

HOW THE ALFALFA PLANT GROWS: IMPACT ON MANAGEMENT



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Introduction

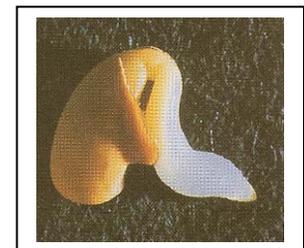
Alfalfa is the premier forage crop with high yield, high forage quality, season long productivity, drought tolerance, and extended stand life. Alfalfa requires intensive management to insure that yield, quality, and stand life are maximized. It should be planted on deep, well drained soils and maintained with optimal fertilizer inputs. It also requires adequate rest periods between cutting for hay or grazing. Alfalfa can be prone to significant insect damage and stands may require insecticide treatments. There are many details to successfully managing an alfalfa stand, but if you understand how the plant grows then you will better understand the positive and negative impacts of management decisions.

Understand growth to be able to manage

There are many books, manuals, extension bulletins, and now websites that give recommendations on how to manage alfalfa. The best managers don't rely on a simple list of recommendations, but instead focus on understanding how the plant grows. Once you understand alfalfa plant growth then you can determine the management strategy that is appropriate for your situation. Since alfalfa management varies according to region, soil type, climatic conditions, etc..., there is no one management scheme that works for everyone. The remainder of this article will focus on plant growth and the impact that growth has on management.

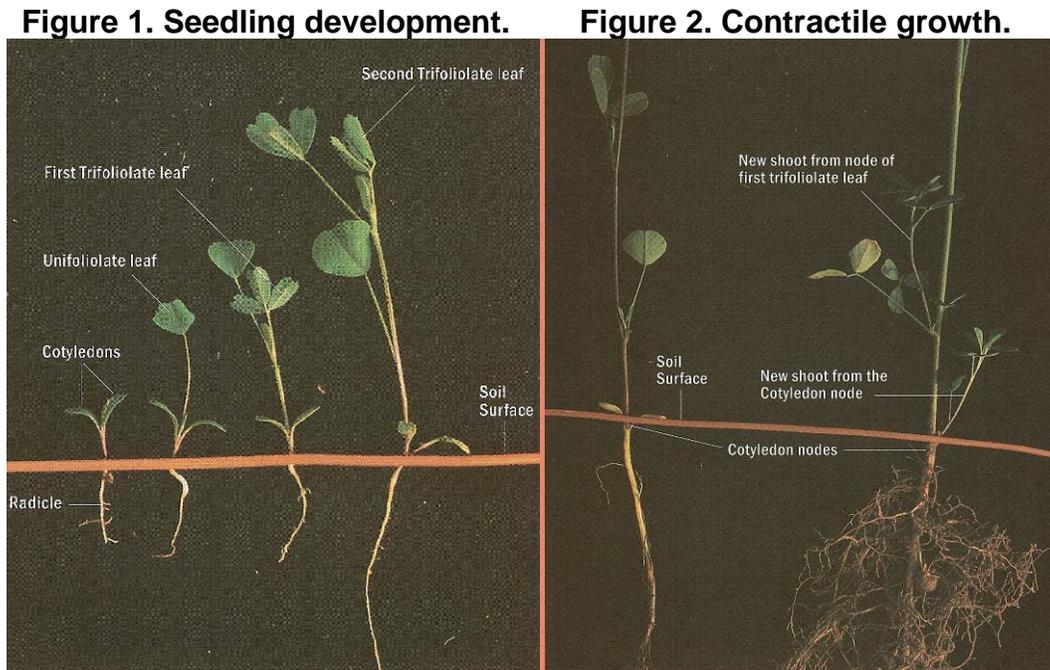
Seeding to Seedling Establishment

Alfalfa plant growth starts when the seed germinates and the radical or root emerges. Once the root is firmly "set" in the soil, the upper part of the root (hypocotyl) begins to elongate and the remaining two halves of the seed (the two cotyledons) are pushed upward and out of the soil and the two cotyledonary leaves are visible. After emergence, the seed becomes a seedling. When alfalfa is planted too deep (over $\frac{1}{2}$ ") the seed often does not contain enough energy to push the small seedling out of the soil. Seedling depth recommendations of $\frac{1}{4}$ to $\frac{1}{2}$ " must be followed to insure a good stand.



