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Assessment of Crop Growth Through Spectral Vegetation Indices

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Spectral vegetation indices (SVIs) are good and useful tools for monitoring crop growth and development, assessing and forecasting crop production and agricultural drought. SVIs can be obtained from different platforms like satellites, aircrafts and in situ measurements. In literature there are more than 50 SVIs, most of them are the ratio of spectral data while the others are linear combinations of different spectral bands. SVIs basicly depend on different spectral properties of vegetation in the red and NIR band. In the red band, vegetation cover highly absorbs electromagnetic radiation incident upon it whereas it reflects most of the incoming radiation in the NIR band. Using this difference, crop's biophysical parameteres such as biomass and crop height can be monitored. In this study, the relationships of mostly used and well accepted SVIs such as NDVI, SAVI, MSAVI, MCARI1 and MCARI 2 with biomass and crop height of sun flower (Helianthus annuus L.) in Kırklareli, Turkey are evaluated. Within the projects supported by TUBITAK (The Scientific and Technological Research Council of Turkey) under the titles of "Investigation of Possible Effects of Climate Change to Crop Growth by Crop Growth Models" and "Determination of CO_2, H_2O and Energy Fluxes of Wheat", using hand-type spectroradiometer, inbetween 325 nm- 1075 nm, spectral reflectance values and dry biomass together with crop height of sunflower are measured in field studies on a biweekly basis. Above mentioned SVIs are derived from spectroradiometer measurements and analyzed by dividing growing season into planting to inflorescences (13.04.2010-23.06.2010) and full flowering to harvest (26.07.2010-23.08.2010). Results are showing all of the SVIs are exponentially related with both biomass and crop height for planting to inflorescences. MCARI 2 is the best related SVI both for biomass and crop height with correlation coefficient of R2 = 0.91 and R2 = 0.97, respectively whereas MCARI 1 is the worst one with correlation coefficient of R2 = 0.84 and R2 = 0.90, respectively. MSAVI, SAVI and NDVI also very well represents both biomass and crop height with R2 values of 0.87,0.87, 0.90 for biomass and 0.94, 0.93 and 0.96 for crop height respectively. When examining results, because MCARI 2 has the soil adjustment term, and it has very low sensitivity to pigments variation, it is the best SVI that represents biomass and crop height for sun flower. Overall, it can be said that relationships between SVIs and crop biophysical parameters such as biomass and crop height are very significant. Results can be used for better understanding of crop growth and management however, it is necessary to extend the variety of crops and investigating the relationships for longer periods.
Keywords: Spectral Vegetation Index, Biomass, Crop Height, MCARI1, MCARI2, NDVI, SAVI, MSAVI