Update on Options for Managing Thin Alfalfa Stands

Jimmy C. Henning
Extension Forage Specialist

Introduction

Alfalfa is the highest yielding, highest quality hay crop grown in Kentucky. Well cured alfalfa and alfalfa-grass hay is in high demand for dairy and in particular, horse owners. Alfalfa stands in Kentucky remain productive from four to as long as 8 years or more depending on several factors. Long stand life is favored by:

1. Using an improved variety with high resistance to the major diseases of Kentucky and that is proven to be high yielding in relevant trials such as conducted at the University of Kentucky.
2. Deep, well drained soils,
3. Soils that have been limed to pH 6.8 and that have been fertilized according to soil test.
4. Adequate annual fertility, including P and K,
5. Prudent cutting schedules (allowing alfalfa to reach bud to first flower before harvest, not harvesting in the four to six weeks prior to a killing freeze),
6. Controlling economic insect pests, especially the alfalfa weevil and potato leafhopper.

Yield Potential, Stand Assessment and Stand Age

Alfalfa stands in Kentucky can last 5 years and more on good soils and with good management. Since alfalfa establishment costs can exceed $200 per acre, it is prudent to keep stands productive for as long as possible as long as they sustain high yields.

As stands age, yield potential declines. Wisconsin scientists summarized 38 years of alfalfa studies and found that yields peaked in years 2 and 3 after establishment (year 1) and declined to about two thirds of peak levels by year 5.. A similar trend was seen when a limited number of University of Kentucky studies were summarized.

Similarly, in a long-term Missouri study, yields were highest in year 2 (seeding year not reported) and were fairly constant through year 8 and declined steeply in year 9, never recovering to previous yields. It should be noted that adequate P and K fertility was required to maintain good yields through year 8. Yields declined every year when no additional K fertilizer was added after establishment.

Alfalfa stand density declines year over year in both plants and stems per square foot. In a University of Missouri study, stand density (plants per square foot) declined from around 9 in year 3 to between 2 and 3 in year 10. Wisconsin work suggests that yield potential declines when stem density falls below 50 to 55 stems per square foot. Missouri research indicates that the plant density threshold for high yields may be 35 to 40 stems per square foot (extrapolation of data from Nelson et al., 1992). Assumed in these evaluations is that plants are uniformly distributed across the field.

The Missouri work by Nelson and co-workers looked at the effect of phosphorus and potassium fertility and stand age on plant density, stem number and yield over 10 years on a low fertility site. They found that rainfall-corrected dry matter yields were maintained in alfalfa fields until the plant density fell below 3 plants per square foot for well fertilized plots and 4 plants per square foot in plots that received no

potassium topdress after establishment. As expected, well fertilized plots yielded more than unfertilized controls.

Potassium status affected the ability of the alfalfa plant to increase stems per plant to compensate for low plant density. Stems per plant increased from about 5 to 25 from year 7 to year 10 with topdressed potassium compared to an increase 2 to 8 in the unfertilized control over the same time. Clearly good potassium fertility is essential in alfalfa's ability to compensate for stand thinning.

Well fertilized plots maintained higher plant densities longer compared to unfertilized controls, especially with potassium. Alfalfa that received no potassium after establishment fell below 3 plants per square foot after 5 years compared to between 6 and 7 years for plots receiving annual potassium fertilization. Alfalfa topdressed with potassium maintained an additional one to two plants per square foot than plots receiving no potassium over the life of the stand.

To summarize stand assessment, alfalfa yield potential does exhibit some decline over time even with good management. Production can be sustained for as long as 7 or 8 years with good management of pests, weeds and soil fertility. To remain productive, alfalfa stands need to maintain 3 to 4 plants per square foot. These plants need to be healthy and vigorous enough to compensate for thinning stands by increasing the number of shoots per plant. Adequate annual fertilization, especially with potassium is necessary for plants to compensate for stand thinning by increasing stems per plant.

Management to Extend the Life of Stands

Beyond adequate fertility and good pest, weed and cutting management, what else can be done to extend the life of an alfalfa stand? Several options are outlined below.

