

Alfalfa Establishment Alternatives

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Cover photo: At the Padlock Ranch, in Dayton, Wyoming, alfalfa fields are productive and stands remain dense and vigorous.

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Alalfa is a versatile crop that can be rotated with other crops on cropland and grow on non-cropland meadows and pastures. In Wyoming, alfalfa is grown primarily under irrigation for hay; however, it also is grown on dryland and for pasture. Short growing seasons and wind influence establishment options.

Good stands are necessary to realize alfalfa's potential profitability. Alfalfa stand failures are more costly than with many other crops, because in addition to out-of-pocket re-establishment costs, forage production is lost when less-than-optimum stands are maintained.

Before selecting an establishment method, several topics must be considered:

- site potential
- seedbed preparation
- time of year to seed
- herbicide use
- soil fertility
- equipment need
- companion crop and/or grass use
- seeding rate

Seeding equipment should be in good condition and properly calibrated.

The following information is intended to facilitate planning and to improve chances for successful alfalfa seeding. There is no one best way to establish alfalfa.

Carefully evaluate the field. Many fields are not suited for alfalfa. Unless alfalfa has been grown successfully on the field under consideration, field characteristics should be assessed. Alfalfa performs best on well-drained, deep soils. Avoid fields where water stands for prolonged periods or where the seasonally high water table is less than 3 feet from the surface.

A soil sample will reveal other potential problems such as high pH and salinity and inadequate nutrient levels. The previous crop, presence of rocks, slope, and the need to adjust soil fertility will influence establishment.

Select a seedbed. Several conditions enhance alfalfa establishment: a seedbed free of live vegetation,

surface rocks, and soil aggregates no bigger than ½ inch; good soil fertility, particularly phosphorus; adequate soil moisture reserves; favorable physical soil conditions such as drainage, aeration, depth, and absence of a water table in the top 3 feet; and avoiding problematic salinity, alkalinity, excessively high pH, and herbicide residue.

A surface mulch is particularly important in Wyoming. It reduces erosion from wind and water, holds surface moisture by preventing excessive drying between irrigations and rains, prevents soil surface crusting, moderates surface soil temperature, and increases probability of success with late spring or summer seeding. Mulch is not necessary on all fields, but it can be helpful.

Time the seeding. In Wyoming, most alfalfa is seeded in the spring when weeds are troublesome; however, Wyoming's relatively short growing season limits planting dates. So, when is the proper spring planting date? Can alfalfa be planted too early?

While there is the possibility of frost kill if alfalfa is planted in early spring, frost rarely kills alfalfa seedlings. Usually, injury occurs when alfalfa is planted during mild weather and sub-freezing temperatures follow seedling emergence. Establishment failure from frost is less likely than from excessive heat and desiccation later in the season.

An August seeding reduces weed pressures and may allow a seeding without herbicide. This technique works best if an annual, such as oats or barley, is grazed or taken off as hay or silage and the stubble left intact. To avoid fall competition with alfalfa seedlings, annual crop regrowth should be killed and a companion crop should not be used. In order to adequately establish plants before winter, alfalfa should be seeded no later than six weeks before the first fall hard frost (24 degrees Fahrenheit). At locations above 6,000 feet, alfalfa should be seeded no later than the first week in August. At lower elevations, alfalfa can be seeded later that month.

It is not recommended to seed alfalfa in the fall or early winter, but a late winter dormant seeding is acceptable. A dormant seeding means alfalfa will not germinate due to low temperature and/or inadequate moisture. In many Wyoming areas, there are snow-free periods from December through March when alfalfa can be drilled.

Frost in the ground does not interfere with seeding unless there is a need for tillage. Because alfalfa requires shallow seeding, frost actually might help prevent seeding too deep. Dormant planting takes advantage of early spring precipitation and avoids conflict with other field operations and crops.

To till or not to till? Fields are tilled for various reasons. Plowing and other forms of tillage kill and bury weeds, incorporate surface litter that could harbor diseases and insects and interfere with planting, allow incorporation of fertilizer, loosen soil, and increase water infiltration. Repeated tillage with expensive equipment, however, may become economically unsound.

