



NDSU EXTENSION SERVICE

NORTH DAKOTA STATE UNIVERSITY

ProCrop

## Allelopathy In Alfalfa

Allelopathy is a condition where a plant gives off a chemical that affects another plant. Plants like oats and rye are known to give off chemicals that reduce or prevent the growth of weeds in the community. Alfalfa is known to have an allelopathic chemical also, but the chemical 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 said to be autotoxic or toxic to itself.

Autotoxicity in alfalfa was demonstrated in the field in the mid 1980s by researchers at the University of Illinois. They seeded alfalfa 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 seven 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. These data suggest that 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 the 0 to 8 inches of the hub and plants that did were generally weak and spindly. Seedlings generally emerged in the next 8 inches but productivity was about 75% of maximum. These data suggest that even if alfalfa seedlings established, productivity may be reduced greatly.

In 2001, we evaluated autotoxic effects in alfalfa. Alfalfa established in 1996 was tilled during the 2000 fall and again as early as possible in spring 2001. Alfalfa was seeded the same day as spring tillage and one, two and three weeks latter. Nearly 1.2 inches of rain occurred two days after the first seeding date, which created a good seedbed and removed concerns about a poor seedbed, especially for the one week after seeding. Plant density was about 10 plants per square foot for the first and second seeding date in the spring-tilled plots but greater than 40 plants per square foot in fall-tilled plots. Plant density in spring-tilled plots improved with delay in seeding but never obtained the level in fall-tilled plots. The 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 tillage treatments, but the spring-tillage increased more. Obviously, the first-harvest forage yield was impacted by the autotoxic chemical. Forage yield in the second harvest was the same for both the

spring and fall tillage and all seeding dates. To have equal productivity from 10 to 40 plants per square foot in the second harvest of the seeding year is similar to earlier work at Fargo.

Seasonal forage yield in this experiment was 2.3 tons/acre in the fall-tilled plots. What is not clear is how much the yield was lowered by seeding on the fall-tilled area, since we did not have 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 four 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 three to four weeks after tillage, but we don't know if the chemical persists in the soil. Remember the early Illinois data where the autotoxin was accumulating in the soil and reducing productivity. Does seeding alfalfa one year after alfalfa also decrease yield?

If winterkill occurs, do not reseed alfalfa on the field without at least one grass crop intervening. Seed the alfalfa on a new field to stay away from the possibility of reduced yield due to the autotoxic effect.

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