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Assessment of the spatial variability in tall wheatgrass forage using LANDSAT 8 satellite imagery to delineate potential management zones

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Abstract Little information is available on the degree of within-field variability of potential production of Tall wheatgrass (*Thinopyrum ponticum*) forage under unirrigated conditions. The aim of this study was to characterize the spatial variability of the accumulated biomass (AB) without nutritional limitations through vegetation indexes, and then use this information to determine potential management zones. A 27-×-27-m grid cell size was chosen and 84 biomass sampling areas (BSA), each 2 m^2 in size, were georeferenced. Nitrogen and phosphorus fertilizers were applied after an initial cut at 3 cm height. At 500 °C day, the AB from each sampling area, was collected and evaluated. The spatial variability of AB was estimated more accurately using the Normalized Difference Vegetation Index (NDVI), calculated from LANDSAT 8 images obtained on 24 November 2014 ($NDVI_{nov}$) and 10 December 2014 ($NDVI_{dec}$) because the potential AB was highly associated with $NDVI_{nov}$ and $NDVI_{dec}$ (r^2 = 0.85 and 0.83, respectively). These models between the potential AB data and NDVI were evaluated by root mean squared error (RMSE) and relative root mean squared error (RRMSE). This last coefficient was 12 and 15 % for $NDVI_{nov}$ and $NDVI_{dec}$, respectively. Potential AB and NDVI spatial correlation were quantified with semivariograms. The spatial dependence of AB was low. Six classes of NDVI were analyzed for comparison, and two management zones (MZ) were established with them. In order to evaluate if the NDVI method allows us to delimit MZ with different attainable yields, the AB estimated for these MZ were compared through an ANOVA test. The potential AB had significant differences among MZ. Based on these findings, it can be concluded that NDVI obtained from LANDSAT 8 images can be reliably used for creating MZ in soils under permanent pastures dominated by Tall wheatgrass.

Keywords Forage yield variability · Pasture · Remote sensing · Spectral information · *Thinopyrum ponticum*

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Introduction

With the advancements in remote detection and use of variable application rate systems, the study of within-field

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