Technology is available to reduce or eliminate tillage prior to seeding alfalfa. The no-till method involves using herbicides for weed control and may require using specialized drills to penetrate surface trash and sod and achieve seed-to-soil contact. When seeding into previous crop stubble (a form of no-till seeding), a conventional disk drill should be adequate. Wyoming researchers have shown diseases and insects are no more troublesome when alfalfa is no-till seeded than when seeded into a tilled seedbed. For a more thorough discussion on no-till alfalfa seeding, see Reference 1.

Broadcast or drill? Broadcasting usually requires 30 to 50 percent more seed than drilling, and even when carefully done, the stand is often uneven. Nearly 100 percent of seed will be placed at a uniform depth with drilling; however, as much as half of the broadcast seed could be left on or near the surface after shallow tillage. For successful broadcast seeding, seed may need to be mixed with a bulkier material and uniformly spread onto a firm soil surface, then lightly incorporated with a harrow or cultipacker. Some seed will be too deep and some left on the soil surface. Often a drill can be leased for the same amount of money as the difference in seed cost.

With a cultipacker-seeder, seed is broadcast between two sets of corrugated rollers. The front rollers firm the soil ahead of seeding and the rear rollers cover the seed and firm the soil over the seed. While some seed is planted too deep, very little ends up on the soil surface.

If an air applicator is used to broadcast seed, the seedbed should be prepared as it would with any

other seeding. When used just prior to broadcasting seed, a cultipacker will ensure a firm seedbed. Cultipacking after broadcasting covers and firms the soil over the seed.

Avoid seeding too deep. Planting too deep may cause an alfalfa seeding to fail. Drilling or broadcasting on a loose seedbed or seeding alfalfa through a grain box in which seed is dropped between disk openers may result in deep planting. If seeding through the grain box, the seed tubes should be removed and the seed run on the ground. Dragging a chain will help cover seed ahead of the packer wheels. A no-till drill is heavier in design than a conventional drill and, even with depth bands, will tend to plant too deep on a tilled seedbed.

Generally, seeding depth is not a problem when planting into the stubble of the previous crop or into a chemically killed sod. Ideally, seed should be placed at a 1/2- to 3/4-inch depth on coarse-textured sandy soils and 1/4- to 1/2-inch depth on fine-textured soils. Because the surface soil dries quickly, seed placed too shallow will be subject to desiccation before a root system is developed. Seed planted too deep will not have the stored energy to push a seedling above ground. Depth bands can further aid in controlling planting depth. Firming the soil over the seed with packer wheels or a cultipacker is important because a firm soil retains moisture longer. The seed and seedling will be less likely to desiccate between irrigations.



Oats are often used as a companion crop, but they can be too competitive with alfalfa seedlings if planted at too high a seeding rate or allowed to grow too long.

Table 1. Effect of seeding rate on a March 13, 1987, seeding without a companion crop, at the Powell Research and Extension Center. Means are averages of four replications and five varieties.[†]

Harvest year	Alfalfa seeding rate, lb/A				LSD _{.05}
	5	10	15	20	
	T/A [‡]				
1987	2.68	2.84	2.85	2.91	n.s.
1988	5.26	5.86	5.89	5.96	.27
1989	6.77	7.13	7.00	6.94	.24
3-year total	14.71	15.83	15.74	15.81	.35

[†]Means were averaged over the following varieties: Ladak 65, Wrangler, DK-120, Apollo II, and WL-320. Harvests were July 14 and September 8, 1987; June 16, July 21, August 25, and October 21, 1988; and June 16, July 26, August 30, and October 26, 1989.

[‡]Hay yield at 12% moisture.

