



## Legume N Credit for Crops Following Alfalfa

**Corn and other crops following alfalfa require lower rates of N as fertilizer or manure** than when following a non-legume forage or grain crop. This is due to the residues left in the soil by alfalfa being richer in N than those of non-legume crops. An estimate of this “legume credit” is needed for N budgets developed by dairy producers to comply with waste discharge regulations adopted by the Central Valley Regional Water Quality Control Board in 2007.

What is the amount of this legume credit? No recent field studies have been carried out in California to answer this question. Field experiments conducted by Williams in the 1950s at lower yields than currently are obtained by farmers suggest a legume credit of 60 lb N/acre. A University of California, Davis, researcher who specialized in biological N fixation by legumes, D.N. Munns, reviewed the circumstantial evidence and research conducted outside California. He noted that although alfalfa takes up prodigious amounts of nutrients and usually obtains a large proportion of its N from the atmosphere, under the climatic conditions and intense management in the Central Valley, much of this N is removed in the harvested forage. He concluded that the likely contribution of alfalfa residues to a following crop is 40-80 lb N/acre higher than that provided by the residual soil organic matter (D.N. Munns. 1975. Alfalfa as a soil builder. pp. 89-92 in Proceedings, California Alfalfa Symposium).

This is consistent with an informal survey of six UC and industry experts conducted in 2004 by the authors of this guide. All six recommended that under Central Valley and desert conditions in California, the legume credit should be no more than 60-80 lb N/acre. Those surveyed cited personal observations of corn and other crops following alfalfa, and one person had observed very low soil nitrate levels in several fields following alfalfa.

Based on the older research, the review by Munns, and the informal survey of experts, we recommend a legume credit of 40-80 lb N/acre depending on alfalfa stand density during the last year. This legume credit is somewhat lower than that recommended by other land grant universities in the US, especially at the high end of the recommended ranges (see table below). Research under irrigated California conditions is needed to confirm the recommended range.

Credit*, lb N/acre	Adjustment within range based on:	Source of information
40-140	Alfalfa plant density	Michigan State U. (1997)
0-120	Alfalfa plant density	Kansas State U. (2007)
0-150	Alfalfa plant density	South Dakota State U. (1998)
40-150	Plant density, soil texture	U. of Nebraska, Lincoln
40-150	Corn yield goal	U. of Minnesota (1990)
0-140	% stand	Colorado State U. (2003)
40-190	Plant density, regrowth after last cut, soil texture	U. Wisconsin A3591
<b>40-80</b>	<b>Stand density, yield</b>	<b>Recommendation for Central Valley of California (this publication)</b>

\*Amount by which applied N should be reduced following alfalfa vs. full rate applied to crop following corn or other high yielding, non-legume crops

## References

Kansas State University, 2007, pub L-778  
University of Wisconsin, pub A3591  
Colorado State University 2003 Pub XCM574A

---

Authors: G.S. Pettygrove, Cooperative Extension Soils Specialist, Department of Land, Air & Water Resources and D.H. Putnam, Cooperative Extension Forage Agronomist, Department of Plant Sciences, University of California. Davis.

©2009 by the Regents of the University of California  
Unaltered copies of this guide may be made for non-commercial purposes.

December 2009

---



University of California Manure Technical Guide Series  
*for Crop Management Professionals*

## Sponsors

California Certified Crop Adviser Program  
International Certified Crop Adviser Program  
California Dairy Research Foundation  
California Department of Food & Agriculture FREP  
California USDA Natural Resources Conservation Service

Financial support for the Manure Technical Guide Series was provided by the California Department of Food & Agriculture and the California Dairy Research Foundation. Contents of this publication do not necessarily reflect the views or policies of the sponsoring organizations or the University of California.