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PRECISION AGRICULTURE TOOL FOR ASSESSMENT OF FERTILISER USING MULTISPECTRAL SATELLITE IMAGERY

Abstract

Precision Agriculture (PA) provides a way to efficiently manage agricultural inputs while increasing yield volume. The main practices in PA involve on site-specific management of resources taking into account the characteristics, requirements and variations of the field and are greatly empowered by the use of Earth observation methods and advanced technology in agriculture. Several studies have shown that the use of site-specific nitrogen management brings both economic and environmental benefits. Economic benefits are realised by giving the field only what it needs according to the fertilisation plan, making a better planning of the required input resources, and achieving a bigger yield potential. Environmental benefits are fulfilled by applying only the amount of fertiliser that the crop needs, reducing the nitrate pollution in soil and water. The use of multispectral satellite imagery combined with Geographic Information Systems (GIS) enables detection of variations in crop biomass across the field. Plant biomass has shown a significant correlation with chlorophyll content, and by using spectral vegetation indices, such as the Normalized Difference Vegetation Index. It is possible to estimate the chlorophyll content by measuring the difference in the reflected light in the red and infrared bands, which provides information contributing to the assessment of the crop nitrogen requirement. Currently, commercial providers of PA services are not able to deliver quickly fertilisation plans, which correspond to the precise growth stages of the crop, as they require specific agronomist knowledge of the field and crop conditions. This paper will describe a novel decision support tool which could help farmers to determine variable rate nitrogen fertiliser application plans for their crops through the use of satellite images. The main module will be an expert system, which captures agronomist knowledge of the crop, soil, and field to provide farmers with adequate fertilisation plans that may be modified by them further to comply with more particular conditions. The tool will feature capabilities to process multispectral and GIS data, host the expert system, as well as perform the calculations required by the agriculture model to provide a nitrogen application recommendation fitted to a particular field. This PA tool will be able to accommodate different agriculture models. Due to that it could be used in countries with a highly mechanized agriculture to reduce costs and improve yield volume, but also in developing countries to bring adequate agriculture practices that improve yield volume, soil quality and helps small farmers to make decisions.