



## Growth rates of natural grassland, improved natural grassland and cultivated pasture in six locations in highland of Santa Catarina State <sup>1</sup>

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<sup>1</sup>Work supported using the fund to support Santa Catarina research (Fapesc)

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**Resumo:** A taxa de acumulação de matéria seca (A.RATE) de forragem é fundamental para o manejo de pastagens. O objetivo deste trabalho é avaliar as taxas de acumulação diária da pastagem natural (NG), pastagem natural melhorada (ING) e pastagem cultivada (CP) em seis locais do planalto catarinense. Foram instaladas 15 unidades observação em propriedades particulares em áreas que variam de 1,5 a 10 ha, no outono de 2012, nos municípios de São José do Cerrito (SJC), Capão Alto (CA), Lages (L), Paineis (PA), Bom Jardim da Serra (BJS) e São Joaquim (SJ). As espécies introduzidas foram: Centeio, aveia branca, azevém, trevo branco, trevo vermelho, datilo capi, lanudo e cornichão. Foram avaliadas as ARATES por meio da técnica de alocação de gaiolas emparelhadas de exclusão ao pastejo de janeiro de 2014 a fevereiro de 2015. O manejo do pastejo foi realizado visando a manutenção de uma altura e massa residual em torno de 8 cm e 1500 kg de MS. Foram utilizados bovinos de corte com peso médio que variou de 130 a 450 kg. Em SJC são observadas as maiores A.RATES em todas as pastagens e em todas as épocas avaliadas. As menores A.RATES foram encontradas nos meses de inverno em BJS e SJ, o que se recomenda o uso de ING e principalmente de CP no planejamento forrageiro das propriedades rurais destas regiões.

**Palavras-chave:** espécies hibernais, sobressemeadura, adubação, manejo de pastagem.

**Abstract:** The accumulation rate expressed in kg of dry matter (A.RATE) is fundamental to the management of pastures. The aim of this study is to evaluate the daily accumulation rates of natural grassland (NG), improved natural grassland (ING), and cultivated pasture (CP) in six locations in the Santa Catarina highlands. In the fall of 2012, fifteen observation units were installed on private properties in areas ranging from 1.5 to 10 ha, in the municipalities of São José do Cerrito (SJC), Capão Alto (CA), Lages (L) Paineis (PA), Bom Jardim da Serra (BJS) and São Joaquim (SJ). The species introduced were: rye, oat, ryegrass, white clover, red clover, dactyl, meadow soft grass and birdsfoot trefoil. We evaluated the A.RATES through a paired cages allocation technique with grazing exclusion from January 2014 to February 2015. The grazing management maintained a high and residual mass of around 8 cm and 1500 kg DM. Beef cattle were used with an average weight ranging from 130 to 450 kilograms. SJC had the largest A.RATES that were observed in all pastures and during all periods. Smaller A.Rates were found in the winter months in BJS and SJ therefore the use of ING and especially CP forage in the planning of rural properties in these regions is recommended.

**Keywords:** accumulation rate, cool season species, pasture management, overseed

### Introduction

The base of pasture management starts with the correct adjustment of stocking rates. For this, the manager needs knowledge of parameters such as the available forage mass. This parameter can be expressed in a simplified manner through its relationship with the height, with the number of days of occupancy of pickets, and especially with the growth rates of pastures. Among the parameters, the daily accumulation rate is the one which has the strongest relationship with primary and secondary production of pastures. At the same time, it is the parameter that is most difficult to measure and has high variability in results. This is due to a number of factors related to climate (ex. precipitation, temperature, light), soil (eg. physical and chemical), and pasture (management, structure, mono or multi-specific). The highlands region of Santa Catarina is characterized by a wide variability of very specific local soils and microclimates. According to the Brazilian System of Soil Classification (EMBRAPA, 1999), there is a predominance of Cambissolos, Litholic Neosols and Nitossolos, with Oxisols, Ultisols and Gleysols also occurring, and there are steep slopes, rocky outcrops and a shallow arable layer. The climate is subtropical humid, without dry seasons, with mild summers, with an average annual temperature of 13.6 oC and rainfall around 1600 mm, which is well-distributed throughout the year (Ritter & Sorrenson, 1985). The grasslands have a high variability in landscape scale, differing in the cities studied. This is due to soil variability, the altitudinal gradient and the management history