Drilling alfalfa into thin stands

Farmers frequently ask 'Can I drill alfalfa into an old stand to thicken it up?' While the answer is not always totally clear cut, generally this is not a recommended practice. Alfalfa will not germinate and grow in the vicinity of older mature plants due to autotoxicity, which means the plants are toxic to itself, or at least the seedlings. Generally we say that it takes twelve months out of alfalfa for re-establishment of more of the same crop.

The toxic factor has been proven to originate in the topgrowth of alfalfa, is water soluble and inhibits germination of the new plants. The toxin would come from leaf and stem tissue left on the field to decompose and would be leached through the soil profile by rainfall. Conversely, under drought conditions the toxin would likely remain in the upper soil profile longer to hinder germination and emergence of the new seedlings. Tillage would help mix the toxin into the soil and away from the germination zone for seedlings. Logically, the thinner the stand, the less autotoxicity towards the new seedlings. Therefore to extend the productive life of an alfalfa field, we must look to other options to add to the existing stand.

Drilling other crops into thin stands of alfalfa

Many forages can be drilled into existing alfalfa stands. The best choice will depend on many things, but especially the intended use. For example, for many, alfalfa is a cash hay crop marketed towards the horse market. This market will likely lead you to choose orchardgrass as the crop to use to extend the life of alfalfa stands. If the added forage is simply to boost yields over the short term and perhaps provide some competition for annual weed encroachment, then adding small grains might be the best choice. There is little replicated research on these practices, so much of what will be shared here will be from producer experiences.

Orchardgrass

Orchardgrass is the most common forage drilled into alfalfa to extend stand life boost yields. It should be drilled in the fall after the late August or September cutting. Experience has shown that it is better to wait for rain prior to seeding rather than to plant into extremely dry conditions. Alfalfa-orchardgrass hay is in high demand in the horse market and for growing cattle. Orchardgrass will add three to four years to the productive life of the stand..

Timothy

Timothy is also a very viable option for drilling into thin alfalfa stands. Alfalfa-timothy mixes are also in demand for the horse market. Like orchardgrass, timothy should be fall seeded after the late August or September cutting. The resulting mixed stands may also require added nitrogen fertilizer to provide high yields. Nitrogen should be applied only once in spring prior to first cutting since timothy provides very little regrowth. Timothy should add two and occasionally three years to the productive life of mixed stands.

Small Grains

Small grains such as wheat or spring oats may also drilled into alfalfa, with wheat being more common. Wheat should be fall seeded after the August or September cutting. If the alfalfa is very thin, seeding rates may need to be as for a pure stand. Apply moderate amounts of nitrogen in the spring (50 lb N/A or less) depending on the thickness of the alfalfa stand. Wheat will suppress many winter annual weeds and will boost first cutting yields. The resulting heavy first cutting is best harvested as baleage because curing to dry hay moisture may be difficult. Experience has shown that adding wheat will thin the alfalfa stand and should be considered as part of a rotation strategy for taking out alfalfa in the following growing season.

Spring Oats can be drilled into thin alfalfa in the early spring and will provide 1 to 2 tons of dry matter by early to mid-June. Apply moderate rates of nitrogen (50 lb N/A) at seeding to stimulate yields. As with wheat, using spring oats should be considered part of a rotation strategy because of the competition with the existing alfalfa.

Red Clover

Red clover is often mentioned but seldom used to extend the life of alfalfa. Like alfalfa, red clover's erect growth habit is erect, yields are high, and cutting schedules are similar. Red clover is also high in nutritive quality (often containing less lignin in stems than alfalfa). Red clover will extend the alfalfa stand life by 1 to 2.5 years. Red clover that is interseeded in fall will be in full production by spring of the following

year. Red clover may be frost seeded over alfalfa in late February/early March. In this case, continue to harvest alfalfa on its regular schedule and the red clover seedlings should be in sync with existing alfalfa afterwards. Alfalfa-red clover mixes can be hard to cure, especially in the first cutting. Hay from these mixtures will tend to be dusty and will not usually be in demand in the cash hay market. Baleage from these mixes will be extremely high in quality.

