, with 0% serving as the control, as contained in Table 1. Twenty growing West African Dwarf (WAD) goats of mixed sexes, aged 5 to 7 months were randomly allotted to four experimental diets comprising COLM at 0, 10, 20 and 30% inclusion level, which were fed to the WAD goats at 2% body weight with a basal ration of *Panicum maximum* at 3% of their body weight, in a completely randomized design. The growth trial lasted 98 days, including initial feed adaptation of 14 days. Goats

were weighed weekly throughout the duration of the experiment. Parameters measured include daily feed intake, average daily gain, total weight gain and feed conversion ratio. Laboratory analysis of diets was carried out using the procedure of AOAC (2000). Data collected were subjected to a one-way analysis of variance using the General Linear Model (GLM) procedures of SAS (2003) while differences between means were separated using the Duncan's Multiple Range Test of the same package.

Table 1: Gross composition of experimental diets for WAD goats

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
COLM	-	10.00	20.00	30.00
Corn bran	45.00	45.00	45.00	45.00
BDG	35.00	25.00	15.00	5.00
Palm Kernel Cake	17.50	17.50	17.50	17.50
Bone meal	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50
Vitamin	0.50	0.50	0.50	0.50
Total	100	100	100	100

RESULTS AND DISCUSSION

The chemical composition of the compounded concentrate diets fed to the WAD goats is shown in Table 2. The dry matter, crude protein, crude fibre, ether extract, ash, neutral detergent fibre, acid detergent fibre and acid detergent lignin contents of the diets increased with increasing level of *Chromolaena odorata* leaf Meal (COLM) inclusion. The CP contents, which is about the most critical nutrient, in all the diets were far above the 8% needed to provide the minimum ammonia levels required for microbial activities in the rumen (Norton, 1994).

Table 2: The chemical composition of experimental diets offered to WAD goats

Parameter(g/100g)	Diet 1	Diet 2	Diet 3	Diet 4
Dry Matter	92.82	93.11	93.22	93.45
Crude protein	16.90	18.50	18.76	19.53
Crude fibre	14.52	15.15	15.27	16.32
Ether Extract	8.55	8.60	10.19	11.12
Ash	7.52	8.18	9.62	9.05
Nitrogen free Extract	52.51	49.57	46.16	43.98
Fibre Analysis				
Neutral detergent fibre	51.87	54.33	58.10	66.53
Acid detergent fibre	30.05	30.99	32.24	34.04
Acid detergent lignin	15.51	17.88	18.54	19.25
Hemicellulose	21.82	23.34	25.87	32.49
Cellulose	12.54	13.11	13.70	17.79

Diet 1 (Control): 0% COLM inclusion; Diet 2: 10% COLM inclusion; Diet 3: 20% COLM inclusion; Diet 4: 30% COLM inclusion

