



ECPA
BARCELONA 2025

**15TH EUROPEAN CONFERENCE
ON PRECISION AGRICULTURE**

BOOK OF ABSTRACTS OF ALL THE POSTERS



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

BARCELONA, SPAIN
29TH JUNE - 3RD JULY 2025

**PRECISION AGRICULTURE:
A REALITY FOR EVERYONE**

Published by Universitat Politècnica de Catalunya, Barcelona, Spain

ISBN: 979-13-87613-57-0

Doi: 10.5821/ebook-9791387613570

The correct form of reference for this publication is:

Author(s). (2025). Poster Title. In: Poster Proceedings of the 15th European Conference on Precision Agriculture, June 29 – July 3, Barcelona, Spain. pp. XX. e-book publication. Universitat Politècnica de Catalunya. ISBN: 979-13-87613-57-0. <https://doi.org/10.5821/ebook-9791387613570>

34. Vegetation indexes in tropical pastures obtained from unmanned aerial vehicle

J.R.M. Pezzopane¹, H.B. Brunetti¹, R. Pasquini Neto², D.S. Rocha¹, L.C. Giglio³, A.C.C. Bernardi¹, J.O.A. Bueno⁴

¹Embrapa, Embrapa Southeast Livestock, Brazil; ²University of São Paulo, College of Veterinary Medicine and Animal Science, Brazil; ³Federal University of São Carlos, Brazil; ⁴University of São Paulo, São Carlos School of Engineering, Brazil.

Correspondence: jose.pezzopane@embrapa.br

Introduction

Among the technologies used for the indirect estimation of forage production traits, remote sensing stands out through reflectance parameters to generate vegetation indices that can be applied as indicators of system productivity (Barnes et al., 2014). This information can support management actions for livestock production systems based on tropical pastures (Pezzopane et al., 2022). Therefore, this study aimed to evaluate the capacity of different vegetation indices derived from images obtained by a multispectral camera mounted on an unmanned aerial vehicle to estimate the production characteristics of tropical forages.

Materials and methods

The research was conducted under tropical conditions in São Carlos, SP, Brazil (21°57'S, 47°50'W, 860 m asl.). From June 2023 to August 2024, monthly forage biomass destructive samplings were carried out at ground level in four paddocks (0.50 ha each) of a rotational grazing system of *Urochloa brizantha* cv. BRS Piatã (INT) and in two areas (3.0 ha each) of *U. decumbens* cv. Basilisk pastures maintained under continuous stocking (EXT). Samples were obtained using 0.5 x 0.5 m squares, and georeferenced with GNSS Receiver Topcon Hiper VR RTK, totaling 12 subsamples per paddock in the INT and 18 subsamples per pasture area in the EXT. For each experimental unit, samples of total forage mass (kg DM ha⁻¹), fractions (% of leaf, stem, and dead material), and leaf area index (LAI, m² m⁻²) were obtained.

In the days leading up to the forage sampling, the images of the production systems were derived from overflights in an unmanned aerial vehicle Matrice 210 (DJI, China) equipped with a multispectral camera AGX 710 (Sentra, USA), with a flight of 120 m AGL and 70% frontal and lateral overlap. Image processing was performed using Pix4D and QGIS software, allowing the statistics of the reflectance of the Red, Red-Edge, and Near-Infrared (NIR) bands (670, 720, and 760 nm, respectively). From this, vegetation indices such as the Normalized Difference Vegetation Index (NDVI), Normalized Difference Red Edge (NDRE), Simple Ratio Index (SRI), Chlorophyll Index (ChL), and Modified Simple Ratio (MSR) were calculated.

The relationships between the vegetation indices and forage variables were determined using the data collected in all experimental units. The determination coefficient (R²) values obtained from linear regressions were used to select the best index for each pasture variable.

Results and discussion

Figure 1 presents the relationship between the best vegetation indices and forage production traits. The various vegetation indices did not perform well in estimating total forage mass (R² ranging from 0.04 to 0.09, Fig 1A) due to the large amount of dead material in the pastures during the dry season of the sampling period, in agreement with Barnes et al. (2014). However, the best leaf + stem fraction estimates were obtained with the NDRE and ChL indices (R² = 0.78, Fig 1B). The best correlation for the leaf fraction and the leaf area index was obtained with the MSR index, with determination coefficients of 0.82 (Fig 1C) and 0.72 (Fig 1D), respectively.

