PERENNIAL FORAGE GRASSES RESPONSE TO DEFICIT IRRIGATION AS AN ALTERNATIVE FOR WATER-LIMITED CONDITIONS OF SOUTHERN CHILE

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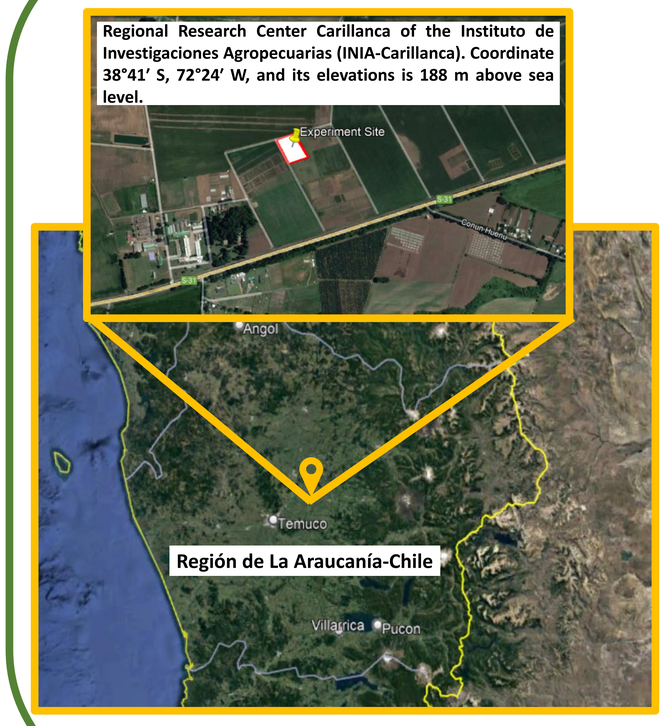
INTRODUCTION

Perennial grasses are an important pasture forage source for animal production industry around the world. The lack of persistence has been a problem due to low survival of plants caused mainly by biotic and abiotic factors, type of genotype, and agricultural managements (Nie et al. 2008; Neal et al. 2009). The survival of perennial grasses may be moreover reduced due to changes in the quantity, distribution and frequency of rainfall patterns, and extreme heat events during maximum water demand period (López-Olivari and Ortega-Klose 2020). A possible alternative is the incorporation of deficit irrigation (DI) concept, where it could be applied in zones with under water limited conditions. The purpose of this study was to evaluate the response in dry matter production (DMP) and irrigation water use efficiency (IWUE) under different levels of water stress on perennial temperate grasses.

METHODS AND STUDY SITE



- Seven perennial varieties/species of grasses: *Bromus valdivianus* Phil, *Lolium perenne* L., *Festuca arundinaceae* Schreber, and *Dactylis glomerata* L..
- Four irrigation water treatments: T1 (full irrigation), T2 (80% of T1), T3 (60% of T1) and T4 (rainfed).
- Volumetric soil moisture sensors were used to monitor the frequency and time irrigation.
- Strip-plot statistical design with 7x4 factorial arrangements and three repetitions were used.
- Measurements: Forage yield (FY, kg DM/ha) and irrigation water use efficiency (IWUE, kg DM/m^3).
- Analyses of variance (ANOVA) and mean comparison (Tukey's HSD test at $p \leq 0.05$). One year evaluation, data presented of third and fourth cuts.

RESULTS AND DISCUSSION

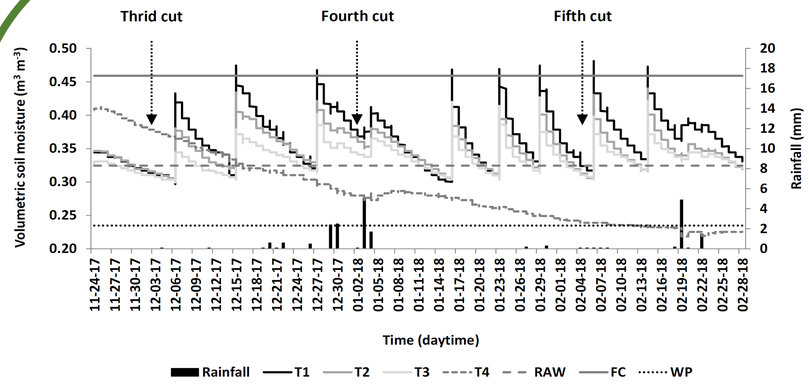


Figure 1. Daytime variation of volumetric soil moisture and rainfall measured during the maximum atmospheric demand for the season 2017/2018. T1: full irrigation, T2: 80% of T1, T3: 60% of T1 and T4: rainfed. The RAW is the readily available soil water ($p * TAW$). FC is soil moisture at field capacity, and WP is soil moisture at permanent wilting point.

- Deficit irrigation (DI) technique could be an alternative to improve the water use efficiency, water productivity and the marginal irrigation responses in several perennial grasses species (Rawnsley et al. 2009; Ates et al. 2013).
- Forage yield (FY) responses of the perennial grasses subjected to different DI strategies could vary according to the species, cultivar, and meteorological local conditions (Neal et al. 2009).
- Evaluation of native perennial grasses original from southern Chile (*Bromus valdivianus* Phil) and other exiting materials around the world under DI or water stress conditions could be a novel alternative for maintaining a stable and sustainable dry matter productivity in zones with low water available for irrigation or change in the rainfall patterns with decreasing natural water precipitation.

Table 1. Total values of forage yield (FY) and average irrigation water use efficiency (IWUE) for the different irrigation water levels (IWL) and perennial grasses (G) evaluated during the maximum atmospheric demand for the 2017/2018 season.

Treatments	*FY* (Kg DM ha^{-1})	*IWUE* (kg DM m^{-3})
Irrigation water Levels (*IWL*)		
T1 (full irrigation)	4338.1 a	1.72 b
T2 (80% of T1)	3868.4 ab	1.91 b
T3 (60% of T1)	3732.3 ab	2.43 a
T4 (rainfed)	3296.5 b	-
Significance ANOVA	*	**
Genotypes (*G*)		
Bronco INIA (*Bromus valdivianus* Phil)	4453.9 a	2.41 a
3771 (*Bromus valdivianus* Phil)	4406.3 a	2.27 ab
Greenly (*Dactylis glomerata* L.)	4060.2 a	2.21 ab
3287 (*Bromus valdivianus* Phil)	3957.3 a	2.12 ab
Bromino INIA (*Bromus valdivianus* Phil)	3673.7 ab	1.91 ab
Kora (*Festuca arundinaceae* Schreber)	3203.1 ab	1.68 ab
Nui (*Lolium perenne* L.)	2907.0 b	1.54 b
Significance ANOVA	***	**
IWL* x *G		
Significance ANOVA	**n.s.**	**n.s.**

Means in a column with the same letter are not significantly different according to test Tukey HSD ($p \leq 0.05$). ANOVA (*$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$; n.s.: not significance when $p > 0.05$).

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