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**RESIDUAL FORAGE AND ANIMAL PERFORMANCE FROM A KIKUYO PASTURE  
UNDER MIXED GRAZING AND SUPPLEMENTATION.**

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**Abstract**

Five grazing strategies were compared: grazing by ewes only and mixed grazing (ewes + heifers), in mixed grazing heifers received no supplement or one of three supplements. Ruminal undegradable protein (RUP) varied among supplement: 4.25, 9.11 and 9.13%, the supplement with the highest RUP included protected methionine. All supplements were 21% crude protein and 3.0 Mcal/kg of metabolizable energy. Grazing was on kikuyu, ratio was 30 kg of ewe per 100 kg of heifer in the mixed grazing treatments. Experimental grazing lasted 84 days. Variables measured were residual forage, proline content in residual forage and liveweight gains per animal and per hectare. Experimental design was a completely random with two replicates. Residual forage was the highest ( $P<0.05$ ) in mixed grazing and RUP in supplement was above 4.25%. The highest ( $P<0.05$ ) proline content was found in grazing by ewes only, 52% above the proline content found in mixed grazing without supplement, when heifers received supplement proline content decreased ( $P<0.05$ ) further. Grazing by ewes only and mixed grazing with heifers receiving the highest RUP in supplement showed the highest ( $P<0.05$ ) daily liveweight gain per

ewe of 134 g. Mixed grazing in which heifers received no supplement gave a 100% increase ( $P < 0.05$ ) in liveweight gain per hectare compared to grazing by ewes only. In mixed grazing offering a supplement with 9.13% RUP and protected methionine gave both the highest liveweight gains per animal and per hectare. It was concluded that mixed grazing allowed a lower stress level on kikuyu due to defoliation and a higher liveweight gain per hectare than grazing by ewes only.

**Keywords:** Proline content, ruminal undegradable protein, ewes, heifers.

### **Introduction**

Kikuyo (*Pennisetum clandestinum*) has proven to be a reliable forage resource on marginal lands of temperate highlands of México. High forage utilization during the rainy season is one way to take the best advantage of Kikuyo pastures. However, animal production on per animal basis tends to be moderate as forage quality turns to be limiting (Orozco *et al*, 1997). Mixed grazing and supplementation can become a management tool to achieve high forage utilization without a large negative impact on production per animal (Nolan, 1980; Pulido and Leaver, 1997). Then, the objective of this study was to determine amount of residual forage, level of plant stress and live-weight gain from a Kikuyo pasture under mixed grazing (ewes and heifers) and supplementation of heifers.

### **Material and Methods**

Five treatments were compared: grazing by ewes only and the other four were mixed grazing: ewes+heifers. Within mixed grazing treatments heifers received no-supplement, or one of three supplements varying in the proportion of ruminal undegradable protein (RUP) and

protected methionine. Experimental design was a completely random with two replicates, experimental unit was a Kikuyo pasture with six ewes (ewes only) or a Kikuyo pasture with six ewes and four heifers (mixed grazing). Experimental grazing lasted 84 days (two grazing cycles), rotational grazing with 7-day occupation and 35-day rest was followed. Paddock size was variable as to always keep a 7% daily herbage allowance in all treatments. Ewes and heifers were on pasture 8 hours/day, the rest of the time they were kept in pens. Water was available on pasture and in the pens. Before going to the pasture heifers were offered in individual pens 1.7 kg DM of the supplement for two hours. Supplements were composed of: (a) corn (84%) + cane molasses (12%) + urea, 45%N (4%); (b) corn (79.25%) + cane molasses (12%) + urea, 45%N (2%) + blood meal (6.75%); or (c) corn (79.24%) + cane molasses (12%) + urea, 45%N (2%) + blood meal (6.75%) + protected methionine (0.01%). Supplements were 21% crude protein and 3.0 Mcal/kg metabolizable energy. Estimated ruminal undegradable protein were 4.25, 9.11 and 9.13% for the urea only, urea + blood meal and urea + blood meal + protected methionine supplements, respectively. At the start of the experiment the ratio in mixed grazing treatments was 30 kg of ewe per each 100 kg of heifer. All animals were weighed every 14 days, before leaving the pens and the offering of the supplement. Variables measured were: residual forage, proline content (Bates *et al.*, 1973) in residual forage, average daily liveweight gain in ewes and heifers and liveweight gain (ewes + heifers) per hectare. Residual forage was determined by cutting to ground level all the forage within a 20X30 cm sampling unit, which was located at random four times in each paddock. Pasture measurements were analyzed by grazing cycle.

