Secrets to Getting a Good Stand of Alfalfa

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Getting a good stand of alfalfa quickly is very important to Kentucky because it is the highest yielding, highest quality forage crop. In addition, it can be used in many different ways. Cool wet springs and hot dry falls have caused alfalfa seedings to fail in recent years. It would be easy to begin to believe that there was some 'magic' step or ingredient that has been missing. There are no magic steps to getting a good stand. Attention to a few major details can help maximize your chances of success.

Steps to getting a good stand of alfalfa:

1. Find the proper site.

Alfalfa or alfalfa-grass mixtures grow best on deep, well drained soils. In fact, the best use of level-to-gently sloping, deep and well-drained land would be to plant the highest yielding, highest quality crops such alfalfa or a mixture of alfalfa-orchardgrass or alfalfa-timothy. Alfalfa-cool season grass mixtures work well where soils are at least 2 feet deep and well drained. More rolling sites can be seeded to alfalfa using no-till planters.

2. Supply proper fertility.

Lime, phosphorus, and potassium should be applied according to soil test recommendations prior to seeding. For alfalfa, soils should be pH 6.5 to 7. Limestone can be applied to raise soil pH (makes soil less acid). Low soil pH reduces availability of P and inhibits the formation of N-fixing nodules on the roots of new legumes. Low pH can also make aluminum more soluble in the root zone, which is toxic to roots. Legumes are more sensitive to low pH than grasses. If lime is required to correct a low soil pH, application should be made several months prior to seeding so the proper pH adjustment can occur. Virginia research has indicated that topdressing limestone on acid sites ahead of no-till alfalfa seedings will allow good alfalfa establishment. However, little data is available on how far ahead of seeding this limestone should be applied. As a working guide, apply lime 6 months in advance of seeding when planting alfalfa no-till.

Nitrogen is not required for alfalfa establishment and is usually not recommended. If the only way to supply needed phosphorus is Mono- or Di-

Ammonium Phosphate (MAP or DAP), don't worry about the nitrogen carried with the P. While the N will stimulate the growth of weeds, it will also stimulate the growth of the alfalfa. In these cases, observe the field frequently and be prepared to use herbicides or timely clipping for any weed flushes that may come.

Phosphorus is essential for good yields and for fast root growth. Where soil tests indicate that additional P is needed, the yield response of legumes to added P will be as dramatic as adding N to grasses.

Potassium is frequently needed for maximum alfalfa yields, developing good winterhardiness and for overall plant disease resistance.

3. Select high quality seed of an adapted variety.

Planting high quality seed of an adapted, improved variety is an essential step toward establishment and longevity of an alfalfa stand. Such seed should have a high percent germination and purity, low percentages of weed seed, and freedom from noxious weed seed. Certified seed meets or exceeds minimum standards for purity, germination and quality and will have a blue tag attached to the bag. Some varieties are not available as certified seed because the company has taken the responsibility of assuring the genetic purity and seed quality rather than use a seed certification agency. This approach provides no outside guarantee of seed quality and genetics other than the company's integrity. However, it is in the company's best interest for the product they sell to perform as expected. To address this concern, current alfalfa variety tests at the University of Kentucky are conducted with seed from sources available to farmers. Performance of varieties reported in these tests should be very similar to farmer experience with the same variety. The best assurance of the genetic purity of the variety selected is to plant certified seed, if available.

In addition, the certified seed should be from an 'improved' variety adapted to your farm. Improved means that the variety has been selected for improved yield, quality, persistence, disease resistance or other desirable traits. If you are uncertain about a variety's adaptation and performance, refer to University of Kentucky forage variety test reports. These can be found at your local County Extension office. It is never a good practice to plant large acreages to varieties of unknown performance or adaptation. Poor quality seed and/or unadapted varieties are never a bargain, at any price.

Alfalfa research at UK has found that choosing a top yielding variety is worth 1500 pounds of hay per acre per year for the life of the stand compared to the check varieties (such as Arc, Saranac AR, and Buffalo).

Specific Considerations in Selecting an Alfalfa Variety

Local Adaptation and Persistence. High yields in variety tests over a range of years and locations within the region are the best indication that a variety is locally adapted and persistent. Several varieties are adapted for use in Kentucky as determined from the test results in this report.

