METHODICAL APPROACHES TO PLANT IDENTIFICATION IN HIGH-RESOLUTION IMAGES IN MULTISPECTRAL MONITORING USING UAVS

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The aim of the work is to develop a method of plant identification on multispectral images of high resolution for continuous sowing crops, on the example of winter wheat.

Conducting experimental research

The above survey was carried out on March 17, 2019 on production crops of winter wheat, Mulan variety, territorially in the area of the Left-Bank Forest-Steppe (50º16 'N, 30º58'E). The plants were in the tillering stage. Open areas of soil were in an air-dry state. To study the effect on the spectral parameters of moist soil, two areas without vegetation (dried depression - "saucer") were selected, one of which was pre-moistened so that 15 minutes before the flight puddles from the ground were not visually fixed.

Aerial monitoring was performed using a Slantrange 3p spectral system mounted on a DJI Matrice 600 UAV. The flight altitude was 100 meters, which provided a spatial resolution of 14 mm/pixel for each of the channels. The Slantrange 3p system has 4 measuring monochrome channels (Green, Red, RedEdge, iRed) and a standard light correction system based on an anti-aircraft sensor. Specialized SlantView software allows you to calibrate the results of shooting by lighting and positioning and create maps of the distribution of vegetation indices (VI). Because the program does not provide access to the distribution map on the source channels, we used an additional interface of the snapshot window.

To extract the reference graphic data from the SlantView program, a copy of the screen was made in full-screen mode of the image window, which was stored in the graphic editor Paint Windows 7 pro in bmp format (24 bits). Cropping of the image with positioning on reference points was done in the program MS Office Picture manager. Statistical processing of graphical data of spectral monitoring results was carried out in the program MathCad (ver.14) according to the method presented in (Pasichnyk N.A. et al., 2019) in [8]. In the program, the original bmp or jpeg image was first converted into a matrix, which allowed to uniquely identify each pixel of the image, and then counted the number of pixels for each of the 256 gradations of color intensity.

Research results.

To adjust the soil filtration during the analysis, a program was written that counted the number of pixels by the intensity of the color components for the selected area.

Based on the obtained results, it is problematic to reliably determine the parameters of the soil for filtration exclusively on a separate channel. If for the area with sparse vegetation for the iR channel with dry soil there are coincidences, but with wet soil there are none, then for red it is the opposite. A possible reason for this is the different terrain in the arable land and in the depression. In addition, the soil in the shade of plants could have an intermediate state of drying. Considering the prospects for industrial application of this technology should take into account the difficulties in determining soil filtration.

Given the possible variations of soil types and subtypes, a great versatility of the identification method can be obtained by filtering from the total mass not the soil, but directly the plants by their spectral portraits. For the considered plants the value of G component is lower or close to iR, in contrast to dry or moist soil. According to the assumption, to identify plants, it is proposed to "weed out" pixels for which the condition $iR-G \geq F$ is not met. The value of F is adjustable, may be determined by the characteristics of the variety (culture).

Assessing the effect of filtration on spectral parameters, it was found that the largest adjustment occurred on the R and iR channels, which will affect the vegetation indices based on them. Interesting are the results of the calculated horizontal area of plants, which has changed many times, which can be used to assess the condition of plants as an additional parameter.

***Conclusions*.**

- Reliable establishment of the spectral portrait of the soil for its pixel-by-pixel filtering from many spectral images is a difficult task, as its color significantly depends on the state of moisture, which may differ in open and shaded by plants.
- A more promising way to weed out random inclusions is to use a spectral portrait of plants, namely the intensity ratios of its components.
- A promising parameter for assessing the condition of crops is to estimate the area of their horizontal surface, which can be determined by pixel-by-pixel image analysis.