USDA Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

Stockpiling Perennial Cool-Season Grasses

U.S. Dairy Forage Research Center

Introduction

The concept of stockpiling forages for winter grazing, sometimes referred to as 'deferred grazing,' has been used effectively, particularly in beef-cattle operations throughout the upper South. This technique usually requires removal of residual forage by close grazing, clipping, or haying in late summer. Subsequently, all cattle are removed from the pasture and a modest application of nitrogen (**N**) fertilizer is applied to stimulate forage growth. Forage is allowed to accumulate until fall and/or winter when livestock re-enter the pasture for grazing. Generally, N fertilization rates for stockpiling cool- or warm-season forages are modest (~ 50 lbs N/acre), owing to the limited late-summer growth potential of these forages as well as the financial risk imposed by the possibility of late-summer and/or fall drought. Overall, the technique is effective at extending the grazing season, often reducing the overall reliance on stored hays and silages.

Stockpiled forages often are strip-grazed, where livestock are permitted access to a limited portion of the pasture at one time, thereby preventing trampling and improving harvest or utilization efficiency. This usually requires the producer to move an electric wire daily or on some relatively short time interval that allows for adequate forage intake but discourages waste.

Stockpiling forages for deferred (winter) grazing is uniquely suited for use throughout the upper South, which is a transition zone between a predominance of warm- and cool-season perennial forages. Thus, it is possible to stockpile both forage types, usually bermudagrass and tall fescue, respectively. Among perennial cool-season forages, tall fescue is noted for its accumulation potential under stockpiling management techniques. Stockpiled tall fescue is a good fit for beef cow-calf systems managed for spring calving because the nutritional requirements of pregnant, spring-calving beef cows are relatively low throughout most of the fall and winter, which further contributes to the effectiveness of this management technique throughout the upper South.

Stockpiled perennial cool-season grasses can extend the grazing season in the Upper Midwest

Historically, this approach has been applied less frequently within dairy enterprises located in the north-central United States compared to the upper South. This may be due in part to the potential for the early onset of severe cold weather and/or significant snowfall events, which results in a shorter window for utilization of stockpiled forages. Additional barriers for the adoption of this practice include limited research information tailored specifically to a colder climate, as well as concerns about meeting the generally greater nutritive requirements of dairy animals, which comprise the majority of cattle populations throughout the region.

Some Caution Advised

In late summer and early fall, perennial cool-season grasses produce new tillers that will be a basis

for growth the following spring. Because growing conditions may be less than optimum at this time, grazing pressure normally should be controlled to ensure continued pasture productivity the following year. Severe defoliation near the end of the growing season will likely reduce future forage production. Under typical grazing management in the north-central United States, it is best to allow grasses to grow 3 to 4 leaves (uninterrupted) before a killing frost in order to store sufficient carbohydrate reserves for spring regrowth, and then leave a 3- to 4-inch residual sward height. Stockpiling forages for deferred grazing can be used without violating these management recommendations, but some caution is advised in applying this unique grazing application. There is little or no research that identifies potential long-term damage to perennial cool-season grass swards in the north-central United States when stockpiling is employed.

Stockpiling Cool-Season Forages

Agronomic options have been evaluated to assess the best methods for stockpiling perennial cool-season grasses in Wisconsin (Riesterer et al., 2000). In that experiment, early-maturing 'Benchmark' orchardgrass, late-maturing 'AC Nordic' orchardgrass, 'Roseau' quackgrass, 'Palaton' reed canarygrass, 'Alpha' smooth bromegrass, 'Barcel' tall fescue, and 'Colt' timothy were evaluated under four N fertilization schemes at three University of Wisconsin locations (Marshfield, Arlington, and Lancaster). Fertilization treatments included:

- No N applied (F0)
- N applied at a rate of 60 lbs N/acre on about August 1st (F60)
- N applied at rates of 90 lbs N/acre after the first spring harvest, and at 60 lbs N/acre on about August 1st (F150-1)
- N applied at rates of 40 lbs N/acre before the first spring harvest, 50 lbs N/acre after the first spring harvest, and 60 lbs N/acre on about August 1st (F150-2)

Residual forage was removed to a 3.2-inch (8-cm) stubble height with a flail chopper on August 1st before stockpiling was initiated. Stockpiled forages were removed in a two-stage procedure at each research location such that the percentage of total standing organic matter (OM) could be partitioned into two categories:

- OM > 3.2 inches (8 cm) above ground level
- OM between 1.0 and 3.2 inches above ground level

This approach was used to assess the effects of weathering from wind and snow cover, as well as leaf senescence, on the vertical distribution of forage. Yields of standing OM were evaluated in October, December, and March.

