SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)
Tools and Technology in Support of Integrated Applications (1)

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BUSINESS CASE DEVELOPMENT FOR PRECISION AGRICULTURE APPLICATIONS USING UAV AND SPACE BORNE PLATFORMS.

Abstract

In 2015 United Nations (UN) defined 17 global Sustainable Development Goals to address the world's most crucial problems. This paper addresses population growth, clean water access and sustainable food sources problems, which lead to an increasing need for more efficient use of agricultural surfaces.

In this work, the current state of art in rice, maize and wheat fields monitoring was considered. These crops provide over 50% of the world's plant-derived food energy. rop production geography study allowed us to identify common field sizes, climates and widespread reasons of yield loss, one being weeds. Three average field sizes were identified: 150 hectares (ha), 30'000 ha and 300'000 ha. Crop diseases showed to be a cause of 10% yield loss worldwide. However, some diseases may lead to 50% yield loss and more.

We propose to utilize hyperspectral imaging (HSI) technology to monitor agricultural surfaces for disease identification at early stages of their development. Based on crop damaging factors and the ability of visual identification, six most harmful diseases were studied. They are Bacterial Blight and Rice Blast, Common Smut and Northern Corn Leaf Blight, Yellow Rust and Fusarium Head Blight (FHB) for rice, maize and wheat respectively. In addition, Ambrosia was chosen as an example of weed. Literature research showed that spatial resolution better than 1 meter is required to monitor these diseases at early stage. Revisit time should be smaller than 5 days and spectral bands should be in range from 400 to 1100 nm. Near-ground drone, stratospheric drone, small satellite constellation and large satellite were studied as potential carriers. The latter two don't meet spatial resolution requirement or become too expensive for agricultural purposes. Therefore, they were excluded from further research.

The goal of this paper is to prepare a sustainable business case for disease monitoring. It was assumed that the proposed technology will decrease the yield loss by 50% of and reduce pesticide use by 25%. The near-ground drones showed to be beneficial for farms up to 30'000 ha, while stratospheric drones better to be used on larger territories. Cost analysis demonstrated a substantial increase of economic profitability for detection of all illnesses apart from FHB. The ability of corn diseases monitoring is uncertain due to lack of previous studies in that field. Ambrosia detection also seems to be unprofitable for farms. However, there might be government interest in Ambrosia monitoring, as it causes strong allergies.