

Profit more by using less, without sacrificing yield

by Sarah Carlson

Corn and soybean prices are riding high but so are the costs to produce these crops. How can farmers reduce production costs and protect themselves should the price of corn and soybeans take a dive? A study launched in 2002 by Dr. Matt Liebman of Iowa State University shows that crop diversity holds the key.

Iowa farmers raise an estimated 23 million acres of corn and soybeans in any given year. All other crops pale in comparison. In 2007, for example, 130,000 acres of small grains, which were harvested for grain, were grown in the state. In that year, 13.8 million acres of corn for grain and 8.6 million acres of soybeans were harvested.

Corn and soybeans reign in the state, but as the prices of corn and soybeans increase in the marketplace, the costs on the input side of the equation increase at nearly the same rate. It is predicted that this year farm expenses will pass the \$300 billion high set in 1979 to reach an estimated \$320 billion (<http://www.ers.usda.gov/briefing/farmincome/nationalestimates.htm>).

What if prices drop?

What happens should the price of corn and soybeans drop? What options are there for those who don't want to bet the whole farm that this trend of market prices being higher than the cost of production will last? An ongoing Iowa State University study of cropping systems launched in 2002 by Liebman shows that the key to real protection from market fluctuations and rising costs of production is diversification of crops. But can farmers increase their crop portfolio without sacrificing yield? Liebman's research says, "Yes!" Now is the time, and the results show that it is possible.

Marsden Farm Cropping Systems Experiment

Liebman established the cropping systems experiment at ISU's Marsden Farm near Boone. Three crop rotation systems are being compared: corn-soybean (two-year),

Rotation	Corn	Soybean
Two year (conventional)	Agrigold 6395 Yield Guard Plus (GE) Broadcast preemergence herbicides: Dual II Magnum Balance Pro 100 lb N/A applied at planting with additional N sidedressed according to soil test results	Kruger 287RR (GE) Broadcast post-emergence herbicide: Glystar Plus
Three year and Four year (low external input)	Agrigold 6395 (non-GE) Banded post-emergence herbicides: Callisto Steadfast Interrow cultivation Red cover or alfalfa residues incorporated and cattle manure applied (7 ton/A) N sidedressed according to soil test results	Kruger 2918 (non-GE) Banded post-emergence herbicides: Select Max Phoenix Resource Interrow cultivation

corn-soybean-oat with red clover (three-year), and corn-soybean-oat with two years of alfalfa (four-year). The plot area is big, covering 22 acres, which allows all parts of all the rotations to be present in every year. Each rotation is also replicated four times to ensure the study is scientifically rigorous. Dr. Craig Chase from Iowa State University Extension and Outreach provides the economic analysis of the three different rotations while Liebman's team analyzes the production results.

Contrasting crop production packages

Beginning in 2006, corn and soybeans in the two-year rotation were managed with "technology packages" that differed from those used in the three-year and four-year rotations. These different packages comprise contrasting crop production and protection scenarios that Iowa farmers may use depending on their cropping system, their ability to band herbicides or use cultivation, and their use of conventional seeds or genetically engineered (GE) materials. Above is a table describing the cropping systems, the corn hybrids or soybean varieties planted and the herbicide and fertilizer programs used for the corn or soybean year of each of the three different rotations. Notice that in the three-year and four-year rotations, where conventional corn hybrids or soybean varieties are used, the weed

management is a mixture of steel (cultivation) and post-emergent, banded herbicides. In the two-year rotation, where the GE materials are used, broadcast pre-emergent herbicides are used in corn and a broadcast post-emergence application of glyphosate is used in soybeans. The fertilizer program for the two-year rotation is based on a flat 100 lbs N/A application of urea in the spring followed by additional side-dress of liquid UAN based on soil tests. In the three-year and four-year rotations, no at-planting N fertilizer application is made; fertilizer is sidedressed to those systems only if soil test results indicate it is necessary.

Results

Longer rotations=higher yields

Yield data from 2006 through 2011 indicate that under the Liebman team's management, corn and soybean yields of the longer rotations were significantly higher compared to the two-year rotation. Oat and alfalfa hay yields in the longer rotations were above averages recorded for commercial farms in surrounding Boone County.

