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Effect of dietary *Thais coronata* shell on odour reduction and nitrogen output in rabbit farm

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Abstract

This work investigated the effect of integrated forage-concentrate diets with Thais coronata as additive on reducing odour and nitrogen output in rabbit production. Thais coronata shells were thoroughly washed, dried and ground to 2mm particle size. Forty-five growing rabbits were fed diets comprising 25% forage and 75% concentrate with 0%, 0.25%, 0.50%, 0.75% or 1.0% ofthe shells for two weeks in a completely randomized design (CRD) experiment. The treatments were designated T1, T2, T3, T4 and T5, respectively with 9 rabbits per dietary treatment and replicated thrice with 3 rabbits per replicate. Faeces and urine were collected and odour perception scored by 10-member panel on a 5-point scale. The mean odour perception scores of T_1 (urine =4.02, faeces=3.55) represented the strongest (P< 0.05) degree of pungency while T_4 (urine=3.05, faeces=2.76) gave the least (P<0.05) pungent odour. Average total nitrogen yield from treatment 1 (2.93g/day) was significantly higher than those from treatments 3 (2.53g/day) and 4 (2.31g/day) but similar to those from treatments 2 (2.74g/day) and 5 (2.70g/day). Inclusion of T. coronata shell at 0.75% in a forage-concentrate (T4) diet of rabbit reduces odour in rabbit production and elicits the least yield of nitrogen.

Keywords: *Thais coronata,* Odour reduction, Nitrogen output, Mitigation of greenhouse gas emission, Global warming, Climate change

Introduction

Rabbits are capable of utilizing forages and fibrous feeds not digested by other monogastrics (Aduku *et al.*, 1989) and thus represent a valuable natural resource for meeting future increases in national and international protein supply (Guzman *et al*., 2013). Use of forages especially tropical species encourages production of methane and other greenhouse gases (Archimedes *et al*., 2013; Rira *et al*., 2013). Concerns for increase in greenhouse gas emissions into the environment and their potential effects on global warming have aroused interest in developing production systems which reduce gas emissions without compromising animal productivity. Decrease in the dietary forage:concentrate ratio (that is, increase in the proportion of concentrates) in livestock diets have been reported to lower enteric methane (Bayat *et al*., 2013; Tapio *et al*., 2013). Also, manipulation of the caecal microbes and microbial fermentation through the use of feed additives is another promising approach (Alluwong *et al*., 2011; Islam *et al*., 2005). In fact, feed additives such as *Thais coronata* have been incorporated in broiler diets with positive odour reduction effects (Ukachukwu *et al.,* 2013). Therefore, an integrated approach which strikes a balance between forage:concentrate ratios and concentrate fortification with *Thais coronata* as additive will go a long way in reducing odour and nitrogen output without

compromising the productivity of rabbits. This has formed the basis for this work.

Materials and methods

Thais coronata shells were obtained from a local market in Uyo, Akwa Ibom State of Nigeria. The shells were thoroughly washed with warm water, rinsed with distilled water, air dried for 3 days and further dried in an oven at 110^0C until constant weight was attained. Thereafter, they were crushed into fine particles to achieve homogeneity; then sieved using a 2mm mesh to remove the coarser particles. In a feeding trial, 45 growing rabbits were fed diets comprising 25% forage and 75% concentrate fortified with graded levels (0%, 0.25%, 0.50%, 0.75% and 1.0%) of *Thais coronata* as T1, T2, T3, T4 and T5, respectively for two weeks in a completely randomized design (CRD) experiment. Each dietary treatment comprised 9 rabbits replicated thrice with 3 rabbits/replicate. Faecal and urine sample collection and perception scoring were done on the 5^{th}, 6^{th} and 7^{th} day and also on the 12^{th}, 13^{th} and 14^{th} day of the experimental period. The samples were stored in a deep- freezer until the time of nitrogen analysis. Perception scoring of the degree of pungency of faecal and urine odour were scored by 10 panelists on a 5 point scale namely; very strongly pungent, strongly pungent, moderately pungent, weakly pungent, and very weakly pungent, and rated 5, 4, 3, 2 and 1, respectively. Data collected were subjected to analysis of variance (ANOVA) in CRD, separating significant means by Duncan's new multiple range test using SPSS (2007) computer package.

Results

Reduction of urine odour

The degrees of pungency from the urine of rabbits fed forage plus concentrate diets fortified with graded levels of *Thais coronata* shells are presented in Table 1. There were significant ($P< 0.05$) differences among treatments in the degree of pungency from the rabbit urine. In week 1, the degree of pungency of urine from treatment 1 (4.10) was significantly ($P< 0.05$) stronger than those from the other treatments while T2 (3.53), T3 (3.17), T4 (3.07) and T5 (3.53) were similar ($P> 0.05$).

In week 2, urine odour from treatment 1 (3.93) was significantly stronger than urine from other treatments, though odour from other treatments were similar. The mean scores from weeks 1 and 2 revealed that the treatment without dietary inclusion of *T. coronata* generated the strongest ($P< 0.05$) degree of pungency while T_4 fortified with 0.75% dietary inclusion of *T. coronata* generated the least ($P<0.05$) pungent odour. This strongly indicates that inclusion of *T. coronata* shells in rabbit diets reduces the degree of pungency in their urine, with 0.75% inclusion level exhibiting the greatest ability to reduce odour. This result was in line with the result of Ukachukwu *et al.* (2013) who concluded that non activated form of *T. coronata* at 0.05% level of inclusion gave the highest odour reduction effect.

