2nd International Conference on Nutrition and Healthcare

Theme

Use of an unmanned aerial vehicle as an alternative to assess the nutritional status of the cotton crop

Author

Jonathan C. Espinoza Delgado

Abstract

The use of unmanned aerial vehicles in photogrammetric studies allows obtaining spatial data in short periods of time and with high spatial resolution. In the research, multispectral images were processed for the study of nutritional conditions of the cotton crop (*Gossypium hirsutum*). An experimental design of the crop was developed, with different doses and nitrogen sources, in a factorial arrangement with 16 treatments and 4 repetitions in plots completely distributed at random. The EBEE SQ agricultural drone, equipped with the Parrot Sequoia camera, was used and a photogrammetric flight was planned, with the Emoticon AG software, which was synchronized with the drone to establish the flight parameters and capture the reflectance information of the visible spectrum, infrared and red border. The captured images were processed with the PIX4D Mapper software to generate the orthophoto and the 4 spectral bands used in the calculation of the chlorophyll index. Using map algebra tools from ArcGIS software on the results obtained, an analysis of variance was performed with the

ANOVA model. With the calculated indices it was possible to show differences in the vigor of the crop depending on the treatments. The analysis of the results showed significant differences in the spectral response of the cotton crop fertilized with different sources (urea, pine nut cake, chicken manure and bovine manure) and nitrogen doses (50, 100, 150 and 200 N kg.ha^{-1}). Urea treatment at the 150 dose of N kg.ha^{-1} showed the best spectral response.

Keywords: EBEE SQ, Sequoia, chlorophyll Index, multispectral, visible spectrum.

Introduction

Remote sensing based on satellites and unmanned aircraft reduces the problem in the scarce implementation of technological alternatives for planning in agriculture. This technology, in attention to the various physiological and nutritional characteristics that crops present, allows improving the planning of agricultural activities, predicting damage and making appropriate decisions in situations that evolve their development (Duarte et al., 2021).

The images of the unmanned aerial vehicles, equipped with a multispectral camera, capture spectral images that are useful for agricultural purposes in estimating the efficiency of some treatments and their effect on the phenological development of the crop (Burbano et al., 2020). . The concentration of chlorophyll in the leaf can vary depending on the growth stage of the plant and proportional to the amount of nitrogen it has (Ledesma et al., 2020).

The chlorophyll index is applied to estimate the total amount of chlorophyll in plants and is generally calculated from the reflectance in the green, red and red edge bands of the electromagnetic spectrum. These bands respond to slight variations in the amount of chlorophyll and are consistent for most types of plants. The cell structure of plants tends to reflect waves within this spectral range, resulting in more reflected light; therefore, the higher the reflection, the greener the area, indicating the level of vigor of the crop, allowing, in turn, to identify the affected areas and respond in a timely manner (Prando et al., 2018).

RGB and multispectral data have been used to estimate the chlorophyll index (Cl), which is based on the random application of nitrogen in crops. With the

application of remote sensing techniques and with the support of multispectral images to analyze the morphological and nutritional conditions that the human eye cannot easily observe, it is intended to support a technified agricultural system. The information cameras are managed by geographic systems and aerial tools, which delimit parameters in the crops for their better management (Kharuf-Gutierrez et al., 2018), hence the objective of the present investigation was to process multispectral images for the study of nutritional conditions of cotton cultivation.

Conclusions

The unmanned aerial vehicle showed great efficiency for the application of the procedures mentioned, which is why they are a fundamental part in the application of technology in agriculture and production, thanks to its easy handling and the large amount of information that it can provide. generate.

The analyzed indices were able to visually show the differences in the vigor of the crop, depending on the various nitrogen fertilization treatments. Therefore, with the application of this technology, the application of fertilizers can be optimized by selecting the most efficient nitrogen source for the study conditions.

The GIS tool proves to be very useful in differentiating the areas of the crop with greater or lesser development of the plants based on the chlorophyll index, thus being able to take advantage of the information obtained to cover the needs of the areas with nutritional deficiency.

The application of the chlorophyll indices made it possible to determine the most effective treatments of nitrogenous sources in plants, with urea at a dose of 150 N kg.ha-1 being the source with the best spectral response for the four calculated indices.

The results of the investigation allow the recommendation of doses and nitrogenous sources that could imply improvements in the production of the crop in economic and environmental terms in the study area.