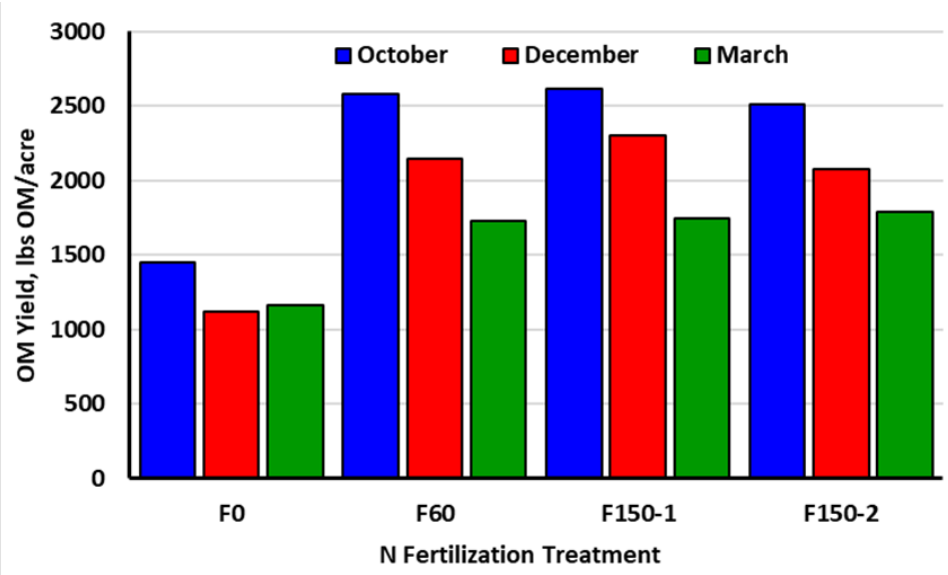

Figure 1. Yields of standing organic matter (OM) for seven stockpiled forages as affected by N fertilization and harvest date. Fertilization treatments were: i) F0, no N applied; ii) F60, N applied at a rate of 60 lbs N/acre on about August 1st; iii) F150-1, N applied at rates of 90 lbs N/acre after the first spring harvest, and at 60 lbs N/acre on about August 1st; and iv) F150-2, N applied at rates of 40 lbs N/acre before the first spring harvest, 50 lbs N/acre after the first spring harvest, and 60 lbs N/acre on about August 1st. Results are averaged over (7) forages, (3) locations and (2) years [adapted from Riesterer et al. (2000)].

The effects of N fertilization indicated several key points. First, application of N fertilizer at the initiation of stockpiling (August 1st) was essential to promote fall growth. Averaged over all forages, locations, and N fertilization treatments, fertilized forages yielded 77, 95, and 52% more standing OM than unfertilized controls (F0) in October, December, and March, respectively (Figure 1).

Secondly, there was no practical carryover or residual benefit derived from early-season fertilization. Standing OM yields for forages receiving early-season fertilization (F150-1, F150-2) varied from those just receiving N fertilizer on August 1st (F60) by only 20, 45, and 53 lbs OM/acre on the October, December, and March harvest dates, respectively.

Lastly, N fertilization was important in maximizing the percentage of the sward at a height > 3.2 inches. Averaged over all forages, locations, and harvest dates, forages receiving N fertilization (F60, F150-1, F150-2) exhibited a greater percentage of standing OM > 3.2 inches from the soil surface than did unfertilized controls (F0) (54.2 vs. 36.6%). This response was especially strong for late-maturing orchardgrass (57.6 vs. 33.0%).

Not surprisingly, there were significant differences among forage species with respect to stockpiled standing OM which suggests some species are better suited for this management approach (Figure 2). Across the seven forages evaluated, smooth bromegrass and quackgrass appeared to be poorly suited for stockpiling because of their low respective accumulations of standing OM by October (≤ 1925 and 1890 lbs OM/acre). In contrast, tall fescue and early-maturing orchardgrass appeared to offer the best potential for fall growth, reaching mean respective yields of 2,810 and 2,703 lbs OM/acre by the same date. The superior response for tall fescue was not unexpected, as this species is noted for its fall growth potential and is actively used for stockpiling within beef operations in the upper South. Other species exhibited intermediate growth responses.

