Alfalfa Seeding Year Management

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Minnesota forage, including alfalfa hay and haylage, dry hay, and corn silage, was produced on more than 5.8 million acres in 2014[1], yielding more than 3 million tons of hay. Direct sales revenue, not including animal utilization, was more than $1 billion[1] (based on 2.3 tons/ac^{-1} average yield.) If annual production increased by 10%, this relatively small increase of 0.2 ton/ac^{-1} would equate to over $100 million in annual revenues.

During the past 60 years, alfalfa yields, forage quality, and persistence have been increased through a combination of improved genetics, disease and insect control, and more intensive nutrient and harvest management. Even though there has been substantial work in improving alfalfa production, these technologies and research findings focus on the 1st through 3rd production years with limited research associated with seeding year yield improvements.

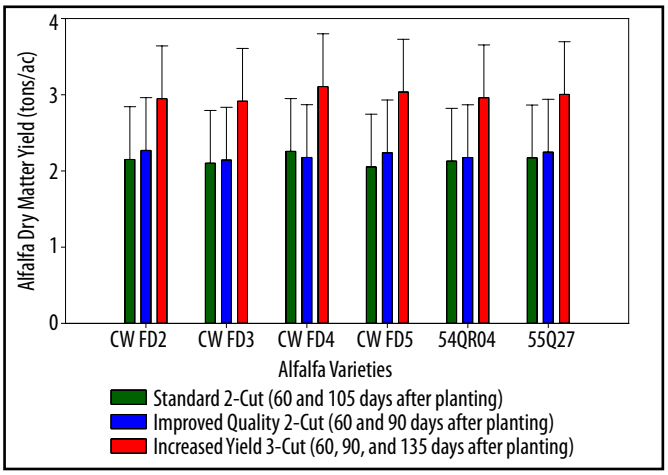
In 1972, Tesar and Jacobs reported greater seeding year alfalfa yield in a 3-harvest compared to a 2-harvest system[2]. They also reported, under ideal situations, maximal seed year yield expectations were 40-60% of those from established alfalfa[2]. In Minnesota, Sheaffer (1983) found seeding year yield and nutrient concentrations were maximized by early May seedings with initial harvests 60 days at bud stage with an additional 2-3 harvests per year. Brummer, et al.[3], explored seeding year yield improvement by mixing seed of nondormant alfalfa with more seeding year growth using conventionally dormant alfalfa varieties[3]. However, their findings demonstrated inclusion of nondormant seed with dormant alfalfas in the seeding year, reduced yields in the year following seeding because the nondormant alfalfa died[3].

With today's modern varieties capable of yielding 6-7 tons/ac^{-1} and alfalfa hay prices at $195-$295/ton^{-1} (Martens, Sauk Centre Hay Auction, 2015), there is an incentive to develop management practices that not only improve seeding year management, but also optimize total revenue stream. A potential optimization area is improvement in seeding year yields. Current recommendations are designed to enhance persistence throughout production years[4].

New moderately dormant to semi-dormant alfalfa varieties are characterized as "very winterhardy" to "winterhardy."[5] Increased fall and spring growth potential of new semi-dormant winterhardy varieties provides opportunities for new management strategies to increase both seeding year alfalfa (while not hampering persistence) and yield in production years. Our objectives were to evaluate seeding year harvest regime effects on forage yield, quality, and persistence of new moderate to semi-dormant alfalfa varieties.

In spring of 2014, six alfalfa varieties (four Alforex Seed and two DuPont Pioneer) with fall dormancies ranging from 2-5 were direct seeded at three Research and Outreach Centers (Rosemount, Becker, and St Paul, MN). The alfalfa varieties were subject to three different seeding year cutting regimes of increasing harvest intensity systems: a) 'Standard 2-Cut' (harvested at 60 and 105 days after planting); b) 'Improved Quality 2-Cut' (harvested at 60 and 90 DAP); and c) 'Increased Yield 3-Cut' (harvested at 60, 90, and 135 DAP, i.e., early October). Forage yield (dry matter) and quality were assessed for each of the harvest intervals. The newly seeded alfalfa was management weed-free using post-emergent broadleaf and grass herbicides.

