



Tradeoffs between vigor and yield for crops grown under different management systems

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Remote sensing can provide an effective means for rapid and non-destructive monitoring of crop status and biochemistry. Monitoring pattern of traditional vigor algorithms generated from Landsat 8 OLI satellite data represents a robust method that can be widely used to differentiate the status of crops, as well as to monitor nutrient uptake functionality of differently treated seeds grown under different managements. This study considers 24 factorial parcels of winter wheat in 2013, corn in 2014, and soybeans in 2015, grown under four different types of agricultural management. The parcels are located at the Kellogg Biological Station, Long-Term Ecological Research site in the State of Michigan USA. At maturity, the organic crops exhibit significantly higher vigor and significantly lower yield than conventionally managed crops under different treatments. While organic crops invest in their metabolism at the expense of their yield, the conventional crops manage to increase their yield at the expense of their vigor. Landsat 8 OLI is capable of 1) differentiating the biochemical status of crops under different treatments at maturity, and 2) monitoring the tradeoff between crop yield and vigor that can be controlled by the seed treatments and proper conventional applications, with the ultimate goal of increasing food yield and food availability, and 3) distinguishing between organic and conventionally treated crops. Timing, quantity and types of herbicide applications have a great impact on early and pre-harvest vigor, maturity and yield of conventionally treated crops. Satellite monitoring using Landsat 8 is an optimal tool for coordinating agricultural applications, soil practices and genetic coding of the crop to produce higher yield as well as have early crop maturity, desirable in northern climates.