

Quantifying Machinery Traffic During Alfalfa Harvest & Assessing Yield & Forage Quality Impact

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Alfalfa is unique from other crops as it requires a variety of machines to harvest. Whether it is being harvested for silage or hay, alfalfa harvest can require up to five different pieces of equipment per cutting. With this many machines traveling through a field during a single harvest, a significant portion of production field can be affected by machine traffic. Specific machines involved in alfalfa harvest include a mower, merger or rake, tedder, forage harvester or baler and multiple different types of transport vehicles. In the United States, over 6.7 million hectares of alfalfa were harvested in 2019, worth over \$9 billion (USDA/NASS, 2019) with some of this area seeing multiple passes of machinery traffic. This substantial amount of production in the US shows the impact machine traffic could have.

In 2019 and 2020 all machines involved in alfalfa harvest were monitored using GNSS receivers to determine their paths through the field. The area impacted by the tires was subtracted from the total field area. Results showed that on average, 49% of the field area had tires pass over it.

Research plots were assessed at the Arlington Agricultural Research Station with 7 different treatments. Yield results were collected in 2019, 2020, and 2021. Wheel traffic applied to the alfalfa plots showed statistically different results for the no-till (P-value = 0.17 and 0.007 respectively) and medium tillage (P-value = 0.01 and 0.11 respectively). Heavy tillage showed no statistically different results due to external factors in the field. Average yield reduction was shown to be 0.68 ton/ac.

Reducing wheel traffic in alfalfa production systems has the potential to increase yield and reduce plant damage and compaction. Future research will investigate ways to reduce wheel traffic and identify methods of reducing the impact of machinery traffic on alfalfa.