

ALFALFA AND THE ENVIRONMENT

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We live in a society in which many people don't understand or appreciate agriculture as much as they really should. After all, only about 2% of the population of the United States is involved in agriculture, so most people don't know much about it. Furthermore, most don't spend much time thinking about it. Forage crops, including alfalfa, are especially under-appreciated because forage is not consumed directly by humans (alfalfa sprouts being a minor exception).

However, alfalfa contributes to our society in countless ways that most people don't realize. It is an important source of nutrition for many animals that produce meat or dairy products, it is widely fed to horses, zoo animals, and other forage-consuming creatures, it is a major source of pollen and nectar for honey production, and it contributes to the production of other products such as leather and wool.

It is unfortunate, but understandable, that for many years there has been a great deal of apathy regarding agricultural production. However, these days those of us who are interested in agriculture sometimes have more to contend with from the general public than apathy. Criticism of various aspects of agricultural production is increasingly common. In the case of alfalfa, most criticism has been related to environmental issues (real or perceived).

This gives us an incentive to think about alfalfa's relationship to the environment. We need to be aware of, and sensitive to, the concerns of the public regarding environmental issues. We also need to make certain that there is appropriate consideration of the numerous *beneficial* impacts of growing the crop, which will be the primary focus of this paper.

Adaptation, Versatility, And Widespread Use

One reason why alfalfa is important to the environment is simply because it occupies a significant amount of farmland. The alfalfa acreage in the United States is around 20 million, and there are an estimated 74 million acres grown worldwide. It is the most widely grown forage legume in the world. It can be grown on many different soil types and under a wide range of climatic conditions.

Alfalfa has long been recognized as a superb forage crop, which is why it is widely grown for dairy cattle, horses, sheep, and many other types of domesticated forage-consuming animals. Other reasons for its popularity and widespread use include that it has good yield potential, perennial growth habit, a long growing season, and nitrogen-fixing ability.

Benefits To The Soil

Any astute agriculturist understands the value of protecting the soil from water and wind erosion. In recent decades, much progress has been made in reducing soil erosion, but it is still a major problem in many situations. Alfalfa provides a good cover for land, and when a stand is established on a soil and site where it is well adapted and is properly managed, it will normally last for years, thus greatly reducing soil erosion as compared to that which often occurs with annual crops.

Alfalfa actually does much more for the soil than protect it from erosion; it actually improves it. Alfalfa has an extensive and deep root system that creates channels and facilitates micro-organism activity that in turn favors improved soil tilth. The result is better water infiltration (thus less rainfall runoff) and more aggregation of soil particles. To use a term that seems to be increasingly in favor in recent years, alfalfa improves soil health.

Nitrogen Fixation

A unique attribute of legumes is that most have the ability to fix nitrogen when their roots are in association with *Rhizobium* bacteria. Of course this is economically beneficial to producers because this biologically-produced nitrogen reduces or eliminates the expense and inconvenience of needing to periodically apply nitrogen fertilizer to stimulate crop growth. When nitrogen is biologically fixed instead of being applied in the form of commercial fertilizer, the risk of N-containing runoff is virtually eliminated and the likelihood of leaching of nitrogen is reduced.

The amount of nitrogen fixed by alfalfa varies based on a number of factors including stand density, harvest management, and climatic conditions, but is usually in the range of 150 to over 200 pounds/acre/year. On a dry matter basis, the crude protein content of alfalfa hay is typically 16 to 24%, which is difficult or impossible to attain with most forage grasses even with application of high levels of nitrogen fertilizer. It is expensive for livestock producers to provide supplementary protein in livestock rations, but in the case of alfalfa there is no nitrogen expense involved in providing high levels of protein.

Value In Crop Rotations

The two topics just addressed help explain why alfalfa is extremely valuable in crop rotations. Improved soil tilth that results in a healthier soil and increased water infiltration, combined with root channels that allow deeper rooting, favor growth of a crop that follows alfalfa, with the result typically being significantly enhanced yields and profit. Alfalfa often provides 50 to over 150 pounds of nitrogen per acre to a crop that immediately follows it, and may provide 50 pounds or more per acre to a crop the second year after alfalfa was grown. In addition to the economic benefit, these are significant contributions toward a goal for which producers should strive and of which the general public should approve; namely, sustainable agricultural production.

Wildlife Enhancement

Most environmentalists enthusiastically endorse the concept of wildlife enhancement. Evidence of alfalfa's potential in this regard is that wild animals have always recognized it as a great crop; they feel free to visit alfalfa fields, consume alfalfa forage, or otherwise use it any time it is planted within the geographical area in which they live. In fact, some animals even alter their range in order to access it more easily or more frequently! There is hardly any alfalfa producer who has not had the experience of seeing deer, birds, and other wild animals in their alfalfa field(s).

