



# Alfalfa

## The Queen of Forage Crops

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Alfalfa has been grown as a forage crop since the beginning of recorded history and can now be found almost anywhere in the world. It is generally agreed that alfalfa originated in the vicinity of Iran and was first brought to North America by the European colonists in the early 1700s. The first real success with alfalfa production in the United States came when it was brought into the Southwest by way of Mexico. It is now grown to some extent in every state. Over 350,000 acres are grown in Kentucky, while up to 2 million acres of land are suitable for alfalfa production.

Alfalfa has spread and become popular because of its productivity and high feed value. It has the highest yield potential of any perennial forage legume adapted to the United States. It is also among the highest in feed value. With its high protein content, it complements corn silage and grains in formulating livestock rations. Alfalfa is a versatile crop and can be used for pasture, hay, silage, green-chop, soil improvement, and soil conservation. It has great potential in Kentucky for the cash hay market and for intensive grazing.

Four major objectives that will help you successfully produce alfalfa are:

- Pay attention to details before and during establishment to get a dense, weed-free stand.
- Use good fertility and pest control programs to keep plants vigorous and healthy.
- Follow a harvest schedule that will preserve the stand and produce good yields of high quality forage.
- Market the forage through livestock or as cash hay for profit.

The information presented in the rest of this publication can help you achieve these objectives.

### Soils for Growing Alfalfa

The ideal alfalfa soil is deep and well drained. Alfalfa has a vigorous root system which enables it to obtain water and nutrients from a large volume of soil. This characteristic helps alfalfa produce high yields and live through dry periods. Poor soil drainage restricts oxygen supply to the roots, increases winter heaving problems, causes more disease problems, and damages alfalfa's nitrogen-fixing bacteria. These effects all lead to low productivity or loss of the stand.

Less than ideal soils can be used for growing alfalfa. However, you will need to give more attention to management factors. Also, you should expect lower yields and shorter stand life. Soils maps provided by the Soil Conservation Service are useful for helping you select the fields best suited to growing alfalfa.

### Lime and Fertilizer Needs

Alfalfa removes large amounts of nutrients from the soil. A ton of alfalfa hay contains 54 lb of nitrogen, 12 lb of phosphate, 50 lb of potash, 30 lb of calcium, 5 lb of magnesium, and 5 lb of sulfur plus the micronutrients. Nitrogen fertilization is not necessary because alfalfa gets nitrogen from the air by converting nitrogen to a usable form by special bacteria that live in nodules on the alfalfa roots. Soils vary considerably in their ability to supply nutrients and some require the addition of large amounts of lime and fertilizer to meet alfalfa's needs.

Test soils before sowing alfalfa to determine the nutrients needed. Lime should be applied to adjust the soil pH to 6.5 to 7.0. If the starting pH is below 6.2, apply lime at least 6 months before alfalfa is to be sown because the increase in pH does not occur immediately. Where this is not possible, a seed treatment of molybdenum can be used to help get the alfalfa established and give the lime time to dissolve and raise the pH.

Phosphate and potash are the two fertilizers needed in the greatest amounts to establish and grow alfalfa. The soil test recommendation will show how much lime, phosphorus, and potassium are needed. All other nutrients are normally supplied by the soil or from the atmosphere, except for boron. Apply boron at the rate of 1.5 to 2 lb of elemental boron per acre. All

fertilizers needed to establish alfalfa should be applied before sowing. Established stands should be top-dressed with the amounts of each element required based on soil test results.

## Sowing Alfalfa

Establishing a good stand of alfalfa is expensive and time consuming, but the success rate is high if you give attention to the important factors. Follow these steps for best results in getting a dense, weed-free stand.

### Step 1. Variety selection

A large number of adapted varieties are available to select from. Selection of varieties should be based on yield potential, pest resistance, and winter hardiness. When planting large acreages or more than one field, use 2 or more varieties. Try new varieties on small acreages to see how well they perform on your farm.

### Step 2. Seeding rates

Alfalfa should be seeded at 15 to 20 lb of seed per acre for pure alfalfa stands. When moisture, timing, and seed-bed preparation are optimum, the lower rate can be used. When conditions are less than optimum, use the 20-lb/acre rate.

