Poster Session | Farming System | P2: Poster Session

[P2] Farming System
Thu. Sep 9, 2021 12:15 PM - 2:00 PM Room 2 (Poster) (Farming System)

1:15 PM - 2:00 PM

[P2-28]Satellite-Based Assessment of Soybean Plant Density by Using UAV Imagery and Machine Learning Algorithm

*Nominated for Presentation Awards

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Stable seedling establishment of soybean is an essential component for high crop yield; thus, the prediction of plant density would be a valuable information to develop more effective agronomic practices. A current development of remote sensing and machine learning algorithm may enable us to examine plant density effectively. The objective of this study was to develop a model for predicting the number of established soybean plants using machine learning algorithm (YOLOv3) and UAV-based imageries. The YOLOv3 model trained with a dataset of 450 images and confidence threshold of 0.65 scored the highest predicting capability with R^2 value of 0.912 and RMSE of 0.84 plants m^{-2}. Furthermore, we examined the possibility of predicting plant density using satellite imageries through a linear mixed effect model analysis. Normalized difference vegetation index data derived from PlanetScope imageries was treated as a fixed effect, and sowing date was treated as a random effect. Different sowing dates were assumed to affect the following development of soybean canopy; thus, it might influence the plant density. Consequently, the model with variable slopes and intercepts according to the sowing dates showed the highest accuracy with RMSE of 1.64 plant m^{-2} and smallest value of Akaike information criterion. This result indicated that the model that did not incorporate the effect of sowing dates might lead to unreliable results. To improve the model capability, we should include other factors such as soil and weather condition data in further studies.