

Yield

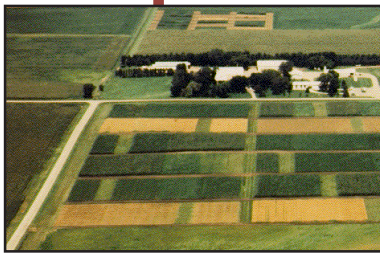
Results from the VICMS study at the Southwest Research and Outreach Center, Lamberton, Minnesota

Paul Porter, Dave Huggins, Catherine Perillo, Steve Quiring, and Kent Crookston

University of Minnesota, Departments of Agronomy and Plant Genetics, and Soil, Water, and Climate

What are the VICMS trials?

The Variable Input Crop Management Systems (VICMS) trials were started in 1989 at the Southwest Research and Outreach Center in Lamberton, MN to monitor long term differences among four management strategies and two crop rotations.



The VICMS 1 plots on the Elwell Farm are shown in the lower half of this picture. The VICMS 2 plots are the smaller set of plots at the top of the picture, north of the buildings.

The four management strategies are:

- No inputs (**NI**) = No fertilizers or herbicides. The only inputs are seed and tillage.
- Reduced input (**RI**) = Reduced rates of banded fertilizer and herbicides. Reduced tillage, with no-till in most years.
- High input (**HI**) = Broadcast fertilizer and herbicides. Moldboard plowed most years.
- Organic input (**OI**) = No chemical fertilizers or herbicides. Aged manure is applied. Weeds are controlled through delayed planting and cultivation.

Two rotations are used with each of the four strategies:

- 2-yr rotation = corn-soybean
- 4-yr rotation = corn-soybean-oat/alfalfa-alfalfa

Initial soil fertility

All eight treatments (four management strategies for each rotation) were established at two locations:

- VICMS1 (**V1**) = Low initial fertility. These plots were established on the Elwell Agroecology Farm on land with a history of no fertilizer or pesticide application and where soil fertility levels, specifically P, had been depleted over time.
- VICMS2 (**V2**) = High initial fertility. These plots are on land with a history of conventional fertilizer and pesticide application and where soil fertility levels had been built up over time.

Why study these management systems?

Acres devoted to corn and soybeans have approximately doubled in the last 50 years – a response, in part, to the development of effective fertilizers and pesticides, government policies, and favorable economics. These two crops now dominate the Midwestern countryside, and account for more than ninety percent of southwestern Minnesota's landscape. As acreage has increased and production has intensified, concerns have grown about the sustainability of this cropping system. The concerns relate to environmental issues, such as water quality; economic issues, such as increased reliance on government subsidies; and social issues, such as the continuing decline in rural populations.

In response to these concerns, the VICMS trials were established to examine alternatives to common management strategies.

The yield study

This fact sheet describes how rotation length and management strategies influenced crop yield. Results from the first four years, 1989-1992, are not reported to avoid the transition period while the new management systems were being established. Yield results are shown below and explained on the back of this fact sheet.

Corn, 1993-1999

	2-yr rotation		4-yr rotation	
	V1	V2	V1	V2
HI	143 bu/ac	139 bu/ac	137 bu/ac	139 bu/ac
OI			129 bu/ac	129 bu/ac

Soybean, 1993-1999

	2-yr rotation		4-yr rotation	
	V1	V2	V1	V2
HI	43.1 bu/ac	40.7 bu/ac	44.4 bu/ac	43.1 bu/ac
OI			35.0 bu/ac	34.1 bu/ac

Alfalfa, 1993-1999

	4-yr rotation	
	V1	V2
HI	5.21 tons/ac	5.11 tons/ac
OI	4.77 tons/ac	5.11 tons/ac

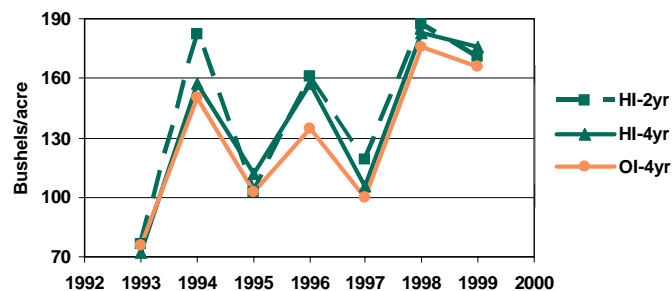
The bottom line

- Long-term corn and soybean yields were lower in the 4-yr organic input (OI) strategy compared with the 2-yr high input (HI) strategy. However, the OI strategy had lower production costs, and consequently net returns for the two strategies were equivalent, even without accounting for organic price premiums. These results are consistent with those of several other studies conducted in the Midwest, and suggest that organic production systems can be competitive with conventional production systems.
- This research documents the yield benefits for soybean of expanding a crop rotation from 2 years to 4 years. The beneficial effect of the longer rotation can be masked by external inputs in the reduced input (RI) and high input (HI) treatments.

