

Establishing Alfalfa for Forage

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Alfalfa is one of the highest quality and highest yielding forages. Alfalfa is used for hay, silage or grazing for many types of livestock and grows under a wide range of environmental conditions. A properly established and managed stand of alfalfa can remain productive for 5 to 10 years (Figure 1).

Established alfalfa stands can be harvested four to five times per year. The first harvest is at early bloom in April to early May, and each successive harvest will occur on approximately 30-day intervals with good soil moisture. Establishing an excellent stand is critical for long stand persistence. Careful attention to the planting process will ensure excellent establishment (Table 1).

Site Selection

Select fields convenient for moving cattle or machinery. Convenient location will facilitate timely harvest and management.

Soils for alfalfa must be relatively deep and must have good surface and internal drainage. Alfalfa is a deep-rooted perennial legume. It has the potential to develop a root system which can penetrate deeper than 15 feet in unrestricted soils. Information regarding soil depth and drainage class on a farm is provided in the Arkansas Soil Survey. Soil survey information is available through the Natural Resources Conservation Service and on Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>).



Figure 1. A properly managed alfalfa stand.

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For optimum production and long stand persistence, alfalfa should be planted on soils that have a drainage classification of well drained, moderately well drained or somewhat excessively well drained. Alfalfa will not persist well in poorly drained soils or on sites that flood. Medium-textured soils such as loams, silt loams and sandy loams are ideal. Coarse sands and heavy clays are not good soils for alfalfa.

Soil depth should be at least 3 to 4 feet with no impermeable layers or hard-pans that restrict root growth within that zone. Alfalfa will grow well in rocky soils as long as no shallow impermeable layers are present (Figure 2). Soils previously planted to row crops often have shallow manmade “plow pans” occurring at plow depth (4 to 8 inches) caused by improper tillage and equipment traffic. Plow pans restrict plant rooting depth and should be broken by deep tillage before planting alfalfa (Figure 3).



Figure 2. Alfalfa roots growing in rocky soil. Roots appear crinkled from growing past rocks and gravel but can reach deep into the soil profile if no solid restrictive layers are present.



Figure 3. Restrictive layers in soil caused by improper tillage and equipment traffic impede root penetration. Alfalfa root (lower plant in photo) stopped at the hard tillage layer (shown by the thumbprint on the soil core). Alfalfa root (upper plant in photo) growing in an area with no hard tillage layer penetrated deeper and produced higher yield.

Variety Selection

Selecting the perfect alfalfa variety is seldom a clear-cut choice. Dozens of varieties are on the market, and the list of available varieties changes annually. Fortunately, several varieties may have similar performance for any given location. Consult your county Extension agent to narrow down the

list to a few varieties that fit your growing conditions, then check on seed availability through your ag dealer.

Winter dormancy ratings are very important and indicate the region where a variety is best adapted. Varieties with dormancy ratings of 2 or 3 are very winter dormant and are grown in the northern U.S., while varieties with values of 8 or 9 do not go winter-dormant and are only grown in areas with warm winter growing seasons. In general, varieties for Arkansas should have a winter dormancy rating in the range of 2 to 7 with those in dormancy class 7 being adapted only to the extreme southern parts of the state. Dormancy classes of 3 to 5 are adapted statewide.

Seed cost should not be the main factor considered when choosing an alfalfa variety. Cheap seed or seed of an unadapted variety can prove to be more expensive in the long run due to lower yield or poor persistence.

Intended use: Some varieties are developed for hay production, some primarily for grazing and some are classed as dual-purpose varieties. Traffic tolerance for hay-type varieties and grazing tolerance are traits that improve stand persistence and yield.

Disease resistance: Varieties with high ratings for root rot diseases such as phytophthora crown rot should be used for sites that are occasionally wet or have marginal drainage. These areas tend to have higher disease problems than soils that are very well drained.

Fertility Requirements

Good soil fertility is essential for establishing and maintaining productive and persistent alfalfa stands. Fields should be soil tested well in advance of planting so that fertilizer and lime can be applied to correct deficiencies.

Poor establishment and survival will result if alfalfa is planted in soil that is too acid or too low in fertility. Optimum soil fertility levels for good establishment include a soil pH of 6.5 to 7.0, a soil test phosphorus level of ≥ 60 pounds per acre and a soil test potassium level of ≥ 250 pounds per acre. Commercial fertilizer or animal manure can be used to build soil nutrient levels before establishing alfalfa.

