



The Future of Corn Production in the Upper Midwest

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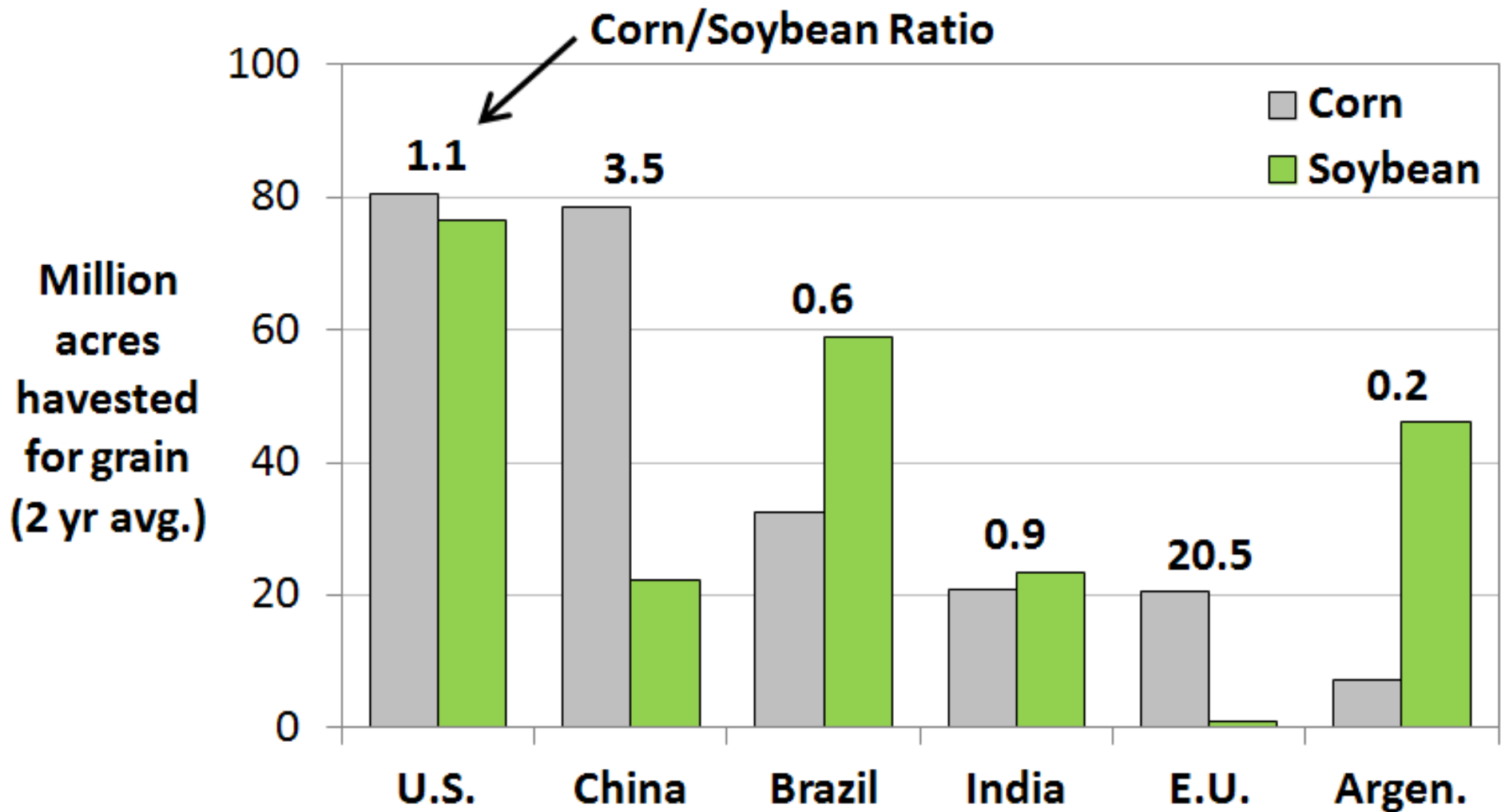
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Overview

