



# Breeding alfalfa cultivars with high yield in acidic and aluminum-rich soils

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*Progression of low pH and high aluminum's effect on a panel of alfalfa populations, evaluated over multiple years. Field soil pictured was naturally acidic (pH = 5) and rich in aluminum (extractable aluminum = 11 mg/kg). The best plants from the best populations were selected for crossing and advancing to another cycle of recurrent selection. Photos courtesy of Ali Missaoui, University of Georgia.*

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Acidic soils limit alfalfa production unless amended with lime and fertilizer, creating management challenges and added costs for growers. For decades, researchers have studied the physiological, biochemical, and genetic mechanisms underlying tolerance to low pH and aluminum toxicity in alfalfa, but these efforts have not yielded cultivars with reliable yield and persistence under field conditions.

From a production standpoint, true tolerance should mean that plants grow, develop, and accumulate biomass under low-pH and high-aluminum conditions at levels comparable to those in neutral, non-toxic soils. To test this, University of Georgia researchers evaluated 133 populations selected from 966 diverse alfalfa accessions that had previously been tested in acidic and high-aluminum field soils. These populations were evaluated for three years at two locations under both natural low-pH/high-aluminum soils and adjusted-pH soils.

Using an Acid Soil Adaptation Index, the researchers identified 56 acid-tolerant populations that performed as well as or better in low pH soils than in soils with adjusted pH. High heritability of forage yield and acid-soil adaptation indicates useful genetic variation that will be leveraged in future selection. This work paves the way to breed higher-yielding alfalfa cultivars adapted to acidic and aluminum-toxic soils.

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Wright Presley, H., & Missaoui, A. (2026). Improving low-pH and high-aluminum field tolerance in alfalfa (*Medicago sativa* L.). *Crop Science*, 66, e70291.

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