Field Area Impacted by Alfalfa Harvest Wheel Traffic

Brian Luck, University of Wisconsin-Madison

Alfalfa harvest for haylage and hay production requires many machines. Machinery traffic on established alfalfa plants has an impact on yield the next harvest. Preliminary UW-Madison research results show wheel traffic applied to alfalfa damages regrowing stems, causing reduced regrowth vigor and yield. We wanted to determine production field area impacted by harvest machine tires, so we collaborated with a dairy that produces alfalfa haylage for feed. Every machine involved in harvest (2 swathers, 2 mergers, 2 choppers, and 12 transport vehicles) were instrumented with Global Navigation Satellite Systems (GNSS or GPS) to log locations every 1 second. Arduino™ microcontrollers were used as the "brain" of the system and GNSS and storage breakout boards were connected to generate and store location data. Data were collected in the 2019 and 2020 growing seasons on a 76-acre field with three representative harvests collected in each season.

Machinery footprint was determined by documenting tire size. Total loaded footprint was applied as a continuous line along the machinery path, generating an area impacted while the machine was in the field. Total field area was measured using a Real-Time Kinematic GNSS coupled with an agricultural field computer capable of generating field boundaries.

Results – on average, 49% of the field had tires on it at least once during harvest. Some field areas were driven on multiple times (data has not yet been broken into number of passes), equating to 37 alfalfa acres that had yield potential reduced due to machinery interactions. The number of machines, specifically transport vehicles, involved at harvest varied. Generally, first, third, and fourth cutting had lower percentages of the field impacted, but second cutting showed 61% (46 acres) of the field was impacted. Yield loss due to traffic can be as high as 0.7 ton/ac. Yield loss over the average field coverage of 49% equates to 26 tons of alfalfa haylage yield potential lost.

Factors, such as field shape and number of entrances, contribute to how much of the field is covered by wheel traffic. Irregular shapes, especially those including grassed waterways, require transport vehicles to travel longer distances to the harvester. Multiple entrances can help minimize distance traveled to the harvester.

You can minimize traffic impact on alfalfa regrowth by checking tire pressure. Running agricultural tires at the proper pressure increases tire footprint, thus spreading the load over a greater area and minimizing the force applied to soil and plants. One of the largest offenders is on-road tires on transport trucks to haul alfalfa haylage. These are usually inflated to 100+ psi and have zero compliance, meaning 100% of the vehicle weight is transferred to plants and soil. This is great on asphalt but does substantial damage in a perennial crop. A slightly more difficult solution would be to identify in-field roads and have machinery, specifically transport vehicles, stay on those to drive to the harvester. This guarantees you will damage or likely kill plants within the roads, but limit the area impacted. One road across each field headland and then turning 90 degrees to get to the harvester will lengthen travel time but limit wheel traffic.

Optimizing your alfalfa production system requires not only paying attention to what machines are used, but also where they travel in the field. Using agricultural tires wherever possible and limiting where machines travel within the field will decrease damage to the crop and maintain yield potential between harvests.

For more information, see bit.ly/3stQLtG.