## **Results and Discussion**

In both grazing cycles, residual forage showed no difference ( $P>0.05$ ) between ewes only and mixed grazing without supplement or supplement with urea (Table 1). Residual forage

increased ( $P<0.05$ ) when heifers received higher proportion of RUP in the supplement. The increase in RUP in the supplement given to heifers brought some substitution of forage for supplement, and a higher ratio of ewes to heifers would be needed as to keep high forage utilization. Though, residual forage was similar between ewes only and mixed grazing without supplement, the stress level, as measured by proline content, imposed by these two treatments on Kikuyo plants was different ( $P<0.05$ ). On the average, for both grazing cycles, ewes only gave a 52% higher proline content than mixed grazing. The proline content decreased further if supplement was offered and even more if the supplement contained higher RUP content, the lowest proline content was found in control plants outside of the pasture area. Mixed grazing and supplement showed an additive effect on lowering the stress level on Kikuyo plants due to defoliation.

Ewes only and ewes+heifers with blood meal and methionine gave the highest ( $P<0.05$ ) daily live-weight gain in ewes, on the average for both treatments it was 134 g/day (Table 2). The ewes that grazed with heifers without supplement showed a daily liveweight gain 46% lower than the ewes that grazed alone. Daily liveweight gain in heifers increased ( $P<0.05$ ) when supplement was given up to a maximum gain of 759 g/day when the supplement included blood meal and protected methionine. Mixed grazing with no supplement gave a 100% increase in liveweight gain/ha compared to ewes only, further increases came from the offering of supplement to heifers up to a maximum liveweight gain/ha of 265 kg obtained when the supplement had the highest RUP content and protected methionine. This treatment was able to yield both the highest daily liveweight gain/animal and liveweight gain/ha.

Mixed grazing (ewes + heifers) gave similar pasture utilization, lower stress on Kikuyo plants and ewes daily liveweight gain, and higher live-weight gain/ha than grazing only by ewes. Mixed grazing where heifers received RUP and protected methionine in the supplement increased

both liveweight per animal and per hectare but decreased pasture utilization compared to mixed grazing without supplement, when both herbage allowance and the ratio of ewes: heifers are kept the same.

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**Table 1** - Residual forage and proline content in Kikuyo under mixed grazing and supplementation

Grazing treatment	Supplement type	Residual forage (kg/ha)		Proline content (ng/g)	
		Grazing cycle		Grazing cycle	
		1 <sup>st</sup>	2 <sup>nd</sup>	1st	2nd
No grazing				1.6 e <sup>1</sup>	1.4 d
Ewes only	None	1300 c	1273 b	12.1 a	15.2 a
Mixed	None	1035 c	1100 b	8.6 b	9.4 b
Mixed	Urea	1224 c	1121 b	6.6 c	9.6 b
Mixed	Urea+Blood	2231 b	2101 a	3.9 d	5.3 c
Mixed	Urea+Blood +Methionine	2859 a	2216 a	3.2 d	4.9 c
C.V. (%) <sup>2</sup>		11.7	18.8	12.0	13.1

1. Means within columns followed by same letter are not different ( $\alpha = 0.05$ , Tukey).
2. Coefficient of variation.

**Table 2** - Liveweight gain per animal and per hectare under mixed grazing and supplementation

Grazing treatment	Supplement type	Gain: g/head/day		Gain:Kg/ha/84days
		Ewes	Heifers	
Ewes only	None	143 a <sup>1</sup>	---	60 d
Mixed	None	77 b	313 c	120 c
Mixed	Urea	81 b	450 b	160 bc
Mixed	Urea+Blood	83 b	519 b	180 b
Mixed	Urea+Blood +Methionine	124 a	759 a	265 a
C.V. (%) <sup>2</sup>		37	20	44

1. Means within columns followed by same letter are not different ( $\alpha = 0.05$ , Tukey).

2. Coefficient of variation.