

MANAGEMENT OF ALFALFA FOR INCREASED FORAGE PRODUCTION

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Alfalfa is a plant that is well adapted to the high temperatures, bright sunshine, alkaline soils, and irrigation practiced in the West. Hay can be cut and processed under excellent weather conditions throughout most of the year in Arizona and California. In order to obtain high productivity and maximum returns from alfalfa, it should be treated as a cash crop.

Alfalfa management is a broad term and may mean different things to different people. In the broadest sense, it is an integration of all the things done in growing a crop of alfalfa. This includes seeding, stand establishment, fertilization, irrigation and harvesting. Good management is optimizing all of these factors.

Cutting Management

I wish to restrict my discussion largely to one phase of alfalfa management and that is cutting management. Perhaps one of the most important but least understood management practice, particularly with growers, is cutting or harvest management. Many growers have the mistaken impression that you can cut or pasture alfalfa anytime when topgrowth is present and that your stands will remain healthy and vigorous. This is far from reality.

Alfalfa is a perennial plant and proper management is critically important for high yields of a good quality forage and for the maintenance of a vigorous and long-lived stand. Stage of growth at harvest is one of the most important management factors affecting growth, yield, and persistence of alfalfa plants. In reality, the yield of alfalfa harvested depends on the amount of stem and leaf tissue produced per unit land area during the preceding growth period.

Manufacture, Use, and Storage of Food Material

Essentially, all of the food material that a plant uses to produce growth, to maintain cellular activities, and to store is manufactured in the leaves. Therefore, the amount of leaf surface area and the length of time that this leaf surface area is permitted to remain intact on the plant control the amount of carbohydrate material manufactured by the plant. If we have knowledge of when these substances are the highest and lowest, then we should know more about cutting management for that plant.

Any food material that is manufactured in excess of that needed immediately by the plant is stored in the crown and roots for future use. Such reserve food material, which is primarily carbohydrates, is used to initiate and promote regrowth after cutting until the leaf surface area is sufficient to manufacture enough daily photosynthate to equal that used by the plant. Our research work conducted in Southern Arizona has shown that the leaf surface area of alfalfa plants during the growing season is not sufficient to manufacture food in excess of that needed for growth until the plants are about 10 to 12 inches tall. Alfalfa plants then are growing and expanding their stems and leaves at the expense of stored food material until they are about 10 to 12 inches in height. At this time enough carbohydrates are being formed by photosynthesis in the green leaves that some are moved to the roots and crowns for storage. Carbohydrate reserves are replenished rather rapidly in the roots and crowns, both in amount and percent, during the later stages of growth prior to harvest.

The stage at which enough topgrowth has been produced so that storage of carbohydrates begins is influenced to some degree by weather. During cloudy, wet, and warm weather more topgrowth is required to reach the stage at which food is stored than will be required during sunny, dry, and cool weather. The maximum percentage of available carbohydrates in the roots and crown is normally reached at or near the full bloom stage of growth. Between the time of full bloom and when seed is mature on the plant, the

percentage of available carbohydrates may decrease as new shoots form at the crown of the plant. The formation and growth of these shoots require energy.

Cutting at Immature Stages of Growth

Cutting or grazing alfalfa at an immature stage of growth usually provides forage with high protein and low fiber levels but also with lower total yields. With the varieties presently available today, when plants are cut repeatedly at the bud or 1/10 bloom stage of growth in Southern Arizona and Southern California, there is not sufficient time for the reserve food materials to accumulate and regrowth will be retarded. If cutting or grazing at these stages of growth is continued over a period of time, the reserve food materials will be greatly decreased or depleted, the plants will be weakened, and eventually death occurs. In the lower desert valleys of Arizona and California, this stand depletion can occur as early as the summer of the second harvest year.

Harvesting or clipping alfalfa plants when they are in more mature stages of growth such as full bloom will produce a forage with less protein and a higher fiber content, but this stage of growth at cutting is most favorable for storage of reserve food material and total yields. When alfalfa plants reach the full bloom stage of growth there is a lower proportion of leaves to stems which accounts in part for the change in chemical composition. This decrease in protein content is only slight and if you look at this in terms of protein per acre, the grower is ahead by cutting at a later stage of growth.

