Lessons Learned in Managing Alfalfa-Grass Mixtures

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Alfalfa-grass mixtures have a number of benefits making them attractive, but can be problematic to establish and maintain. Benefits and challenges of alfalfa-grass mixtures:

Greater winter survival in cold weather climates. Alfalfa plants can withstand low temperatures if crown buds and roots are protected by an insulating layer of snow. Grass stubble helps catch snow and reduces risk of freezing these important tissues. Dense grass roots near the soil surface also reduce movement (heaving) of young alfalfa plants out of the soil during thawing and freezing cycles. If alfalfa in a mixture dies from winter injury, the grass companion can usually fill in, providing some insurance for forage production. Also, grass crowns provide cushioning of alfalfa crowns from machinery wheel traffic, reducing damage to alfalfa, improving stand life and productivity.

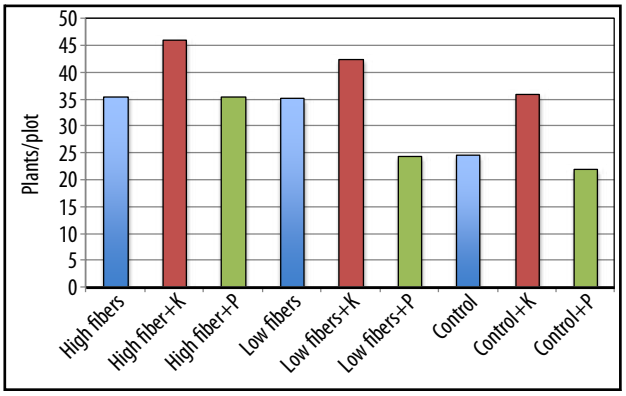
Less expensive to establish and maintain. Seed is the largest cost in establishing a pure alfalfa stand. When establishing a mixture, less alfalfa seed is used, reducing seed cost. Studies recommend a 2:1 to 3:1 alfalfa to grass seed ratio for a successful stand. In grass monocultures, annual nitrogen (N) fertilization is needed for stands to remain productive and is a major cost. Alfalfa increases nitrogen in soil that can be used by other plants. Tracer studies by USDA-ARS scientists in St. Paul using 15N nitrogen gas, a naturally-occurring stable isotope of nitrogen, found most nitrogen from alfalfa comes from breakdown of fine roots and root nodules.

Fewer insect problems. Two major alfalfa insect pests are potato leafhopper and alfalfa weevil. Potato leafhoppers migrate south to north each summer and once populations pass a threshold level, they cause significant yield reductions in alfalfa monocultures. Insecticide applications can be effective, but must be applied in a timely manner, and increase production cost. Research conducted in two New York locations over two years found potato leafhopper populations are significantly reduced when alfalfa is grown in grass mixtures. Populations of alfalfa weevil were also reduced. Since potato leafhoppers do not feed on forage grasses, they tend to continue moving in an alfalfa-grass mixture, rather than building up to damaging levels.

Greater dry matter yields. Compared to grass monocultures, alfalfa mixtures often have higher total yields. The "summer slump" of cool season grasses can be reduced by including a legume in the mixture that continues to be productive during the summer. Also, harvest intervals for a mixed stand may be longer, allowing for more biomass accumulation. Because grass regrowth is mostly composed of leaves, there is less of a decline in forage quality over time than for a pure alfalfa stand. Use of a non-lodging type of alfalfa in a mixture was shown to increase yields when harvest intervals are extended. Current research at the University of Minnesota is investigating the benefits of lower lignin alfalfa varieties with a grass companion on forage yield and quality.

Potassium (K) fertilization needed. Maintaining K fertility is important to maximize mixture yields and for maintaining healthy alfalfa. K is relatively immobile in soil. As a consequence, it is absorbed only when roots are in close proximity to the nutrient. Thus, highly branched fibrous grass root systems are very efficient in taking up K compared to alfalfa root systems having deep taproots and few fibrous roots. ARS scientists in St. Paul, MN, conducted an experiment with three alfalfa germplasms, one developed with a higher proportion of fibrous roots (high fibers), one with few fibrous roots (low fibers), and a control not selected for root type grown in a mixture with orchardgrass. Phosphorus or K was added each year to maintain optimal fertility. As shown in Figure 1, the number of alfalfa plants remaining after 3 years was significantly greater in the plots receiving adequate K fertilization. This also occurred in alfalfa monoculture plots.

Figure 1. Surviving alfalfa after 3 years of cultivation with orchardgrass. K fertilization increased alfalfa survival regardless of the amount of fibrous roots.



Site selection and cutting management are keys to success. When selecting a site for an alfalfa-grass mixture, requirements of both plants need to be taken into consideration. Good soil drainage and soil pH of 6.5-7.5 will promote alfalfa development. When harvesting a mixture, it is important to recognize the different characteristics of an alfalfa and a grass plant. Alfalfa regrows from crown buds located near or below soil surface and can therefore tolerate a low mowing height. Grass plants regrow from meristems located much higher and are vulnerable to harvest damage. Mowing too low can reduce the grass composition of the mixture. A mowing height of 4" is recommended for most harvests, with a 6" mowing height in fall so adequate stubble remains for catching snow cover. Fewer cuts per season will put less stress on alfalfa and help maintain it in the mixture.

Table 1. N uptake in alfalfa after 1 and 2 selection cycles.

Selected Populations	Forage N Concentration %	N Uptake from Fertilizer lbs/ac
High N Uptake Cycle 2	4.03	29
High N Uptake Cycle 1	3.97	27
Low N Uptake Cycle 1	3.97	23
Low N Uptake Cycle 2	3.95	24
LSD 0.05	NS*	3

Most forage grasses and alfalfa breeding programs strive to optimize monoculture production. Research is needed to develop ideal mixed stand partners. Although alfalfa produces sufficient N to sustain forage grass productivity, N is not transferred unless grass is competitive with alfalfa. Also, alfalfa will use soil N, if it is available, even though it is a N-fixing legume. In research, progress has been made in selecting alfalfa that preferentially fixes N rather than removing it from the soil to develop alfalfa germplasm better suited for use in grass mixtures. After two selection cycles, alfalfa populations differed significantly in N uptake while maintaining similar N in the forage (Table 1). The long range research goal is to combine this trait with a more fibrous root system to improve nutrient use of alfalfa in grass mixtures.