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Dryland Alfalfa

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Uses

Alfalfa (*Medicago sativa* L), called queen of forages, is the most important and productive forage crop in North America. It is the most widely adapted legume known. It was introduced to the western United States in the 1850s, and it is well suited to the dry climates and irrigated soils there.

Alfalfa is grown for hay, silage, haylage, pasture, seed, and cosmetics. Fresh alfalfa sprouts are eaten in salads. The crop is rich in proteins, vitamins, and minerals, and it is a source of nectar for honeybees.

Alfalfa grown under dryland conditions normally is used for hay or pasture (grazing). The crop makes an excellent pasture for lactating cattle.

Alfalfa fixes nitrogen, so it is ideal for improving soil nitrogen levels. It is an excellent crop to include in a rotation, because it improves soil quality and provides nitrogen for crops that come after it.

Description

Alfalfa is a perennial legume that can remain in a field for 10 to 20 years, even though economic stand decline can start after the fifth year. It has woody crowns, each of which produces about 5 to 25 erect stems. The plant has a deep taproot system that can penetrate to depths of 30 feet. Flowers are purple to yellow. Pods contain one to many kidney-shaped seeds.

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Conditions for growth

Climate

Alfalfa grows under many different environmental conditions, but temperature extremes cause yield losses and shorten longevity of stands.

The plant is cold tolerant. In the fall, alfalfa undergoes many changes which make it possible for the roots and crowns to survive temperatures below 0°F. This is cultivar dependent—some cultivars are more winter hardy than others. The plant survives freezing winter stress by becoming dormant during the winter months. Very cold temperatures can cause winter injury.

Alfalfa cultivars grown in temperate regions rarely tolerate continuous high temperatures above 95°F. An air temperature of 81°F and soil temperature of 54°F are required for optimum herbage and root growth, respectively. High temperatures can inhibit growth.

Some cultivars have developed mechanisms to protect themselves from heat stress injury. In many of the alfalfa growing areas of the South, southern California, and Arizona, summer temperatures can exceed 104°F. Adapted cultivars can survive this stress. However, there is a decline in forage yield during hot summer months regardless of cultivar. This condition is called summer slump.

Soil

To get the best stands, plant alfalfa on loam soils (e.g., silt loams, fine sandy loams, or clay loams) with a pH between 6.5 and 7.0. Yield declines as pH falls below 6.5, and only a few cultivars can tolerate higher pH soils. Do not plant on saline soil, as seedling survival is poor.

Cultural practices

Field selection and seedbed preparation

To establish new alfalfa seedings, choose fields that previously were planted to small grain crops. That way, there is less trouble with volunteer crops.

Good seedbed preparation is necessary to ensure good stand establishment. An ideal seedbed is firm, moist, and free of weeds.

Begin seedbed preparation about a year before planting to allow vigorous control of perennial weeds. These weeds can cause serious loss of stand and yield. Use either conventional tillage or reduced tillage to prepare the seedbed. Seed–soil contact and placement are key in whichever system you use.

Seeding date

You can plant alfalfa in spring or fall depending on the area. In eastern Oregon, late winter (February or March) to early spring plantings are best, because there is abundant moisture to help seedling germination and stand establishment before summer.

A note of caution: Estimate when the last spring freeze might occur in your area, and plan to plant after that. Alfalfa plants are quite cold tolerant at emergence, but they are very susceptible to injury at the seedling stage (before the trifoliate leaf stage) if temperatures fall below 26°F.

Cultivars

Consider the following characteristics when you choose a cultivar to grow.

1. Yield potential
2. Persistence
3. Disease resistance
4. Winter hardiness
5. Insect resistance
6. Nematode resistance
7. Fall dormancy
8. The intended use: hay, haylage, silage, pasture, etc.

Yield and persistence are the most important factors in alfalfa production.

According to Dr. Berdahl of USDA-ARS in North Dakota, alfalfa germplasm that has the capacity to go dormant during extended periods of drought is best to plant in eastern Oregon. He suggests 'Rangelander' and 'Travois,' two older cultivars that have a high

percentage of *Medicago falcato* parentage. These cultivars have high first-cut yields and broad, deep-set crowns. They also have a fibrous root system and spreading habit. This spreading trait, and high levels of drought- and cold-induced dormancy, contribute to their long-term survival in the northern Great Plains.

Table 1 gives disease ratings for some cultivars grown in North Dakota. The Alfalfa Council also publishes a list of cultivars and their pest resistance and fall dormancy ratings each year.

Seed preparation

Rhizobia bacteria form the root nodules that fix nitrogen for the plants. It is important to inoculate alfalfa seeds before planting to ensure nodulation.

