

Cattle diet composition under a short- duration grazing with and without deferment in puna rangelands

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Abstract. The treatments of rest and deferment periods have shown to be effective tools to improve range condition, but little is known about their effect on the diet of animals. The present research aimed to evaluate the effect of the deferment period when applied to a short-term grazing system. The experimental design was a completely random factorial where the treatments resulted from combination of two grazing management systems: short-duration with deferment period (WD) and no deferral period (ND) both evaluated for three years. Forage yield (4.9 vs. 4.5 Tm DM ha⁻¹ year⁻¹) like range condition (55.5 vs. 50.7%) improved significantly (P<0.05) under a deferment period regime, unlike diet quality that decreased, evidenced by a low in vitro dry matter digestibility level (40.6 vs. 45.7 %), a higher neutral detergent fiber content (79.0 vs. 74.6 %) and a lower crude protein content (10.0 vs. 11.4%). We conclude deferment period treatments improved rangeland condition and forage availability but not the quality of the diet.

Introduction

Grazing management is a low-cost and low-risk alternative to improve range condition, forage yield, and carrying capacity. This advantageous capacity can be empowered by the application of a rest and deferment periods (Waterman y Vermeire 2011). Rangeland researchers have proposed that one of the main disadvantages of postponing grazing until plant species have matured and disseminated their seeds is that forage quality will be low when animals enter the paddock and decrease over time (Olson *et al.* 1989). In the past, deferment period treatments have been applied in native prairies under a low frequency and high-intensity grazing scheme, but information regarding its effect on vegetation structure and its interactions with the opportunity of selection and the resulting diet quality in short-duration grazing is scarce. The objective of this study was to evaluate the effect of deferment period when applied in a simulated short duration grazing system (01 herd – 21 paddocks) in a high-mountain range site grazed by cattle.

Study Area and Research Methods

The present study was performed in a humid tussock grassland area dominated by the species *Festuca humilior* – *Plantago tubulosa* – *Calamagrostis spicigera*, with a vegetation cover of 86%, 5% of plant litter and little presence of bare soil patches 9%. The experimental treatments were short duration grazing with application of a deferment period and no deferral period. The deferment period was applied consecutively for the three years of study with the purpose to improve range condition and forage yield. The grazing scheme considered 3 days of grazing and 60 days of rest, a carrying capacity of 0.4 AU/ha/year and a grazing stock density of 8.4 AU/ha. Range condition was determined based on the percentage of desirable plant species, vegetation cover and the plant vigor of key species (Flórez y Malpartida 1980) and forage yield was estimated by cutting and manual segregation (Austin *et al.* 1983). Diets were obtained by hand simulation method after the deferment was concluded and at the beginning of the grazing period using four heifers in three specific moments, late rainy season, dry season and early rainy season (Quispe *et al.* 2021). The nutritional value of the diet was estimated from the neutral detergent fiber (Van Soest 1963), in vitro dry matter digestibility (Tilley y Terry 1963) and crude protein content (AOAC 1984). The experimental design was a completely random factorial which include 2 grazing management systems x 3 years with two experimental paddocks of 1250 m² per treatment.

Results and Discussion

Forage Availability and Range Condition

The results showed that rangeland condition and forage yield improved due to the effect of the deferral ($P < 0.05$) as shown in Table 1, opening up the opportunity for animals selecting a better-quality diet (Da Trindade *et al.* 2012), given the concomitant increase in forage allowance when the stocking rate remains constant and forage availability increases. The levels of increase in forage yield and range condition, due to the deferral, occurred, however, at relatively slow rates (Tácuña *et al.* 2021) perhaps due to the limitations imposed by the semiarid climate of the Puna, characterized by low and variable temperatures (Martínez *et al.* 2011)

Table 1. Range Condition and Forage Yield

Attribute	Short-Duration				Short-Duration + Deferment period			
	2016	2017	2018	\bar{X}	2016	2017	2018	\bar{X}
Range Condition (%)	48.1	50.8	53.1	50.7^b	52.3	55.8	58.3	55.5^a
Aboveground Biomass (kg DM/ha/year)	4,641.8	5,165.0	6,385.8	5397.5^a	4,526.3	5,860.0	6,582.0	5656.1^a
Forage Species (%)	81.0	84.0	87.0	84.0^a	86.0	87.0	89.0	87.3^a
Forage Yield (kg DM/ha/year)	3,759.8	4,338.6	5,555.6	4551.3^a	3,892.6	5,098.2	5,858.0	4949.6^a

Different letters in each row reveal differences between treatments ($p < 0.05$)

Diet Nutritional Quality

The diet of the animals when entering the differed paddocks were of lower quality than those under short duration grazing as evidenced by the lower in vitro dry matter digestibility, a higher content of neutral detergent fiber, and lower crude protein content of the diets (Table 2). Nonetheless the nutritional values were superior to those considered critical for animal nutrition (NASEM 2021). A characteristic of Andean native grasses is their low nutritional value which declines rapidly with the advance of maturity (Rodríguez *et al.* 1986). Their cell wall content is quite high, markedly limiting forage intake to lower levels, below 2 % body weight (Flores *et al.* 2006); thus, grazing at the appropriate time and assigning an adequate level of forage per animal, constitutes a fundamental task in order to maximizing animal production.

Table 2. Chemical Composition of Cattle Diet

Chemical Composition	Short-Duration				Short-Duration + Deferment period			
	2016	2017	2018	\bar{X}	2016	2017	2018	\bar{X}
IVDMD (%)	41.1	45.9	50.0	45.7^a	45.5	36.3	40.2	40.6^b
NDF (%)	76.9	76.4	70.5	74.6^b	81.3	78.5	77.1	79.0^a
CP (%)	10.6	12.3	11.2	11.4^a	8.1	10.6	11.2	10.0^b

Different letters in each row reveal differences between treatments ($p < 0.05$)

Conclusions

The deferment period treatment improved forage yield and range condition without markedly reducing the quality of the diet below levels considered critical for animal nutrition. Factors associated with the level of forage allocation and selection opportunity, when forage availability increased, would have played a role in decreasing forage quality. We recommend not failing to take into account the role of forage allocation and grazing pressure on the nutritional response when researching on grazing systems.

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