## 52ª Reunião Anual da Sociedade Brasileira de Zootecnia

Zootecnia: Otimizando Recursos e Potencialidades

Belo Horizonte – MG, 19 a 23 de Julho de 2015



of the area. The aim of this study is to evaluate the daily accumulation rates of natural grassland, improved natural grassland, and cultivated pasture in six sites representing the Santa Catarina highlands. These data will be used to assist in pasture management recommendations for technical and local producers.

### Material e Methods

In the fall of 2012, fifteen observation units (OU) were installed on private properties in areas ranging from 1.5 to 10 ha. The municipalities are São José do Cerrito (SJC), Capão Alto (CA), Lages (L) Paineis (PA), Bom Jardim da Serra (BJS) and São Joaquim (SJ), in order to represent the climate and the soil of the different regions of the Santa Catarina highlands. Observations were carried out on natural grassland (NG) and improved natural grassland (ING) in PA, L, and BJS. The municipalities of SJC, CA and SJ have added winter cultivated pasture (CP). The evaluation period was from January 2014 to February 2015. The correction of fertility was based on soil analysis of ING and CP. The species introduced were: rye (*Secale cereale*) oat (*Avena sativa*), ryegrass (*Lolium multiflorum* Lam), white clover (*Trifolium repens*), red clover (*Trifolium pratense*), dactyl (*Dactylis glomerata*) meadow soft grass (*Holcus lanatus*) and birdsfoot trefoil (*Lotus corniculatus*). The daily accumulation rates of dry matter were evaluated (A.RATEs) by means of a paired cages allocation technique with grazing exclusion (Klingman et al., 1943). Three grazing exclusion cages were used in each OU. The grazing management of the OU was conducted by producers for the maintenance of a high and residual forage mass around 8 cm and 1500 kg DM. Steers or beef heifers were used with an average live weight ranging from 130 to 450 kg throughout the year. In January 2015 new soil analyses were conducted in each OU, in order to aid with the data found in the accumulation rates.

### Results and Discussion

The soil analyses that were carried out in the six locations are presented in Table 1. The low fertility of NG is clear, with critical levels of primarily phosphorus, and with a large presence of exchangeable aluminum (Al), which is characteristic of this region. The PA producer uses the fertilizer NG, which explains the fertility levels found. Two years after the implementation of ING it is possible to observe that there was still the presence of Al in the soil in the regions of PA, SJ and BJS. These regions are characterized by the largest soil and climate limitations to crop production, especially in SJ and BJS. These municipalities are in the regions of the country that have the lowest annual temperatures. In addition, there is high rainfall, low light and high content of organic matter in the soil. These factors, combined with the presence of Al in these municipalities, indicate that the current recommendation of using a liming that is one-quarter of the doses for winter perennial crops may be insufficient for the persistence of introduced species in ING. The A.RATEs for each municipality in each season are shown in Figure 1. In the autumn, ING and CP have not been evaluated in the city of SJC because the reintroduction of winter species was carried out by the producer. Also, this is the only municipality in which NG is actually naturalized grassland, with a predominance of *Axonopus compressus*, which came about during the replacement of forests in the 1940s. It must be emphasized that this region is the one with the smallest soil and climatic limitations of the highlands and the producer tends to invest in inputs. In this municipality, the largest A.Rates are observed in all pastures and in all periods. It is worth mentioning that the ING and the CP A.RATEs in SJC are higher in winter than the summer rates of other municipalities.

Table 1. Soil analysis of natural pasture (NP), improved natural pasture (INP) and cultivated pasture (CP) in six local in highlands of Santa Catarina.

