Cocktail Forage Mix Yield & Quality – On-Farm Field Study

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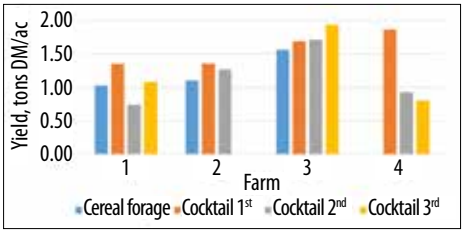
Cocktail forage mixes (CFM) have gained interest due to a few factors, including use after a spring-harvested cereal forage or perennial forage winterkill, ability to apply manure between cuttings, and potential high-quality forage. The mix used depends on soil properties and forage management. Mixes often contain a warm-season annual (usually BMR sorghum-sudangrass), Italian ryegrass, and a mix of various legumes (berseem, crimson, or red clover; hairy vetch; and others). While some omit the warm-season annual if soil is poorly drained or slow to warm in spring, most contain a high level of warm-season annual or Italian ryegrass due to quick emergence/growth and good regrowth. Work in Waupaca County showed yields of a sorghum-sudangrass-based CFM were ~4 tons DM/ac, plus 0.7 tons DM/ac from a cereal rye harvest. Other yield and quality data are limited, so in 2021 we conducted a project supported by the UW Dairy Innovation Hub (DIH) to gather forage data from four dairy farms and a feeding study looking at cow performance when fed a CFM.

On-farm forage management. Forage data were collected from production fields at three dairy farms in Northeast WI and the Marshfield ARS. Commercial farms harvested a cereal forage crop in mid-late May, then seeded CFM in early June. At Marshfield, the CFM was no-till drilled into an over-wintered cover crop of Italian ryegrass treated with glyphosate. At three farms, the mix was seeded at 35 lbs/ac with 60% BMR sorghum-sudangrass, 25% Italian ryegrass, and 15% from a combination of berseem and red clover, and hairy vetch. The fourth farm used a mix seeded at 50 lbs/ac with 59% cowpeas, 17% Italian ryegrass, 6% each of millet, alfalfa, and red clover, 4% timothy, and 2% radish. Fertility programs were variable, with one farm applying 9,000 gallons liquid manure pre-plant then synthetic nitrogen (N) fertilizer (60 lbs N/ac) between harvests. Another farm applied synthetic N pre-plant (66 lbs N/ac), then 6,000 gallons liquid manure between cuttings. One farm only applied synthetic fertilizer each cutting (45 lbs N/ac); while the fourth applied 20 lbs N/ac pre-plant and no subsequent N due to drought. The farms had a goal to harvest high-quality forage when sorghum-sudangrass was 24-36" canopy height. Harvest schedules were 40-50 days after planting for first harvest, 30-35 days for second, and 45-60 days for third taken in late September to mid-October. Species present at each harvest were variable, with sorghum-sudangrass being dominant in first harvest, then slightly less in second harvest as Italian ryegrass growth increased. Italian ryegrass increased further in the third harvest. Overall, legumes looked to have small contributions (<10%), likely due to competition from fast-growing grasses; however, legumes may provide more value and yield the following spring if these over-winter. Italian ryegrass and legumes have been observed to over-winter, providing a high-quality forage crop the following spring. At one farm, yield of spring-harvested (May 31), over-wintered Italian ryegrass was 1.8 tons DM/ac.

Yield and quality. Total-season forage yields averaged 4.6 tons DM/ac, ranging 3.7-6.9 tons DM/ac. Across the three farms, cereal forage yields were good at 1-1.5 tons DM/ac and are similar to previous data. Yields of CFM were more variable across farms likely due to differences in soil, fertility, and weather. The first harvest was the highest-yielding (1.4-1.9 tons DM/ac) on three of the four farms. For farms using synthetic N between cuttings, yields were lower for subsequent harvests (0.7-1.1 tons DM/ac), while the farm that applied liquid manure had consistently high yields (1.7-1.9 tons DM/ac). Fertility is likely key to optimal growth of grasses in these mixes, with additional work currently being conducted by other UW researchers. Some using manure between cuttings have seen damage to sorghum-sudangrass stands, suggesting Italian ryegrass-dominant mixes may be better suited for in-season manure application. Drought was an issue for the farm using the cowpeas-dominant mix, and only allowed for two CFM harvests and total season yield of 3.7 tons DM/ac. In sandy soil types, use of a warm-season annual grass-dominant mix may improve persistence through drought conditions.

Figure 1. Forage yield across the harvest season for each farm.



Cereal forage quality was excellent (19% protein, 43% NDF, 67% NDFD-30h, and 72% TDN). The CFM quality was lower than expected compared to previous data. Energy was 53-68% TDN with the highest sample

being primarily Italian ryegrass. Protein content was moderate (8.4-16.5%) with protein decreasing across harvests even with N fertilizer between harvests. Fiber content was fairly consistent across cuttings (48-56% NDF), except for a third cutting of predominantly ryegrass (42% NDF). Fiber digestibility averaged 55% NDFD-30h (41-65%) which is lower than expected considering the use of BMR trait sorghum-sudangrass and Italian ryegrass. Harvesting sorghum-sudangrass at 30-36" is important to improve fiber digestibility. Undigested NDF (uNDF-240) was between 5-12% of DM, with the CFM samples having mostly sorghum-sudangrass between 8-12% uNDF as DM. Italian ryegrass-dominant harvest was only 5% uNDF, very low compared to other forages usually fed.

CFM prior to first harvest in Oconto County, Wisconsin. *Photo: Dan Olson*

Understory of CFM prior to first harvest in Oconto County, Wisconsin. *Photo: Dan Olson*

Initial findings of lactating cow study. As part of the DIH project, we conducted a 10-week feeding study with 32 lactating cows at Marshfield (16 cows for each diet treatment). Two diets were fed and differed in the haylage source [either alfalfa/grass silage (Control) or CFM silage (Treatment)] with both contributing ~18% of the diet DM (~40% of forage DM), with corn silage making up the remaining forage DM (29% of diet DM). Soybean meal was used to balance protein across diets since the CFM silage was lower in protein. All other ingredients were similar across diets.

Dry matter intake was similar across treatments (57.2 lbs DMI average). Cows fed the CFM diet had lower milk production (81.4 vs 83.7 lbs/day), however, when milk fat and protein content were considered, energy corrected milk yields were more similar (88.2 lbs/day for CFM vs 89.2 lbs/day for control). This was mainly due to higher milk protein content (3.46% vs 3.38%) for cows fed the CFM diet. It is worth noting the CFM silage had poor stability after opening the silage bag due to a slow feedout rate, with farm staff discarding moldy silage to reduce impact on feed intakes. The impact was likely minimal as feed intake was not depressed and actually increased throughout the study. Additional analysis is being conducted to measure nutrient digestion, greenhouse gas emissions, and economics.

CFM plots (predominantly Italian ryegrass) at third harvest in Marshfield ARS. *Photo: Matt Akins*

Overall, CFM use can be a good fit after cereal grain forages with total-season yields of 4-5 tons DM/ac (including cereal forage), possibly more depending on weather conditions and fertility. Forage quality can be excellent if harvested at an optimal time and provides a forage source that can fit well in lactating cow rations. Consider input costs for these crops since they need adequate fertility to improve yield.