MINNESOTA - Adding Alfalfa Benefits Corn-Soybean Rotations

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There are many advantages to including forage legumes in the crop rotation. A primary advantage is the nitrogen (N) credits provided to subsequent grain crops. For example, when an alfalfa stand with ≥ 4 plants/ft^2 is terminated, N fertilizer rates can be reduced by 150 lb N/ac for first-year corn and by 75 lb N/ac for second-year corn.

Perennial forage legumes also disrupt the life-cycles of pests such as corn rootworm and weeds, thereby protecting against crop yield losses while reducing crop-protection input expenses. Forage legumes also enhance soil structure and tilth while reducing soil erosion and organic matter loss. Under dry conditions, however, deep-rooted forage legumes such as alfalfa can reduce the amount of subsoil moisture available for the following grain crop.

From 1992-2007 at the University of Minnesota Southwest Research and Outreach Center near Lamberton, a 4-year oat/alfalfa-alfalfa-corn-soybean rotation was compared with a 2-year corn-soybean rotation within 'zero-input', organic, 'low-input', and 'high-input' crop-management systems. This trial was established at every stage in both rotations, so each crop was present every year.

Averaged across years, soybean yield was 7% higher with the 4-year rotation than the 2-year rotation, regardless of crop-management system. For corn, however, the yield advantage due to the 4-year rotation varied with management system and declined as the amount of agronomic inputs increased (Table). Corn yield within the 4-year rotation was greatest and similar under high-input, low-input, and organic-management systems; but greatest corn yield in the 2-year rotation occurred only with the high-input system.

Results demonstrate the potential to increase soybean and corn yields with a longer crop rotation that includes alfalfa, and that such rotations provide more options for reducing agronomic inputs without sacrificing corn yield.

Table. Average corn yield in a 2-year corn-soybean rotation vs. a 4-year oat/alfalfa-alfalfa-corn-soybean rotation under different management systems at Lamberton, MN from 1992-2007.

Management System	Weed Management	Nutrient Application	Average Corn Yield		Yield Increase with 4-Year Rotation
			2-Year Rotation	4-Year Rotation	
			----*bushels/ac*----		*%*
Zero-Input	Tillage Only	None	55	77	41
Organic	Tillage Only	Manure	113	142	25
Low-Input	Tillage + Banded Herbicide	Banded Fertilizer	123	139	13
High-Input	Tillage + Broadcast Herbicide	Broadcast Fertilizer	151	146	0†

† Corn yields in the 2-year and 4-year rotations were not statistically different at the 5% probability level.

Source: J.A. Coulter, C.C. Sheaffer, D.L. Wyse, M.J. Haar, P.M. Porter, S.R. Quiring, and L.D. Klossner. 2011. Agronomic performance of cropping systems with contrasting crop rotations and external inputs. Agronomy Journal 103:182-192.