

Research on crop estimation of major rice varieties in Jeollabuk-do based on drone images

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드론영상 기반 전라북도 주요 벼 품종 작황 추정 연구

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Abstract

Every year, the Jeollabuk-do Agricultural Research and Extension Services surveys the crop conditions of major rice varieties and creates a database in order to provide basic data necessary for providing agricultural management data and improving cultivation methods. However, existing crop survey methods have the disadvantage of requiring a lot of labor and producing relatively little sample data. Recently, with the development of observation technology using drones, it has become possible to acquire precise data of less than 10 cm, and it is being used to acquire crop growth data. Therefore, this study extracted spectral data based on drone images, calculated the rice vegetation index, and analyzed the correlation with ground survey data in order to use drone images to estimate crop conditions for major rice varieties in Jeollabuk-do at an early stage. On May 30, 2023, Sindongjin, Chamdongjin, Nampyeong, Yechan, and Saenuri rice were each transplanted to the test research field at the Jeollabuk-do Agricultural Research and Extension Services at a planting density of 60 plants/3.3m². Nitrogen treatment was applied at a level of 9kg/10a (50-20-30%) according to standard cultivation methods. Twenty days after transplanting, biomass, including plant height, hard water, dry matter, and nitrogen content, was examined at approximately 10-day intervals depending on the rice growth stage. At the same time, a multispectral sensor (Altum, Micacense Co) was attached to a drone (Matrice 200, DJI Co) to acquire multispectral (Red edge, NIR) and R, G, and B images. The acquired images were matched using FIX4DMapper, and the vegetation index was extracted according to location information using the QGIS program. The correlation between biomass and vegetation index by rice growth stage was highest in NDRE. In terms of biomass and vegetation indices among cultivars at each growth stage, Chamdongjin showed the highest and Yechan showed the lowest. The average dry weight after planting by rice variety was 59.4g, with Chamdongjin showing the highest at 67.1g and Yechan showing the lowest at 49.5g. The average NDRE was 0.45 in early July, the beginning of rice growth, and increased to 0.67 during the heading date, but gradually decreased from the end of August and tended to decrease to 0.38 at the end of September. Regression analysis of NDRE and biomass (dry weight, etc.) for each rice variety showed a high correlation with a coefficient of determination (R²) of up to 0.83. It is believed that it will be possible to estimate rice crop conditions based on drone images through the construction of an advanced DB that takes into account comprehensive growth environments such as weather and soil over many years.

Keywords: drone image, rice, NDRE, Jeollabuk-do agriculture