Determine seeding rate. Seed is a major cost of alfalfa establishment because seeding rates of 20 pounds per acre or more are often recommended. A seeding rate study was conducted in Powell, Wyoming, where rates of 5 to 20 pounds pure live seed per acre were evaluated. Over a three-year period, a 10 pounds per acre seeding rate (when compared to the 5 pound rate) produced 1 ton per acre additional forage. However, there was no advantage to planting more than 10 pounds pure live seed per acre (Table 1). For optimum stands, 10 to 12 pounds per acre of pure live seed should be drilled. A 12 to 15 pound pure live seed per acre seeding rate is desirable when broadcasting with a cultipacker-seeder or an air applicator.

Should alfalfa go solo? A companion crop, such as oats, provides a quick cover, preventing wind and water erosion and soil crusting. By using reduced tillage methods, erosion can be controlled without companion crops. Although a companion crop controls weeds and provides high-quality forage while alfalfa establishes, it may be as competitive as weeds. Many producers use companion crops to avoid a slump in production during the alfalfa seeding year. Other methods, however, will yield similar amounts of forage during the establishment year.

Benefits of a grass-alfalfa mix. In Wyoming, most alfalfa grown for hay is established in pure stands. Yet some hay buyers, particularly horse owners,

prefer a grass-alfalfa mixture. Although pure alfalfa stands can be grazed, most pasture seedings are mixtures.

There are several possible advantages of a legume-grass mixture. Grass reduces the possibility of bloat in animals that graze alfalfa. Alfalfa is compatible with several grasses, and the mixture will generally not detract from total seasonal yield if alfalfa dominates. The early-season cutting usually will be a balance of legume and grass, while later cuttings will be dominated by alfalfa. On fields marginally suited to alfalfa, a grass component might prevent weed encroachment as alfalfa declines. On fields that are not uniform, grass can be over-seeded in poor drainage areas. Grasses help control water erosion on sloping fields, and alfalfa-grass mixtures cure more quickly than alfalfa alone.

Unfortunately mixtures can have several disadvantages. Alfalfa-grass mixtures reduce options for using a post-emergent herbicide. A grass-alfalfa mixture may have a lower feeding value than that of a pure alfalfa stand. Since there is no way to predict how successful each species will be, the end result can vary greatly. As alfalfa thins, increasing amounts of nitrogen fertilizer are necessary to maintain the grass's forage yield.

Seeding alternatives. Although many successful stands have been obtained with the traditional method, which usually involves plowing, disking, leveling, and cultipacking, there is still a high



The traditional method of establishing alfalfa requires a fine, firm seedbed.

incidence of less-than-desirable stands or stand failures. Depending on which crop alfalfa follows and the amount of crop residue, various types and amounts of tillage are needed for the traditional seeding method. While the companion crop helps to control weeds and wind erosion, competition from the companion crop often weakens and/or eliminates the much slower establishing alfalfa.

One alternative to the traditional establishment method is to substitute herbicides for companion crops (Table 2). Alfalfa grown after using a herbicide will be more productive than alfalfa grown with a companion crop. Total forage production during the seeding year may be nearly as great as

Table 2. Traditional and alternative methods of establishing alfalfa on cropland.

Method	Advantages	Limitations
Traditional[†]		
Tilled seedbed Oat companion crop Spring seeding	Weeds controlled Wind erosion control Good seeding-year production	Excessive competition for alfalfa seedlings
Alternative 1 (Substitute herbicide for companion crop)		
Tilled seedbed No companion crop Spring seeding	Alfalfa seedlings more vigorous than with traditional seedings Greater alfalfa production the seeding year	Herbicide needed Cannot seed grasses Possible crusting Erosion hazard
Alternative 2 (Dormant seeding, rather than spring seeding)		
Tilled seedbed (or no-till) No companion crop Dormant [‡] seeding	Alfalfa seedlings more vigorous than with traditional seedings Greater alfalfa production the seeding year	Difficult to use PPI herbicides [§] May need post-emergent herbicide Erosion hazard
Alternative 3 (August seeding into stubble)		
Stubble seedbed No companion crop August seeding	Seedling protection Erosion control Good first-year production Minimal weed competition Can use conventional drill	May need to control previous crop regrowth or volunteer May need to remove straw Need late-summer water

[†]A variation on this method would be to apply a post-emergent herbicide to kill oats when they are 4 to 6 inches tall.

