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Comparison of the use of multispectral orthomosaics and RGB panoramic images for plant cover calculation in *Urochloa* hybrids

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Introduction

- The use of multispectral drone images is a quick and accurate way to measure variables of interest in plant breeding programs.
- However, these multispectral images are associated with preprocessing and analysis that varies depending on the degree of information that the images present.
- There are cheaper drones with RGB cameras that allow to obtain images with greater definition but with fewer bands than a multispectral camera and without georeferencing.
- The potential of RGB images as a replacement for multispectral images is unknown. For this reason, the objective of this study was to compare the obtaining coverage of *Urochloa* hybrids from the RGB panoramic image method with the standard multispectral orthomosaics methodology.

Methodology

To obtain coverage with the DJI Phantom 4 multispectral drone, 4 control points were marked with targets and georeferenced with high-precision GPS to use as control points, then mapping was carried out over 300 plants at a height of 20 meters with intervals of 6 photos every 2 seconds, corresponding to each of the bands included in the multispectral camera with a total of 721 photos.

For post-processing, the orthomosaic was created and the images and coordinates were corrected in the Metashape software and the coverage calculation in the QGISgis software (V 3.28.0-Firenze) through annotations and selection of thresholds to segment only the vegetation cover.

In the case of panoramic images, a single photo was taken with the Mavic 2 Pro drone at a height of 120 meters, the coordinate correction was carried out in Qgis using the georeferencer on the control targets and the coverage calculation was carried out as follows: same way used as with multispectral images.

The statistical analysis was carried out in the software RStudio version 2022.07.2 Build 576.

Results

When georeferencing the panoramic image (Fig 1B) with the help of the Qgis software in the control points also marked in the orthomosaic (Fig 1A), an overlap very close to the original coordinates was obtained, allowing work with the same regions of interest (ROIs) designed for orthomosaics.

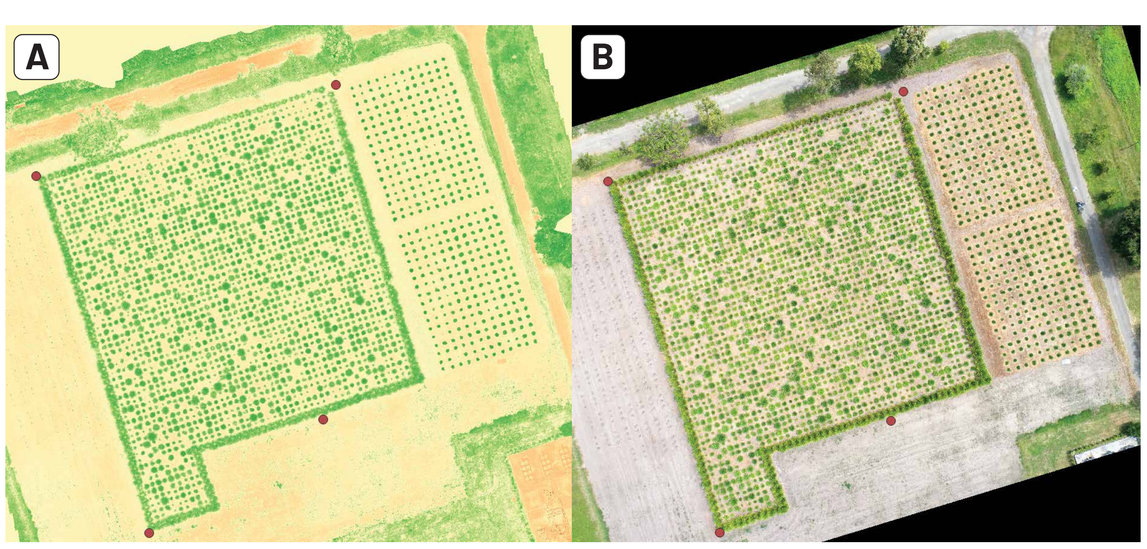

Figure 1. Compared images, observing A) Orthomosaic obtained from multispectral images and B) georeferenced panoramic photo on control points.

With the ROI of the 300 plants evaluated, the vegetal cover was calculated, first calculating the NDVI index for the orthomosaic with the objective of making the plants visible and then segmenting by pixels, values greater than 0.34 corresponding to vegetal cover (Fig 2A). In the case of the RGB image, it was also segmented by pixels but using the green band as a discrimination scale, selecting pixels equal to or less than 161 as vegetation cover (Fig 2B).

