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Use of distance methods in cannabis cultivation

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Introduction

Appropriate nutrition has a significant effect on yield and quality of hemp seeds and stem. Appropriate nutrition has a significant effect on yield and quality of seeds and hemp stalk. Deficiency of needed nutrients can be caused by inappropriate size of the applied dose of fertilizer or improper application deadline. Another reason for the inadequate supply of nutrients may be the variability of the land on which the crop is grown. Subsequent inequality production can have a bad influence on the final quality and wrong yield prediction. Especially in periods of higher plant length can be a problem with monitoring using conventional methods. In past years there was investigated the effect of nitrogen nutrition on yield parameters of the hemp (*Cannabis sativa L.*) seed and stem as part of solving research projects.

From the point of view of agrotechnical interventions in the later stages of vegetation, the disadvantage of cannabis is its high growth. Standard mechanization is not designed for use in tall plants.

It is suitable to use UAVs (drones) equipped with a sensing device for monitoring crops. An RGB camera or special sensors for different bands of the scanned wave can be used as a

Fig. 1 *UAV with scanning device*

This article was based on the results of the project project of the longtime development of the Research Institute of Agricultural Engineering p. r. i. No. RO0618 and the project of the Ministry of Agriculture of the Czech Republic No. QK21010151.

Methodology

The experiments were based on the system of field plot trials in four replications with the area of plots 10 m^2. Hemp, variety Fedora was investigated. Monitoring of hemp crop was implemented for assessing the usability and effectiveness of UAVs equipped with apparatus for sensing crop. For images processing in different parts of the verified spectrum there was used a methodology based on using the program ImageJ and subsequent evaluation. Picture 2 shows non-prepared image and picture 3 shows the results of photographing hemp crop prepared for subsequent image analysis. Monitored experiment was focused on determining the sowing density and effect of N fertilization on the growth and yield of the hemp. Similarly, you can also specify a bad seed quantity.

Fig. 2 *Image before prepare for spectral analysis*

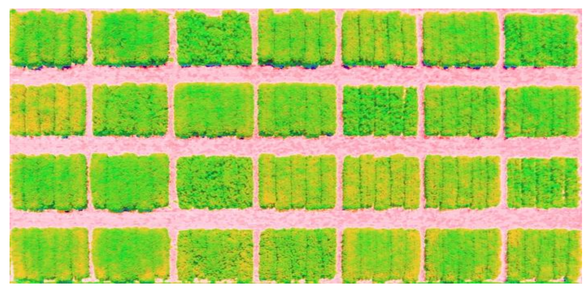

Fig 3 *The retouched image prepared for spectral analysis*

Results

All the monitored alternatives were transferred to individual parts of the visible spectrum into grayscale and were selected shades of red, green and blue for testing of statistically significant differences. Results showed the highest resolution in the red part of the visible spectrum and manifest by the transfer of the whole visible spectrum into greyscale. Conversely, in the area of green colors they are almost indistinguishable. In the blue area of color the individual variants of fertilization did not show any influence on the analysis results.

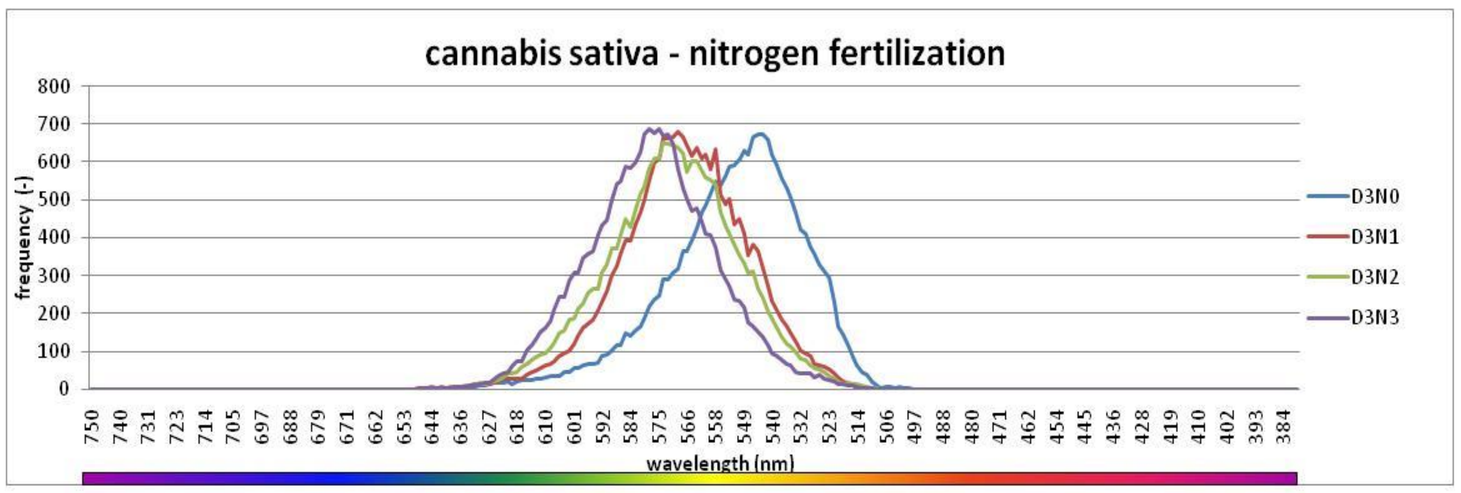

Fig. 4 *Analysis of the gray spectrum of alternatives N fertilizer in the form of a histogram*

Distance methods for monitoring cannabis growths using UAVs appear to be promising. Their advantage is easy data acquisition, even in high vegetation, which cannot be possible to cultivate by classical mechanization. The potential can also be seen in the possibility of local application of fertilizers or plant protection products.