

Characterizing Benefits of Alfalfa in Rotation & Communicating Value of Environmental Services to the Public

Nicole Tautges, Michael Fields Agricultural Institute
Dan Putnam, University of California-Davis
Emily Woodward, University of California-Davis

Although alfalfa (*Medicago sativa* L.) has long been recognized as an important rotation crop that improves soil 'tilth' and health, these benefits are often not well documented. We compared tomato production following a three-year alfalfa crop compared to an annual corn rotation, measuring the effects on soil health properties and the effects on the need for N fertilizers in an irrigated Mediterranean climate in Davis, CA. With no N fertilizer applied, residual N following alfalfa increased tomato fruit yields by 17 tons/acre compared to tomato following corn, and were 85% of fruit yields following corn with 250 lb. N/acre applied through drip irrigation. An N fertilizer credit of 170 lb N/acre should be credited to tomato following alfalfa in rotation. Tomato yields were positively correlated with the previous year's microbial biomarkers following alfalfa but not corn. Of all soil health indicators evaluated, alfalfa had the greatest impact on soil aggregation, increasing soil macroaggregates relative to the corn-based rotation. Soil macroaggregation was positively correlated with tomato cash crop yields following alfalfa, indicating that the benefit for soil structure increased subsequent yields. Soil genomic analysis revealed that alfalfa significantly altered soil microbial community structure, detectable even in the crop following alfalfa in rotation. Genes encoding enzymes related to denitrification were significantly less abundant in the tomato rhizosphere following alfalfa than maize, carrying implications for potentially lower nitrous oxide emissions in rotations with alfalfa, although further research in this area is needed. In summary, our study found that alfalfa exerted positive effects on soil biochemical characteristics that were detectable even after alfalfa was terminated and that benefited subsequent crops and environmental indicators in the long term.