



Capabilities of unmanned aircraft vehicles for low altitude weed detection

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Sustainable crop production and food security require a consumer and environmental safe plant protection. It is recently known, that precise weed monitoring approaches could help apply pesticides corresponding to field variability. In this regard the site-specific weed management may contribute to an application of herbicides with higher ecologically aware and economical savings.

First attempts of precision agriculture date back to the 1980's. Since that time, remote sensing from satellites or manned aircrafts have been investigated and used in agricultural practice, but are currently inadequate for the separation of weeds in an early growth stage from cultivated plants. In contrast, low-cost image capturing at low altitude from unmanned aircraft vehicles (UAV) provides higher spatial resolution and almost real-time processing. Particularly, rotary-wing aircrafts are suitable for precise path or stationary flight. This minimises motion blur and provides better image overlapping for stitching and mapping procedures. Through improved image analyses and the recent increase in the availability of microcontrollers and powerful batteries for UAVs, it can be expected that the spatial mapping of weeds will be enhanced in the future.

A six rotors microcopter was equipped with a modified RGB camera taking images from agricultural fields. The hexacopter operates within predefined pathways at adjusted altitudes (from 5 to 10 m) by using GPS navigation. Different scenarios of optical weed detection have been carried out regarding to variable altitude, image resolution, weed and crop growth stages.

Our experiences showed high capabilities for site-specific weed control. Image analyses with regard to recognition of weed patches can be used to adapt herbicide application to varying weed occurrence across a field.