Predicting and Monitoring Weed Distributions in Dryland Wheat Using Landsat Data

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Weeds are a serious management issue in the U.S., with an estimated $20 B being spent annually in attempted control, causing an estimated $136 B in crop damage each year. Remote monitoring of weeds can provide information about long term changes in weed distribution, management practices, and estimating regional crop yields. Despite this, there has thus far been a lack in our ability to detect, map, and monitor weeds at spatial scales relevant for decision-making. In part, this inability is due to the prohibitively high cost of reference data over broad geographic ranges and environmental conditions. This study examines the potential of hyperspectral on-combine sensing as a source of reference data for mapping weeds distributions in dryland wheat. We compare on-combine visual assessments of weediness along with hyperspectral measurements made during the harvest of a 17 acre field of dryland spring wheat in the Columbia basin. The objective of this study was to use these two sources of reference data as the basis for developing a model predicting weeds distributions in Landsat 8 imagery. In comparing these two methods of generating reference data to map green weed distributions, the highest correlation was found between NDVI at the time of harvest and medium and high density visual weed observations. A good linear relationship ($R^2 = 0.685$, $p < 0.001$) was found when comparing NDVI values from the satellite image with visual medium and high density weed observations. Hyperspectral measurements made in the grain stream did not perform as well as visual estimates for predicting weeds distributions in satellite images.

Ground reference measurements of weed density obtained from a combine harvester.

Landsat 8 providing multispectral image data at 30 m spatial resolution and 16 day repeat coverage.

Note: This work was presented as a poster at the Western Society of Weed Science (WSWS) annual meeting 2016.