WISCONSIN–From IoT to UAV, UW Biological Systems Engineers Focus Work on Advancing Forage Technology

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Funded by MFA's Midwest Forage Research Program (MFRP), Matthew Digman's team is investigating a portable, cloud-connect system for predicting drying rate and ultimately identifying the best time to cut hay. Last summer they developed a hardware proof-of-concept and conducted six drying studies to calibrate the system. Utilizing these data, relevant variables were identified and a model was developed to predict alfalfa drying rate. Although the model fit the data well, it didn't yet meet expectations in an independent trial. They will continue to improve the model as funding becomes available.

Digman's lab is also working to improve logistics of removing round bales from fields. Bale collection is tedious and labor-intensive. It is also time-sensitive to avoid loss of dry matter or damage to crop regrowth. Ultimately, the project seeks to utilize unmanned aerial vehicle to determine bale location, identify field obstacles, and develop optimal paths. Project results could be used by manned and unmanned bale collectors for in-field navigation and retrieval.

Brian Luck's team was featured in a recent *Forage Focus* issue on its research seeking to quantify yield and quality reductions caused by compaction. During the 2019 season, a total of 84 plots were defined with seven different treatments simulating different alfalfa harvesting schemes. Initial results indicate any traffic applied to alfalfa during harvest has a negative impact on yield. Maintaining common traffic lanes and double-checking tire pressure on all machinery used in alfalfa harvest can help reduce negative impacts.

Another study, supported by NAFA's Alfalfa Checkoff, seeks to improve quality of wrapped dry hay. In-line bale wrappers are sometimes used to wrap dry hay bales to conserve value during outdoor storage. Experience shows this works well with very dry bales, but when bales have slightly elevated moisture condensation at the hay-film interface, it can lead to spoilage. Kevin Shinner's lab is modifying bale wrappers to allow a breathable film to be applied rather than stretch plastic film. Research will then be conducted to determine storage characteristics of bales wrapped with both materials at different moisture contents.

Did you know that as much as 50% of forage fiber passing through the dairy cow's digestive tract is not utilized for milk production? Shinner's lab is committed to understanding, quantifying, improving, and managing forage fiber digestibility to contribute to the growing field of dairy nutrition because of its impact on milk production and feed economics. Through novel approaches to improve forage fiber digestion by extreme mechanical processing (ExMP), it hopes to increase the forage specific surface area and rupture plant cells, which will enhance microbial attachment in the rumen and increase the rate and extent of fiber digestion. Initial experiments with cannulated dairy cattle have been promising. A full-scale feeding trial is planned as the next step in the research.

Lastly, Zhou Zhang's lab focuses on improving ability to measure and manage forage yield. The project aims to produce a non-destructive and efficient way to monitor crop growth using hyperspectral imaging and machine learning. Some initial data was collected in conjunction with the compaction field trials and plans are to further expand the dataset this summer.