



Effect of drought on performance in continuous grazing with breaks with and without inclusion of a rotational grazing module systems.

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Abstract

Rangelands are the mainstay of cattle and sheep systems in Uruguay. The current demand for global results from different grazing systems puts pressure on the generation of new knowledge. In this context, spring droughts in Uruguay are one of the most relevant challenges for livestock farmers. The objective of the following work is to evaluate the impact of drought on a continuous grazing with breaks with and without inclusion of a rotational grazing module system. The study was conducted during the 2021/2022 and 2022/2023 seasons, with the former encompassing a spring drought and the latter a severe spring and summer drought, examined two grazing systems: continuous grazing with breaks (CG) and continuous grazing with breaks plus rotational grazing module (CGR). The results showed that Aboveground Net Primary Productivity (ANPP) decreased by about 12% in both groups. The Meal Plate Index (MPI), an index that relates available grazing to the grazing required for optimal animal performance, decreased by 13% in CG and 7% in CGR. Grass Availability (GA) also decreased by 15% and 4% for CG and CGR respectively. The proportion of pasture greater than 5 cm (PRG5) decreased from 19% to 12% for CG and increased from 26 to 33% for CGR for both seasons. The main differences are that CGR maintains Meat Production (MP) (105-107 Kg per hectare) and Efficiency per Stock Unit (MPES) (133-132 kg). On the other hand, CG was not able to maintain its MPES (144-128 kg), which decreased by 12%. For CG, 9 out of 12 were negatively affected, resulting in a 22% decrease of MP. Within CG, the least affected had values of PRG5=16 and MPI=0.72, while the most affected had values of PRG5=7 and MPI=0.6. The severe drought had a differential impact on systems, CGR group showed improved levels of grass indicators and reduction in the negative impact on MP and MPES.

Introduction

Rangelands are the mainstay of cattle and sheep systems in Uruguay. The current demand for information on the overall results obtained from the different grazing systems is putting pressure on the generation of new knowledge, FPTA 356 proyect (e.g. Singh, pers. comment.). In this context, spring droughts in Uruguay are one of the most relevant challenges for livestock farmers. The objective of the following work is to evaluate the impact of drought on a continuous grazing with breaks with and without inclusion of a rotational grazing module system.

Methods

The study was conducted during the 2021/2022 and 2022/2023 seasons, with the former encompassing a spring drought and the latter a severe spring and summer drought, examined two grazing systems: continuous grazing

with breaks (CG) and continuous grazing with breaks plus rotational grazing module (CGR). We work with 19 cattle and sheep ranches (average 1300 hectares) that were part of the FPTA N° 356 (Pereira Machin, 2020) pasture management project implemented by the Instituto Plan Agropecuario (IPA). The six outputs or index that were analyzed were: 1 - Aboveground net primary productivity (ANPP) expressed in kg DM. The ‘Paddock Monitoring’ module allow updating the status of the paddocks, as well as displaying the following outputs or global forage performance indicators of the establishment; 2 - Grass Availability (average stock in kg DM per hectare that the establishments have at a given time). 3 - Meal Plate Index (MPI), an index elaborated in the FPTA-INIA Project No. 345 (Duarte, 2020), this index is the result of comparing the forage or grass available in the establishment, with the one that should be available for an optimal performance of the livestock. The result is expressed in decimals, MPI value 1 means that the available grazing area is equal to that needed, while lower or higher values show shortages or surpluses. 4 - Proportion of area available for grazing at different height ranges (*i.e.* generated from the proportion of area at three height ranges), this variable is represented by the following three indicators: Proportion of area with forage height; ‘less than 2.5 cm’ (PGR-2.5), ‘between 2.5 and 5 cm’ (PGR2.5To5) and ‘greater than 5 cm’ (PGR5). In order to assess the performance of pasture management, it was necessary to develop an indicator to describe pasture management (Lombardo, 2023). 5 - Meat Production (MP) in Kg per hectare / year, and 6 - Efficiency per Stock Unit (MPES) expressed in kg of meat produced per kg of live weight maintained in the system.