Contractile growth

Alfalfa seedlings have the unique ability to pull the growing point of the plant (cotyledon nodes) below the soil surface (Figures 1 and 2). This is called contractile growth and having a protected growing point is the reason that alfalfa can survive cold temperatures, close cutting, and grazing. Contractile growth usually takes about 8 to 10 weeks and sometimes as long as 16 weeks. With fall plantings young seedlings are not ready for cold winter temperatures until the growing point is protected below the soil surface. Therefore, late summer plantings of alfalfa should occur by the middle of August. Earlier planting in the fall also reduces the chances for *Sclerotinia*. In the same way, care should be taken before cutting or grazing spring planted fields to avoid damage to the growth point. The growing point later becomes the plant crown as more and more stems originate from this region of the plant.



“How an Alfalfa Plant Develops” by Marvin Hall. Available for download or for sale at www.alfalfa.org.

Harvest Management and Root Carbohydrate Storage

Alfalfa has the unique ability to store carbohydrates (starches and sugars) in its large taproot and then metabolize these carbohydrates for growth in the spring and for regrowth following cutting. Typically root carbohydrate levels drop from a high of 30 and 40% (of total root dryweight) to around 10 to 15% after approximately two weeks of growth (Figure 3). Once a plant has enough new leaf growth for maximum photosynthesis, it begins to store carbohydrates back in the taproot. Normally this occurs during the 3rd week of regrowth or when the plant is 6 to 10” depending on soil moisture and environmental conditions. When a plant reaches a medium bloom stage

root carbohydrates are at their highest levels. High root carbohydrate levels are important for winter survival and for rapid regrowth after cutting.

Traditional harvest management recommendations are based on the root carbohydrate cycle and harvest is not recommended until alfalfa reaches an early or 1/10 bloom stage. Carbohydrates are not at their highest levels at this stage, but are sufficient for rapid regrowth and plant health. Since alfalfa quality declines rapidly as the plant matures to the medium and full bloom stages, 1/10 bloom is a good compromise between yield and plant health.

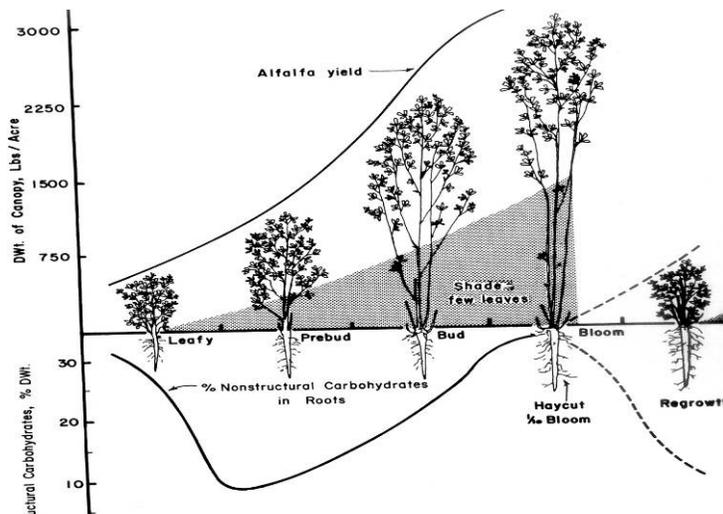
If maximum stand longevity is most important then allow alfalfa to reach a bloom stage before harvesting. In recent years some producers have preferred to harvest alfalfa at a late bud stage to maximize quality. New varieties have been developed that are more tolerant to frequent harvests, but Craig Schaefer (Univ. of Minnesota) reported that when cutting repeatedly at the late bud stage, delaying at least one cutting a season until the medium bloom stage will increase stand life.

Cutting height for alfalfa is less important than for grasses since the energy for regrowth comes from stored root carbohydrates. With grasses, a cutting height of 3 to 4" is recommended to maintain leaf area/photosynthesis needed for regrowth. Alfalfa can be cut as low as 1", though many producers cut from 2 to 3" to prevent scalping on uneven terrain.

Managing alfalfa based on root carbohydrates is an important consideration during the fall. Alfalfa stands should not be harvested during the critical fall period to allow sufficient root carbohydrate storage before winter. This critical period is 6 weeks before the first killing frost (normally defined in alfalfa as 24°F or below). In Kentucky this period is considered September 15 to November 1, although it will vary somewhat from north to south and from one year to the next. Therefore, the last cutting for the summer should occur before September 15th, and then a final cut can occur after November 1. Killing frosts do not always occur on or before November 1st, but the cooler soil temperatures during November generally prevent enough regrowth to allow carbohydrate depletion before winter.

There are exceptions to every rule and when forage is short supply you may decide to take a risk and cut during the critical fall period. The following considerations may aid in making your decision concerning fall harvest timing: 1) Older stands have a greater chance of winter injury than younger stands; 2) If killing frosts normally occur earlier or later than November 1 in your area then shift your critical fall period earlier or later; 3) Cash hay producers will break the critical period rule when potential profit is high enough to offset the risk of winter injury; and 4) The best insurance for winter stand survival is to never cut in the fall, but this conservative approach is rarely recommended because of wasted forage.