Winter Hardiness. Each variety has a fall dormancy rating ranging from 1 (very dormant) to 9 (non-dormant). In general, varieties with lower dormancy ratings take more warm weather in spring to initiate growth, and they stop growing sooner in the fall. This growth habit can, but does not necessarily, reduce annual yields compared to less dormant varieties. Generally alfalfa should have a fall dormancy rating of 2 to 5 to perform well in Kentucky and have good winter survival. Ratings of 6 and above are not winter-hardy under Kentucky conditions.

Disease and Pest Resistance. In Kentucky, producers should use varieties that have at least an "MR" (moderate resistance) rating to Phytophthora root rot (PRR), anthracnose (An), bacterial wilt (Bw), and fusarium wilt (Fw) as well as an "R" (resistance) rating to aphanomyces root rot (APH). Kentucky research indicates that APH is a widespread problem in the state and that resistance is beneficial, particularly in soils also infested with Phytophthora root rot.

Phytophthora root rot is a fungal disease associated with poorly drained soils or excessive rainfall. This disease causes yellowish to reddish-brown areas on roots and crowns that eventually become black and rotten. The top growth of infected plants appears stunted and yellow.

Anthracnose, also caused by a fungus, attacks the stems of alfalfa, preventing water flow to the rest of the shoot and causing sudden wilting. These wilted shoots have a characteristic "shepherd's crook" appearance. Anthracnose can also cause a bluish-black crown rot.

Bacterial wilt and fusarium wilt are infections of the water-conducting tissues of alfalfa roots and do not cause any noticeable root rot. These diseases prevent water flow to leaves, resulting in wilting of shoots and the eventual death of infected plants. Roots infected with bacterial wilt often have a yellowish-brown discoloration of the inner woody cylinder of the taproot. Fusarium infection can be recognized by brown to red streaks in the inner woody cylinder of the taproot.

Aphanomyces root rot is another fungal disease associated with poorly drained soils or excessive rainfall. Affected seedlings will be stunted but remain upright, unlike symptoms of damping off. In established plants, root symptoms are not as well defined as those for Phytophthora root rot, but brown lesions on the

taproot indicate where lateral roots were destroyed. This disease can be associated with Phytophthora root rot, and together they may form a root disease complex. Aphanomyces root rot is known to affect new seedings in Kentucky, but it is still unclear how it affects established alfalfa. In years with overly cool and wet spring weather, alfalfa stands have suffered great damage to Aphanomyces when planted to varieties that are susceptible to this disease.

An alfalfa study planted in Princeton in the spring of 1997 showed clear evidence of the value of aphanomyces resistance during the seeding year (Table 1). Varieties with some resistance to the disease had better color and vigor after seeding and yielded better for the year. Follow-up observations of this study in 1998 found that all varieties had good stands, but that Arc and Saranac were still lagging behind the others in total yield (Table 2).

Table 1. Dry Matter Yields (Tons/acre) and Ratings for Color and Plant Vigor of Alfalfa Varieties Sown 10 April 1997, at Princeton, Kentucky[1].

Variety	Aphanomyces Resistance[2]	Color[3] Jun 10	Vigor[4] Jun 10	1997 Harvests			1997 Total
				Jun 25	Aug 6	Sep 18	
Commercial Varieties - Available for Farm Use							
CHOICE	R	4.00*	4.38*	1.01*	0.59*	0.31*	1.91*
FEAST	R	4.00*	3.88*	0.91*	0.63*	0.28*	1.82*
RUSHMORE	HR	3.88*	3.50*	0.86*	0.65*	0.31*	1.81*
ABT405	R	3.75*	3.38*	0.85*	0.57*	0.31*	1.73*
WL326GZ	HR	3.50*	3.75*	0.88*	0.54*	0.25*	1.67*
631	MR	3.13*	3.50*	0.77*	0.59*	0.28*	1.65*
WL332SR	HR	3.63*	3.63*	0.86*	0.51*	0.27*	1.64*
WINTERGREEN	R	3.50*	3.25*	0.81*	0.56*	0.25*	1.62*
ABT205	R	3.63*	3.38*	0.67*	0.55*	0.27*	1.50*
AMERIGRAZE401+Z	R	4.13*	3.75*	0.70*	0.52*	0.28*	1.50*
FORTRESS	-	3.00*	3.00*	0.70*	0.54*	0.23*	1.48*
GEM	S	2.75*	2.75*	0.65*	0.50*	0.22	1.37*
SARANAC AR	-	1.88	1.88	0.54	0.52*	0.17	1.22
ARC	-	2.38	2.5	0.51	0.50*	0.17	1.19
Experimental Varieties - Not Available for Farm Use							
ZG9651	-	4.25*	4.00*	0.95*	0.63*	0.30*	1.88*
MEAN		3.43	3.37	0.78	0.56	0.26	1.6
CV,%		32.32	34.07	37.33	21.19	25.03	26.01
LSD, 0.05		1.58	1.64	0.41	0.17	0.09	0.59