[‡]During January, February, or March.

[§]Preplant incorporated.

with companion seedings. Pure alfalfa seedings will be subject to wind erosion and a finely tilled seedbed is necessary if a pre-plant incorporated herbicide is used. In some parts of the state and on light soils, the incidence of blowout is high. Also, on soils that have been annually cropped or are low in organic matter, crusting can occur. Surface crusting can result in complete alfalfa stand failure.

Another alternative method is to prepare the seedbed in the usual way and make a dormant seeding. Over a three-year period, Wyoming research has shown that alfalfa seeded in January, February, and March is as productive during the year of seeding and in the following years as it is with traditional spring seedings. Because pre-plant incorporated herbicides cannot be used, there will be more reliance on post-emergent herbicides if weeds are a problem. Also, the field is bare over the winter unless a stubble or crop residue cover is maintained.

Comparative yields of a March (dormant) seeding and the usual May seeding are shown in Table 3. During the seeding year (1987), yield of the March seeding was less than the May seeding because the May seeding regrowth was harvested. The March seeding regrowth was not harvested due to an early snow. The estimated total yield of the March and

May seedings was similar, however. Yield advantage over three years was about 1 ton per acre, in favor of the dormant seeding. This pattern of a slightly greater yield with dormant season establishment was seen in two previous seeding comparisons, as well. One year, the May seeding failed when excessive soil surface temperature followed alfalfa emergence. Of the six dormant seedings at two different locations, frost did not damage any alfalfa seedlings.

Still another nontraditional alternative is an August planting into the stubble of the previous crop. The crop could be a cereal or other annual forage such as sudangrass or millet. Crops that mature or can be harvested by early August are preferred because, in most locations, alfalfa should be planted by mid-August to adequately establish before winter. The stubble protects alfalfa seedlings from desiccation and sand blasting by soil particles. Usually, weeds are of much less concern in the fall compared to the spring and a herbicide is not needed unless it is to control competition from previous regrowth or volunteer. In most cases, a conventional drill can be used. Production the following year will be only slightly less than with alfalfa seeded in the spring under a companion crop. Alfalfa should not be seeded in August unless

Table 3. Effect of seeding date on alfalfa during the establishment year and the two following years at the Powell Research and Extension Center. Means are averages of four replications, five varieties, and four seeding rates.[†]

	Alfalfa seeding date	
	March 13, 1987	May 14, 1987
Harvest year	T/A [‡]	
1987	2.82 [†]	3.22
1988	5.75	5.09
1989	6.96	6.21
3-year total	15.53	14.52

[†]Fall regrowth was not measured after the August cutting. With all other years and seeding dates, standing forage was harvested in October.

[‡]Hay yield at 12% moisture.



Growing an interim crop, such as hay barley, allows for the correction of soil phosphorus, which is very important to sustaining alfalfa production. Note the response to phosphorus in the foreground. Following hay harvest, alfalfa was planted in early August at the Polo Ranch near Cheyenne.

water is available into the fall. Dryland seeding should be delayed until late winter or early spring.

An example of an August seeding success is shown in Table 4. Alfalfa was established in tilled plots and in small grain stubble. An excellent stand was obtained on both stubble and tilled seedbeds; however, there was a nearly complete winter kill of alfalfa seedlings in the tilled seedbed.

Non-cropland alternatives. The traditional approach is to plow when soil moisture is adequate, then repeatedly disk and harrow until an adequate seedbed is prepared for oats or another annual forage (Table 5). After one or two annual forage crops, the field is tilled again and seeded in the spring with alfalfa and a companion crop.

Table 4. Yield of alfalfa the year following an August 13, 1987, stubble seeding at Laramie. Means are averages of four replications, four varieties, and three small grain stubbles.[†]

Harvest date	T/A [‡]
June 27, 1988	2.35
August 18, 1988	1.49
Total 1988	3.84

[†]Yields include average of seedings into winter wheat, rye, and triticale stubbles and the average of the varieties Apollo II, Wrangler, Commander, and Vancor. In this trial, seedings planted into a tilled seedbed were winter killed.