In summary, alfalfa stands naturally decline in production and density over time. Well managed stands can be productive as long as they maintain three to four healthy plants per square foot across the field. Productive stand life can be extended by interseeding orchardgrass, timothy, red clover, wheat or small grains.

Recent Results

In fall of 2021, two aged stands of alfalfa in Fayette Co Kentucky were interseeded with orchardgrass, annual ryegrass and wheat. In early spring, half of the plots were topdressed with 50 pounds of nitrogen per acre, including the alfalfa control. These plots were harvested on May xx and June xx using a sickle-bar mower to determine total yield. Sub-samples were taken from each plot prior to each harvest and hand separated to determine percent alfalfa, grass or weeds. Stand density was assessed in September 2021 and again after the first harvest.

Yield of the first plus second cutting of plots interseeded with orchardgrass, orchardgrass plus N and ryegrass were similar to the alfalfa controls (Figure 1). Only ryegrass plus N, wheat and wheat plus N treatments resulted in noticeable yield increases. Additional nitrogen had little effect on total yield, except for the ryegrass plus N treatment.

First cutting yields were larger than second cutting for ryegrass plus N, wheat and wheat plus N (Figure 2). Second cutting yields were greater than first cuttings for alfalfa plus N, orchardgrass, orchardgrass plus N and ryegrass treatments. Yields of the alfalfa control were similar in both cuttings.

The addition of grasses inhibited the amount of alfalfa (lb/A) present compared to the non-interseeded alfalfa (Table 1, Figure 3). The presence of ryegrass severely reduced the amount of alfalfa (lb/A) in both the first and second harvests being. The alfalfa yield component of the wheat treatments was also small (less than 400 lb/A) in the first harvest but had rebounded to more than 1100 lb/A in the subsequent cutting. Nitrogen boosted grass yield in every case in the first harvest, but only for ryegrass in the second. Weeds were minimal in either harvest.

Stand density was assessed by counting plants and stems on a square foot basis before and after interseeding. Plant density before and after interseeding was between three and four plants per square foot (data not shown). Stem density was approximately 20 per square foot initially and declined year over year. The change in stem density is presented as a stem ratio - the number of stems per square foot present after seeding divided by that present initially Figure 4). A value of 1.0 would mean the same number of stems was present before and after interseeding. In general, (including the alfalfa control), the stand density declined from fall 2021 to spring 2022. The addition of nitrogen resulted in greater loss of stems in ryegrass and wheat, but seemed to have little effect with orchardgrass. The addition of grasses generally reduced stem density compared to the alfalfa control except for wheat with no nitrogen.

Summary and Conclusions

In general, interseeding grasses into old alfalfa stands can be accomplished if moisture is adequate. The seeding was successful in 2021 because moisture adequate in 2021. A follow up study in 2022 has been less successful so far in achieving grass stands.

The most consistent effect of interseeding grass into alfalfa is to substitute grass yield for alfalfa more so that adding total yield. If additional yield is the goal, this study suggests that wheat is the better choice of these three grasses. These results also suggest that additional nitrogen does not provide an economic advantage when interseeding grasses, at least into stands with three to four plants and 20 plus stems per square foot.

Interseeding tended to accelerate the normal decline in stand density (stems per square foot). With orchardgrass, the loss in alfalfa density is mitigated by the continuing presence of the grass. These initial results indicate that alfalfa interseeded with annuals should be terminated at least by the second cutting because of the likelihood of weed encroachment. In this study, crabgrass encroachment was significant in the ryegrass and wheat treatments (data not shown).

Ryegrass plus heat was the grass that consistently increased yield over the alfalfa control. Adding grass inhibited the alfalfa present in the first and second cuttings, and the effect was greatest with ryegrass. Adding nitrogen provided little benefit in extra yield.

The results of any single-year study should be interpreted as preliminary, needing confirmation with further work.