Limestone should be applied and preferably plowed in the soil at least six months in advance of planting to increase soil pH to acceptable levels. Incorporating limestone into the top six inches of soil allows it to reduce soil acidity more rapidly. Surface-applied limestone takes longer to neutralize soil acidity because it is exposed to less soil surface area. When submitting soil samples, ask for crop code 101, “Alfalfa Establishment,” for establishment fertilizer and lime recommendations and crop

codes 102-105, "Alfalfa Maintenance," for hay production recommendations.

Seed inoculation: Seed inoculation refers to the rhizobia bacteria applied to seed to make the alfalfa fix nitrogen from the air. Well-inoculated alfalfa needs no nitrogen fertilizer.

Most alfalfa seed companies sell seed that is coated and preinoculated. Coated seed is heavier than raw seed, resulting in fewer seed per pound and fewer seeds being planted per acre at a given seeding rate. But, research has shown that the coatings improve seedling survival so stands are equal to or better than those planted with raw seed even though fewer seed are planted per acre.

Raw seed which has not been preinoculated, or preinoculated seed with an expired inoculant date, needs to be treated with fresh inoculant according to product directions. Hot storage conditions will reduce or destroy inoculant viability. Inoculated seed should be planted immediately or stored in the shade or other cool place for only a short time until it is planted.

Planting Method and Seed Placement

Proper calibration of planting equipment is critical for successful establishment. For step-by-step instructions on calibrating drills or broadcast planters, refer to FSA 3111, *Calibrating Drills and Broadcast Planters for Small-Seeded Forages*. Set equipment to plant seed an average of ¼-inch deep.

Conventional planting on tilled seedbed: Planting with a drill planter on a conventionally tilled seedbed is often the preferred method for establishing alfalfa (Figure 4). Tillage allows lime and fertilizer to be incorporated into the root zone to promote rapid plant establishment. Conventional planting involves tillage to develop a clean, crumbly, firm seedbed. Chisel plowing and disking, followed by

rolling or cultipacking, will generally produce the desired result.

The number of times the field must be worked depends on field conditions. The final seedbed must be smooth enough for easy machinery operation since hay harvesting and other operations require many trips over the field per year. Soil firmness can be judged by walking across the seedbed. On properly firmed soil, an adult's footprint should be about ¼-inch deep. If the seedbed is too soft, the seed will be planted too deep, and if the seedbed is too hard or cloddy, the seed may not make good soil contact, which impairs germination. Because of the variable field conditions, the depth of seed placement should be checked frequently during planting, regardless of the type of equipment or planting method used.

Alfalfa seed can be broadcast planted on a clean, tilled seedbed instead of planted with a drill seeder. If broadcast seeding is used, the seedbed should be firmed with a roller or cultipacker before seeding. After the seed is broadcast, it should be covered with a roller or cultipacker. The sequence should be roll or cultipack the field, make sure the seedbed is well-firmed, broadcast the seed, then roll or cultipack the field again to cover the seed. Rolling broadcast seed into a loose, soft seedbed will push the seed too deep and will lead to establishment failure.

No-till planting in killed sod: Alfalfa can be no-till planted into killed sod or into stubble from a preceding grain crop (Figure 5). No-till planting alfalfa is best when planting in rocky soil or on steep slopes. No-till drills plant seed in a shallow slice cut in the killed sod, and press wheels firm the soil over the seed.

Some primary differences between no-till planting and conventional tillage are in fertility management and sod control. Soil tests should be made well in advance (at least six to twelve months) of no-till



Figure 4. Planting alfalfa with a drill on a firm, smooth, tilled seedbed.



Figure 5. Alfalfa no-till planted on a killed sod. Photo taken in late winter.

planting alfalfa to allow time for fertility deficiencies to be corrected. When using no-till methods, fertilizer and lime cannot be incorporated into the seedbed during establishment since tillage is not used. In cases where soil fertility is medium or high, lime and fertilizer may be applied on the surface at planting time. On low-fertility soils, surface-applied lime and fertilizer may not correct deficiencies quickly enough for immediate planting. On low-fertility soils, it may take 6 to 12 months after lime and fertilizer application for fertility levels to reach suitable levels for successful establishment.