In many cases, grasses should be planted with alfalfa to control soil erosion on sloping land and reduce weed problems. Use 15 lb of alfalfa seed per acre when sowing with a grass. Table 1 shows the grasses adapted to Kentucky conditions and suitable for sowing with alfalfa. If you use tall fescue, select an endophyte-free variety. Use only one species of grass in a given field.

Table 1.—Grasses To Be Sown with Alfalfa in Kentucky

Species	Seeding Rate (lb/acre)
Orchardgrass	6
Timothy	4
Tall Fescue	6
Kentucky Bluegrass	4

### Step 3. When to sow

Alfalfa can be sown either in early spring or late summer in Kentucky. Make spring seedings in prepared seedbeds after the danger of late freezes has passed. Adding grass suppression herbicides such as paraquat or glyphosate before sod-seeding alfalfa is highly recommended to allow the legume to get established.

Late summer seedings need 6 to 8 weeks to germinate and grow before the first hard freeze. This usually means planting between August 15 and September 15. Major concerns at this time are a lack of adequate soil moisture and, in some areas, sclerotinia crown rot. Sclerotinia stem and crown rot of alfalfa only infects in the late fall (October/November) and almost always only affects tender seedling plants. Planting alfalfa early in the late summer seeding period allows the plant to grow and develop more of its natural resistance to sclerotinia

before the infectious period. Earlier seeding is helpful but does not guarantee immunity to sclerotinia. Where sclerotinia has been known to occur and be a problem, strongly consider establishing in the spring.

If the soil is dry, prepare the seedbed but do not plant alfalfa until an inch or more of rain falls. Then, finish preparation and plant the alfalfa as soon as possible. If an inch or more of rain does not fall before September 15, it is best to sow 1/2 to 1 bu/acre of small grain and wait until spring to sow alfalfa.

### Step 4. Seed inoculation

Poor nodulation can be a problem with new alfalfa seedings. Some causes of this problem are low soil pH, low molybdenum levels in the soil, the wrong type of inoculant, dead inoculant, and poor inoculant application. The following checklist will help ensure that live nitrogen-fixing bacteria are present when the seed is planted:

- Have a soil test done before planting alfalfa and follow the instructions on liming discussed previously.
- Be sure the word “alfalfa” is listed on the inoculant container.
- Check to be sure the inoculant expiration date has not passed and that the container has no breaks.
- Verify that the inoculant was stored in a cool, dry place before you purchase it.
- Inoculate the seed just before planting.
- When using pre-inoculated seed, check the date it was inoculated. If more than 6 months have passed, re-inoculate before planting.

To be sure the inoculant stays on the seed, use a commercial adhesive, a sugar solution, milk, etc., as a sticking agent. Add a small amount of the sticking agent to the seed and mix thoroughly so that all the seed is moistened. Then, add the inoculant and mix thoroughly with the moistened seed. The inoculant will absorb the moisture and the seed will flow through the seeder.

## Other Seed Treatments

Other materials in the form of seed coatings are currently being added to alfalfa seed prior to planting. These materials may include lime, inoculant, and fungicide. Seed may be treated with any combination of these three additives and the treatments used will vary by variety, distributor, and seed producing company. Pre-inoculating or treating with fungicides will not displace any significant weight of seed in each bag. However, lime treatment cuts the weight of actual raw seed in each bag by approximately one-third. Research continues on whether seeding rates should be increased when using lime-coated seed. Currently, there is no clear answer to this question. Pre-inoculated seed must have an expiration date for the Rhizobium bacteria printed on the label. Check this date to make sure that the bacteria are still guaranteed to be viable. Seeds are being treated with fungicides to protect the seedlings from diseases such as Pythium and damping-off during early emergence and development.

## Step 5. Tillage method

Alfalfa can be established using conventional tillage or no-till. Tillage may be necessary to cover excess crop residues, control competition from other plants, or smooth the soil surface. In most cases, a good disking is sufficient. A corrugated roller can be used to smooth and firm the seedbed after disking. A second rolling after the seed is sowed helps cover the seed and ensure good contact with the soil.

No-till planting of alfalfa following a row crop may be best if soil erosion is a risk. No-till seeders are available that will open a narrow slit in the soil and drop the seed at the right depth (1/4 to 1/2 inch). Weed control is very important in no-till plantings, and pre- and post-emergence herbicides are often required.