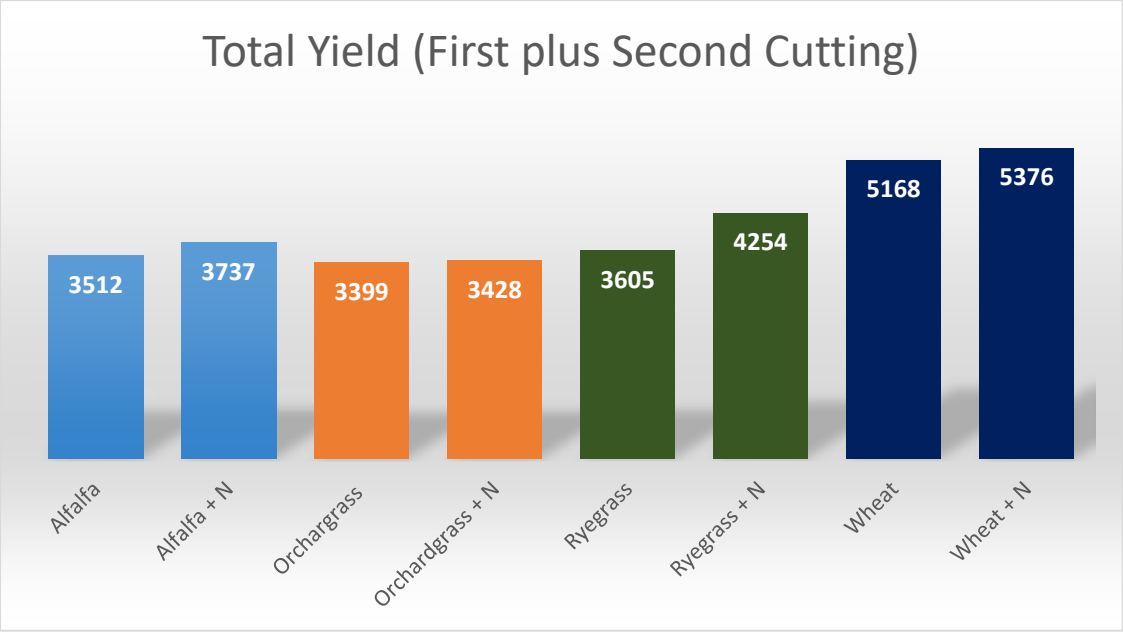

Figure 1. Effect on the total yield of the first plus second cuttings in an old alfalfa stand interseed with orchardgrass, annual ryegrass and wheat with and without 50 lb of N/A.

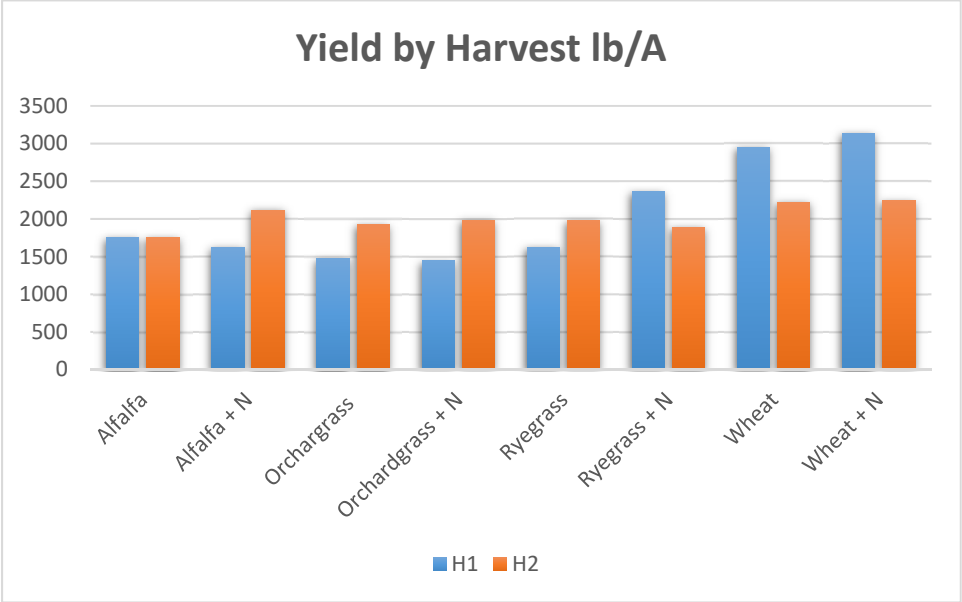

Figure 2. The effect on first (H1) and second harvest yield (H2) in an old alfalfa stand interseed with orchardgrass, annual ryegrass and wheat with and without 50 lb of N/A.