Suitability of forage species for stockpiling also was associated with timing of utilization. For example, late-maturing orchardgrass and timothy exhibited a precipitous decline in standing OM after December, suggesting they should be utilized by that date. Generally, tall fescue, early-maturing orchardgrass, and reed canarygrass exhibited the most stable responses across harvest dates, suggesting they could be utilized at any point during the winter. Varietal selection is likely important for stockpiled pastures. Seasonal yield distribution, as assessed in variety trials, should be evaluated closely before seed purchases are made. For stockpiling applications, particular emphasis should be placed on potential for fall or late-season forage growth.

The percentage of standing OM > 3.2 inches from the soil surface is likely an important indicator of resistance to weathering and leaf senescence. In this research, it was hypothesized that as grass remains standing in the field during winter, it tends to lodge from wind and snow cover. Potentially, these factors may affect utilization by grazing livestock. These data are summarized for the seven forages by harvest date in Figure 3. Among them, tall fescue, early-maturing orchardgrass, and reed canarygrass maintained the greatest percentages of standing OM above the 3.2-inch vertical threshold by March, ranging closely between 39 and 43%. All other forages exhibited < 30% of their standing OM above this threshold by that late harvest date, indicating they were generally unsuitable for fall stockpiling, or their stockpiled forage should be grazed by December.

Use of Dairy Slurry as a Source of Nitrogen

The potential for accumulation of stockpiled forages using dairy slurry as a N source has been evaluated recently in a two-year experiment conducted at the University of Wisconsin Marshfield Agricultural Research Station (Wells, 2022). Nine 2.5-acre pastures of ‘Kora’ tall fescue, ‘Hidden Valley’ meadow fescue, or ‘Hay Master’ orchardgrass were established at a seeding rate of 20 lbs/acre. Meadow fescue and orchardgrass pastures were established in 2016 and had been used previously in other studies, while tall fescue replicates were established in 2020. Pastures also contained small proportions (5 to 17%) of red clover.

In Year 1 (2020), pastures were mechanically harvested in late-July, and 3,200 gallons/acre of liquid dairy slurry were broadcast-applied on August 11th, providing 34 lbs N/acre of available N. Forage was then allowed to accumulate until early October. Procedures were similar for 2021, except that forages

