



Long term impact of soybean rust on the Midwest corn-soybean rotation system

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Outline

- *Factors affecting corn-soybean ratios*
- *Potential magnitude of acreage shifts*
- *Corn-corn production issues*
 - *Yield*
 - *Insects & diseases*
 - *Weed management*
 - *Tillage practices & fertilization*
- *Potential benefits to acreage shifts?*
 - *Soybean production*
- *Implications*
 - *Corn management decisions & tools*



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Factors affecting corn-soybean acreage ratio

- *Corn price*
- *Soybean price*
- *Corn production cost*
- *Soybean production cost*
- *Yield*



Corn-soybean acreage ratio in Iowa

- Ratio has dropped long-term due to soybean adoption
- Ratio has increased since 2000

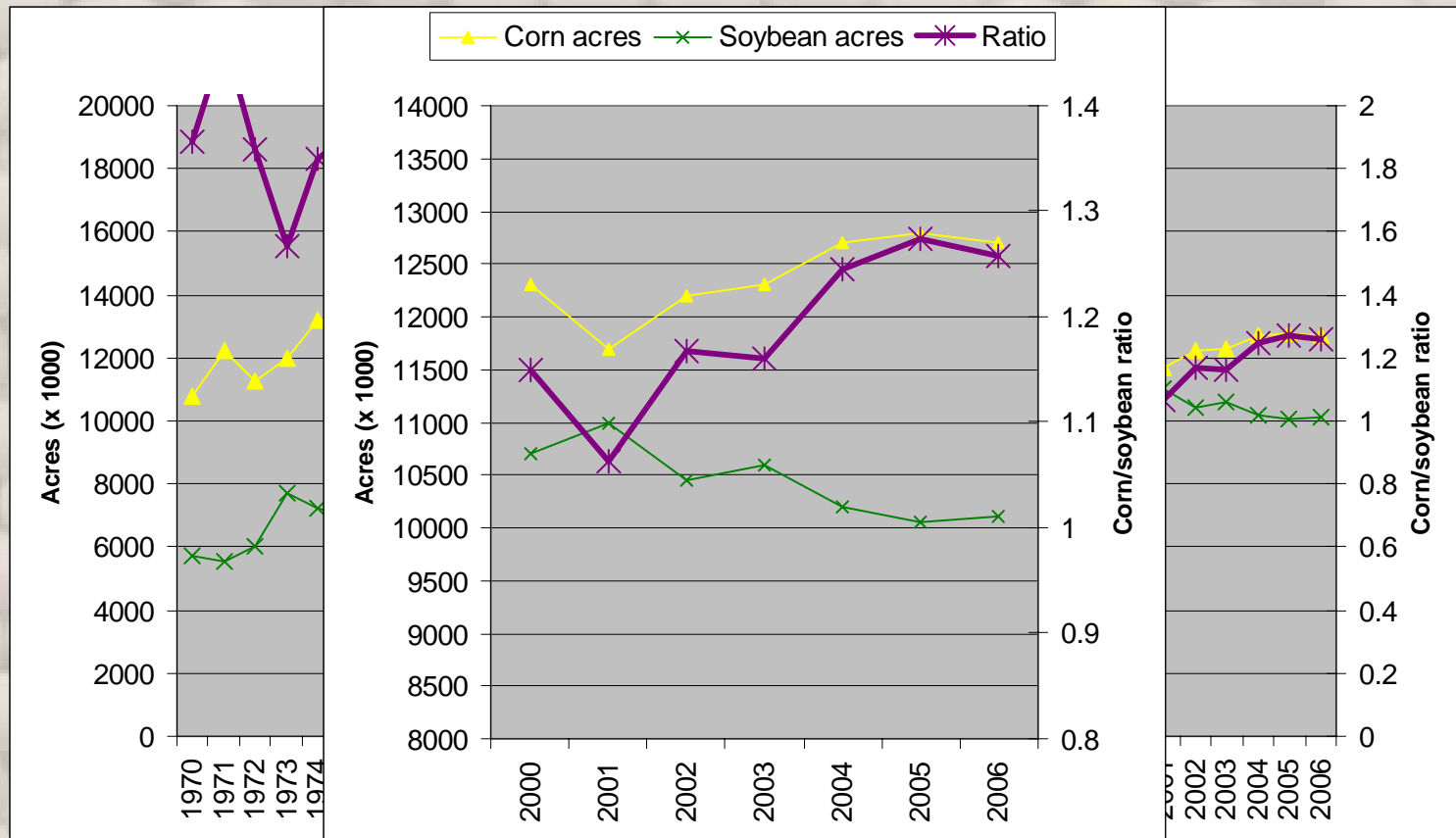
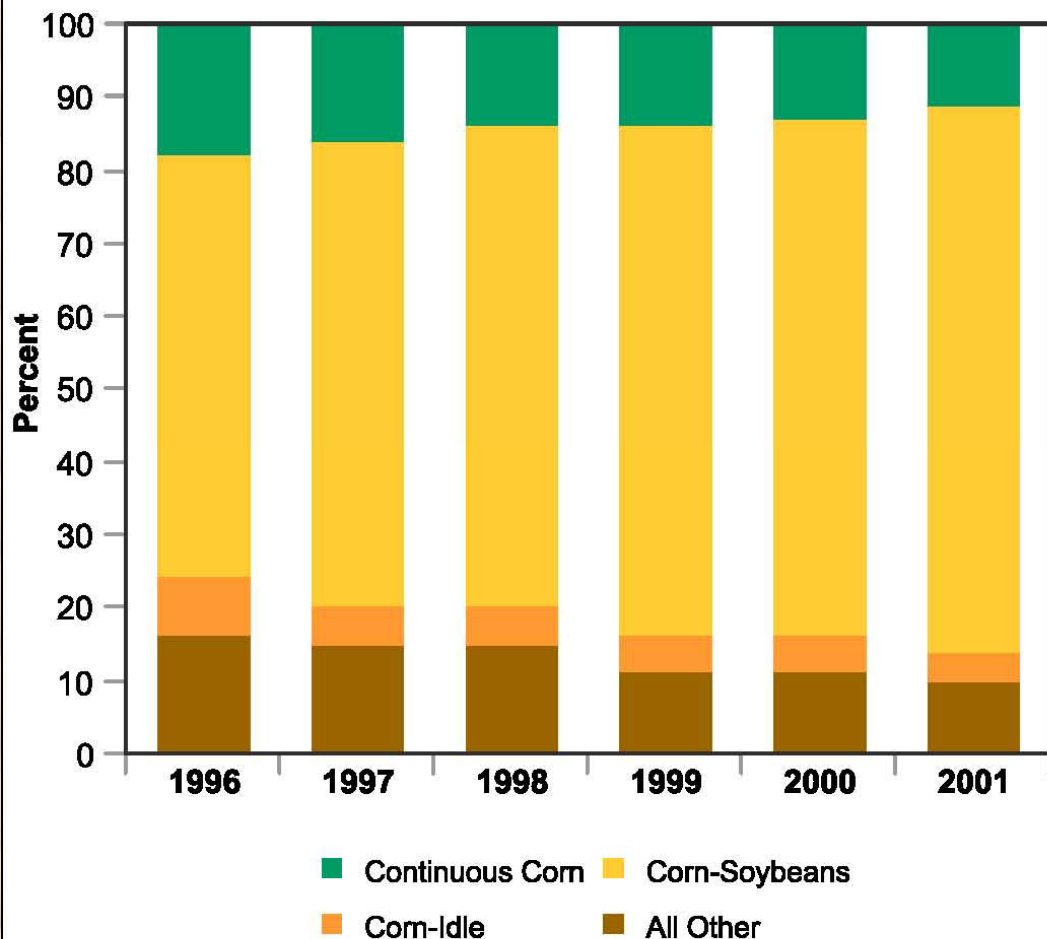