These significant findings provide a deeper understanding of the potential of different vegetation indices for estimating productive traits of tropical forages, becoming a valuable tool to support decision-making that improves the management of tropical pastures (Serrano et al., 2011). Leaf+stem mass, leaf mass, and LAI were accurately estimated using vegetation indexes. This is a good indication of the usefulness of these vegetation indexes for pasture-based systems since the live fractions are the most important for animal feeding (Pezzopane et al., 2022).

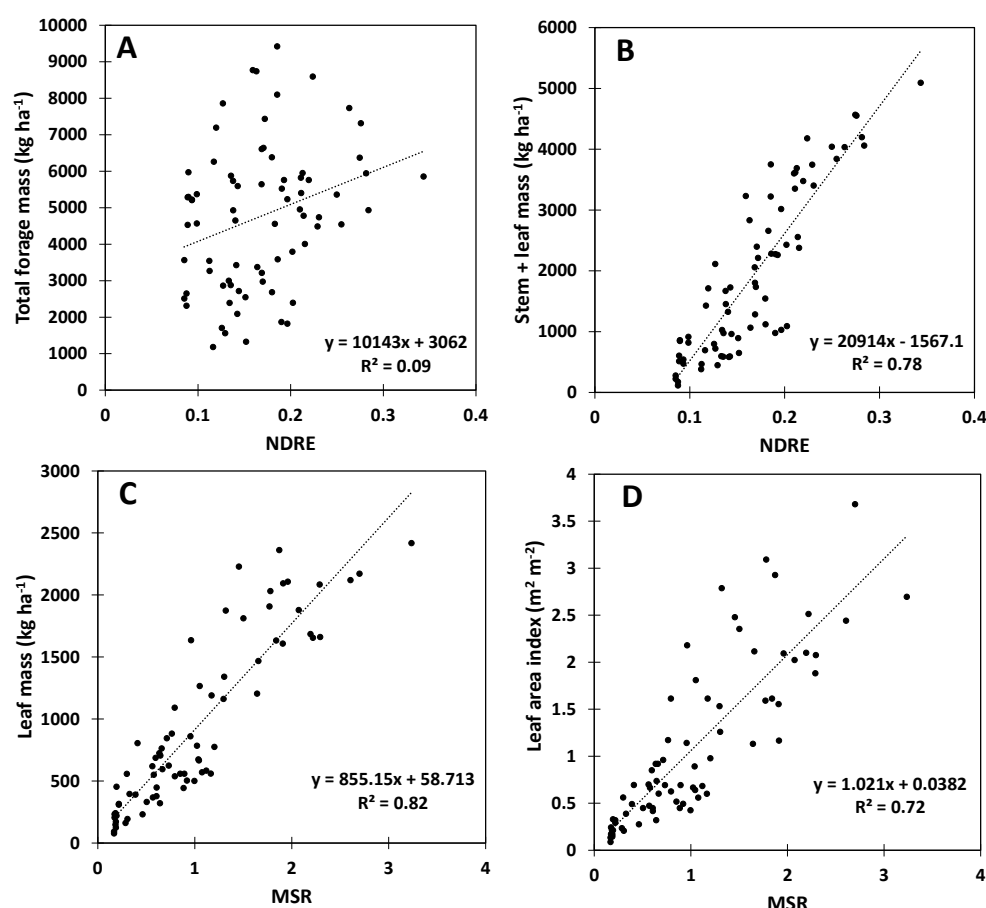


Figure 1. Relationships between the Normalized Difference Red Edge (NDRE) and total forage mass (A), leaf + stem mass (B), and between the Modified Simple Ratio (MSR) and leaf mass (C) and leaf area index (D) of tropical pastures under different management systems.

Acknowledgment

This research was supported by IABS/Rede ILPF and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) [grant number 2023/02444-5].

References

- Barnes, P., Wilson, B.R., Reid, N., Bayerlein, L., Koen, T.B., Olupot, G., 2014. Examining the impact of shade on above-ground biomass and normalized difference vegetation index of C3 and C4 grass species in North-Western NSW, Australia. *Grass Forage Sci.* 70, 324–334. <https://doi.org/10.1111/gfs.12118>
- Pezzopane, J.R.M., Bernardi, A.C.C., Bosi, C., Sengling, O., Bonani, W.L., Brunetti, H.B., Santos, P.M. 2022. Estimating productivity and nutritive value of Marandu palisadegrass using a proximal canopy reflectance sensor. *Experimental Agriculture*, 58, e28. <https://doi.org/10.1017/S0014479722000242>
- Serrano J., Peça J., Marques Da Silva J., and Shahidian S., 2011. Calibration of a capacitance probe for measurement and mapping of dry matter yield in Mediterranean pastures. *Precision Agriculture* 12, 860–875. <https://doi.org/10.1007/s11119-011-9227-4>