Just prior to planting, inoculate seed with a commercial preparation of *Rhizobium meliloti* in a peat-based mix. Mix thoroughly and plant immediately. Be sure to use *R. meliloti*, because it is specific for alfalfa. The bacteria that fix nitrogen in peas, clover, and other legumes will not fix nitrogen on alfalfa. There is also a clay-based inoculum, which has a longer shelf-life.

Or, you can buy preinoculated seeds. These seeds also contain fungicides that protect them from disease-causing organisms at germination and seed emergence stages. **Read labels carefully before making an application**.

Seeding method and rate

Under irrigated conditions in Oregon, recommended minimum rates are 12 to 15 pounds seed per acre to ensure an adequate stand. Lower rates usually are used in arid regions. Growers seed at rates of 7 to 8 pounds per acre in Montana.

Use a regular grain drill with a small seed attachment or an alfalfa drill for planting. Use a cultipacker to firm the soil for good soil covering. This ensures contact with soil and enhances germination.

There are about 200,000 seeds in a pound. But, seed size varies between cultivars and even between seed lots of the same cultivar. So, recalibrate seeding equipment when you use new cultivars or seed lots.

For higher seed yields, row plantings are better than broadcast seedings. A 12-inch row spacing is best for dryland production.

Recommended planting depths are 0.25 to 0.5 inch. Plant at 0.25 inch deep when seeding on fine-textured soils and at 0.5 inch when seeding on sandy soils. In Montana, growers plant alfalfa up to 1 inch deep on sandy dryland soils.

Some growers plant alfalfa with a companion or "nurse" crop like spring oats. The nurse crop is more competitive with weeds than alfalfa seedlings. A nurse crop can help reduce wind erosion. And, it may bring in additional income.

However, in some cases, nurse crops compete with the alfalfa for light, water, and nutrients, resulting in stand and yield reductions. Some nurse crops have reduced alfalfa yields by 20 to 35 percent. If you use a companion crop, you must harvest it early for forage. Do not allow it to produce grain.

Fertilizer

Soils differ in their nutrient requirement. Do a soil test to determine how much of each nutrient you need to apply.

Generally, you can broadcast and incorporate fertilizer, apply it with a drill at planting, or do a combination of both. Banded fertilizer under dry seedbed conditions reduces emergence.

Nitrogen

Alfalfa fixes nitrogen (N), so it does not require soil amendment. In fact, application of nitrogen fertilizer inhibits nodulation of the plant roots by the bacteria.

On the other hand, some soils may be very low in nitrogen. Since the nitrogen fixation may not occur immediately after germination, some growers apply 20 to 30 pounds per acre of N to help initial stand establishment in the first year.

Phosphorus

Phosphorous is the most important nutrient for alfalfa stands. Applying more than

Table 1. Agronomic characteristics of selected alfalfa cultivars grown at the Dickinson Research Extension Center Ranch, Manning, ND.

Cultivar	Company	FD[1]	Bw	Vw	Fw	An	PRR	SAA	PA	SN	APH	NRKN
120	DeKalb	3	hr	–	r	1r	r	–	r	–	–	–
5262	Pioneer Hi–Bred	2	hr	1r	mr	–	r	r	r	mr	–	–
5364	Pioneer Hi–Bred	4	r	mr	r	mr	mr	hr	hr		r	–
5454	Pioneer Hi–Bred	4	r	mr	hr	hr	hr	r	r	mr	1r	–
Allegiance	Keltgen Seed/Lynks Seed	3	–	–	–	hr	r	r	r	r	–	–
Avalanche+Z	America's Alfalfa	2	hr	hr	hr	hr	hr		r	mr	r	–
Blazer XL	Cenex/Land O'Lakes	3	r	r	hr	hr	hr	hr	r	r	r	–
Cenex 740	Cenex/Land O'Lakes	3	r	r	r	r	–	–	–	–	–	–
Cenex MG	Cenex/Land O'Lakes	2	–	1r	–	–	–	–	–	–	–	–
200	Lakes	–	–	–	–	–	–	–	–	–	–	–
Crown II	Cargill	3	hr	r	hr	hr	–	–	–	–	–	–
Cut/Graze	Agri–Pro	3	r	1r	hr	mr	r	–	r	mr	r	–
Defiant	Agri–Pro	2	hr	hr	hr	r	hr	–	r	mr	–	r
DK 127	DeKalb	3	hr	r	r	hr	hr	hr	hr	r	hr	r
Ladak 65	Public	1	mr	s	s	s	–	–	–	–	–	–
LegenDairy	Cenex/Land O'Lakes	2.5	hr	hr	hr	hr	hr	–	–	–	–	–
NK919 Rangeland	Northrup–King	blend	–	–	–	–	–	–	–	–	–	–
NK 919–10	Northrup–King	blend	–	–	–	–	–	–	–	–	–	–
Proof	Keltgen Seed	3	hr	r	hr	hr	hr	r	r	–	r	–
Rainier	Northrup–King	3	hr	r	hr	hr	hr	hr	hr	r	hr	r
Ranger	Public	3	–	–	–	–	–	–	–	–	–	–
Spreader III	Northrup–King	1	hr	mr	hr	r	mr	s	mr	mr	s	–
Sterling	Cargill	2	hr	r	hr	hr	hr	r	r	–	r	–
Vernal	Public	2	r	–	mr	–	–	–	–	–	–	mr