Figure 4.2.1 – Cropping patterns on corn for 10 major production States, 1996-2001



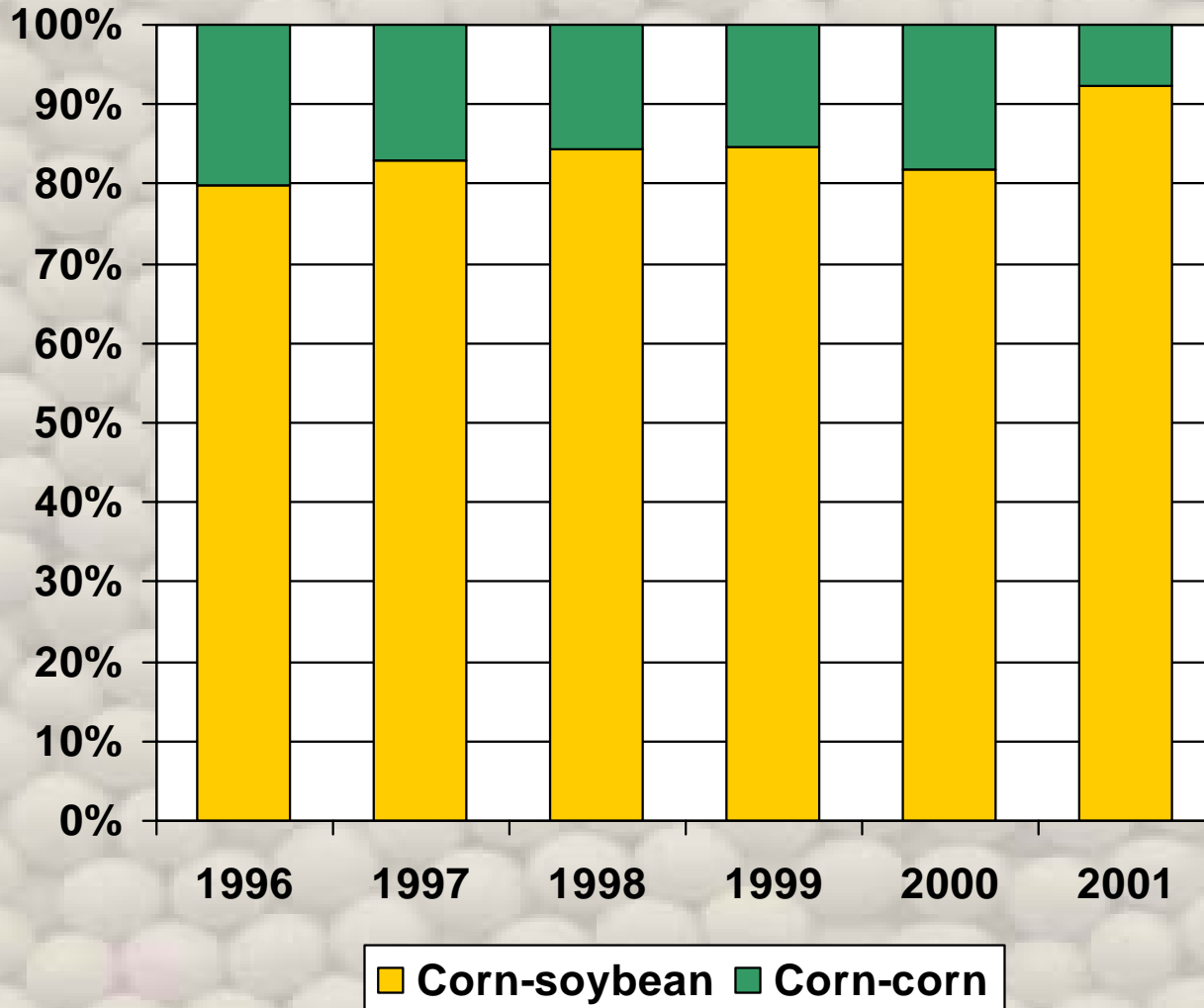
Source: USDA, ERS, Agricultural Resource Management Surveys.