Figure 3. Alfalfa growth and root carbohydrates.



“Forage Animal Management Systems” Roy Blaser et. al (1986).
 Available at <http://www.caf.wvu.edu/~forage/books/fams/index.htm>

When to Remove a Stand

Alfalfa stand life usually varies from 4 to 7 years depending on soil type, fertility, management, and environmental conditions. While it is difficult to predict stand life ahead of time, a careful examination of alfalfa roots in older stands will show when the stand is nearing the end of its productive life. Most stands eventually die out due to crown rot. Crown rot is normally caused by plant injury (eg. - wheel traffic, winter injury, grazing, etc...) followed by one or more diseases. Since there is no known variety resistance to crown rot, ideal management provides the best insurance for prolonged stand life.

Use figure 4 below to determine the health of your stand. If the majority of your plants in your alfalfa stand fall into categories 0, 1, and 2 then your stand should be productive for another year or more. If 30% or more of plants in the field fall into categories 3 and 4 then the alfalfa stand should be considered for replacement (originals of the images in Figure 4 can be found in the “Alfalfa Management Guide” footnoted below).

Remember that new varieties have been developed with resistance to many of the common diseases that affect alfalfa (just not crown rot). Always purchase seed of a multiple disease resistant variety.

Figure 4. Varying degrees of crown rot in alfalfa.



“Alfalfa Management Guide”, Undersander et al. (2000). Available at http://www.asa-cssa-sssa.org/publications/pdf/alfalfa_guide_production.pdf

Grazing Alfalfa Management

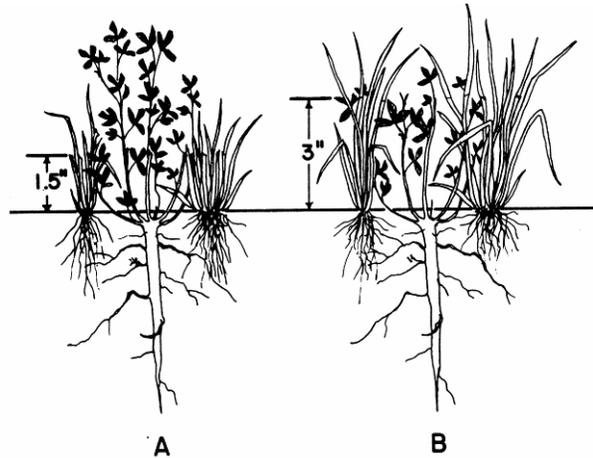
There is increased interest in grazing alfalfa due to its productivity, long growing season, and its ability to continue to grow under high temperatures. Managing alfalfa stands under grazing is very similar to managing for hay production. Therefore the management recommendations described above are all valid if the stand is being hayed or grazed.

There are several unique considerations when grazing alfalfa though. Do not allow livestock to remain on the field more than 7 days (to avoid regrazing young shoots). Since plants should be at a late bud to early bloom stage before grazing, rotational grazing is essential for stand survival and productivity. Some producers prefer grazing alfalfa before the bloom stage for maximum quality. If you would like early or more frequent grazing to be an option, then it is essential that you choose a grazing tolerant variety (see KY variety test reports to choose adapted grazing type varieties, www.uky.edu/Ag/Forage).

Managing mixed stand – favor alfalfa

For many hay and pasture stands of alfalfa, mixtures with grass species such as orchardgrass is preferred. The grass adds to the nutritional balance, improves hay curing, and help provides a sod for hoof traffic. The common rule of thumb when managing a legume/grass mixture is to manage for the legume. For example, with an alfalfa/orchardgrass mixture you want the alfalfa to reach the late bud to early bloom stage before cutting or grazing. If the grass starts to dominate the stand then closer cutting or grazing will benefit the alfalfa since its regrowth energy comes from root carbohydrates (Figure 5). If the alfalfa starts to dominate the stand then and higher cutting or grazing height (3 to 4”, even 5”) benefits the grass since it retains sufficient green leaf area for continued photosynthesis.

Figure 5. Alfalfa/orchardgrass stand at two cutting heights.



“Forage Animal Management Systems” Roy Blaser et. al (1986).
Available at <http://www.caf.wvu.edu/~forage/books/fams/index.htm>

In Conclusion

When managing alfalfa there are many considerations. Remember the basics of planting on fertile well drained soils, soil test regularly, and follow the liming and fertilizer recommendations closely. Always consider the growth of the plant when making management decisions and you will insure productive alfalfa stands in your hay fields and pastures.