Table 1. Botanical components of alfalfa plots interseeded with orchardgrass, annual ryegrass and wheat with and without 50 lb of N/A.

	Alfalfa lb/A		Grass lb/A		Weeds lb/A		Total lb/A		
Treatment	Alf-H1	Alf-H2	Gr-H1	Gr-H2	W-H1	W-H2	Alfalfa	Grass	Weeds
Alfalfa (Control)	1321	1553	58	27	373	180	2875	84	552
Alfalfa + N	920	1845	0	15	699	256	2766	15	956
Orchargrass	563	821	577	1084	329	24	1384	1661	354
Orchardgrass + N	345	605	849	1372	249	8	950	2221	258
Ryegrass	165	400	1424	1576	38	2	564	3000	40
Ryegrass + N	157	331	2157	1557	52	0	488	3714	52
Wheat	394	1121	2434	1081	124	15	1515	3515	139
Wheat + N	176	1216	2864	1022	95	3	1392	3886	98

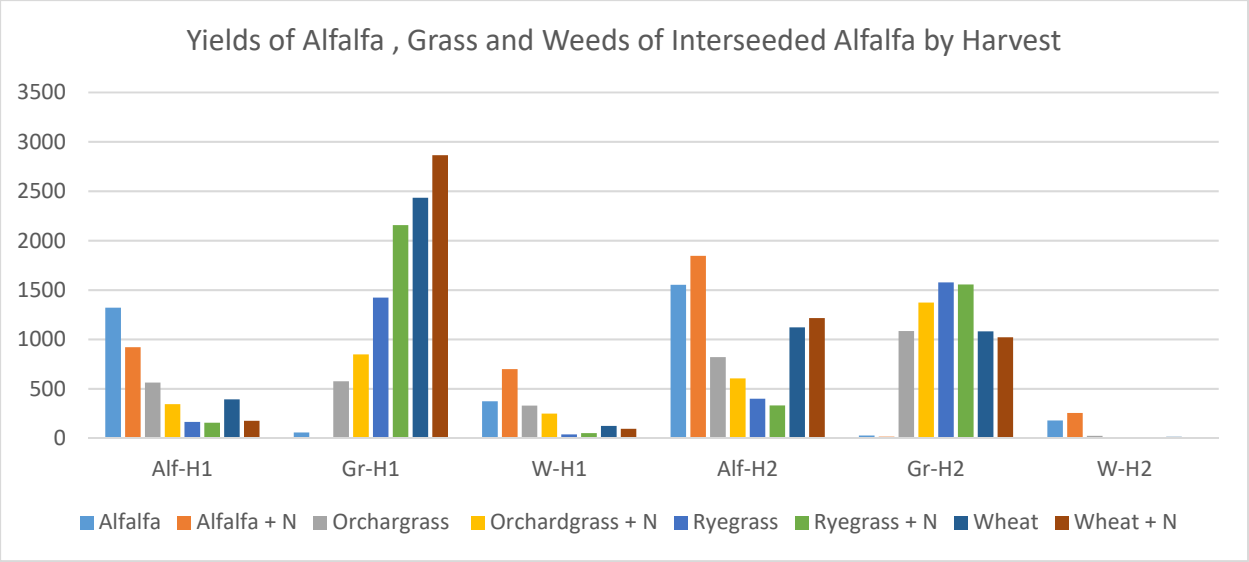

Figure 3. The effect on botanical yield of alfalfa (Alf), grass (Gr) and weeds (W) in first (H1) and second (H2) harvests in an old alfalfa stand interseed with orchardgrass, annual ryegrass and wheat with and without 50 lb of N/A.

