



Reestablishing Alfalfa into Existing Stands Damaged by Flooding

by Edward K. Twidwell, *Extension Forage Specialist,*
and Kevin D. Kephart, *Forage Research Agronomist*

Excess moisture conditions in 1993 caused damage to many stands of alfalfa throughout South Dakota. Floods killed alfalfa in many low-lying areas, and in some instances, entire stands were lost because of excess water. Alfalfa cannot tolerate wet soil conditions for an extended period of time. Several diseases that persist under wet conditions can further damage or even kill alfalfa plants. In addition, standing water can damage plants by reducing oxygen levels necessary for adequate respiration within the plant.

Producers may wish to "thicken up" dead areas of existing alfalfa with a new seeding of alfalfa or to reestablish entire stands. As you consider your options for reestablishing alfalfa, be aware of autotoxicity, a condition that may influence the choice and/or possible success of your reseeding efforts.

What Is Autotoxicity?

Autotoxicity is a form of allelopathy. Allelopathy is any direct or indirect harmful effect by one plant or another through the production of chemical compounds that escape into the environment. Alfalfa autotoxicity refers to a condition in which the existing alfalfa plants produce compounds that are toxic to alfalfa seedlings. For many years, alfalfa producers have observed that they cannot successfully reestablish or "thicken up" an existing stand that is unproductive or dead.

Research Results

Early research indicated that there was a "soil sickness" related to soil continuously seeded to alfalfa. In Illinois, the negative aspects of growing continuous alfalfa were reported in the early 1980s (Table 1). These results suggested that there should be an intervening crop between the planting of two alfalfa crops.

Research conducted in Michigan, however, has shown that there is little or no harmful effect of autotoxicity in the field if seedlings are made several weeks after plowing or spraying the existing stand with Roundup to kill the alfalfa (Table 2). The suggested reason for the lack of an

autotoxic effect is degradation of toxic compounds during the break between killing the existing stand and seeding the new stand. These compounds apparently are broken down by microorganisms or chemical means and escape into the environment soon after they are produced. The Michigan researchers recommend waiting at least 14 days after destruction of the old alfalfa stand before attempting a new seeding.

Table 1. Effects of various crop sequences on alfalfa yields and stand counts.

Sequence	Yield	Stand density
	—tons/acre—	—plants/ft ² —
Corn-alfalfa	3.8	4.6
Corn-soybean-alfalfa	3.5	3.8
Alfalfa-alfalfa	1.9	2.0

Miller, 1983

Table 2. Seedling densities and yields during the seeding year and the year after seeding of alfalfa planted under different stand destruction methods.

Previous crop	Seeding treatment	Seedling density (1982)	Yield	
			—seedlings/ft ² —	—tons/acre—
			1982	1983
Kentucky Bluegrass	12 days after plowing	29	0.7	6.8
6-yr-old-alfalfa	12 days after plowing	27	0.7	6.7
6-yr-old-alfalfa	19 days after Roundup	28	0.7	6.6
LSD (0.05)		NS	NS	NS

Tesar, 1993

In South Dakota, alfalfa autotoxicity has not been investigated extensively. However, a study was conducted in 1988 and 1989 to evaluate the production of alfalfa planted into soil previously cropped for three years to alfalfa, red clover, or birdsfoot trefoil (Bortnem et al., 1990). Soil received a summer 1987 tillage and planting, a summer 1987 tillage and spring 1988 planting, or spring 1988 tillage and planting.

Alfalfa crops on 1987 plantings were not significantly different in 1988 among the three previous legume crops. Tillage timing did not seem to influence establishment-year alfalfa yields regardless of the cropping history. Both 1988 and 1989 were dry years, but autotoxicity did not seem to be a factor causing reduced alfalfa yields under the droughty conditions that prevailed during the study. It is commonly believed that autotoxic effects are greater when conditions are wet.

