

How can unmanned aerial vehicles be used for detecting weeds in agricultural fields?

ABSTRACT

Weeds are among the most harmful abiotic factors in agriculture, triggering significant yield loss worldwide. Remote sensing can detect and map the presence of weeds in various spectral, spatial, and temporal resolutions. This review aims to show the current and future trends of UAV applications in weed detection in the crop field. This study systematically searched the original articles published from 1 January 2016 to 18 June 2021 in the databases of Scopus, ScienceDirect, Commonwealth Agricultural Bureaux (CAB) Direct, and Web of Science (WoS) using Boolean string: “weed” AND “Unmanned Aerial Vehicle” OR “UAV” OR “drone”. Out of the papers identified, 144 eligible studies did meet our inclusion criteria and were evaluated. Most of the studies (i.e., 27.42%) on weed detection were carried out during the seedling stage of the growing cycle for the crop. Most of the weed images were captured using red, green, and blue (RGB) camera, i.e., 48.28% and main classification algorithm was machine learning techniques, i.e., 47.90%. This review initially highlighted articles from the literature that includes the crops’ typical phenology stage, reference data, type of sensor/camera, classification methods, and current UAV applications in detecting and mapping weed for different types of crop. This study then provides an overview of the advantages and disadvantages of each sensor and algorithm and tries to identify research gaps by providing a brief outlook at the potential areas of research concerning the benefit of this technology in agricultural industries. Integrated weed management, coupled with UAV application improves weed monitoring in a more efficient and environmentally-friendly way. Overall, this review demonstrates the scientific information required to achieve sustainable weed management, so as to implement UAV platform in the real agricultural contexts.

Keyword: Precision agriculture; Unmanned aerial vehicle; Weed