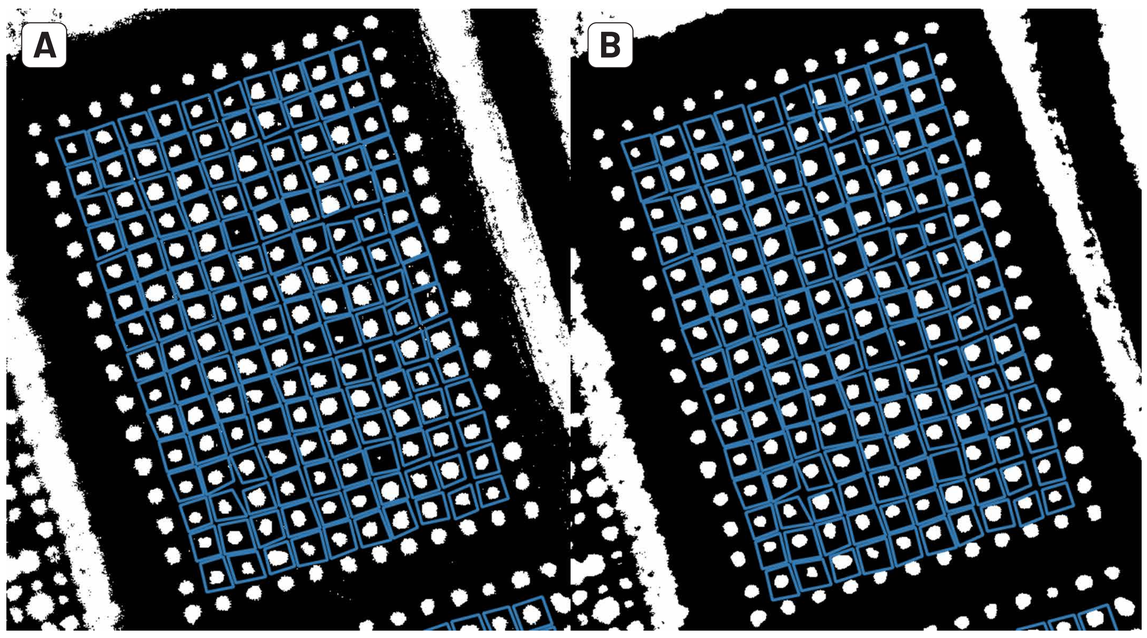

Figure 2. Obtaining vegetation cover through pixel segmentation in: A) multispectral images and B) panoramic images.

Dividing the number of positive pixels for coverage by the equivalent of 1 m^2 in pixels (in this case 1,162 pixels), the coverage in m^2 was obtained. Finally, When performing a linear regression analysis of cover values between methodologies, a determination coefficient of 0.97 (Fig 3), regression coefficient $\hat{\beta}$=1.02 and confidence intervals 1.00-1.04, was obtaining. Finally, the final equation to calculate multispectral coverage from panoramic RGB information was:

Multiespectral coverage= 0.009102 + 0.806574 * Panoramic coverage

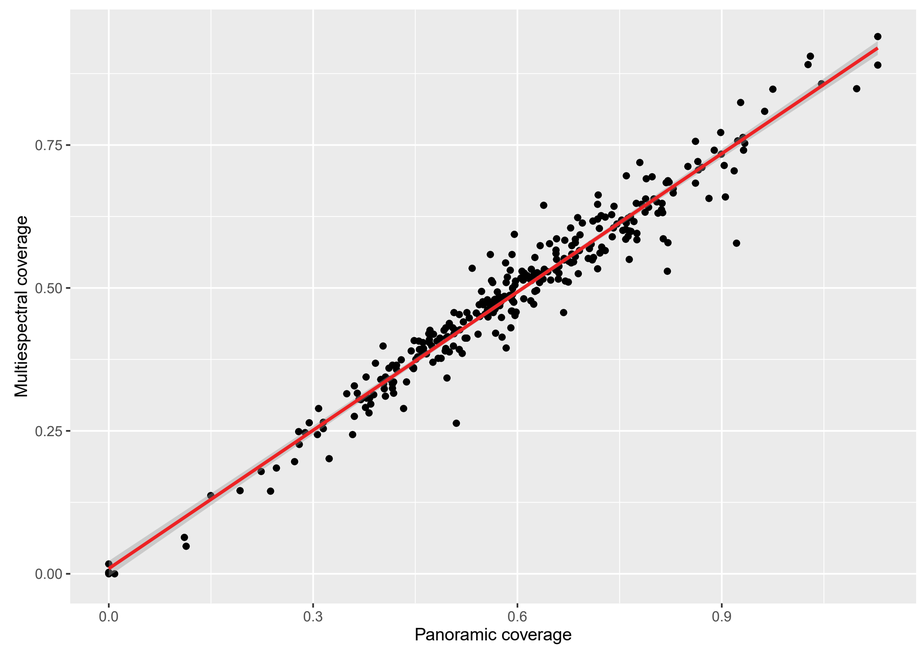

Figure 3. Lineal regression between Multiespectral coverage and panoramic coverage.

Conclusion

With the data obtained, it can be concluded that a single RGB image has the same capacity to calculate coverage as orthomosaics of multispectral images. This represents a decrease in collecting and processing time, size of the information collected and personnel and equipment costs.

References

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