On-Farm Evaluation of Alfalfa/Grass Mixtures: Establishment and Initial Performance

Paul Peterson, Doug Holen, Dan Martens, Dave Nicolai, Jim Paulson, Betsy Wieland, and Nathan Winter; University of Minnesota Extension

MFA Grant Report submitted 31 July 2009

Introduction

Alfalfa and corn silage are the primary forages fed in total mixed rations (TMRs) for dairy cows in Minnesota and the North Central region as a whole, largely because of their high yield and forage quality potentials. Grasses have usually played a lesser role, and have been less appreciated for their capacity to contribute to farm profitability. However, during the last decade, interest in forage grasses for pasture, hay, and haylage has been increasing; but data and experience to determine when and how grasses can best benefit forage and dairy production enterprises are lacking. While grass use as pasture is certainly important for sustainable agriculture, this project addresses the agronomic and nutritional potential of grasses and grass-alfalfa mixtures as harvested forage for dairy and beef animals.

Reasons for increased interest in grasses include, among others, their digestible fiber, yield and persistence potential, and responsiveness to manure. Compared to alfalfa, grasses generally have greater total fiber content, as measured by neutral detergent fiber (NDF). Greater NDF content usually implies less intake potential by dairy cows. NDF is a key negative contributor to the Relative Feed Value (RFV) calculation, so grasses usually have lower RFV than alfalfa and thus are assumed to have less dairy feeding value. However, the NDF of grasses can have double the ruminant digestibility of that of legumes, so NDF amount tells only part of the story. Commercial labs are now routinely offering NDF digestibility (NDFD) analyses. Also, a newer forage quality index, relative forage quality (RFQ), developed to incorporate NDFD, is growing in acceptance and use.

Grasses can be grown alone, but greatest potential is likely in mixtures with alfalfa. Alfalfa-grass mixtures are the norm in areas such as the Northeast. Well-managed grasses can yield as much or more than alfalfa. Also, their presence in mixture with alfalfa can improve overall forage stand persistence. Since alfalfa is currently most often grown solo on Minnesota farms, this project includes several grasses in mixtures with alfalfa vs. alfalfa alone to demonstrate and document yield, forage quality, and persistence differences and potential on farms.

Procedures

Alfalfa/grass mixture trials were seeded near Hutchinson (Red Cedar Farm) on 25 August 2008, near Underwood (Jon Wold farm) on 29 August 2008, on the St. Paul campus on 8 September 2008, and near Avon (Jim Barg farm) on 4 May 2009. Treatments included binary mixtures of alfalfa with different perennial grasses compared to alfalfa seeded alone at 3 different seeding rates. Three different alfalfa varieties were used: Rebound 5.0, 4S419, and Spredor 4. Rebound 5.0 is a standard high-yielding hay-type variety that has done well in previous UMN trials. The
seed was coated, and thus 65% pure live seed (PLS). 4S419 is a hybrid type that also did well in previous UMN trials. Spredor 4 is a grazing-type, fall-dormant variety with some yellow-flowering (falcata) alfalfa in its genetic background. Alfalfa seeding rates in binary mixtures for the three 2008 seedings were 10 lb PLS/acre (15 lb/ac with coating) for Rebound 5.0, and 15 lb/ac for 4S419 and Spredor 4. Three different alfalfa varieties were used to determine if different alfalfa regrowth genetics affects compatibility with grasses, and also to increase overall robustness of our results.

Two varieties of each of nine different grass species were also included in the trials. Grass species (and seeding rates) included smooth bromegrass (10 lb/ac), meadow bromegrass (10 lb/ac), timothy (4 lb/ac), reed canarygrass (6 lb/ac), orchardgrass (6 lb/ac), perennial ryegrass (8 lb/ac), festulolium (8 lb/ac), tall fescue (8 lb/ac) and meadow fescue (8 lb/ac).

Individual plots were 3’ x 20’, with alfalfa and grass seeded together in 5 rows per plot. Two replications were seeded at all sites with alfalfa varieties as whole plots (as “internal reps”) and grass species as subplots. The two varieties of each grass species mixed with each alfalfa variety were seeded side-by-side. Estimated seeding depth was ½-1”. Initial fertility and pH at Hutchinson and St. Paul were at optimum levels, so no amendments were added. Some P and K fertilizer was top-dressed at Underwood after seeding to bring their levels to optimum. pH, P, K, and OM (coarse-textured soil) were suboptimal prior to seeding at Avon; so lime, N, P, K, and S were applied and incorporated prior to seeding there.

To date in 2009, two harvests have been obtained from the Hutchinson and Underwood trials. The Hutchinson site was harvested May 29 and July 1. The Underwood site was harvested June 11 and July 10. Plots were harvested to a ~4” residual using a flail harvester to determine fresh weight yields. Samples were obtained from 28 selected plots per site per harvest for dry matter determination and forage quality analyses. These samples were placed in paper bags, dried in a forced-air oven at 140°F for 3-5 days, and sent to the University of Wisconsin Forage Testing Lab at Marshfield WI for processing and analyses.