A system that has proven effective for converting grass sod to alfalfa is the spray-smother-spray method. Nonselective herbicides such as glyphosate (e.g., Roundup) or paraquat (e.g., Gramoxone) are often used for killing the sod or existing weeds before planting.

Pasture sod should be grazed or mowed to a 3- to 4-inch height before spraying. The sod should be actively growing at the time of herbicide application for best sod suppression. For a fall alfalfa planting, spray the grass sod in spring after growth begins, plant a summer annual forage, then plant the alfalfa in the fall after the summer annual forage is harvested. For a spring alfalfa planting, spray the sod in the late summer or early fall, plant a winter annual forage, then plant the alfalfa the following spring after early hay harvest or grazing of the winter annual forage.

Herbicide application is often necessary after last harvest of the annual smother crop and before planting alfalfa to suppress any regrowth of the annual forage, as well as any other weeds or remaining sod. Remove any heavy residue of the annual forage to leave a clean field for planting the alfalfa. Piles or clumps of heavy plant residue left on a field reduces soil penetration by the no-till drill, resulting in poor seed placement. Seed planted in clumps of crop residue without reaching the soil will not establish.

Planting Rate and Date

The recommended seeding rate for alfalfa is 15 to 20 pounds per acre. For pure stands, rates should be 18 to 20 pounds per acre. Pure alfalfa hay generally has a higher market value than alfalfa-grass hay. However, mixed alfalfa-grass hay has more than enough quality for beef cattle. Alfalfa-grass mixtures may be more desirable if the field will be used for grazing.

More herbicide options are available for pure alfalfa stands than for alfalfa-grass mixtures. Some producers plant pure alfalfa to take advantage of a larger selection of herbicides for weed control at establishment, then drill in a companion grass a few years later. Orchardgrass is the most common grass planted with alfalfa. When planting alfalfa/grass mixtures, the seeding rate is 15 to 16 pounds per acre of alfalfa and 3 to 5 pounds per acre of orchardgrass.

Seeding rates should be 10 to 20 percent higher for broadcast planting compared to drill planting because seeding depth is less uniform.

Alfalfa can be planted in spring or fall. The recommended fall planting dates are from September 1 to October 15, and spring planting dates are from March 1 to April 15. Fall-planted stands must develop three to four trifoliate leaves to be winter hardy. Occasionally, a seedling disease called sclerotinia crown rot can be devastating to fall seedlings. Alfalfa should be planted only in the spring in fields where this disease is known or suspected to be present.

Pest Management

Weed control: Weed control should always be planned as part of the establishment process for alfalfa. Existing fescue or bermudagrass sod should be controlled well in advance of planting alfalfa. Fall-planted stands generally have less weed infestation than spring-planted stands. However, heavy infestations of winter annual weeds such as chickweed, henbit or annual ryegrass can cause severe stand thinning. Spring plantings are prone to competition from weedy grasses such as crabgrass and foxtail and certain broadleaf weeds. New stands should be scouted frequently for weed infestation. If weeds become large and obvious, much damage to the stand may have already occurred.

Many companies now produce both standard alfalfa varieties and Roundup Ready alfalfa varieties that are glyphosate resistant. The RR trait can simplify weed control but must be managed properly to prevent glyphosate resistance in weed populations. In eastern Arkansas, many weed populations are already glyphosate resistant, making this trait less valuable in those areas. However, growing RR alfalfa may still be necessary in row crop-producing areas to avoid damage caused by drift of glyphosate being applied to adjacent crop fields. Recommended herbicides and the weeds controlled by each are listed in Extension publication MP44, *Recommended Herbicides for Weed and Brush Control*, available through the county Extension office.

Insect control: No-till alfalfa planted into grass sod can be prone to soil insect pests such as certain species of wireworms and grubs. Research has shown better no-till stands are established when an insecticide is applied at planting. Check with your county Extension office for approved insecticides to use for no-till planting of alfalfa.

Stand Emergence and Plant Development

Alfalfa planted at the proper depth, and with optimum moisture and temperature, will begin emerging in less than one week. If proper planting methods are used and weather conditions are

optimum, 25 to 30 plants per square foot should be visible within 30 days (Figure 6).

