

Solving the Mystery of Alfalfa Autotoxicity: Causes & Solutions

Virginia Moore, Cornell University

Paige Baisley, Michigan State University

Sarah Werner, Michigan State University

Kim Cassida, Michigan State University

Autotoxicity is a type of intraspecific allelopathy in which alfalfa releases compounds that are allelopathic to new alfalfa seedlings, causing poor germination or seedling death. Autotoxicity prevents renovation of thinning alfalfa stands and delays replanting and is widely recognized as a significant challenge to alfalfa establishment. However, it is a complex problem with many poorly understood interacting factors and has resisted an easy solution. A new project addressing alfalfa autotoxicity was funded by the USDA Alfalfa Seed and Alfalfa Forage Systems (ASAFS) program. Taking place between 2023 and 2026, the overall research goal is to improve understanding of what causes autotoxicity in alfalfa and better understand how it can be mitigated. The specific research goals are to (1) use a previously developed soil bioassay to identify compounds associated with autotoxic or non-toxic soils, (2) elucidate how the shoot and root microbiome influence production and dissipation of these autotoxins, (3) investigate the potential influence of nutrient stress on production of autotoxins in root exudates and plant tissue, (4) initiate breeding of less autotoxic and more tolerant alfalfa cultivars, and (5) engage farmers in extension efforts to understand and reduce yield losses caused by autotoxicity. This work will take advantage of technological advances in study of metabolomics, genomics, and the microbiome to take a fresh look at the causes of autotoxicity. Improved understanding of why alfalfa becomes autotoxic will ultimately drive development of better management tools to reduce autotoxicity, improved alfalfa establishment, and better alfalfa cultivars, which will contribute to increasing alfalfa forage yields and reducing the cost of production.