Results

The results showed that Aboveground Net Primary Productivity (ANPP) decreased by about 12% in both groups. The Meal Plate Index (MPI), an index that relates available grazing to the grazing required for optimal animal performance, decreased by 13% in CG and 7% in CGR. Grass Availability (GA) also decreased by 15% and 4% for CG and CGR respectively. The proportion of pasture greater than 5 cm (PRG5) decreased from 19% to 12% for CG and increased from 26 to 33% for CGR for both seasons. The biggest differences are in this indicator, CG decreased by 7 percentage points (37 % overall) while CGR increased by 27 % overall, which shows the capacity to provide pasture in both systems. The results show that in the 2021-2022 season, the majority (14/19) of the ranches maintained PGR5 with values above 15%. In 2022-2023, only 9 of the 19 were able to maintain this condition. In the same direction, the main differences are that CGR maintains Meat Production (MP) and Efficiency per Stock Unit (MPES). For this analysis we can look at that CGR systems have the best values for grass use efficiency (MPES), linked to improved values of GA, MPI, PRG5, MP.

Table 1. Results outputs of CG and CGR in two seasons

	CG		Difference in %	CGR		Difference in %
	2021-2022	2022-2023		2021-2022	2022-2023	
ANPP (KgMS/ha/year)	4980	4400	-12%	4690	4150	-12%
MPI [0 To 1.2]	0,77	0,67	-13%	0,74	0,69	-7%
GA (KgDM/ha)	871	736	-15%	997	959	-4%
PGR5 (%)	19	12	-37%	26	33	27%
MP (Kg/ha/year)	99	87	-12%	106	107	1%
MPES (Kg/Stock Unit)	145	128	-12%	134	133	-1%

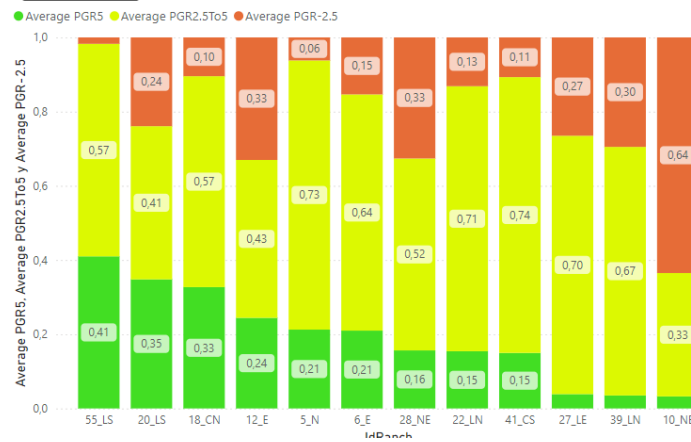


Figure 1. Proportion of area with forage height; ‘less than 2.5 cm’ (PGR-2.5) in red, ‘between 2.5 and 5 cm’ (PGR2.5To5) in yellow, and ‘greater than 5 cm’ (PGR5) in green by CG in 2021/2022.

