Harvest Management Impacts on Potential Ethanol and Crude Protein Yield in Alfalfa

JoAnn Lamb, Hans Jung, and Heathcliffe Riday
USDA-ARS, University of Minnesota, Saint Paul, MN and Madison, WI

The proposed alfalfa (*Medicago sativa L*) biomass energy production system will produce two products. Leaves will be separated from stems to produce a high protein feed for livestock and the stems will be processed to produce ethanol. Therefore, maximum yields of both leaves and stems are essential for profitability of an alfalfa biomass production system. Our objective was to assess the impact of growth environment (locations, years and plant density) and harvest-stage (early bud (4 cuts) and late flower (3 cuts)) on variability in leaf crude protein yield, stem cell wall concentration and composition and potential ethanol yield for four alfalfa germplasms. Two cultivars, 4A421 and 6415 were chosen because they had been selected for improved forage quality. The cultivar 54H11 was included because it is a resistant check for standability expression (non-lodging) in alfalfa. Experimental germplasm MN Bio 1_{C3} (UMN3988) created as a bioenergy alfalfa by three cycles of selection for large, erect non-lodging stems when alfalfa was in bloom was also included. Results showed that leaf crude protein and potential ethanol yields responded differently in MN compared to WI. Results are reported separately for the two locations. Potential ethanol yield was greater at late flower compared to early bud, while leaf crude protein was similar at the two harvest maturity stages at both locations. The four germplasms were similar for ethanol yield in MN, but in WI the two non-lodging germplasms had greater potential ethanol production compared to the high forage quality cultivars. Leaf crude protein yield was greater in MN compared to WI. In WI, no difference were found among the germplasms for leaf crude protein yield, but the high quality cultivars had greater leaf crude protein yield than the non-lodging germplasms in MN. Germplasm difference were found for leaf crude protein and potential ethanol yield, but environmental influences had the greatest impact on these to alfalfa biomass energy products.