

New Data on Wheel Traffic Effect on Alfalfa Yield

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The first field season for investigating wheel traffic effect on alfalfa yield and quality was completed in 2019 at UW-Madison. The research goal is to quantify yield and quality reductions by simulating silage and hay production passes in plots; assess production alfalfa fields with commercially available remote sensing technology to quantify area impacted by wheel traffic; and define mechanisms causing yield and potential quality losses by compacting the soil or damaging plants. Plots were planted at Arlington Agricultural Research Station in the spring of 2019. Four tillage treatments were applied in blocks: spring and fall tillage, spring tillage only, no-till, and previously established alfalfa. A total of 84 plots were defined with seven different treatments simulating different alfalfa harvesting schemes (Table 1). Four harvests were completed during the 2019 growing season. A small walk-behind plot harvester was used and compaction was considered negligible. Compaction treatments were applied with a swather weighing ~19,000 lbs. Yield results are shown in Table 2. Alfalfa grown with no compaction applied throughout the season provided nearly 3.7 Mg/ha (1.7 tons/ac) more yield than the nearest significantly different treatment, which was treatment 5 (three-pass hay). As expected, the lowest yielding treatment was 6 (five-pass hay) yielding 4.0 Mg/ha (1.8 tons/ac) less than the zero-compaction treatment. These initial analysis yield differences are at harvest moisture content and do not reflect dry matter content differences, which are currently being analyzed. Initial results indicate any traffic applied to alfalfa during harvest has a negative yield impact. Maintaining common traffic lanes and double-checking tire pressures in alfalfa harvest can help reduce negative impacts. Future research steps: analyze soil compaction, UAV remote sensing data, and forage quality data.

Table 1. Machinery traffic treatments applied to alfalfa plots in 2019 to assess the effect on yield and quality parameters.

Treatment	Name	Description
1	Single-Pass Silage	One application of compaction immediately after harvest covering the entire plot.
2	Three-Pass Silage	Three applications of compaction. One immediately after harvest, one 24 hours after harvest, and one 26 hours after harvest. Full plot application.
3	Five-Pass Silage	Five applications of compaction. One immediately after harvest, two passes 24 hours after harvest, and two passes 26 hours after harvest. Full plot application.
4	Simulated Silage	Two wheel tracks applied within the plot. One pass immediately after harvest, one pass 24 hours after harvest, and two passes 26 hours after harvest.
5	Three-Pass Hay	Three applications of compaction. One immediately after harvest, one 48 hours after harvest, and one 56 hours after harvest. Full plot application.
6	Five-Pass Hay	Five applications of compaction. One immediately after harvest, two passes 48 hours after harvest, and two passes 52 hours after harvest. Full plot application.
7	Zero Compaction (control)	No machine traffic applied.

Table 2. Yield results from alfalfa compaction treatments during the 2019 growing season.

Treatment	Mean Yield (ton/ac)	Standard Error (ton/ac)
7. No-Compaction	7.5 ^a	0.23
1. Single-Pass Silage	6.5 ^{ab}	0.21
4. Simulated Silage	6.4 ^{ab}	0.24
5. Three-Pass Hay	5.8 ^b	0.23
3. Five-Pass Silage	5.8 ^b	0.23
2. Three-Pass Silage	5.8 ^b	0.23
6. Five-Pass Hay	5.7 ^b	0.23

*Letters denote statistically significant differences (alpha = 0.05).