Technical Note

Effect of *Tithonia diversifolia* (Hemsl.) A. Gray Inclusion on the Diet of Calves

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INTRODUCTION

The World Food Program (FAO, 2023), the International Fund for Agricultural Development, and the World Health Organization are advocating for intensive food production, so there is a need for developing sustainable agriculture. Verdecia *et al*. (2021), noted that *Tithonia diversifolia* is a widely used species for animal nutrition, and the previous knowledge about it (characteristics, benefits of the crop, and the crop's response) makes this species suitable for sustainable animal production systems in the tropics. Accordingly, the aim of this paper is to measure the effect of *Tithonia diversifolia* (Hemsl.) inclusion in the diet of calves.

DEVELOPMENT

This study was conducted at Recria No. 63 Center from the Livestock Genetic Company of Matanzas, in Guanabana, municipality of Matanzas, Cuba. A total of 80 young heads of cattle (Mambi Cuba) from both sexes were selected; the animals' average weight was 84.24 kg. The experiment was based on a completely randomized design, with two treatments (A and B), and each calf represented a replica: TA: experimental treatment: *T. diversifolia* green forage (45%) + CT-169 (55%) + mineral salts, and TB: control treatment: starter commercial feeds (45%) = 1.13 kg + CT- 169 (55%) + mineral salts.

Overall, 40 calves were selected according to their weights (regardless of sex), which had access to water *ad libitum* and were confined in the shade.

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Feed balances were performed periodically to correct any nutritional deficit. The 15 days before the valuations were considered as an adaptation to the inclusion of *T. diversifolia* forage in the experimental animals. Zootechnical management was conducted according to the guidelines of the Veterinary Medicine Institute (IMV) for calf management and feeding. The chemical composition of the feeds supplied is shown in Table 1.

Table 1. Nutritional value of the feeds supplied to the calves

Feed	DM (%)	CP (%)	CF (%)	As (%)
Starter feeds	87	21.9	18.3	16.38
T. diversifolia forage	10.17	20.56	4.82	13.77
P. purpureum forage	16.50	6.9	33.50	10.43

DM: Dry matter; CP: crude protein; CF: crude fiber; and As: ash.

Several parameters were used to measure the effects of inclusion, such as live weight (LW), and mean daily gain (MDG). These variables were processed using Stratigraphic plus, 5.0, to determine the position and variation used in the hypothesis test for comparing the treatment means every month.

Table 2 shows the effect of *Tithonia diversifolia* (Hemsl.) inclusion in the diet of calves. Both parameters underwent improvements in comparison to group TB. There was a live weight increase from March and until May ($p<0.05$). This result shows the real possibility of using *T. diversifolia* to feed growing calves and use the nutrients of the plant. Several authors (Chongo *et al*., 2010; Ruiz *et al*., 2014) have said that weight gains are not so remarkable in the initial phase, though they have a favorable evolution with animals' ages and immunological state.

The inclusion of *Tithonia diversifolia* in the diet raises DM levels, favors feed digestibility, and improves protein levels, among other aspects (García *et al*., 2022).

Table 2. Live weight and mean daily gain behavior in calves after the inclusion of *T. diversifolia* in their diet

Parameter-live weight (kg)				Sig.
Period evaluated	**Treatment A**	**Treatment B**		
January	84.22	84.22	0.06	$p\geq 0.05^{N.S.}$
February	84.36	84.32		
March	98.33^{a}	94.92^{b}	0.06	$p<0.05^{**}$
April	107.22^{a}	102.02^{b}		
May	116.24^{a}	109.26^{b}		
Parameter-mean daily gain (g/animal/day)				
	Treatment A	**Treatment B**	0.06	$p<0.05^{**}$
	350^{a}	250^{b}		

a,b: unequal scripts on the same row differ significantly for p <0.05 (Duncan 1955). * p < 0.05.

Arguello *et al*. (2021) evaluated the use of supplementation using forage shrubs (*Tithonia diversifolia* (Hemsl.) A. Gray, *Gliricidia sepium* (Jacq.) Kunth, *Cratyla argéntea* (Desv.) Kuntze y *Crescentia cujete* L) to weaned calves (BON x Zebú), though their results did not show any differences as to MDG. Therefore, the inclusion of *T. diversifolia* in the diet of animals should be

considered suitable. Lamela *et al*. (2022) evaluate the use of feedstuffs with Morus. *Alba* L *and T. diversifolia* meal In young fattening bulls, and found no differences between LW and MDG and the group that consumed *Glycine. Max* (L.) Merr. However, it means a reduction in costs under the conditions of Cuba.

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AUTHOR CONTRIBUTION STATEMENT

Research conception and design: YLM, GMF, IPE; data analysis and interpretation: YLM, GMF, IPE; redaction of the manuscript: YLM, GMF, IPE.

CONFLICT OF INTEREST STATEMENT

The authors state there are no conflicts of interest whatsoever.