[1] Aphanomyces root rot was diagnosed in this study, causing yellowing and poor vigor especially among the susceptible varieties and the checks, which are Saranac AR and ARC.
[2] HR=Highly Resistant, R=Resistant, MR=Moderately Resistant, S=Susceptible, and '-' indicates no information is available.
[3] 0 to 5 scale, with 5 being dark green and 0 being yellow.
[4] 0 to 5 scale, with 5 being very vigorous and 0 being very stunted.
* Not significantly different from the highest numerical value in the column based on the 0.05 LSD.

Table 2. Dry Matter Yields (Tons/acre) of Alfalfa Varieties Sown 10 April 1997, at Princeton, Kentucky.

Variety	1997 Total	1998 Harvests				1998 Total	2-yr Total
		May 8	Jun 24	Jul 27	Sep 22		
Commercial Varieties - Available for Farm Use							
CHOICE	1.91 *	1.29 *	2.15 *	1.33 *	0.30 *	5.07 *	6.97 *
ABT405	1.73 *	1.35 *	2.12 *	1.26 *	0.28 *	5.01 *	6.74 *
RUSHMORE	1.81 *	1.21 *	2.04 *	1.29 *	0.25 *	4.79 *	6.61 *
WINTERGREEN	1.62 *	1.29 *	2.07 *	1.24 *	0.29 *	4.88 *	6.50 *
FEAST	1.82 *	1.11 *	2.08 *	1.18 *	0.25 *	4.63 *	6.44 *
WL326GZ	1.67 *	1.33 *	1.97 *	1.19 *	0.20	4.69 *	6.36 *
631	1.65 *	1.40 *	1.88	1.19 *	0.22 *	4.69 *	6.34 *
AMERIGRAZE	1.50 *	1.31 *	2.02 *	1.23 *	0.25 *	4.82 *	6.31 *
WL332SR	1.64 *	1.02	2.12 *	1.25 *	0.25 *	4.64 *	6.28 *
GEM	1.37 *	1.45 *	2.01 *	1.15 *	0.23 *	4.84 *	6.21 *
FORTRESS	1.48 *	1.26 *	1.95 *	1.26 *	0.23 *	4.70 *	6.18 *
ABT205	1.50 *	1.18 *	2.04 *	1.15 *	0.27 *	4.64 *	6.14 *
ARC	1.19	1.42 *	1.84	1.06	0.24 *	4.56 *	5.75
SARANAC AR	1.22	1.24 *	1.87	1.07	0.19	4.37	5.60
Experimental Varieties - Not Available for Farm Use							
ZC9651	1.88 *	1.43 *	2.05 *	1.29 *	0.33 *	5.09 *	6.97 *
Mean	1.60	1.29	2.01	1.21	0.25	4.76	6.36
CV,%	26.01	19.85	9.00	11.64	32.28	9.12	11.99
LSD,0.05	0.59	0.36	0.26	0.20	0.12	0.62	1.09

* Not significantly different from the highest numerical value in the column based on the 0.05 LSD.

4. Prepare a good seedbed.

A good seedbed will be level, firm and as weed-free as possible. The two major ways to prepare the soil or field for planting are to use conventional tillage to completely destroy or bury existing vegetation and to use herbicides to kill or suppress existing vegetation.

Conventional tillage. Seeding into conventional seedbeds are often more successful than no-till seedings due to better weed suppression, better control of existing vegetation, and better seed-soil contact. The soil should be tilled (by disking or plowing or a combination of both) to incorporate lime and fertilizers, destroy weeds and other vegetation, and prepare a level, firm seedbed. Ridges and depressions should be reduced to a minimum to make mechanical harvest operations easier. In general, a foot print on properly firmed seedbeds should not exceed 1/4 inch in depth. Conventional tillage may be required to control troublesome perennial weeds like curly dock and johnsongrass and correct soil compaction problems such as traffic pans.

Herbicide Suppression/No-Till. The no-till method of seeding alfalfa uses herbicides to suppress existing vegetation in preparation for planting. This method is most often employed when trying to convert grass pasture or hay fields to alfalfa.