If alfalfa is to be interseeded into a small grain crop, use a light seeding rate (1/2 to 1 bu/acre) of small grain. Alfalfa can be planted no-till or broadcast after a light disking and smoothed with a corrugated roller. For best development of the alfalfa stand, remove the small grain by grazing or cutting for silage in the boot stage.

## Step 6. Weed control

Unless controlled, weeds such as crabgrass, foxtail, fall panicum, and chickweed can drastically reduce alfalfa stands. Alfalfa is especially susceptible to weed pressure during establishment. Fortunately, herbicides are available that do a good job of controlling the annual grasses and some broadleaf weeds. See UK Extension publication “Weed Control Strategies for Alfalfa and Other Forage Legume Crops” (AGR-146) for current herbicide recommendations for alfalfa.

If pre-emergence herbicides are used to control annual grassy weeds when planting alfalfa, you cannot plant forage grasses with the alfalfa. If mixed stands are desired, the grass should be drilled into the established alfalfa in late summer.

## Managing Established Alfalfa Stands

Managed properly, a good stand of alfalfa should last 5 years or longer. Attention to several management practices is necessary to keep the stand healthy and vigorous.

### Fertilizing

Take soil samples regularly to determine whether you need annual topdressings of lime, phosphorus, and potassium. Low soil test levels of potash often result in premature stand loss. Apply boron each year at 1.5 to 2 lb/acre of elemental boron. Do not use nitrogen on alfalfa.

Fertilizer can be applied at any time of the year and in one application. Research has shown no benefit from split applications of fertilizer. It can effectively be spread either in the fall after the last cutting or in the late winter or early spring before rapid growth begins.

### Pest Control

Diseases are best managed by selecting a well-drained soil, using varieties resistant to diseases, and keeping the plants growing vigorously with good management. For best results, plant varieties that have an “MR” or moderate resistance to the four major diseases of concern in Kentucky: bacterial wilt, phytophthora root rot, fusarium wilt, and anthracnose.

The two major insect pests of alfalfa in Kentucky are the alfalfa weevil and the potato leafhopper. The alfalfa weevil is usually more of a problem before the first cutting in the spring. Potato leafhoppers are more likely to be a problem after the first cutting and through the summer. Other insects that may sometimes cause problems with alfalfa are spittle bugs, aphids, clover-root curculios and grasshoppers. Check alfalfa fields frequently for insect problems. Consult with your county agricultural Extension agent for control methods.

Most weeds in alfalfa can be minimized by good management that results in a vigorous, thick stand. A thick stand of alfalfa makes it difficult for weeds to get started. Close mowing (2-3 inches high) at harvest time kills many annual weeds without hurting the alfalfa. Herbicide treatments are sometimes needed and can be effective. Certain weeds such as curly dock and musk thistle are very difficult or impossible to control using broadcast selective herbicides. Check with your county agricultural Extension agent for herbicides, rates, and times of application.

### Harvesting

Alfalfa can be harvested for hay, haylage, green-chop, or by grazing. Allow spring seedings to grow 70 to 90 days before the first harvest.

By this time, the plants should have a well-developed crown and root system. The other harvests that year should be made at the early bloom stage.

For established stands, make the first cutting at the late bud stage or when the first flowers open. If the plants appear small with under-developed crowns and roots, delay harvest until early bloom. Make successive harvests at early bloom or at 30- to 38-day intervals. If plants are allowed to become more mature, the hay will be higher in fiber and lignin and lower in protein, digestibility, and palatability. If plants are cut too soon, both yields and stand life will be reduced.

Alfalfa plants need a rest period during the fall to get ready for winter. To provide for this rest, make the last summer cutting before September 15. After the first hard freeze (24° F or lower), or November 1, a final harvest can be made. This final harvest will not hurt the alfalfa and may reduce pest problems.

Cutting alfalfa stands during this critical fall rest period affects the plant response in the following year. In the least it will reduce the speed of regrowth in the spring and may reduce the yield of the first cutting. In the worst case, stands may be thinned significantly. However, there are situations where the risks of stand damage or future yield reduction from harvesting between September 15 and November 1 are reduced. If (a) the stand is in bloom at the time of the fall cut, or (b) it has been at least 45 days since the last harvest, or (c) the stand is old and will be plowed under for another crop anyway, the value of the forage may be great enough to risk stand damage. Conditions

where the risks associated with cutting during September 15 and November 1 are greatest are: (a) The stand is less than one year old; or (b) The field of alfalfa has been stressed during the past year by late frosts, disease, excessive insects, or weed pressure, etc.; or (c) The alfalfa field has not been adequately top-dressed with P, K, and boron; or (d) the variety lacks multi-pest resistance.