These cultivars are not all dryland cultivars. They are adapted to western North Dakota.

Column headings

FD=Fall dormancy
Bw=Bacterial wilt
Vw=Verticillium wilt
Fw=Fusarium wilt
An=Anthracnose race 1
PRR=Phytophthora root rot
SAA=Spotted alfalfa aphid
PA=Pea aphid
SN=Stem nematode
APH=Aphanomyces root rot race 1
NRKN=Northern root rot nematode

Pest resistance

% Resistance	*Plants resistance class*
0–5%	Susceptible (s)
6–14%	Low resistance (lr)
15–30%	Moderate resistance (mr)
31–50%	Resistant (r)
>50%	High resistance (hr)

[1]Check cultivar dormancy rating (1 = high, 5 = low)
Norseman=1 Vernal=2 Ranger=3 Saranac=4 Archer=5

Source: Ashley, R., L. Tisor, and G. Ottmar. 1997. Alfalfa Cultivar Performance at the Dickinson Research Extension Center—Manning Ranch, ND. http://www.ag.ndsu.nodak.edu/dickinso/research/1997/alfalfa.htm

needed does not hurt the plants. Ideally, growers can apply 3 to 4 years' supply at seeding or prior to planting. However, under dryland conditions, it is better to make yearly phosphate applications (as is done in Nebraska).

You can apply phosphorus and sulfur as single superphosphate.

Potassium

Yield and stand survival depend on an adequate supply of potassium. Follow the soil test recommendation in your area.

Sulfur

Alfalfa uses 4 to 5 pounds of sulfur per ton of dry matter yield. Follow Oregon State University's soil fertility recommendations in your area.

Lime

The optimum soil pH for alfalfa is 6.5 to 7.0. Apply lime if soil pH is less than 6.5. Apply lime a year before planting.

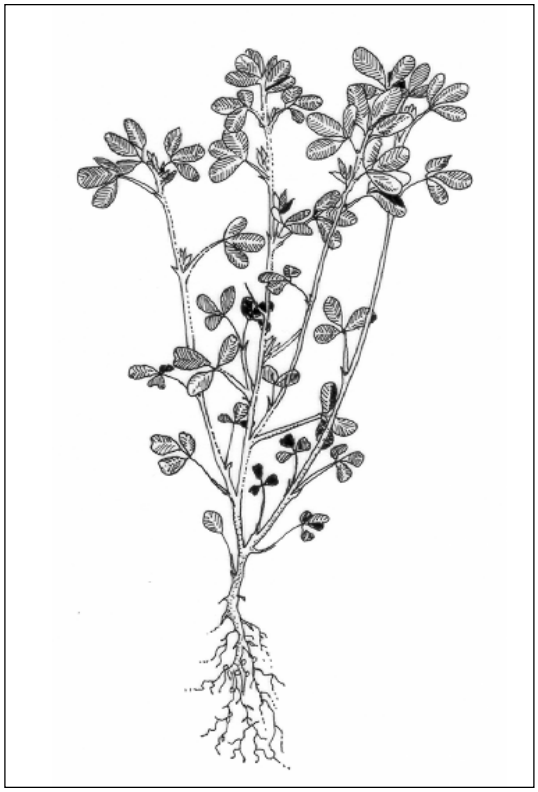
Weeds

Good management practices to control weed infestations are low cost and environmentally sustainable. Alfalfa is a very poor competitor with weeds, especially at the seedling stage, so vigorous preplant weed control is vital. Perennial weeds cause the most trouble in alfalfa stands.

You can control most winter and summer annual and perennial weeds with chemicals when they are small. Hand weeding of some perennials may be effective. Refer to the *PNW Weed Management Handbook* and consult your local crop consultants for help.