Crop rotation practices for corn-top 10 corn states



Crop rotation practices for Iowa corn

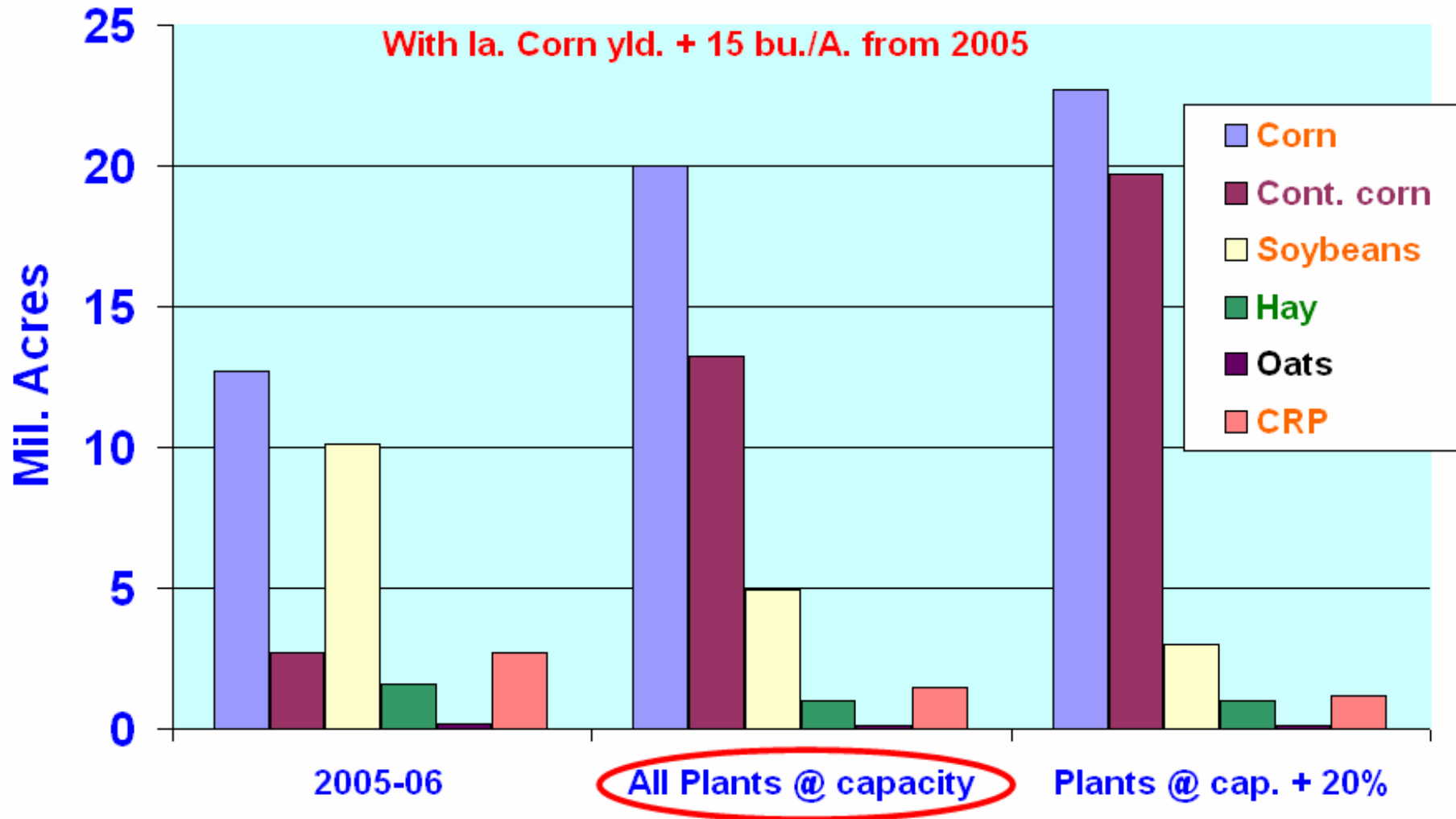


Source: USDA-ERS



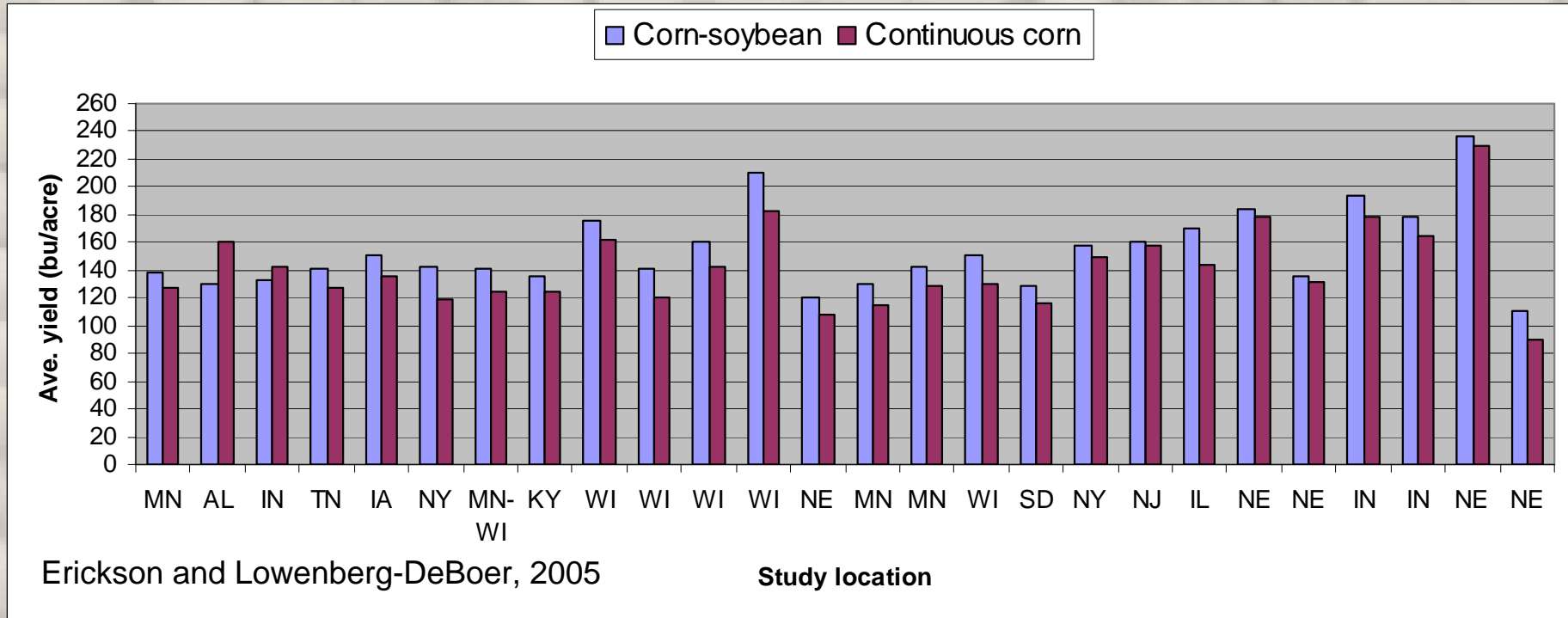
Iowa Current & Potential 2012 Crop Acreages

10/30/06



Corn-on corn issues

Yield



- 24 of 26 studies showed reduced yields for continuous corn
- Average reduction was 9% (range 0 to 23%)
- 2nd year corn yields reduced in 9 of 9 studies (not shown)



Corn-on corn issues

Yield

Table 5. Yield advantage of corn following soybeans over corn following corn at different yield levels*. Four-year study at Waseca, MN. Source: University of Minnesota.