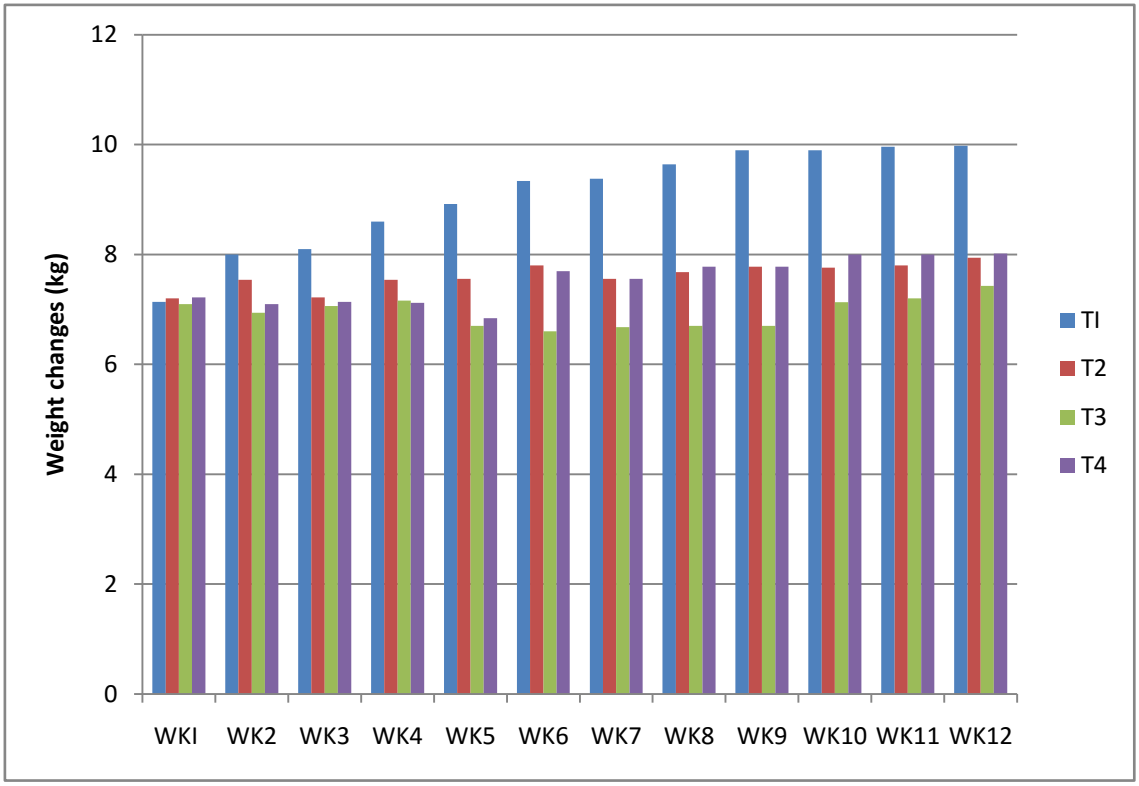
Table 3 shows the Performance characteristics of the WAD goats fed the experimental diets. Average daily intake decreased with increasing content of COLM inclusion in the diet (Table 3). This can be attributed to the bitter taste of *C. odorata,* which is a reflection of its saponin and tannin contents (Igboh *et al*., 2009). Sun –drying method has been reported to reduce the anti– nutrient contents of *C. odorata* and improve acceptance and palatability (Fasuyi *et al.,* 2005). The observed decreased feed intake is in agreement with previous reports on *C. odorata* when fed to birds (Aro *et al*., 1990) and albino rats (Akinmutimi and Akufo, 2006). Average daily gain decreased with increasing COLM content in the diets. Highest ($P<0.05$) daily gain (35.95 g/day) was observed for goats on Diet 1 and the least (15.71 g/day) recorded for goats on Diet 4. The decreasing weight gain could also be attributed to the effect of the reduced feed intake, as well as poor nutrient utilization, although the goats were all in positive weight balance. In terms of efficiency of feed utilization, the WAD goats recorded better performance with decreasing COLM content in the diets, as reflected by the Feed

Table 3: Performance characteristics of WAD goats fed experimental diets

Parameter	Diet 1	Diet 2	Diet 3	Diet 4	SEM (±)	PROB
ADFI (g/day)	249.04[a]	227.99[b]	217.94[c]	220.97[bc]	4.64	0.001
Initial weight (kg)	7.14	7.20	7.23	7.22	0.24	0.99
Final weight (kg)	10.16	9.30	9.37	8.54	0.32	0.34
Total weight gain (kg)	3.02[a]	2.10[ab]	1.70[b]	1.32[b]	0.22	0.01
Ave. daily gain (g/day)	35.95[a]	25.00[ab]	20.24[b]	15.71[b]	2.59	0.01
FCR	6.93[b]	9.12[ab]	10.77[ab]	14.07[a]	1.42	0.03

[a,b,c] means with different superscript differ significantly (P<0.05);Diet 1 (Control): 0% COLM inclusion; Diet 2: 10% COLM inclusion; Diet 3: 20% COLM inclusion; Diet 4: 30% COLM inclusion; ADFI: Average daily feed intake; FCR: Feed conversion ratio.

conversion ratio which increased with increasing content of COLM although the differences in the FCR values of Diets 1, 2 and 3 were not significant (P >0.05). The implication of this is that the WAD goats could tolerate COLM in their diets up to 20% inclusion level without any negative performance.



T1 = Diet 1(0% COLM); T2 = Diet 2 (10% COLM); T3 = Diet 3 (20% COLM); T4 = Diet 4 (30% COLM)
Figure 1: Growth response of WAD goats to the experimental diets

Figure 1 shows the growth response of the WAD goats on the COLM diets. Goats on Diet 1, which is the control diet, without COLM inclusion maintained a consistent daily weight gain throughout the period of the study while for the goats on Diets 2, 3 and 4, a clearly demarcated three growth phases played out. Phase one (Week 1 – 4) recorded a fairly steady increase in body weight gain across the treatment diets while in Phase 2 (Week 5 – 8), a negative growth response was observed. Phase 3

(Week 9 – 12) depicted a period of physiological adaptation to the COLM diets, where the goats exhibited compensatory growth response after the phase of growth depression.

CONCLUSION AND RECOMMENDATIONS

The study concluded that WAD goats can tolerate *Chromolaena odorata* leaf meal (COLM) in their diets up till 30% inclusion level, but best response is obtained at 10% level of inclusion. It is recommended that for optimum performance, COLM should not be fed to goats for more than 4 weeks at a stretch.

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