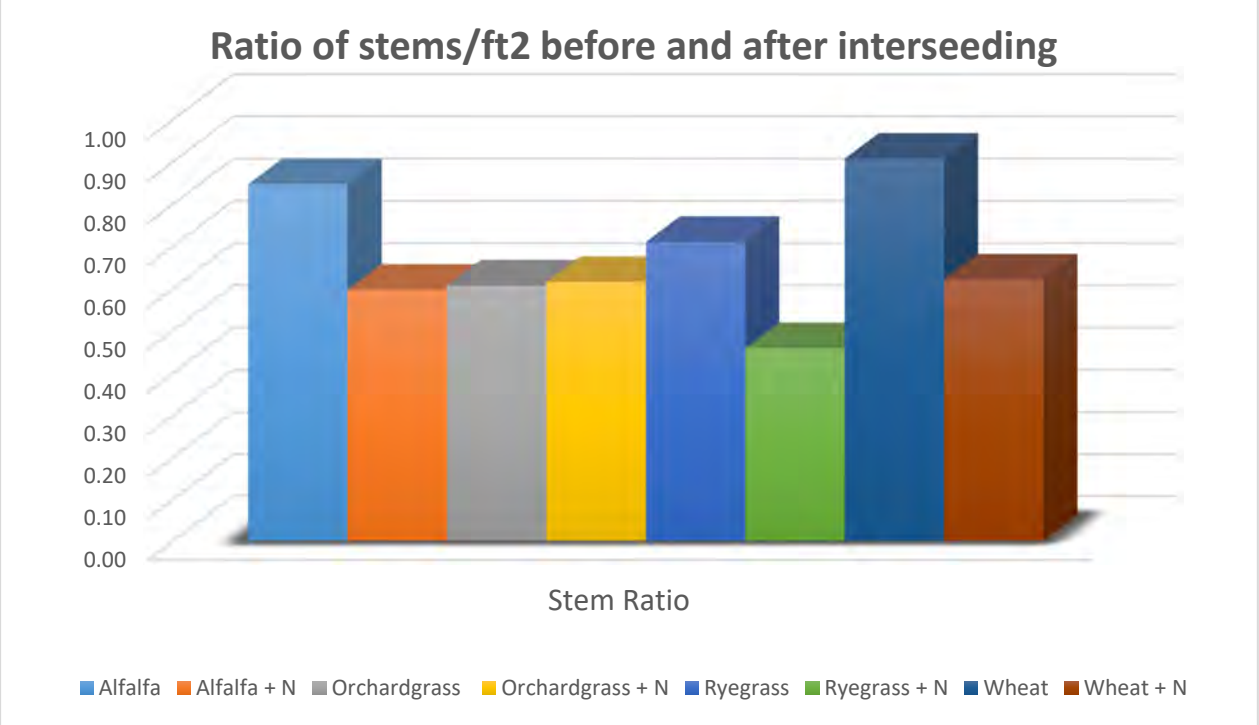

Figure 4. The ratio of stems per square foot in an old alfalfa stand interseed with orchardgrass, annual ryegrass and wheat with and without 50 lb of N/A.

References

Nelson, C. J., D. Buchholz, K. Moore and J. Jennings. 1992. Phosphorus and potassium affect alfalfa persistence. Better Crops/Summer Vol. 76, No. 3, pp 18-21. http://www.ipni.net/publication/bettercrops.nsf/issue/BC-1992-2

Undersander, D. and K. Barrett. 2008. Value of short rotations for alfalfa profitability. https://fyi.extension.wisc.edu/forage/value-of-short-rotations-for-alfalfa-profitability/

Undersander, D., C. Grau, D. Cosgrove, J. Doll, and N. Martin. 2011. Alfalfa Stand Assessment: Is this stand good enough to keep? https://fyi.extension.wisc.edu/forage/alfalfa-stand-assessment-is-this-stand-good-enough-to-keep/