ALLELOPATHY IN ALFALFA

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Allelopathy is when a plant gives off a chemical that influences another plant. Plants like oats and rye give off chemicals that reduce or prevent the growth of weeds in the community. Alfalfa has an allelopathic chemical, but it is not known to affect other plants. The chemical, believed to be ethylene and possibly medicarpin (not known for sure), affects alfalfa germination and seedling growth. Therefore, it is autotoxic (toxic to itself).

Autotoxicity in alfalfa was demonstrated in the mid 1980s by the University of Illinois. Alfalfa was seeded in the spring without a companion crop, took two harvests in the seeding year, plowed out the stand in the fall, and reseeded the stand the next spring for 7 years. The first couple of years stands were very good and yielded greater than 4 tons/acre. By the third year, plant establishment was less and productivity was decreasing. By the seventh year, very poor stands were established and forage yields were less than 1.1 tons/acre. Data suggest the autotoxin was accumulating in the soil.

Jennings in Arkansas seeded alfalfa in a wagon-wheel design with an old plant at the hub. Alfalfa seedlings rarely emerged in 0-8 inches of the hub; plants that did were generally weak and spindly. Seedlings generally emerged in the next 8 inches, but productivity was about 75% of maximum. Data suggest even if alfalfa seedlings established, productivity may be reduced greatly.

In 2001, alfalfa autotoxic effects were evaluated at NDSU. Alfalfa established in 1996 was tilled during Fall 2000 and early Spring 2001. Alfalfa was seeded the same day as spring tillage and 1, 2, and 3 weeks later. Nearly 1.2 inches of rain occurred two days after the first seeding date, creating a good seedbed, especially for week 1after seeding. Plant density was about 10 plants/ft^2 for the first and second seeding dates in the spring-tilled plots but greater than 40 plants/ft^2 in fall-tilled plots with a 12 lb/acre seeding rate. Plant density in spring-tilled plots improved with delay in seeding but never obtained the level in fall-tilled plots. Lower plant density in spring vs. fall-tilled plots was due to the autotoxic chemical found in alfalfa.

Forage yield at 10% bloom was only 0.4 tons/acre for the spring-tilled first seeding date but 0.9 tons/acre for the fall seeding. Forage yield increased as the seeding date was delayed in both treatments, but the spring-tillage increased more. First-harvest forage yield was impacted by the autotoxic chemical; second-harvest yield was the same for both spring and fall tillage at all seeding dates. To have equal productivity from 10-40 plants/ft^2 in the second harvest of the seeding year is similar to earlier work at NDSU.

Seasonal forage yield was 2.3 tons/acre in the fall-tilled plots. It is not clear how much the yield was lowered by seeding on the fall-tilled area since there was not an area without alfalfa to be used as a check. However, the seeding-year yield of a new variety trial seeded on fallow was greater than 3.5 tons/acre. Was the lower yield in the fall-tilled plots due to allelopathic effects? An experiment was initiated last year to test this, but it will take at least 4 years before we have a complete answer, stay tuned.

At present, the best recommendation is to **NEVER** seed alfalfa on alfalfa! We know that adequate stands can be obtained by waiting at least 3-4 weeks after tillage, but it is unknown if the chemical persists in the soil (remember the early Illinois data). Does seeding alfalfa one year after alfalfa also decrease yield?

If winter kill occurs, it is recommended not to reseed alfalfa without at least one or more grass crop(s) intervening. Take advantage of the positive effects of alfalfa on subsequent crop productivity and seed the alfalfa on a new field to stay away from the possibility of reduced yield due to the autotoxic effect.