Figure 1. Seeding year alfalfa yield as influenced by varieties and cutting management.

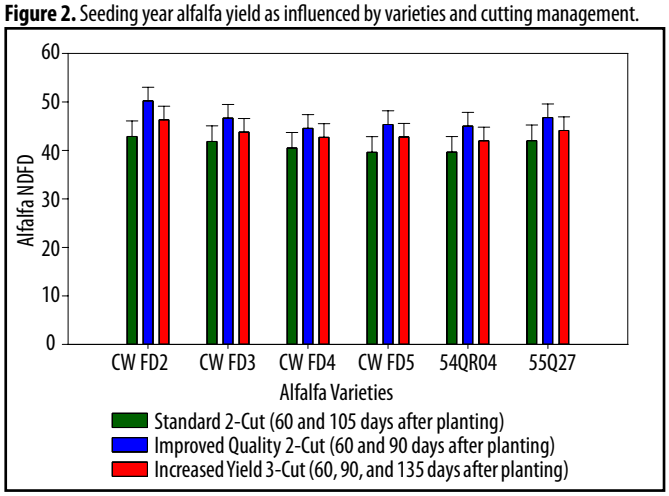


Averaged across the three locations, yield did not differ across the six varieties (Figure 1). Alfalfa yields for both 2-cut systems for all varieties were 0.9-4.0 tons/ac^{-1}, whereas yields from the 3-cut system were 1.5-5.0 tons/

ac^{-1}. The yield was similar for both 2-cut systems (Figure 1). Not surprisingly, the 3-cut system out-yielded the 2-cut systems by nearly 1 ton/ac^{-1} (Figure 1).

Although forage quality was similar across varieties, cutting treatments influenced NDFD. Crude protein was similar across varieties and cutting treatments, ranging 22-24%. Varieties in the 'Improved Quality 2-Cut' system had increased NDFD values compared to the 'Standard 2-Cut' and the 3-cut system (Figure 2). Along with increased NDFD in the 'Improved Quality 2-Cut' system, the most dormant variety, 'CW FD2', had the highest NDFD. This is not surprising since maturation would have been slower (e.g., vegetative to bud) in the 'CW FD2' compared to the other varieties (e.g., bud to early flower), thereby increasing quality.

Figure 2. Seeding year alfalfa yield as influenced by varieties and cutting management.



Error bars indicate ±1 standard error, which is the estimated deviation from the mean.

Summary

A cutting system with a fall cut greatly improved total season year yields, however, fall harvest reduced first cut yields (1.28 tons/ac^{-1}) in the year following seeding by 3% compared to the 2-cut systems (1.38 tons/ac^{-1}). Even though cutting treatments did impact harvest yields, the six alfalfa varieties did not differ in yield. The forage quality analysis is not complete. We are continuing this study in 2015 and adding two additional high-intensity cutting systems.

[1]USDA-NASS. 2014 State Agriculture Overview: Minnesota. (2014). www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=MINNESOTA
[2]Tesar, M. B. & Jackobs, J. A. in Alfalfa Science and Technology 15, 415–435 (American Society of Agronomy, 1972).
[3]Brummer, E. C., Moore, K. J. & Bjork, N. C. Agronomic consequences of dormant-nondormant alfalfa mixtures. Agron. J. 94, 782–785 (2002).
[4]Sheaffer, C. C. Seeding year harvest management of alfalfa. Agron. J. 1, 115–119 (1983).
[5]NAFA. Winter Survival, Fall Dormancy, and Pest Resistance Ratings for Alfalfa Varieties. (2013). www.alfalfa.org/pdf/2013%20NAFA%20Variety%20Leaflet.pdf