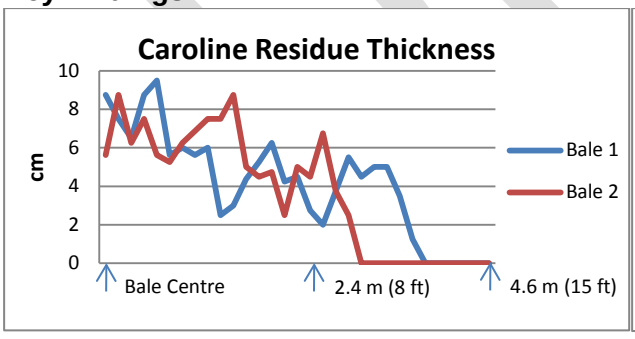
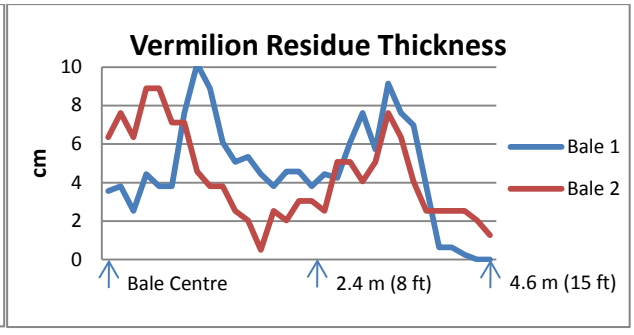
The effects of bale grazing residue on soil moisture and temperature

With support from the Alberta Crop Industry Development Fund, Agriculture and Agri-Food Canada studied the effects of a two-in-three year bale grazing rotation on soil moisture and temperature. Two perennial pastures were selected for the project. The first location is north of Caroline on an Orthic Gray Luvisol while location two is south of Vermilion on a thin Black Chernozem. The adjacent photo shows the type of variability in residue expected following bale grazing.

Bales were placed 40ft (12.5m) apart, bale grazed in 2012/13 and again in 2014/15. Bales for the 2014/15 bale grazing treatment were offset between the 2012/13 bales. Two test bales were grazed at both locations with one bale being grazed early (Dec/Jan) and the other late season (Mar/Apr) over both winter seasons.

Key Findings





Residue

Bale residue thickness was measured for each study bale at 0.5 foot (15 cm) intervals out to 15 feet (4.6 m) from bale centre (see graphs above). Residue cover was uneven in all cases but for Caroline it tended to decrease out from the centre, reducing to zero before the 15 foot (4.6 m) mark. Residue cover at Vermilion had the greatest thicknesses two or three feet (0.6 to 1 m) from centre and at

around 11 feet (3 m) from centre. It also extended out further, 14 and 15 feet (4.3 and 4.6 m) for Bale 1 and 2 respectively.

Soil Temperature

Bale residue reduced soil temperatures for at least three years following bale grazing. While research indicates that this may be disadvantageous for microbes that break down litter and allow nutrients to enter the soil, our study found that residue was broken down rapidly and incorporated into the soil as quickly as two years post bale grazing. Note the graphs on page one showing no remaining residue at 15 feet (4.6m) from bale centre at Caroline and only a little remaining for Bale 2 at Vermilion where 2012/13 bale residue would have occurred. Additional research has indicated that the breakdown of litter into the soil is faster when the daily soil temperature fluctuation is lower. Our study showed no difference in diurnal temperature fluctuation and therefore, no advantage or disadvantage was seen.

Soil Moisture

The residue cover along with increased forage growth resulted in drier soils at the Caroline location. This phenomenon was most likely caused by evapotranspiration and evaporation rates and decreased infiltration, initially due to bale residue and then due to increased forage growth above where the sensors were located. At Vermilion, the data from Bale 1 showed that the residue had a positive effect on soil moisture while the effects on Bale 2 were inconclusive due to missing data. Despite the variability in soil moisture and delayed forage growth due to residue, forage production on the areas impacted by the 2014/15 bale grazing treatment surpassed the 2012/13 bale locations by mid-summer in 2015 (first growing season post bale grazing). As indicated in the adjacent photo taken in 2016, this increase in production continues for the length of the project (3 years) as is evident in the greener circles of growth associated with bale placement. Note the project area (grazed 2012/13 and 2014/15) on the left while the right side was grazed in 2013/14. Additional research is required to better understand the relationship between bale grazing, soil temperature/moisture, residue, and forage production.

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