Insects

Alfalfa weevils, potato leafhoppers, alfalfa aphids, and grasshoppers are the most damaging in dryland areas. Pale legume bugs and pea aphids are major insect pests in the Northwest. Occasionally, caterpillars cause severe damage to alfalfa fields during the spring.



Combine good cultural practices and use of insecticides for insect pest control. Time insecticide application properly if you want to avoid losses. Ask your local Extension agent to help you determine when it is economical to use insecticides.

Nematodes also can be a problem. Root lesion nematodes can cause substantial damage. There are only a few resistant cultivars.

Disease

Verticillium, bacterial, and fusarium wilts are a problem in alfalfa stands. Crown and upper root rots are chronic wherever alfalfa is grown. These fungal diseases normally are found in stands that are over 2 years old. They contribute to the decline of the stands.

The following management practices can help minimize disease in alfalfa and other legume crops.

- Do not plant alfalfa on poorly drained soils.
- Select cultivars that are best adapted to your area and resistant to the most important alfalfa diseases in that area.
- Never follow alfalfa with alfalfa. Use a cereal crop or other grass crop for at least 2 years in rotation with alfalfa.
- Make sure plants get enough nutrients (especially phosphorous and potassium) for healthy growth.
- Practice good field sanitation.
- Clean farm equipment after use to avoid spreading disease-causing organisms from field to field.
- Cut plants at least 30 days before the first autumn frost. This allows plants to grow back enough to store root carbohydrates before the winter. Without adequate stored carbohydrates, plants are weak and unable to withstand pathogen attack.

Harvesting

There is usually a steady increase in leaf dry matter from emergence till early bloom stage, after which decline sets in. Thus, it is best to cut alfalfa by early bloom stage to get the best quality crop.

In eastern Oregon, where annual precipitation is between 10 to 16 inches, a grower might get only one cutting. In fact, a second cutting could hurt the persistence of the stand.

Grazing shortens the life of alfalfa stands compared to mechanical harvesting. However, you can reduce the harmful effects of grazing by using good management techniques. Alfalfa can provide quality grazing in the fall and makes excellent pasture. Early fall grazing is better than late fall grazing. Use rotational grazing to minimize stand impact and compaction.

Bloat

Bloat frequently afflicts animals that feed on alfalfa. Alfalfa leaves are digested rapidly in the rumen, producing large quantities of gas and foam. The gas is trapped in the rumen, which in severe cases can lead to death as a result of intense pressure on the respiratory system.

Young and less mature alfalfa growing at lower temperatures often cause bloat. Do not let hungry animals feed on alfalfa pasture.

Do not feed the crop to livestock right after a killing frost. Frost ruptures plant cells, which leads to an even higher rate of digestion. Delay grazing for about 5 days after freeze damage.

There is a genetic disposition for bloat in livestock—some are affected, others are not. However, during the grazing season, watch all livestock carefully. Remove from the pasture any animals found to have bloat.

Yield potential

'Ladak 65' is a popular dryland cultivar with a proven record of higher yields under dryland conditions. 'Shaw,' a cultivar recently released by Montana State University, currently is yielding better than 'Ladak 65.'

Table 2 gives statewide alfalfa yield trial data from Montana. The data show that there are cultivars that yield as much and, in some cases, more than 'Ladak 65.' Montana State University has statewide yield trial data at its Web site and is a good source for information on alfalfa.

For more information

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Table 2. Statewide summary of alfalfa cultivar trials in Montana planted in 1997 and harvested in 1998, 1999, and 2000. Yield in tons per acre of dry matter per year.

Irrigated/Dry	Bozeman dryland	Moccasin dryland	Statewide avg. Dryland	Dryland % of mean
5396	1.59	0.84	1.22	98
DK 140	1.64	0.87	1.26	101
DK 142	1.73	0.86	1.30	104
Rhino	1.70	0.88	1.29	104
Plumas	1.71	0.86	1.29	104
645	1.69	0.91	1.30	105
Oneida VR	1.69	0.85	1.27	102
Ace	1.54	0.76	1.15	93
DK 143	1.68	0.89	1.29	104
5301	1.64	0.87	1.26	101
Wrangler	1.68	0.87	1.28	103
Cimarron 3i	1.52	0.82	1.17	94
Ladak 65	1.29	0.84	1.22	98
Riley	1.43	0.87	1.15	93
Location Mean	1.63	0.85	1.24	100

Source: Cash, D. 2001. Choosing Alfalfa Cultivars in 2001. http://www.montana.edu/wwwpb/ag/alfvari2001.html

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