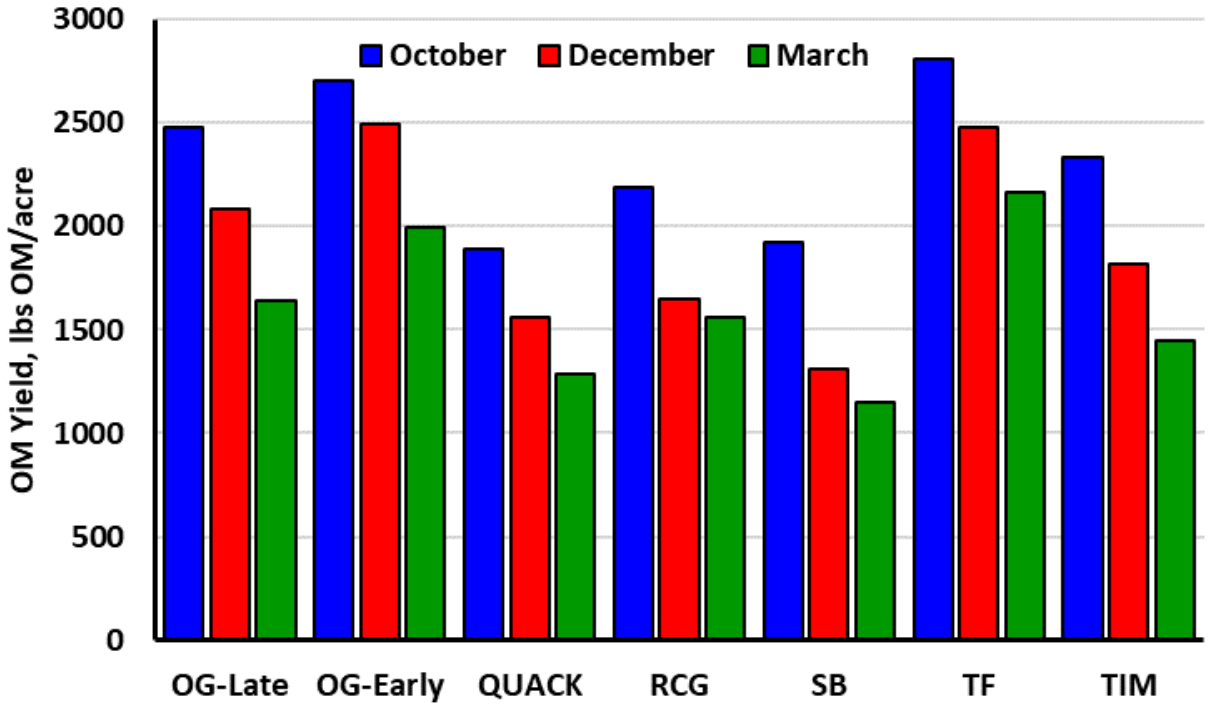

Figure 2. Yields of standing organic matter (OM) for fall-stockpiled perennial cool-season grasses in Wisconsin. Forages are abbreviated as: OG-Late, late-maturing orchardgrass; OG-Early, early-maturing orchardgrass; QUACK, quackgrass; RCG, reed canarygrass; SB, smooth bromegrass; TF, tall fescue; and TIM, timothy [adapted from Riesterer et al. (2000)].

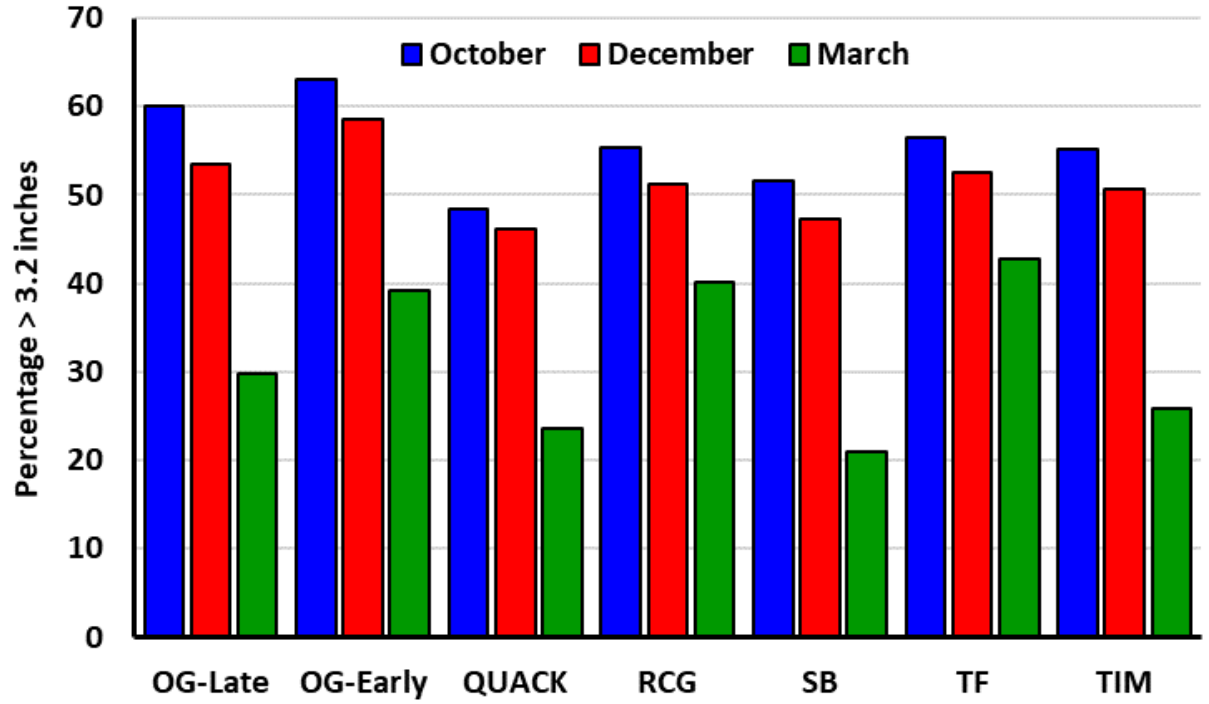

Figure 3. Percentage of standing organic matter (OM) > 3.2 inches from the soil surface. Forages are abbreviated as: OG-Late, late-maturing orchardgrass; OG-Early, early-maturing orchardgrass; QUACK, quackgrass; RCG, reed canarygrass; SB, smooth bromegrass; TF, tall fescue; and TIM, timothy [adapted from Riesterer et al. (2000)].