**Preliminary Results**

**Establishment**

Establishment data were not collected, but general observations were made and are worth reporting. The August 2008 seeding at Hutchinson followed a fallow period, so there were some annual weeds, but not enough to appear to be of competitive significance. Temperature and moisture conditions were near-optimum for alfalfa, so alfalfa established quite rapidly and uniformly. Grass establishment was generally good, but variable and less vigorous than alfalfa. Thus, at Hutchinson, initial stands are generally alfalfa dominant.

The August 2008 Underwood seeding followed wheat harvested for grain, so there was a fair amount of volunteer wheat amongst the forage seeding. However, it did not appear to negatively affect perennial forage establishment; in fact, it may have helped provide winter cover as the seeding was somewhat later than would generally be recommended for that area, and forage seedling development was less vigorous overall than at Hutchinson. The Underwood seeding is
better balanced than the Hutchinson seeding so far, with grasses being considerably more present, perhaps because fall and early spring climate there did not favor alfalfa over grass as it did at Hutchinson. Seeding rates used were identical at the two sites, so it is interesting and somewhat surprising to see how different their initial composition is.

The early September 2008 St. Paul seeding appeared to establish reasonably well initially, but uncontrolled Canada goose grazing resulted in the entire plot area being grubbed to the ground prior to winter. The result was nearly 100% winter kill, so the site was abandoned.

The early May 2009 seeding at Avon is encountering significant annual grass and mustard competition as well as periodic drought stress due to the coarseness of the soil. No data have yet been obtained, but the entire plot area was mowed once in late June to attempt to suppress weeds. It is difficult to assess initial perennial grass establishment amidst the weeds, but the presence of some perennial ryegrass and festulolium seedheads in their respective plots indicates these species have established at least to some degree. Alfalfa stands look fairly good, but are still short in stature due to drought and weed competition. This site also included a few red clover/grass mixtures, and red clover appears to be doing quite well.

**Initial Forage Yield**

Figure 1. Total forage DM yields of alfalfa/grass mixtures seeded 25 August 2008 at Hutchinson, MN, and harvested 29 May and 1 July 2009. Mid-August and mid-October 2009 harvests have yet to be obtained.
Yield data for alfalfa/grass mixtures totaled over their first two 2009 harvests at Hutchinson and Underwood are shown in Figures 1 and 2, respectively. To date, average total yields at Hutchinson (2.1 ton DM/ac) are almost double those at Underwood (1.1 ton DM/ac), whereas average grass percentages at Underwood (30.4 %) are quadruple those at Hutchinson (7.6 %). The yield range across individual plots so far is 1.2 - 2.9 ton DM/ac at Hutchinson, and 0.7 - 1.6 ton DM/ac at Underwood, so there is considerable plot-to-plot yield variability at each site unassociated with treatments.

It is too early to attempt to draw any conclusions about yield potential comparisons, as all mixtures and alfalfa alone are yielding fairly similarly at each location at this early stage. It will be interesting to see how the greater initial grass percentages at Underwood affect yield responses relative to Hutchinson, and whether grass percentages will increase over time for any of the grass species at Hutchinson. The large initial timothy, and thus somewhat small alfalfa, percentages at Underwood will also be interesting to watch.

**Initial Forage Quality**

The RFQ of standing forage of all treatments, shown in Table 1, has generally been of “dairy quality” so far. It is interesting that RFQs have been somewhat higher at Underwood together with greater grass percentages there. This begins to suggest and demonstrate that forage with
significant grass content could consistently be of dairy quality. However, forage quality was measured on oven-dried forage samples. Unavoidable harvest and storage losses would likely result in slightly lower RFQ values in farm-produced forage. So far, there is also no clear quality advantage or disadvantage of alfalfa alone compared to alfalfa/grass mixtures.

Table 1. Weighted-average RFQ (via NIRS Consortium equations) of alfalfa/grass mixtures from the first two (of four) harvests at Hutchinson and Underwood in 2009.

<table>
<thead>
<tr>
<th>Species</th>
<th>Hutchinson</th>
<th>Underwood</th>
</tr>
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<tbody>
<tr>
<td>Alfalfa (A) alone</td>
<td>152</td>
<td>171</td>
</tr>
<tr>
<td>A + Festulolium</td>
<td>145</td>
<td>171</td>
</tr>
<tr>
<td>A + Meadow Bromegrass</td>
<td>155</td>
<td>177</td>
</tr>
<tr>
<td>A + Meadow Fescue</td>
<td>158</td>
<td>171</td>
</tr>
<tr>
<td>A + Orchardgrass</td>
<td>160</td>
<td>174</td>
</tr>
<tr>
<td>A + Perennial Ryegrass</td>
<td>160</td>
<td>169</td>
</tr>
<tr>
<td>A + Reed Canarygrass</td>
<td>150</td>
<td>179</td>
</tr>
<tr>
<td>A + Smooth Bromegrass</td>
<td>160</td>
<td>162</td>
</tr>
<tr>
<td>A + Tall Fescue</td>
<td>163</td>
<td>173</td>
</tr>
<tr>
<td>A + Timothy</td>
<td>152</td>
<td>157</td>
</tr>
</tbody>
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Overall, variations in yield, grass percentage, and quality initially appear to be greater across locations (environments) than across treatments within locations (environments). This suggests a challenge in predicting initial alfalfa/grass performance based on species selection and seeding rates alone, as environment played a significant role in mixture establishment and initial performance.