

Hyperspectral properties of leaves according to different N fertilization regimes and leaf orientation in wheat

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Abstract: Nitrogen fertilization in wheat cultivation has a beneficial effect on the photosynthesis activity of the leaves, thus helping to accumulate more biomass in the grains. Therefore, this study was conducted to understand the growth status and physiological condition of wheat crop by measuring hyperspectral properties of the leaves with hyperspectral camera (Specim IQ Ltd., Oulu, Finland) from the wheat plants under different N fertilization regimes conditions at heading stage. The winter wheat (cv. Jokyeong) used in this experiment were sown on October 30, 2018 at Gyeongsang national university experimental farm. Nitrogen fertilizer was split applied with different rates of basal, 1st, 2nd top dressing (E1, 4 : 6 : 6; E2, 4 : 3 : 3; E3, 4 : 2 : 2; E4, 4 : 1 : 1; E5, 4 : 0 : 0). The wheat plants used for the measuring were the plants having flag leaf oriented to the east and plants having flag leaf oriented to the west in the field. The flag leaf, 1st uppermost leaf and second leaf were subjected hyperspectral imaging and the obtained data analyzed using EVNI 5.5 (Exelis Visual Information Solution, Inc. Pearl East Circle Boulder, CO, USA) program. As a result of spectral reflectance analysis of leaves from 450 nm to 900 nm, the reflectance of blue, green, and red wavelength ranges was lower in the individual having the flag leaf oriented to the west than that have the flag leaf oriented to the east in E1 regime. The reflectance of the blue, green and red wavelength ranges of plants subjected to the E5 regime, which had the lowest level of top dressing, was higher in the individual plant having the flag leaf oriented to the west than the plant having the flag leaf oriented to the east. The blue, green, and red wavelength reflectance in the E4 treated plot, the reflectance was lower in both plants having flag leaf oriented the east and west. The results of this study suggest that it is reasonable to target the leaves facing the sun for obtaining hyperspectral data with portable hyperspectral camera in the field condition. The clear spectral difference of the 2nd uppermost leaf in the range of green and red wavelengths under different N fertilization regimes implies the lower (older) leaves also should be check for knowing the influences of N fertilizer in wheat field.

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Keywords: Wheat, Hyperspectral analysis, N fertilization, , Leaf orientation.