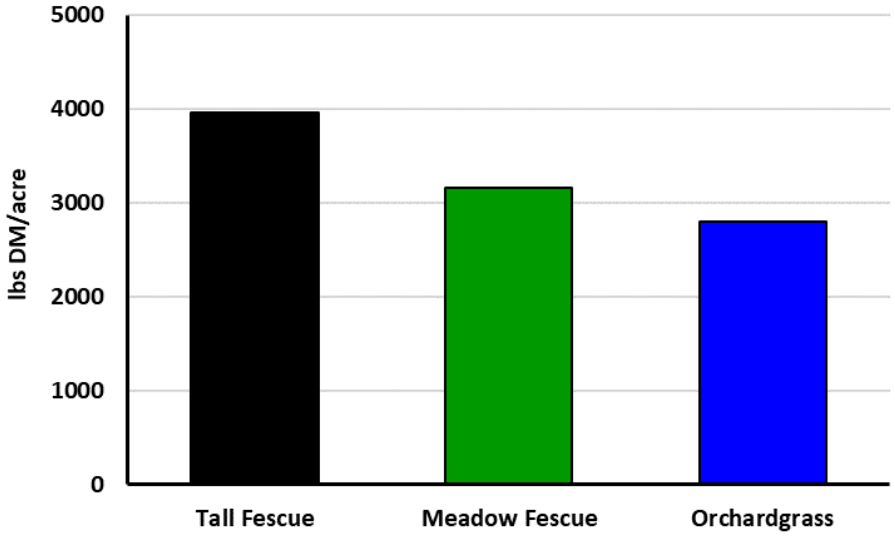

Figure 4. Two-year average production of standing forage DM of stockpiled cool-season grasses fertilized with dairy slurry at Marshfield, WI [adapted from Wells (2022)].

were grazed to a 3 to 4-inch residual height prior to stockpiling. A similar volume of dairy slurry was applied, but the associated available N rate was less (27 lbs N/acre), so an additional 13 lbs N/acre were broadcast-applied as urea before stockpiling began. The 2-year average standing (above ground) forage DM in early October is illustrated graphically in Figure 4. Under this management system, tall fescue accumulated about 2 tons DM/acre, while orchardgrass and meadow fescue accumulated roughly 1.5 tons DM/acre.

Grazing

Dairy heifers (mean bodyweight = 675 lbs) were supplemented with a mineral package at a rate of 0.24 lbs/heifer/day. They grazed stockpiled pastures for about 50 days from early October through late November in 2020 and 2021. The two-year average daily gain for heifers when averaged across all three forages species was about 2.0 lbs/day and met recommended daily weight gain targets for Holstein dairy heifers.

Summary

- Nitrogen fertilization is an essential component of producing stockpiled perennial forages. A modest rate of available N is normally advised (50 to 60 lbs N/acre), which can be provided by commercial fertilizer or dairy slurry. Previous applications of N fertilizers early in the growing season appear to have little residual or carryover effect on stockpiled forage production.
- Smooth bromegrass and quackgrass are not good candidates for stockpiling.
- Tall fescue and early-maturing orchardgrass provide the best fall yields, which may approach 1.5 to 2.0 tons of DM/acre, based on these referenced studies.
- Tall fescue, early-maturing orchardgrass, and reed canarygrass maintain the greatest percentages of standing forage OM > 3.2 inches from ground level through March, and they can be grazed at any point during winter. Late-maturing orchardgrass and timothy should be grazed by December due to significant evidence of weathering; for those forages, the amount of standing forage OM and the percentage of forage > 3.2 inches from ground level deteriorate badly after that point in time.
- Stockpiled perennial cool-season grasses can support acceptable growth rates for dairy heifers during October and November.

References

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