[‡]Hay yield at 12% moisture.

Table 5. Traditional and alternative methods of establishing alfalfa on non-cropland.

Method	Advantages	Limitations
Traditional		
Tilled seedbed (Yr 1)	Sod and weed control	Very costly and labor intensive Excessive competition for alfalfa
Small grain seeding	Good initial year production	
Spring seeding	Good production while alfalfa is establishing	
Tilled seedbed (Yr 2)	Allows leveling of field	
Oat companion crop	Can use conventional drill	
Spring alfalfa seeding		
Alternative 1		
Fall sod kill	Less costly	Need herbicide
No-till oat seeding	Good initial year production	Need no-till drill
Stubble seeding of alfalfa in August	Good production while alfalfa is establishing	Can't level
		Less seeding year production
		Some difficulty in covering oat seed
Alternative 2		
Spring sod kill	Greatly reduced labor and fuel needed	Need herbicide
Sod seeding in spring	Erosion control	Need no-till drill
No companion crop	Fewer annual weeds	Can't level
		Less seeding year production

One alternative on non-cropland is an August stubble seeding similar to that described above for cropland seedings (Table 5, Alternative 1). Interim annual forage crop(s) can be seeded on a rougher seedbed than alfalfa, they allow time for the sod to decompose, they give an opportunity to “clean up” broadleaf weed problems, and they provide good forage production.

This approach is recommended when plowing an old alfalfa stand. Plowing and immediately replanting alfalfa is not advisable. A one- or two-year rotation with an annual forage or other crop will provide a more desirable soil situation. This approach was used in a 1992 to 1993 study conducted at the Polo Ranch near Cheyenne, Wyoming. In May 1992, an old stand of alfalfa-bromegrass was plowed. A soil test showed that phosphorus was relatively low, possibly the reason alfalfa had declined to about 25 percent of the original stand. Interim cropping with annuals allowed fertilizer to be incorporated and soil fertility improved before a new alfalfa seeding was attempted. Monida oats and Westford barley (planted on May 19) yields are

shown at three growth stages (Table 6). Fall plowing would have facilitated seedbed preparation and earlier planting. Phosphorus fertilizer was incorporated at the rate of 100 pounds phosphate (P_2O_5) per acre.

In the Polo Ranch study, alfalfa seeded directly into oat and barley stubble on August 13, 1992, produced 3.19 tons hay per acre in two cuttings (Table 7). By comparison, a dormant planting (March 24, 1993) produced only 1.63 tons per acre, and a later planting into stubble (May 12) produced even less (1.46 tons per acre) when harvested in early August. A traditional spring seeding date (May 12, 1993) produced 1.62 tons per acre of hay.

Weeds were a problem with the dormant and spring seedings, and plots were mowed over the top of alfalfa seedlings in early June. In addition, establishment was slow and yields were low due to the record cool season. This study proved that if alfalfa can be established in August, the first year production can be equivalent to a traditional spring alfalfa-companion seeding, with less weed competition.

Table 6. Yield of oats and barley seeded May 19, 1992, at the Polo Ranch, Cheyenne, Wyoming.[†]

Harvest date	Growth stage	T/A [‡]		LSD _{.05}
		Oats	Barley	
July 22	Late boot	1.71	1.43	0.21
July 28	Mid-heading	2.28	2.07	.023
August 5	Milk	2.78	2.76	n.s.

[†]100 lb/A of P₂O₅ applied.

[‡]Hay yield at 12% moisture.