The primary objective of the alfalfa grower should be to harvest his plants at a time that will provide satisfactory yields of a high quality forage and still give the plants sufficient time to store adequate food reserves in the crown and roots between cuttings, in order for them to remain in a vigorous and healthy condition. In reality then, the grower must try to compromise between quality, yield, and the condition of the plant. He must harvest his alfalfa at a time that will provide adequate yields of a good quality forage but still allow the plant time to accumulate sufficient food reserves in the crowns and roots to remain in a healthy condition. We believe that an alfalfa grower in Southern Arizona and Southern California can meet these conditions with today's varieties by cutting his plants when about 1/4 to 1/2 of the stems have one or more flowers open. Forage yields from plants cut at this stage of growth will be about as high as when cut in full bloom, and the protein content will be only slightly reduced from that of plants cut in the bud stage.

If you are a dairyman or someone who wants only the highest quality forage, which requires cutting at the bud or very early bloom stage of growth, then how can this be accomplished and still maintain stands? Our data have shown that you can cut at an early bloom stage of growth during most the year if you will delay two harvests to the full bloom stage of growth sometime through the year. These two harvests may be successive or they may be separate. It appears that the delaying of just two cuttings to the full bloom stage of growth is sufficient for the plants to replenish their food material and still maintain stands. However, I do wish to emphasize that delaying just one harvest is not adequate. This system of cutting management will permit the grower to harvest at the 1/10 bloom stage of growth during the spring and early summer when alfalfa plants are making maximum growth and then delay a couple of harvests until full bloom during the high temperature periods of the summer when growth is restricted. This cutting management system will mean that a grower will sacrifice some quality during periods of low production in the summer with the hope of obtaining a higher quality product during maximum production periods.

I need to point out that a particular stage of growth such as 1/4 or 1/2 bloom may vary in a calendar date from one year to the next depending on environmental conditions. We know that the number of days between cuttings at the same stage of growth will vary throughout the growing season.

Time of Cutting Based on Stage of Growth

The time of cutting or harvesting alfalfa should be based on the stage of plant growth. This statement is based largely on our knowledge of food manufacture, movement, and use by the plant. Some growers believe that cutting should be based on the development of new shoots from the crown of the plants. My experience would indicate that this is not a satisfactory guide because shoots do not appear regularly at any specific time.

Our research work in Southern Arizona has shown that the height of shoots on Lahoutan alfalfa varied from one to four inches throughout the year when the plants were cut repeatedly at the 1/10 bloom stage of growth. Furthermore, there are several factors that can cause the initiation of new shoots from the crowns. Some of these are irrigation after the plants have been stressed for moisture, when the plants lodge and the crowns are exposed to light, or when there is storage of a high level of carbohydrate reserves.

During the winter and early spring months in Southern Arizona and Southern California, alfalfa continues to grow but flowers very little if at all because of cool temperatures and short daylengths. At this time some growers want to observe the regrowth at the base of the stem to use as an indication of time to harvest. We have found in our work that using a certain number of days between harvest is as good or better guide. If you do use regrowth as a guide during this winter period, then I would suggest that you cut when the shoots are about two inches tall. Also, a grower can remove the topgrowth from alfalfa plants immediately after it has been killed by frost without interfering with carbohydrate storage or injury to the plants.

Height of Cutting

Our data on height of cutting alfalfa plants have shown that height of cutting is not a critical factor when plants are harvested at the proper stage of growth. The stage of growth at cutting is much more critical than the height of cut. If you are cutting your alfalfa consistently at an early stage of growth, such as late bud or early bloom, then cutting height may take on more significance. If growers are harvesting at this immature stage of growth there is a slight advantage to cutting a little higher. The leaf surface remaining on the plant after cutting may enable it to manufacture more carbohydrates for use during regrowth, and the stored carbohydrates will not be reduced to such a low level.

Summary

In summary, I wish to emphasize that stage of growth at harvest is the single more important consideration in cutting management. When plants are harvested at the 1/4 to 1/2 bloom stage of growth, it is possible to obtain high yields of a good quality forage and maintain stands over a number of years.