Some researchers have suggested that older alfalfa plants may have higher levels of toxic compounds than younger plants. Thus, the older the stand, the more chance there is that autotoxic effects may be present and have a negative impact on the seedlings. Recent research conducted in Michigan, however, has not found this to be the case. These researchers found no autotoxic effect on seedling density and yields when reseeding into existing stands ranging from one to six years in age, as long as there was at least a 14-day interval between plowing of the established stand and reseeding.

Alfalfa Variety Selection

While it is difficult to find alfalfa varieties that persist well under wet soil conditions, there are large differences among varieties in terms of disease resistance. When seeding into areas that may be periodically wet, select varieties that have more resistance to Phytophthora root rot. This is a soil-borne fungal disease that occurs in wet, poorly-drained soils. Symptoms include deteriorated root or crown tissue in areas where the stand is thinning. Top growth symptoms generally include wilting, yellowing, and lack of vigorous growth.

Another seedling disease which may be a problem in wet soils is Pythium or "damping off." Symptoms include stunted seedlings with small, dark-green cotyledons. The seedlings eventually fall over (damp-off) and die. Alfalfa does not have resistance to this disease, but many private companies now market alfalfa seed that is treated with fungicides to aid in controlling Pythium and other seedling diseases. While research results with these seed treatment products have been variable, treatment may offer some level of protection against these diseases.

Recommendations

Extensive research has not been conducted on alfalfa autotoxicity. Moreover, not all of the published research

is in agreement regarding how severe a problem autotoxicity is, nor how much time is needed between the destruction of an existing stand and the reseeding of a new stand so that autotoxic effects are minimized.

Most scientists agree that autotoxicity is a condition of which producers need to be aware, but it's difficult to recommend practices that will "guarantee" no autotoxicity problems. It's possible, however, to rank available reseeding options and to range the autotoxicity risks associated with each option from "minimal" to "high," depending on the particular situation. In the rankings below, "kill" refers to either tillage of the existing stand or chemical treatment with Roundup.

Minimal Risk of Autotoxicity

- Kill existing stand in spring, plant another crop, and plant alfalfa the following spring.
- Kill existing stand in fall and plant alfalfa the following spring.
- Kill existing stand in spring and plant alfalfa in late summer.

Some Risk of Autotoxicity

- Kill existing stand in spring and plant alfalfa 2 to 4 weeks later.

High Risk of Autotoxicity

- Kill existing stand and plant alfalfa within 2 weeks.
- Plant no-till alfalfa into existing stand that has been destroyed by flooding without any tillage or chemical treatment.

Although it's important to minimize risks associated with autotoxicity, be sure to consider other crucial aspects of alfalfa establishment: correct planting date, seeding rate, and planting equipment. Knowledge of alfalfa varieties and seed treatments will help to establish a long-lived stand. Monitoring soil conditions and applying fertilizers prudently will help to provide maximum production. These crucial aspects of alfalfa stand establishment are detailed in SDSU Extension Circular 896, available at local Extension offices.

References

- Bortnem, R., A. Boe, and F. Einhellig. 1990. Stand establishment and production of alfalfa cultivars in legume residues. p. 319-323. In Proc. Forage and Grassland Conf., Blacksburg, Va. 6-9 June, 1990. American Forage and Grassland Council, Georgetown, Texas.
- Miller, D.A. 1983. Allelopathic effects of alfalfa. J. Chem. Ecology 9:1059-1072.
- Tesar, M.B. 1993. Delayed seeding of alfalfa avoids autotoxicity after plowing or glyphosate treatment of established stands. Agron. J. 85:256-263.

This publication and others can be accessed electronically from the SDSU College of Agriculture & Biological Sciences publications page, which is at <http://agbiopubs.sdstate.edu/articles/ExEx8099.pdf>



Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the USDA. Larry Tidemann, Director of Extension, Associate Dean, College of Agriculture & Biological Sciences, South Dakota State University, Brookings. SDSU is an Affirmative Action/Equal Opportunity Employer (Male/Female) and offers all benefits, services, and educational and employment opportunities without regard for ancestry, age, race, citizenship, color, creed, religion, gender, disability, national origin, sexual preference, or Vietnam Era veteran status.