Other small grains, such as wheat, triticale, hay millet, or sudangrass, could have been used in the above situation. Advanced planning is necessary when planting alfalfa in August into the stubble of the previous crop. The soil fertility necessary for successful alfalfa production should be adjusted when the soil is being prepared for the annual crop. The spring seedbed should be finer than that for

the annual crop, so it is not too rough for an August alfalfa planting. When furrow irrigated, the field corrugations should be deep enough that the stand does not need recorrugating. Normally, a herbicide is necessary to control either volunteer grain (if small grain is allowed to ripen) or regrowth (if crop is harvested for forage). In the Polo Ranch study, glyphosate (applied as Roundup[®] at 1 quart



Seeding alfalfa into the stubble of the previous crop offers several advantages, including erosion control, moisture conservation, and reduction in crusting.



Alfalfa was successfully established with a no-till drill into a sod-bound brome meadow following application of glyphosate.

per acre) was used to control oat and barley re-growth. This method will not work if irrigation is unavailable in late summer.

Another alternative is sod seeding (Table 5, Alternative 2). Perennial sod is killed with a herbicide, and alfalfa is seeded with a no-till drill. Alfalfa production in the year of seeding is usually about 20 to 25 percent less than alfalfa seeded into a tilled seedbed. This method is not recommended if noxious broadleaf weeds are present, if soil fertility is low, or if leveling for effective irrigation is needed. Certain weeds, such as Canada thistle and hoary cress (white top), are not killed by the glyphosate treatment and increase in density when the sod is killed. They cannot be controlled once alfalfa is established. Quackgrass can be controlled with the following method: spray sod with

glyphosate (Roundup®) after 3 to 4 inches growth in the spring and allow two to three weeks before seeding alfalfa with a no-till drill. This method results in relatively little alfalfa production during the year of seeding. Another disadvantage of this method is that seeding is at a busy time of the year.

Another alternative (Table 5, Alternative 1) is to spray the sod in the fall after allowing several inches of growth following the last harvest. Light frost increases the downward translocation of glyphosate and enhances root kill. Heavy frost (22 to 24 degrees Fahrenheit) will decrease the effectiveness of the herbicide. A fall sod kill allows earlier seeding in the spring. Over the winter the sod mellows, and a seedbed is prepared more easily with less tillage. Most likely, plowing will not be necessary. Oats or other annual forages can be seeded with a no-till drill, provided the seedbed is soft enough for sod penetration. Irrigation prior to seeding may be necessary if the soil is compacted. It may be necessary to drag chains or lightly harrow to thoroughly cover seed. Oat yield for plants that have been no-till seeded into a fall herbicide-killed sod have been equal to the production of oats drilled into a tilled seedbed. If the annual forage crop can be removed by early August, alfalfa can be seeded then, as with cropland seedings. Above 6,000 feet, however, there may not be enough time to grow an annual forage crop and adequately establish alfalfa before winter. There has not been enough research with this method to make specific recommendations.

Table 7. Effect of seeding method and date on alfalfa yield at the Polo Ranch, Cheyenne, Wyoming. Means are averaged over four replications and two stubbles.[†]

Seeding method	Seeding date	Harvest date (1993)	T/A [‡] (1993)
Stubble (summer)	August 13, 1992	July 8 & Aug. 13	3.19
Stubble (dormant)	March 24, 1993	Aug. 8	1.63
Stubble (spring)	May 12, 1993	Aug. 11	1.46
Tilled (spring)	May 12, 1993	Aug. 11	1.62

[†]Alfalfa production in oat and barley stubbles did not differ. No companion crop was seeded with alfalfa.



No-till alfalfa seeding is greatly enhanced if the sod is suppressed with herbicide.

Thickening old alfalfa stands. Use of glyphosate to control old alfalfa plants, grass, and weeds will allow new alfalfa seedlings to establish. However, these seedlings are slow to develop and production will be low during the initial and subsequent year. Many reports indicate that alfalfa is autotoxic, meaning the old plants are inhibitory to new alfalfa seedlings.

For a thinned alfalfa field, the general recommendation is to establish another crop before re-establishing alfalfa, particularly if diseases are responsible for thinning the original stand. Old alfalfa is controlled more easily with a fall glyphosate application than with a spring application. Additionally, if small grain is the alternate crop, a 2,4-D application will eliminate the remaining alfalfa plants.

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