Table 1: Degree of p ungency from urine of rabbits fed forage plus concentrate diet fortified with graded levels of *Thais coronata* shells

Degree of pungency	T_1 (0%)	T_2 (0.25%)	T_3 (0.50%)	T_4 (0.75%)	T_5 (1.0%)	SEM
Week 1	4.10^a	3.53^b	3.17^b	3.07^b	3.53^b	0.09^*
Week 2	3.93^a	2.98^b	3.40^{ab}	3.03^{ab}	3.43^{ab}	0.08^*
Mean	4.02^a	3.26^{bc}	3.29^{bc}	3.05^c	3.48^{ab}	0.06^*
% Reduction	0.00	18.66	18.16	24.13	13.43	

abcd: means along the same row with same superscripts are not significantly different (p>0.05)
***= significant; ns= not significant; SEM= Standard Error of Mean**

Reduction of faecal odour

Table 2 shows the faecal odour reducing effect of diets fortified with *T. coronata* shells. The result revealed that significant differences (P< 0.05) existed among dietary treatments on the degree of pungency of the faecal samples. Treatment 1 gave the strongest (P< 0.05) degree of pungency in weeks 1 and 2, while treatment 4 gave the least degree of pungency. In week 1, treatment 1 (3.50) was statistically similar (P>0.05) to T 2 (3.30) and T5 (3.33) but differed significantly (P< 0.05) from T3 (2.83) and T4 (2.90). However, as intake of the diets extended from week 1 to 2, the faecal odour from treatment 1 became significantly (P< 0.05) stronger than all other treatments. It is obvious from the mean degree of pungency that treatment 4 (2.73) released the least pungent odour while treatment 1 gave the strongest odour (3.55) from the faeces. There were similar trends in faecal and urine odours produced. This suggests that fortifying rabbit diets with *T. coronata* shells has a strong affinity to reducing odour emanating from both urine and faeces of rabbits. This agreed with the findings of Islam *et al.* (2005) in a similar study.

Table 2: Degree of pungency from faeces of rabbits fed forage plus concentrate diet fortified with graded levels of Thais coronata shells

Degree of pungency	T_1 (0%)	T_2 (0.25%)	T_3 (0.50%)	T_4 (0.75%)	T_5 (1.0%)	SEM
Week 1	3.50^{a}	3.30^{ab}	2.83^{b}	2.90^{b}	3.33^{ab}	0.08^{*}
Week 2	3.59^{a}	2.76^{b}	2.83^{b}	2.61^{b}	2.69^{b}	0.09^{*}
Mean	3.55^{a}	3.03^{b}	2.83^{b}	2.76^{c}	3.01^{b}	0.06^{*}
% Reduction	0.00	14.09	20.28	23.10	14.93	

abcd: means along the same row with same superscripts are not significantly different (p>0.05)
***= significant; ns= not significant; SEM= Standard Error of Mean**

Nitrogen output from rabbit excreta

The urinary and faecal Nitrogen yields of rabbits fed forage-concentrate diets fortified with graded levels of *T. coronata* are shown in Table 3. There were no significant differences (P<0.05) in urine nitrogen yield from all the treatments. However, yields from treatments 1 (0.20g/day) and 5 (0.18g/day) were numerically higher while that of treatment 4 (0.14g/d) was the lowest. Faecal nitrogen yield from T_1 (2.73g/d) was significantly higher than those from T_3 (2.38g/d) and T_4 (2.17g/d) but similar (P>0.05) to those from T_2 (2.59g/d) and T_5 (2.52g/d). The total nitrogen followed the same trend with that of the faeces revealing that treatment 1 with no inclusion of *T. coronata* voided the highest quantity of nitrogen in urine and faeces, while treatment 4 containing 0.75% level of *T. coronata* yielded the least quantity of nitrogen. It has been shown that certain feed additives may reduce gaseous emissions modifying the gastrointestinal environment and the faecal chemical composition (Dinuccio *et al*., 2013).

Table 3: Nitrogen yield from urine and faeces of rabbits fed forage plus concentrate diet fortified with graded levels of Thais coronata

	T_1 (0.00%)	T_2 (0.25%)	T_3 (0.50%)	T_4 (0.75%)	T_5 (1.00%)	SEM
Urinary N (g/d)	0.20^{a}	0.15^{ab}	0.15^{ab}	0.14^{ab}	0.18^{a}	0.02*
Faecal N (g/d)	2.73^{a}	2.59^{ab}	2.38^{b}	2.17^{b}	2.52^{ab}	0.07*
Total N (g/d)	2.93^{a}	2.74^{ab}	2.53^{b}	2.31^{b}	2.70^{ab}	0.07*
% Reduction	0.00	6.49	13.65	21.16	7.85	-

abcd: means along the same row with same superscripts are not significantly different (p>0.05)
***= significant, ns= not significant, SEM= Standard Error of Mean**

Conclusion

Fortifying rabbit diets with *Thais coronata* shells at 0.75% inclusion level decreased the degree of pungency and nitrogen content of urine and faeces of rabbits.

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