Results from no-till seedings into sod fields have been variable. Any place where competition was not controlled from the original sod, seedings have failed. Competition from existing sods must be minimized by the use of herbicides prior to seeding. Glyphosate (Roundup Ultra is one current formulation) and paraquat (Gramoxone Extra is one current formulation) are examples of choices for sod suppression.

Glyphosate is a translocated herbicide and works best when grass is actively growing. Sod suppression with glyphosate is improved by the addition of ammonium sulfate in the tank. Glyphosate is often recommended for suppression of orchardgrass because it is tolerant of paraquat. In one demonstration seeding in Bullitt County, orchardgrass was sprayed with 2 quarts of glyphosate with ammonium sulfate. While grass control was eventually excellent, it was slow. Excellent stands resulted.

Paraquat is a 'burn-down' type herbicide with virtually no translocation. When sprayed in high volumes of water (>20 gallons per acre) to actively growing tall fescue, paraquat is very good at suppressing the sod. A single spray of paraquat can give fair suppression of tall fescue, but two sequential applications, spaced about 14 days apart will give better fescue control. Our experience has shown that the more active the fescue is growing, the better the paraquat control.

Most no-till seedings of alfalfa into sod have used spring applications of herbicide to kill the grass, with variable success. There are indications that starting herbicide applications in the fall prior to seeding would aid in getting a more vigorous and weed-free stand. The weakened sod will be damaged further by the winter and should be sprayed again in the spring. Following the fall application with a subsequent spraying the following spring should be effective in killing most of the tall fescue present in the pasture. In addition, glyphosate sprayed in the fall can give some control over problem perennial weeds such as dock, canada thistle, and even white clover.

A demonstration comparing alfalfa establishment when fescue control was begun in the fall versus the spring was begun in Lincoln County Kentucky in the fall of 1996. Where the sod was treated with herbicide (Roundup in this case) in the fall plus paraquat in the spring, stands were noticeably denser and more weed-free.

5. Inoculate legume seed or use pre-inoculated seed.

To insure proper nodulation, inoculate all alfalfa seed with the proper bacteria just prior to seeding or use pre-inoculated seed. Check the seed tags of pre-inoculated seed for the expiration date for the inoculum.

Inoculate legume seed even if it has been grown in the field previously. To ensure that inoculum is stuck to each seed, use an appropriate commercial adhesive or sugar solution. Satisfactory results are obtained when a small amount of sugar solution is first added to seed and thoroughly mixed to get all seed moist, not wet. Then add the inoculum and mix again. If done properly, the peat in the inoculum mix will absorb excess moisture so seed will flow well through the seeder.

6. Seed at the proper rate, date, and depth.

Seeding rate. UK recommends 12 to 20 lb/A of alfalfa seed for new stands. Most seedings are made with 18 to 20 pounds of seed per acre. Research from Penn State indicates that seeding rates higher than about 9 to 10 lb/A do not improve stands or yield when alfalfa is drilled in rows. However, the additional seed is justified to account for the added field variation experienced in no-till seedings. Fields to be established no-till (especially pasture fields) will typically be more variable in their soil and surface characteristics making precise seed placement more difficult than in research or tilled situations.

Seeding Date. Alfalfa may be seeded in either spring or late summer. Actual optimum seeding dates will vary by year. For example, the last few springs have been unseasonably cool and wet. In these years, seeding after the April 15 cut-off for alfalfa has been successful and even advantageous. Fall seedings of alfalfa should only be made into prepared seedbeds (not no-tilled into killed sod) due to sclerotinia risk. Sclerotinia only infects in the fall when young plants are kept continually wet from rain and dew. Alfalfa plants from a spring seeding or plants older than 1 year develop a natural resistance to sclerotinia infection. Several legumes are hosts of sclerotinia, and the inoculum can be brought into newly seeded alfalfa fields by wind. A history of sclerotinia within the county or on the farm indicates that stands are at a greater risk for infection.

Experience indicates the optimum seeding date 'window' for spring planted no-till alfalfa can be extended beyond that for prepared seedbeds. Sprayed sods will retain their moisture longer and will be cooler than conventionally prepared seedbeds. In 1996 and 1997, no seedings were made before April 15, which is usually thought of as the 'cut-off' date for alfalfa seeding in central Kentucky. Over the past few years, cool wet springs have led to poor seedling vigor and also to susceptibility of alfalfa seedling to attack by aphanomyces root rot.