Yet, the extent to which alfalfa is used by wildlife is almost certainly underestimated by most producers. After all, wild animals are shy and secretive, and generally prefer to avoid being in close proximity to humans. Many are primarily or exclusively nocturnal, and thus are active only at times when humans are not usually present. In addition, there may be a considerable amount of unobserved underground biological activity in an alfalfa field including by mice, voles, ground squirrels, etc.

In the Sacramento Valley in California, wildlife biologists did extensive studies of alfalfa fields to determine the extent of wildlife activity. They found that of 643 resident and migratory amphibians, birds, mammals, and reptiles known to occur in that area, 162 species (about 25%) were regularly using alfalfa fields to some extent, and about 10% percent were using alfalfa fields extensively.

Alfalfa is also an excellent insectory. In a study done near Ithaca, New York, entomologists identified 591 insect species in a single field. For many species of birds, including game birds such as quail and wild turkey, availability of a good supply of insects is quite important, especially when the birds are young. Alfalfa provides birds with high quality green leaf material as well as insects.

In some areas alfalfa is planted specifically for wildlife, mainly by deer hunters. Not only is alfalfa forage highly digestible with a high protein content, it also contains high levels of calcium and phosphorus, which are important in antler development. In addition, having alfalfa available during summer helps ensure adequate milk production by does (increasing the likelihood of rebreeding), and helps increase deer body weights prior the onset of winter.

Bridging nutritional gaps is of critical importance in wildlife management, and it is difficult to find a crop that rivals alfalfa with regard to the ability to provide high quality forage over a long period of time. This includes during drought periods when other forage crops are unproductive. Alfalfa can also be used as a tool to help keep wild animals in an area where they are desired.

Finally, although many other plants provide cover for wildlife as well or better than alfalfa, this is another benefit to wildlife that can be mentioned. Alfalfa can be especially attractive to small animals such as rabbits, and for young game birds including quail or wild turkeys that simultaneously need cover as well as a high level of nutrition.

The point is that an alfalfa field is much more biologically diverse than it may appear, and actually offers food and cover for many wildlife species, including game animals and game birds and even more species of non-game wildlife. Thus, anyone who grows alfalfa is, at least to some extent, enhancing wildlife, a fact of which environmentalists need to be aware.

Aesthetic Value

We normally don't give much consideration to the aesthetic value of agricultural production, but perhaps we should. There is no doubt that many people who live in congested, highly-populated areas enjoy getting "out in the country" to breathe the fresh air and enjoy the scenery. Forage crops in general provide a pleasant vista, but an argument can be made that a field of alfalfa is especially attractive.

POSSIBLE ENVIRONMENTAL IMPACTS OF EXPECTED FUTURE DEVELOPMENTS

Low Lignin Alfalfa

For alfalfa producers, an extremely promising development on the horizon is low-lignin alfalfa. It is expected that seed of low-lignin varieties will be available within two years. Although feeding trials with low-lignin alfalfa have not yet been conducted, it is expected that such varieties will have substantially higher overall forage digestibility, thus improving animal performance.

In addition, it is expected that reduced lignin content will expand the harvest window for alfalfa. The reason is that it seems probable that instead of harvesting at (for example) 28 days, a producer could harvest a week or more later and still get forage that has nutritive value as good as conventional varieties harvested at 28 days.

We can only speculate as to the impacts low-lignin alfalfa may have on the environment. However, a longer interval between harvests will be a favorable development for many organisms that spend time in or near alfalfa fields. In some cases low-lignin alfalfa may allow a producer to make one less harvest during the growing season, which would be especially valuable to fauna of many types. In addition, yields could be increased with less expenditure of energy required for harvest.

Increased Rumen Bypass Protein

It is also expected that in the future there will be alfalfa varieties commercially available that will have a higher level of rumen bypass protein. This will result in less need for dairy producers and others who feed animals that have high protein needs to provide expensive supplemental protein. This would have an important environmental impact because protein broken down in the rumen results in more nitrogen being present in urine. Increased by-pass protein will reduce rumen protein breakdown.

Final Thoughts

Agriculture, including alfalfa in some cases, has been criticized in recent years by some environmentalists who believe that virtually everything associated with food production has negative environmental consequences. In reality that is not the case. In many settings, including in areas in which cities are encroaching on agricultural land, alfalfa makes an important contribution to wildlife, to the environment, and to landscape aesthetics. If those of us who work with alfalfa are mindful of the environmental implications of technological advances and management practices implemented, we should be able to make alfalfa even more environmentally friendly in the future.

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