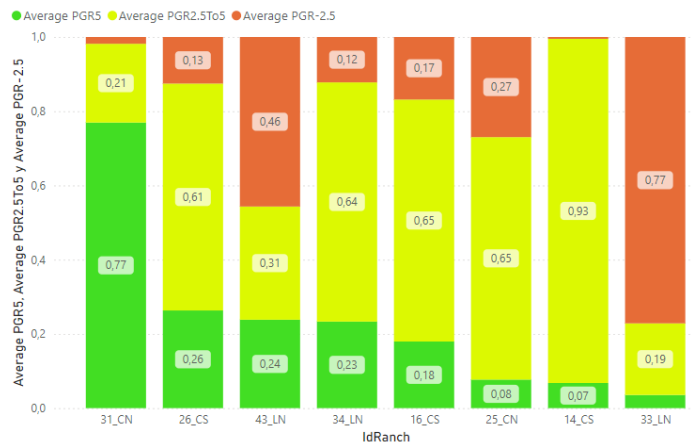


Figure 2. Proportion of area with forage height; ‘less than 2.5 cm’ (PGR-2.5) in red, ‘between 2.5 and 5 cm’ (PGR2.5To5) in yellow, and ‘greater than 5 cm’ (PGR5) in green by CGR in 2021/2022.

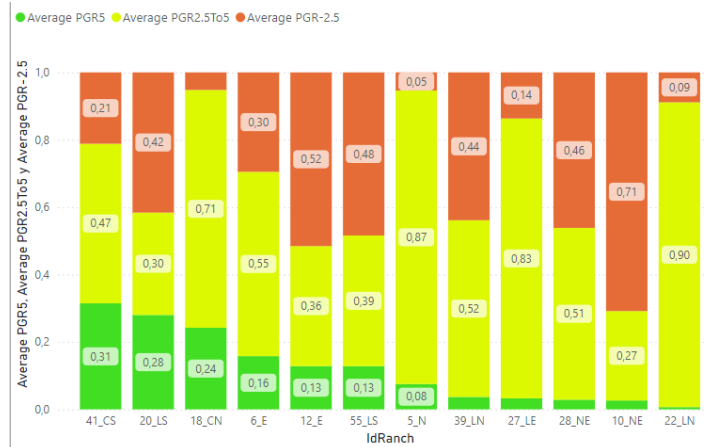


Figure 3. Proportion of area with forage height; ‘less than 2.5 cm’ (PGR-2.5) in red, ‘between 2.5 and 5 cm’ (PGR2.5To5) in yellow, and ‘greater than 5 cm’ (PGR5) in green by CG in 2022/2023.

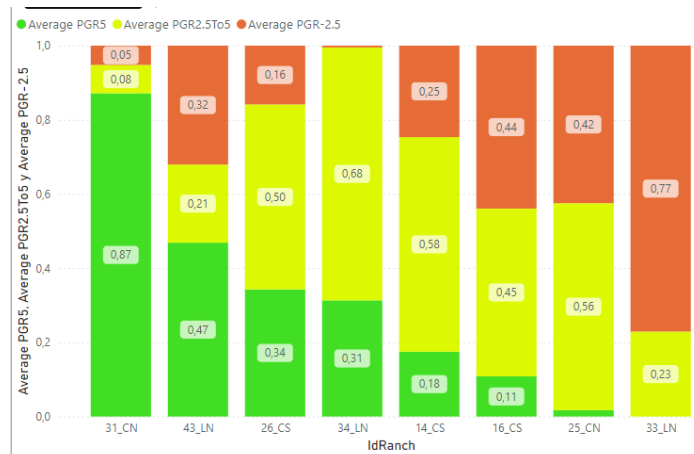


Figure 4. Proportion of area with forage height; ‘less than 2.5 cm’(PGR-2.5) in red, ‘between 2.5 and 5 cm’(PGR2.5To5) in yellow, and ‘greater than 5 cm’(PGR5) in green by CGR in 2022/2023.

Discussion

CG was not able to maintain its MPES (144 -128 kg), which decreased by 12%. For CG, 9 out of 12 ranches were negatively affected, resulting in a 22% decrease MP. Within CG, the least affected had values of PRG5=16 and MPI=0.72, while the most affected had values of PRG5=7 and MPI=0.6. The severe drought had a differential impact on systems, CGR group showed improved levels of grass indicators and reduction in the negative impact on MP and MPES. CGR systems had higher grazing efficiency and productive performance, they also provided higher quantities of forage. The originality of the indicators used (PRG’s) does not yet allow for comparison with local research carried out.

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