Pasture	City	% Clay	pH water	SMP	P	K	M.O	Al	Ca	Mg
ING	BJS	35,2	5,4	5,3	6,2	120	5,9	1,1	4,2	2,6
ING	CA	43,5	5,6	5,6	5,7	143	6,1	0	6,95	3,5
ING	L	43	5,1	4,9	8,7	258	6,2	2	4,1	2,55
ING	PA	43,5	6,1	6,0	8,3	122	5,4	0,0	8,3	3,8
ING	SJ	45,5	5,1	4,9	22,3	188	6,2	3	4,8	2,5
ING	SJC	30	6,1	6,0	16,9	101	4,8	0	8	3,5
NG	BJS	39	5	4,7	2,1	147	6,7	2,5	3,1	1,2
NG	CA	46	4,9	4,8	3,4	272	5,9	3,5	3,1	1,1
NG	L	47,5	4,8	4,5	2,3	162	6,5	4,5	1,5	0,8
NG	PA	34,5	5,5	5,3	16,7	184	6,1	0,0	7,8	2,7
NG	SJ	34	4,6	4,3	3,1	102	7	7,25	1	0,35
NG	SJC	50,5	5,8	5,75	3,5	216	5,45	0	8,05	3,55
CP	CA	42	5,7	5,8	4,2	127	5,7	0	8,85	4,45
CP	SJ	40	5,5	5,4	31,9	210	6,3	0	7,9	3,4
CP	SJC	33,5	6,5	6,5	10	270	5,9	0	10	5

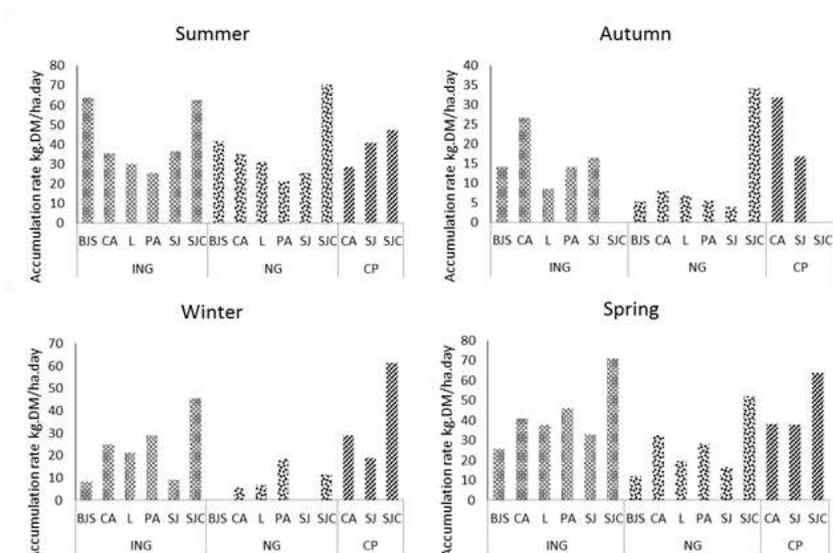


Figure 1. Accumulation rate (kg.DM/ha.day) of natural grassland (NG), improved natural grassland (ING) and cultivated pasture (CP) in six different locals in the highlands in Santa Catarina State.

The smaller A.RATEs were found in the winter months in BJS and SJ. During this period, the NG paralyzes its growth and ING has A.RATEs below 10 kg.DM/ha.day. Taking into account the consumption of 9 kg.DM/ha.day (NRC, 1996) for an adult cow with 450 kg of live weight during pregnancy, and that this animal requires 2.5 to 3 times their intake capacity, then stocking rates in those regions should not exceed 0.5 UA.ha in winter. However, with the adoption of technologies such as NG deferral and ING, allied with CP areas, it becomes possible to reduce seasonal pasture production in this region. With a feed planning of the entire property in BJS, Pinto et al., (2014) showed that it is possible to maintain a system of breeding at two years, stocking rates at around 0.7 UA.ha, with rates approaching the goal of one calf /cow /year.

### Conclusions

In the regions of PA, BJS and SJ a greater number of cover fertilization studies is recommended, especially regarding the use of limestone for the implementation of ING. In addition, it is always recommended to adopt CP as a way to supplement the feed balance in these regions. In the regions of L, SJC and CA the implementation of ING areas is recommended to meet the dietary deficiencies in the winter.

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