SATELLITE IMAGERY FOR WITHIN FIELD SUGARCANE TONNAGE PREDICTION

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Technology has been widely used in agriculture. Inside the farm, devices have been used to provide the position of the agricultural machinery in real-time, autosteering and others. But not only what is used inside the farm can provide good information. Imagery obtained from satellites can also provide information that can be useful for the farm management. Lately, the usage of those images has become more popular since it allows farmers to follow up the crop development during the season and the differences among regions within the same field.

Additionally, research has been done towards using the information that is collected inside and outside the farm combined with artificial intelligence to predict scenarios or important information that could be used by farmers for management decision purposes. In this scenario, LSU AgCenter Precision Agriculture Laboratory developed a study to evaluate the possibility of using artificial intelligence and satellite imagery to predict sugarcane tonnage and its variability inside sugarcane fields.

Three fields at third ratoon located in Jeanerette - LA were used. All three fields had their tonnage evaluated using a harvester equipped with a sugarcane yield monitor. Thus, this information was used as the ground truth for the evaluation. Each field had satellite imagery downloaded (total of 14 images). The images had a total of 115 growth degree days (GDD) in between, including important growth stages that determine the sugarcane yield, such as peak of tiller (500-800 GDD) and tiller stabilization (1200 GDD). Using the information provided from the satellite sensors and the yield assessed in the field, a prediction system was built. Two of the fields were used to teach the AI, while one field was used to evaluate how well the system could predict sugarcane tonnage. Random Forest was the AI system used to perform the predictions.

A map using the harvest yield monitor information from the field not used to teach the AI was generated and compared to the satellite-based yield prediction for this same field. Figure 1 presents the results obtained. Overall, based a visual comparison between the two maps it is possible to say that they are similar. Both maps address well the low and high yielding zones within the fields. In addition, the average yield obtained for this field from the harvester and the prediction differ in 0.17 tons per acre. The predicted map was obtained using the 14-satellite imagery and 1 month before harvest. Therefore, this information could be used to help with harvesting management.

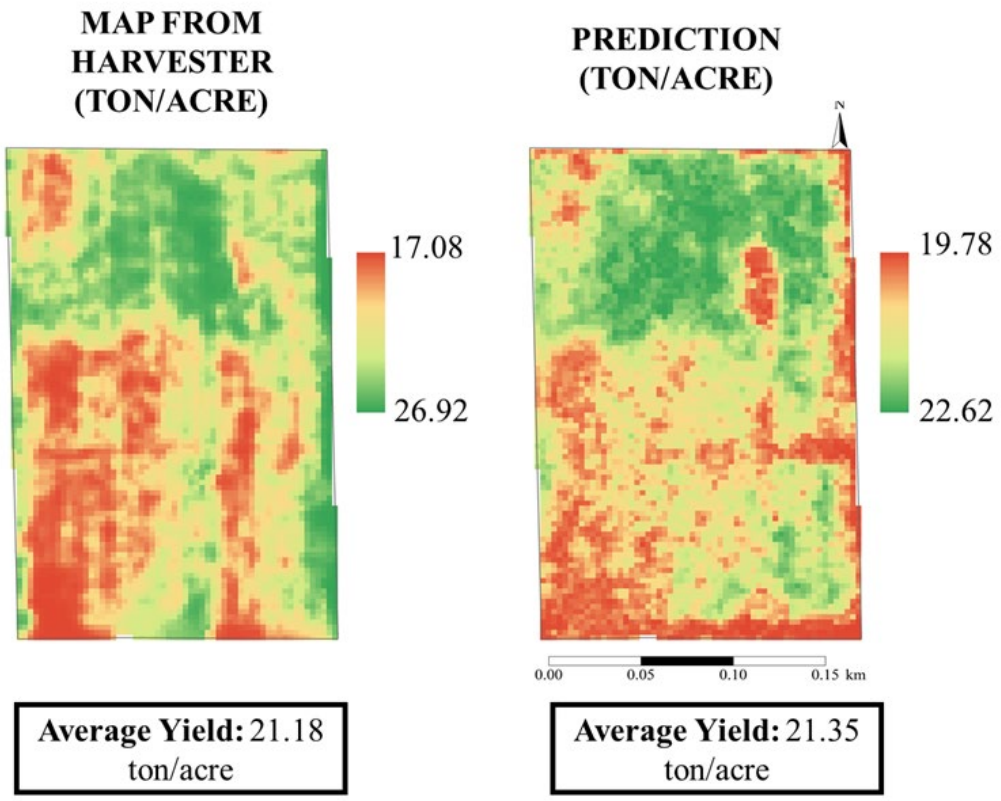

Figure 1. Sugarcane yield (tonnage) maps obtained from a harvester equipped with a yield monitor (left) and the predicted map using an artificial intelligence system (right).

Also, an evaluation was performed using different numbers of images from the season in order to identify if it would be possible to predict the yield earlier in the season. Based on the dataset used for this evaluation, using a total of 4 images (total of 460 GDD – end of April) or the 14 images would produce similar results. Thus, a predicted yield map could be obtained early in the season and be used to guide lay-by nitrogen or ripener applications, as well as help with the harvest management and planning.

Overall, based on the data used for this project, AI and satellite imagery can produce reliable yield maps that can be used as a tool to help with sugarcane crop and harvesting management. However, it is necessary to include more fields from different locations, conditions and cane age to confirm that the results presented at this research can be widely generalized. The results presented in this report show the potential of using data collection and analysis on the development of new tools to support farm decision making.