Use a seeding method capable of precisely placing the seed in contact with the soil. Seeding methods for alfalfa can vary from broadcasting plus cultipacking to no-till drills. Any method that places the seed 1/4 to ½ inch deep and in good contact with the soil will result in a good stand. For prepared seedbeds, it is

perfectly acceptable to broadcast the seed on the soil surface and then roll the field with a cultipacker (corrugated roller). A Brillion-type seeder does this in one trip. For no-till seedings, drills must be used that are properly adjusted to deliver the rate desired at the proper depth. Each needs to be properly adjusted and operated to place the seed about ¼ to ½ inch in the soil regardless of soil conditions.

Seeding too deep is the most common mistake made when using no-till drills to seed alfalfa. Seeding too deep is especially easy to do in the spring when soils tend to be wetter and softer. It absolutely pays to take the time to understand how the drill being used needs to be set in order to deliver the seed into the top ½ inch of soil. Take time to figure out the depth control for the drill to be used. Experience shows that you may not have time to do it right but you will have time to do it over.

Deep planting is probably one of the main causes of uneven stands of spring seeded alfalfa. Deep planting delays emergence, reduces seedling vigor, and decreases seedling numbers in alfalfa. A rule of thumb for seeding depth with alfalfa: If you do not see some seed on top of the ground when seeding no-till, then there is a very good chance that you are seeding too deeply. Open the slit behind the disc openers to determine depth of seeding.

Check calibration of seeding equipment. Make sure that the drill is set properly to deliver the desired amount of seed. Drills differ in the types of mechanisms for adjusting seeding rate. Although, drills will have general settings for seeding rates of particular crops, the actual delivered rate will vary according to seed size, seed coatings, seed-flow characteristics, and the adjustment/wear of the seed metering device. Lime coated alfalfa seed will flow through seed boxes **faster** than uncoated seed. The increase in seeding rate that is due to lime coating seems to differ with the manufacturer of the coating. In one case, the increase is about 30% while another line of coated seed increased flow rate by roughly 10%. Clearly the point here it to check the seeding rate of the drill.

One way to do a rough field calibration is to figure out how far the drill should travel to deliver a pound of seed, collect the output from the seed tubes for this distance and then compare this amount to a pre-weighed pound of material (A one pound bag of dry beans will work). For example, if the desired seeding rate was 20 lb/A and was to be delivered by a 10 foot wide drill, collect the seed from all seed tubes for 218 feet (43560 sq. ft /A divided by 10 ft = 4356 ft to deliver 20 lb of seed. 4356 divided by 20 = 217.8 ft to deliver one pound of seed.) While not terribly accurate or sensitive, this method will keep you from making large errors in seeding rates and does not require a scale.

7. Control Weeds and pests after seeding.

Nearly all seedings of alfalfa will be infested with weeds in the first 60 to 90 days. Late summer seedings are less prone to weed invasion than are spring seedings. Control methods include clipping, limited grazing, or herbicides. Post-emergence herbicides are available for use in pure alfalfa stands during the establishment year, but no herbicides are labeled for alfalfa-grass stands. Therefore, seeding alfalfa alone is desirable because it gives you infinitely more herbicide options during establishment than with mixed stands. For more information on herbicide options for alfalfa, consult UK College of Agriculture publication AGR-148, 'Weed control in alfalfa and other forage legume crops.'

In addition, potato leafhoppers can cause stand loss new spring seedings. These insects come in on storm fronts and cause yellowing and stunting of alfalfa. These symptoms are often masked by a canopy of weeds or are blamed on summer drought.

8. Allow seedlings to become established before use.

Allow alfalfa to become established before the first harvest. Spring seedings will take about 75 to 90 days to get established, but will probably not be in a uniform stage of maturity (plants will be in all stages from vegetative to full bloom). Take the first cutting for hay in stands that are to be grazed, and avoid grazing while the soil is wet and will not support hoof traffic. Significant stand loss can occur from treading damage to young stands.

Summary

There really is not any secret to getting a good stand of alfalfa (but good luck is always helpful). Picking a good, well drained site and addressing the soil fertility needs is the first step. Second, prepare a good seedbed whether by conventional tillage or by no-till methods. Third, place the appropriate amount of seed at the correct depth during a seeding calendar window that will allow the plants to become established. Finally, control weed and insect pests after seeding. Allow the alfalfa plants to become fully established before harvesting for the first time.