In general, it would be better to cut an older stand rather than a younger stand during the fall rest period. Older stands have already allowed the costs of establishment to be recovered and by definition have few productive years remaining. Younger stands have more of their productive years ahead of them and as such should not be abused by being cut between September 15 and November 1.

Deciding whether to cut an alfalfa field in late September or early to mid-October is an individual judgment that should be based on the benefits of the extra yield and quality outweighing the risks of yield and stand loss the following year. Keep in mind that you will never hurt the stand by not cutting during the traditional fall rest period. Also keep in mind that fall cutting will affect next year's production.

If you do cut during the fall and want to get a few more years of production from the field, make sure that soil fertility needs are taken care of by liberally top-dressing during the late fall or winter and using a dormant herbicide spray to control the growth of winter weeds such as henbit and chickweed.

If the alfalfa is to be removed by grazing, don't leave livestock on it too long and don't let them graze when the soil is muddy to prevent damage to the stand. Grazing of alfalfa is becoming more popular in Kentucky. Grazing must be done on a rotational basis to maintain thick productive stands. Stocking rates should be high enough to remove the herbage in 7-10 days. Allow enough time between grazings (4-5 weeks) for alfalfa to reach the bud-to-early-flower stage. Take precautions to prevent bloat in grazing animals. Including a cool-season grass with alfalfa will help to reduce the chances of bloat. Other recommendations for grazing alfalfa include using a bloat preventative and not turning hungry animals out onto alfalfa, especially lush alfalfa that is wet with rain or dew.

## Reseeding Alfalfa

Although alfalfa is a perennial plant, stands tend to thin out over the years and eventually need to be replaced. However, it is not advisable to try to go directly back to alfalfa because of insect and disease buildup and autotoxicity problems. Autotoxicity results when an old alfalfa plant produces a chemical that kills the new alfalfa seedlings as they germinate and try to grow. Therefore, establishing an acceptable stand without rotation is difficult and is not recommended.

One thing you can do when alfalfa stands begin to thin out is to renovate with red clover to help maintain forage production for a year or two. Adding a cool season grass such as orchardgrass can help to extend the life of a thinning, pure stand of alfalfa. Small grains can be drilled into alfalfa. Corn or other annual crops can also be used to rotate between alfalfa crops. Silage corn can be planted in the spring and harvested in August in time to seed alfalfa. Summer annual grasses such as millet and sorghum X sudangrass hybrids can be grown during the summer and followed by no-till alfalfa seeding in late August or early September.

## Conclusion

Alfalfa is the premier forage legume in the United States. Advances in variety development, establishment, pest control, fertility, and harvest management have improved alfalfa yield and quality. With these advances, harvest management can be more intensive than it traditionally has been.

Alfalfa's potential as a grazing crop is virtually untapped. (See ID-97, "Grazing Alfalfa," for more details). With present technology and dedicated management, beef gain per acre can exceed 800 pounds without loss of stands.

Systems have been developed that make it possible to use alfalfa for both hay and grazing. Needs and economics will dictate which practices can be used profitably on individual operations.

### Related Publications

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- AGR-107 Alfalfa: Quality Means Profits.
- AGR-64 Establishing Forage Crops
- AGR-90 Inoculation of Forage Legumes
- AGR-18 Grain and Forage Crop Guide for Kentucky
- AGR-1 Lime and Fertilizer Recommendations
- AGR-148 Weed Control Strategies for Alfalfa and Other Forage Legume Crops
- ENT-17 Insecticide Recommendations for Alfalfa and Clover
- PPA-28 Alfalfa Varieties: Relative Disease Resistance and Winter Hardiness
- AGR-137 Alfalfa Hay: Quality Makes the Difference
- ID-97 Grazing Alfalfa
- ID-101 Interpreting Forage Quality Analysis Reports
- AKES Progress Report 340 1991 Kentucky Alfalfa Yield Results