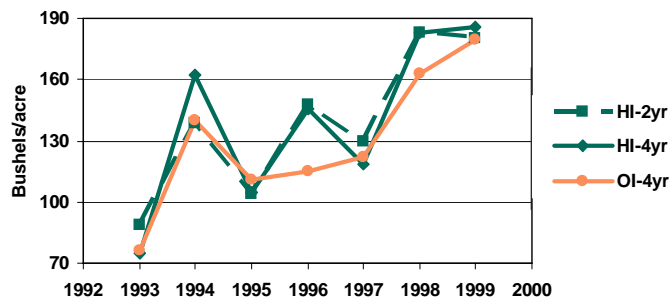
Results

- **HI corn yield** was 4% lower in the 4-yr compared to 2-yr rotation on V1 plots (initially low fertility), and not different on V2 plots (initially high fertility).
- **HI soybean yields** were 3% and 6% greater in the 4-year compared to the 2-year rotation on V1 and V2, respectively. These results suggest soybean was more responsive than corn to the expanded rotation length in the HI strategy. Diseases associated with soybean may have been more of a problem in the 2-yr rotation than in the 4-yr rotation, resulting in some of the observed yield differences between the two rotation lengths.
- **OI yields:** Corn and soybean yields from the 4-year OI plots were generally lower than from the 2-year HI plots. In comparison to conventional production practices, yield of organically produced soybean was reduced to a greater extent than yield of organically produced corn. Specifically, corn yield was lower by 9% on V1 and 7% on V2, and soybean yield was lower by 19% on V1 and 16% on V2.
- **Oat yields** were similar for all management systems when averaged across the seven years. The 4-yr OI and HI strategies yielded 49.2 bu/ac on the V1 plots and 51.5 bu/ac on the V2 plots.
- **Alfalfa yields** did not differ on the V2 plots, but on the V1 plots alfalfa yield was 8% less in the OI treatment compared to HI. We suspect the poorer performance of OI was related to the lower initial P levels in the V1 plots.
- **Year-to-year variation** in weather influenced how the crops responded to rotation length and management strategy (see figures). Weed control, especially in the OI and NI strategies, was greatly influenced by early-season climatic conditions. In 1993, 1996 and 1997 rainfall events precluded timely and effective rotary hoeing and cultivation. Inadequate weed control one season can negatively influence crop productivity that year and influence weed pressure and crop productivity in subsequent years.
- **RI and NI yields** (not shown): Yield under the reduced input (RI) system varied, but were comparable to HI. Yields under the no input (NI) system were severely restricted by the insufficient nutrient supply.

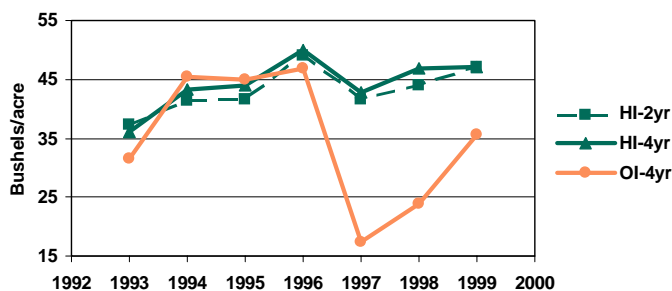
Corn Yields - V1



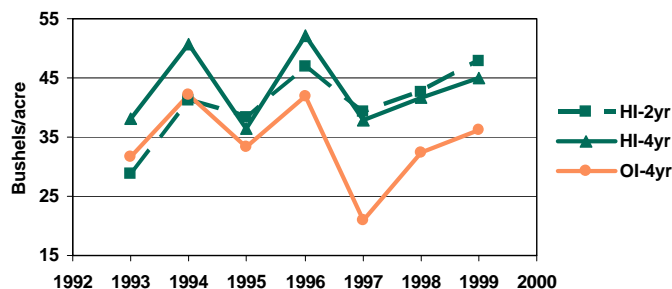
Corn Yields - V2



Soybean Yields - V1



Soybean Yields - V2



For additional information about these results see *Agronomy Journal* 95:233-244 (2003) or contact Paul Porter at the University of Minnesota 612-625-6719.

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