Butzen, 2006

Corn-after-corn yield Bushels per acre	Corn yield increase when following soybeans vs. corn	
	----- % -----	
110	32	29
120	17	14
140	24	17
155	25	16
165	12	7
180	5	3
200	5	2.5

*Nitrogen levels were 200 lb/acre.



Corn-on corn issues

Corn rootworms

- Most important pests of corn (\$1 billion/yr)
- Most problems are on corn following corn
- Transgenic resistance
- ~35% of corn producers “Likely” or “Very likely” to adopt rootworm resistant corn (Payne et al., 2003)

Results (con't)

Q. During 2005, what management practices did you use to prevent corn rootworm injury and how many hectares did you manage with each practice?

Management Practice	Practice Used	Mean Hectares
Crop rotation	76.8%	197 (n=446)
Soil-applied insecticide	43.7%	190 (n=257)
Seed-applied insecticide	26.2%	143 (n=151)
Transgenic rootworm corn	22.8%	76 (n=137)
Adult beetle spray (insecticide)	4.2%	100 (n=26)
Other (please specify)	1.1%	121 (n=5)

Corn-on corn issues

Disease occurrence

- Diseases documented to be more severe in corn following corn
 - Seedling diseases
 - Gray leaf spot
 - Northern leaf blight
 - Diplodia stalk & ear rot
 - Gibberella stalk & ear rot
 - Anthracnose stalk rot & leaf blight
- Foliar fungicide use?



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Corn-on corn issues

Disease occurrence

- Harvest season extension
 - Increases lodging risk
 - Increases ear rot & mycotoxin risk



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Corn-on corn issues

Weed management

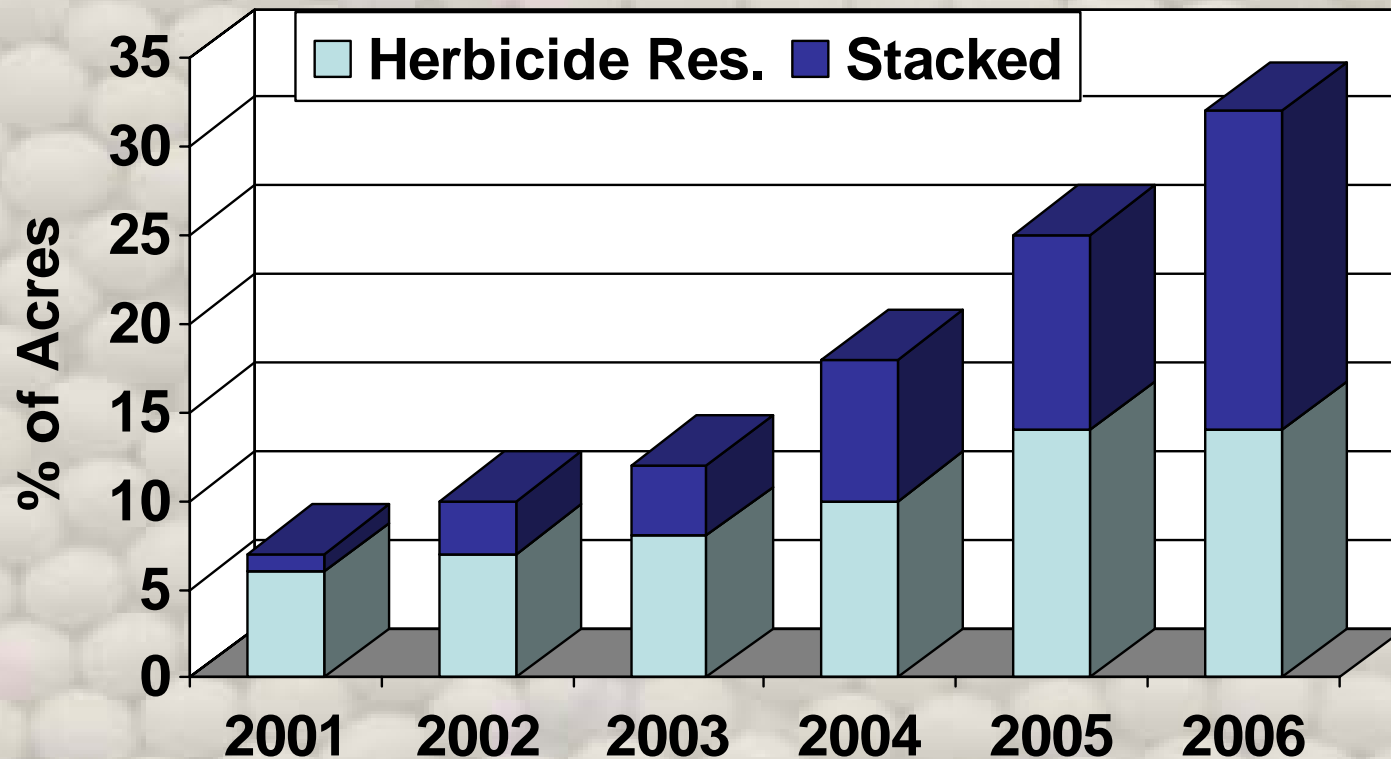
- Fewer herbicide options; fewer strategic options
- Soil-applied herbicide efficacy issues with high levels of residue
- Hasten the trend toward glyphosate-resistant corn
- Additional herbicide resistance options needed



