Nitrogen Fertilization, Interseeding Alfalfa, Rumen Microbes & Production Efficiency, Pastures Producing More Milk

Scientists from the U.S. Dairy Forage Research Center

With a multidisciplinary team of 20 scientists, the U.S. Dairy Forage Research Center (USDFRC) in both Madison and Marshfield, WI, is working on a variety of studies to improve the economic and environmental sustainability of dairy forage systems. Here is an update of four projects.

N Fertilization for Improved Forage Yields Has Little Impact on Nutritive Value – *Wayne Coblentz, Marshfield, WI*

Applications of soil amendments or fertilizers containing nitrogen are a routine part of most grass forage management strategies, with the primary goal of improving forage yields. But an increase in yield is usually accompanied by a decrease in nutritive value. In order to better evaluate this tradeoff, we evaluated the effects of nitrogen fertilization on the nutritive value of a single cultivar (ForagePlus) of fall-grown oat fertilized at planting with six different rates of urea (nitrogen) or two rates of dairy slurry.

Concentrations of fiber components increased consistently with nitrogen fertilization, while water-soluble carbohydrates (sugars) exhibited the opposite response. Overall, the forage nutritive value of fall-grown oat declined mildly in response to nitrogen fertilization, but these responses were not nearly strong enough to offset the advantages obtained by improved forage yields. This study provides forage farmers with the knowledge that fertilizing for improved yields will not greatly reduce the nutritive value of fall-grown oat forage fed to dairy cattle.

Workable Corn-Interseeded Alfalfa Production Systems Would Have Many Benefits – *John Grabber, Madison, WI*

According to recent agricultural statistics, alfalfa was planted on 0.44 million acres and harvested from 2.2 million acres, and silage corn was planted and harvested from 1.0 million acres per year in Wisconsin. Because both crops are often grown in rotation, alfalfa could be interseeded at corn planting to serve as a dual-purpose crop for providing groundcover during silage corn production and forage during subsequent growing seasons.

Unfortunately, this system has been unworkable because competition between the co-planted crops often leads to stand failure of interseeded alfalfa. At the USDFRC, we are conducting a long-term research project to develop a system that works on the farm. Earlier studies demonstrated properly timed foliar applications of a plant growth inhibitor on appropriate alfalfa varieties could increase plant survival of interseeded alfalfa by up to 400%. When successfully established, the average dry matter yield of interseeded alfalfa the following year was two-fold greater than conventionally spring-seeded alfalfa.

Preliminary economic analyses suggest using interseeding in place of conventional spring seeding for alfalfa establishment could improve net returns of first year alfalfa by about $100/ac. Other studies revealed interseeded alfalfa reduced fall and spring runoff of water and phosphorus by 60% and soil erosion by 80% compared to cropland containing only silage corn residues and weeds. These improvements in crop yields, profitability, and soil and water conservation are powerful incentives for continuing research to develop reliable and workable corn-interseeded alfalfa production systems for use on farms.

Rumen Bacterial Community Affects Milk Production Efficiency – *Paul Weimer, Madison, WI*

Improving the milk production efficiency of dairy cows is essential to both the profitability and environmental sustainability of dairy farms. Cows differing in milk production efficiency are known to have different rumen microbial communities, but a direct role of the microbial community in dictating efficiency is lacking.

In this collaborative study (USDFRC and University of Wisconsin), we demonstrated that near-total exchange of rumen contents between pairs of cows differing in milk production efficiency resulted in a temporary change

in their efficiency to more closely resemble the donor cow before gradually returning to the milk production efficiency of the host cow over a period of approximately one week. Likewise, the composition of the bacterial community reverted to that of the host cow over about the same time period.

These results provide the first direct evidence that milk production efficiency can be altered, at least transiently, by substitution of the rumen bacterial community from a cow of different milk production efficiency. Future experiments will attempt to establish "high-efficiency" communities in cows by early-stage (birth through weaning) inoculations of rumen contents into calves, using rumen contents from high-efficiency cows. If successful, this strategy may be useful to dairy farmers as a facile means of improving the profitability and environmental sustainability of their herds.

Milk Production of Grazing Cows Most Highly Associated with Pasture Legumes & Grazing Height – *Geoffrey Brink, Madison, WI*
Organic dairies may have lower milk production as a result of poor pasture production. This collaborative study (USDFRC and University of Wisconsin), determined pasture management factors associated with potential milk production on 20 Midwestern organic dairies.

At each farm, two pastures considered either productive or unproductive were sampled before grazing for species composition, productivity, and nutritive value in June and September. Soil samples and management information were collected in October. Potential milk production was calculated based on forage productivity, nutritional value, and anticipated consumption by grazing cows.

Higher milk production is most highly associated with 1) proportion of improved legumes in the pasture and 2) making sure cattle do not graze shorter than 4˝.

We found higher milk production of grazing cows was most highly associated with 1) proportion of improved legumes such as red clover and alfalfa, which have greater nutritional value than other pasture species, and 2) making sure cattle do not graze the pasture shorter than 4˝, which ensures rapid regrowth by grasses after grazing. Conversely, lower milk production was negatively associated with the proportion of unimproved grasses such as Kentucky bluegrass, which have lower productivity and nutritional value.