Alfalfa stands thin rapidly during the first year and more slowly in subsequent years. Remaining plants increase in both crown size and number of stems as neighboring plants die. A stand of at least 6 to 8 plants per square foot is acceptable after the first year. For older stands, a minimum of 3 to 4 plants per square foot is needed to maintain acceptable yields.

Rotation and Replanting

Alfalfa stands do not reseed naturally in most of the U.S., so stands continually thin over time. Well-managed stands should last 5 to 10 years. Alfalfa cannot be replanted immediately after an old alfalfa stand, and attempts at thickening declining or thin alfalfa stands by planting more alfalfa are seldom successful. The reason is that the old alfalfa



Figure 6. If planted properly, 25 to 30 alfalfa seedlings per square foot should emerge soon after planting.

produces autotoxic chemicals that can damage new alfalfa seedlings.

Autotoxicity causes poor establishment of new alfalfa planted too soon after an old alfalfa stand. Some plants can survive the autotoxic effect and may appear normal, but autotoxicity reduces early root development, causing long-term yield reduction of any new plants that do become established (Figure 7). The autotoxic trait may have originated because alfalfa evolved as a desert plant around the Mediterranean region. Autotoxicity may have been a survival strategy to reduce competition from seedlings with established plants for scarce water resources.

Established alfalfa plants can severely reduce establishment and growth of new alfalfa seedlings emerging within an 8-inch radius from the old plant (Figure 8). This means that an old alfalfa stand as thin as 0.75 plants per square foot would inhibit establishment of new plants over 100 percent of the field surface. The minimum stand recommended for maintaining hay production is three plants per square foot; therefore, inter-seeding more alfalfa to thicken declining stands in this range is not feasible. Research has shown that a one-year rotation out of alfalfa is sufficient for successful reestablishment of alfalfa in the same field. Rotation with small grains or summer annual forages such as sudangrass or millet works well.

Summary

Alfalfa is a high-quality and high-yielding forage. Both yield and persistence depend on establishment of a thick and vigorous stand. Alfalfa can be established by a variety of methods, but regardless of the planting method used, attention must be given to site selection, soil fertility, planting date, seeding depth, weed and insect control and variety selection.



Figure 7. Effect of autotoxicity on alfalfa root system. Alfalfa planted 2 weeks after killing the old stand (left) had a shallow, branched root system compared to alfalfa planted 18 months after killing the old stand (right), which had a deep taproot.



Figure 8. An old alfalfa plant (center) inhibits establishment and growth of new alfalfa seedlings within an 8-inch radius. This makes it infeasible to plant more alfalfa seed to thicken old stands.

Table 1. Alfalfa Establishment Schedule

Suggested Timeline	Management Practice
6 to 12 months prior to planting	Select a deep, well-drained soil. Soil test the field and apply lime and begin major fertility adjustments based on soil test recommendations. Request crop code 101, "Alfalfa Establishment," for establishment fertilizer and lime recommendations and crop codes 102-105, "Alfalfa Maintenance," for hay production recommendations. Low fertility is a common cause of poor alfalfa stands.
6 to 12 months prior to planting	Select a variety and plan the time frame for planting. Plant in spring from March 1 to April 15. Plant in fall from September 1 to October 15.
6 to 12 months prior to planting	For no-till planting, start the spray-smother-spray program to kill old sod to prepare for planting alfalfa.
2 to 3 months prior to planting	Work with the local agricultural supplier to ensure seed of the desired variety is on hand at planting time.
1 month to 1 week prior to planting	Prepare a firm tilled seedbed. For no-till, spray stubble and weeds from preceding annual forage or grain crop.
1 month to 1 week prior to planting	Select the planter to be used, make repairs and calibrate for the proper seeding rate. If using rented planting equipment, plan time to clean it from prior users and to get it in working order.
Day of planting	Finish planter calibration and set it to plant at the proper depth. Set the drill for an average planting depth of ¼ inch deep. The most common cause of stand failure is planting too deep. For no-till stands in killed sod, apply soil insecticide at planting.
After planting	Scout frequently for insect pests and weeds.
For stand maintenance	Harvest when stand reaches early bloom, then on 30-day intervals afterward. Fertilize as recommended in soil test notes. Scout for alfalfa weevil in early spring before first cutting.

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