Corn-on corn issues

Weed management

Herbicide resistant corn in Iowa



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Corn-on corn issues

Stand establishment

- Corn into corn residue
 - Slower warming and drying
 - Residue can interfere with planter
 - Seedling pathogens more prevalent
 - Secondary insect problems
 - Longer planting window needed (even earlier start)





Table 1. Influence of previous crop and tillage on residue cover, soil temperature, and corn grain yield. Source: University of Wisconsin three-year study.

Previous Crop	Residue Cover (%) [*]		Soil Temperature (°F) ^{**}		Grain Yield (Bu/acre)	
	Plow	No-Till	Plow	No-Till	Plow	No-till
Soybean	2	31	65	63	173	176
Corn	5	69	65	58	162	149

^{*} At planting.

^{**} Mid-day, in-row temperature at seed depth, averaged for seven days after planting.

Butzen, 2006

Corn-on corn issues

Tillage practices

- Corn-on-corn yield reduction is worse with conservation tillage
 - Moldboard plow, 3% reduction
 - Chisel plow, 5% reduction
 - No-till, 18% reduction (Indiana, Nielsen et al., 2006)
- Corn planter and herbicide efficacy issues with high levels of residue
- Compaction due to traffic on slow drying soils
- Trend toward more tillage?



Corn-on corn issues

Fertilization practices

- 30-50 lbs additional N per acre in corn-on-corn
 - Production cost; environmental cost
- N side-dress window may be too narrow
- Differing P and K requirements



Benefits to soybean productivity

- Lower exposure to soybean rust losses
- Better management of soybean diseases
 - Cyst nematode
 - Sudden death syndrome
 - Brown stem rot
 - Frogeye & other leaf spots
 - Overall root health



Needed tools for managing corn-on-corn acres

- Range of hybrid choices with insect-resistance genes
- Alternatives for herbicide resistance genes
- Early-season stress tolerance traits
- Improved disease resistance
 - Seedling disease resistance
 - Stalk rots, leaf diseases, some ear rots
- Effective seed treatment package (fungicide/insecticide)
- Creative tillage options
- Dry-down trait?



Summary

- Soybean rust may be one factor driving a trend toward more corn & less beans
- Potential for corn production challenges and environmental issues
- Corn management practices will adjust
 - Tillage & fertilization
 - Weed management
- Corn hybrid options will need to adjust
 - Increased demand for transgenic corn hybrids
 - Increased need for improved disease resistance and other stress adaptation traits in corn



References

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