Longer rotation=fewer herbicides & N fertilizers

The amounts of nitrogen fertilizer and pounds of herbicide active ingredient (a.i.) used differed among the cropping systems. In the two-year rotation, on average for

both years 71 lbs N/A was used while the three-year and four-year rotations needed only 8 lbs N/A and 6 lbs N/A, respectively. The latter values represented reductions of 89 percent and 92 percent compared to N fertilizer use in the two-year rotation.

Controlling production costs the key for profitability longer rotations=greater profits

Economic analyses indicate that gross revenue was greater for the two-year rotation (C-Sb) than for the three-year (C-Sb-O/Red clover) and four-year (C-Sb-O/alfalfa-alfalfa) rotations. Labor requirements were higher in the longer rotations, due to extra hours needed to cultivate, spread manure and harvest hay. Nonetheless, overall production costs, including expenses for labor, were lower in the three-year and four-year rotations than the

manure, whereas alfalfa in the four-year system was used as a multicut hay crop. Removal of P and K in the alfalfa hay was substantial and not entirely offset by manure application to the corn phase, requiring P and K fertilizer applications to maintain a reasonable balance. Also no premium for non-GE grain was given to the grain in the longer rotations.

Crops	Yields		
	Two year rotation	Three year rotation	Four year rotation
Corn (bu • acre⁻¹)	194 b	199 a	203 a
Soybeans (bu • acre⁻¹)	50 b	55 a	57 a
Oat (bu • acre⁻¹)	—	97 b	101 a
Alfalfa second year (ton • acre⁻¹)	—	—	4

Average yields in 2006-2011. Different letters indicate that the averages across a row are statistically different (p<0.05).

conventionally managed two-year rotation. Lower costs in the longer rotations reflected lower expenses for fertilizer, herbicides and gas for drying corn grain. N fertilizer costs were held down due to the contributions of N from the red clover, alfalfa and cattle manure. Herbicide costs were reduced by using banded applications and inter-row cultivation.

Overall, net returns were higher in the three-year rotation (\$380/acre) than in the two-year (\$341/acre) and four-year (\$345/acre) rotations. The superior returns from the three-year system reflected minimal costs for synthetic P and K fertilizer. Red clover in the three-year system was used as a plow-down green

Profitability	Two year rotation	Three year rotation	Four year rotation
	Gross revenue for whole rotation	\$666	\$582
Labor for fieldwork (hours • acre⁻¹ • year⁻¹)	0.69	1.12	1.45
Costs of production (dollars • acre⁻¹ • year⁻¹)	\$318	\$189	\$226
Net returns to land and management	\$341	\$380	\$345

¹2006-2011 time period; 2011 numbers are preliminary

Average cost of production over the time period for each rotation was \$318 (C-Sb); \$189 (C-Sb-O/Rc); \$226 (C-Sb-O/A-A).¹ The 2011 numbers are preliminary and could change. Final 2011 numbers will be known by November of 2012, the end of the marketing year.

Looking for curious farmers

PFI is looking for three or four conventional row crop farmers who would want to add a third or fourth crop to their rotation and document the crop performance, expenses and overall profitability of an extended rotation on a larger scale.

Interested?

Please contact Sarah Carlson, 515.232.5661 or sarah@practicalfarmers.org, for more information.

Rotation	Fertilizers & Herbicides					
	N Fertilizer			Herbicides		
	Two year	Three year	Four year	Two year	Three year	Four year
	lb N/acre			lb a.i./acre		
Corn	140	18	10	1.77	0.07	0.07
Soybeans	3	3	3	1.42	0.12	0.12
Oats	—	3	3	—	—	—
Alfalfa	—	—	3	—	—	—
Rotation av.	71	8	6	1.60	0.06	0.05
Reduction		-89%	-92%		-96%	-97%

Average annual N fertilizer and herbicide use, 2006-2011. To control weeds in the two-year rotation, an average of 1.6 lbs of herbicide a.i./A was used. In contrast, in the three-year and four-year rotations only 0.06 lbs herbicide a.i./A and 0.05 lbs herbicide a.i./A were needed, respectively. These figures represented reductions of 96 percent and 97 percent compared to the two-year rotation.