## DAIRY

## Yield, Quality, & Production Costs of a Cocktail Forage Mix & Italian Ryegrass

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ith recent widespread alfalfa winterkill, low commodity grain prices, wet fields limiting manure spreading options, and opportunities to diversify forage feed inventories for late-lactation dry cow and dairy replacement heifers, there is growing interest in alternative forage crops and cropping systems. However, limited agronomic and economic data exist to evaluate various options, especially when growing a blend of warm- and cool-season forage species together.

To address this growing interest, in 2019 we worked with Waupaca County dairy producers Dan and Ruth Boerst to establish 3 field-scale forage treatments which included corn silage (CS), annual ryegrass (ARG), or a cocktail forage mix (MIX) consisting of BMR sorghum-sudangrass, annual ryegrass, and clover blend. A winter



rye cover crop forage was established the previous fall as a cover crop. On April 21, annual ryegrass was interseeded into the cover crop using a no-till drill at 15 lbs/ac. Winter rye forage was harvested from all fields on June 3 with 0.7 tons DM/ac yield. Following the winter rye harvest, CS was planted on June 7 at 32,000 seeds/ac and the MIX was no-till drilled on June 19. The MIX was seeded at 36 lbs/ac with 21 lbs of BMR sorghum-sudangrass, 9 lbs annual ryegrass, and 2 lbs each of red, crimson, and berseem clover. Fertilization was a challenge due to high rainfall and wet soil conditions, especially for the MIX treatment which did not receive another nitrogen (N) fertilization after the first cutting. Liquid dairy manure (4,900 gallons/ac) was applied before planting the winter rye cover crop in Fall 2018. All treatments were fertilized with urea (150 lbs urea or 70 lbs N/ac) on June 27 (2 days after first ARG harvest) with CS receiving an additional urea application on July 20. The ARG also received a liquid manure application (8,900 gallons/ac) after the second cutting.

For harvest measurements, three areas across the field were harvested either using a small plot harvester (when available) or by collecting forage behind a self-propelled haybine over a measured distance. Harvests of ARG were every 3-4 weeks for a total of 5 cuttings (June 25, July 15, Aug 12, Sept 6, Oct 17) with maturity ranging from late-vegetative to early heading (20-24") except the last harvest in which the forage was 10-12" tall. The average yield across the five cuttings was 0.82 tons DM/ac with a range of 0.7-1.15 tons DM/ac. The MIX was first harvested 42 days after planting (July 31) and consisted mostly of sorghum-sudangrass (30-36" tall; 1.2 tons DM/ac), with a second harvest on Sept 6 consisting of sorghum-sudangrass and ryegrass (2.3 tons DM/ac), and third harvest on Oct 17, which was mainly ryegrass and clover (0.4 tons DM/ac). The CS was harvested on Oct 28 after a killing frost with a yield of 7.3 tons DM/ac.

Forage quality was also measured on all forages. Winter rye forage was high quality with 12% CP, 48% NDF, 72% NDFD, and 70% TDN. CS was also high quality with 7% CP, 43% NDF, 61% 30-hr NDF digestibility, 29% starch, and 76% TDN. ARG was of moderate to high quality and varied significantly by cutting. Overall, ARG had 16% CP, 50% NDF, and 62% 30-hr NDFD, and 62% TDN. However, CP ranged from 14-18%, NDF ranged from 40-55%, and NDFD from 55-78% due to differences in maturity and height especially for the last harvest. For MIX, the quality was generally high and varied somewhat across cuttings with 16% CP, 45% NDF, 69% NDFD, and 65% TDN. The first two harvests were slightly lower quality at 15% CP, 48% NDF, and 67% NDFD due to the greater maturity of the sorghum-sudangrass compared to the vegetative ryegrass and clover in the third harvest. When the yield of winter rye was combined with MIX and ARG, total-season yield was similar to the average alfalfa yield from Wisconsin Alfalfa Yield and Persistence data. This shows potential for similar yields in case forage from a winterkilled alfalfa stand needs to be replaced.

Using the measured yields and production cost data for all field operations and inputs, an economic analysis was conducted with winter rye included for all treatments (Table 1). Corn silage had the highest overall season costs, but the lowest production cost per ton DM due to the greater yield. MIX had slightly lower total cost, but greater cost/ton DM compared to CS. When compared to alfalfa with a 4-year stand life (1 seeding year; 3 production years), MIX had similar cost/ton DM. However, ARG had greater costs than alfalfa and MIX due to two

Table 1. Production costs (combined with winte	r rye forage costs).
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	Winter Rye & Corn Silage	Winter Rye & Cocktail Mix	Winter Rye & Annual Ryegrass	Alfalfa
Combined Yield	8.0	4.6	4.8	4.4
Seed \$/ac	\$123 (\$30+\$93)	\$83 (\$30+\$53)	\$44 (\$30+\$14)	\$15
N \$/ac	\$74 (urea 2x)	\$32 (urea 1x)	\$32 (urea 1x)	\$0
K20 \$/ac	\$0	\$0	\$0	\$43 (½ removal)
Fertilizer Spreading, Herbicide, Scouting \$/ac	\$96	\$77	\$167	\$134
Interest \$/ac	\$23	\$15	\$19	\$16
Planting/tillage \$/ac	\$40	\$40	\$40	\$5
Harvest \$/ac	\$215 (\$70+\$145)	\$280 (4 x \$70)	\$420 (6 x \$70)	\$280 (4 x \$70)
Future N Credits	\$0	-\$18	-\$18	-\$20
Total Costs \$/ac	\$570	\$510	\$704	\$476
Cost/ton DM	\$70/ton DM	\$110/ton DM	\$147/ton DM	\$108/ton DM

additional harvests and greater custom manure application costs. Increasing the number of harvests without increased yield is detrimental to production costs/ton and should be considered in harvest management strategies.

Overall, compared to alfalfa the ARG and MIX provided similar forage yield when combined with a rye cover crop forage. Both would fit well in lactating cow rations with partial replacement of corn silage and haylage, but MIX would be more cost-effective. If ARG yield was able to increase or kept similar with fewer cuttings, this would help even cost/ton DM. Use of MIX or ARG may work well in late-lactation or heifer rations due to higher fiber content and moderate protein values. These forages also allow manure application during the growing season and lessen fall or spring applications. If thinking of using these, check with your agronomist and nutritionist to evaluate crop rotation and forage inventory impacts.