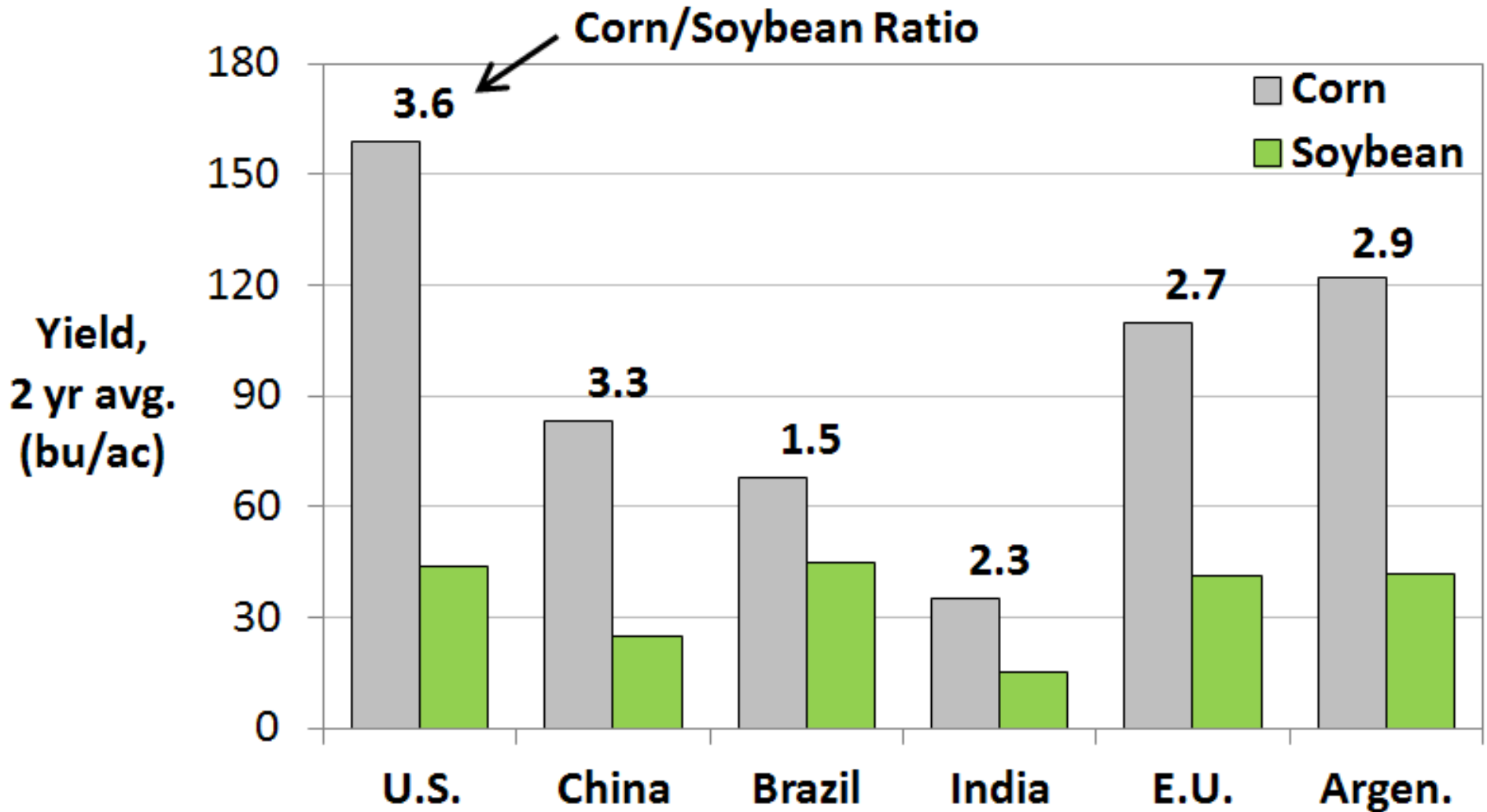
- **Corn & soybean production trends - world & U.S.**
- **Corn silage**
- **Corn hybrid improvements**
- **Agronomics**
- **Weather**



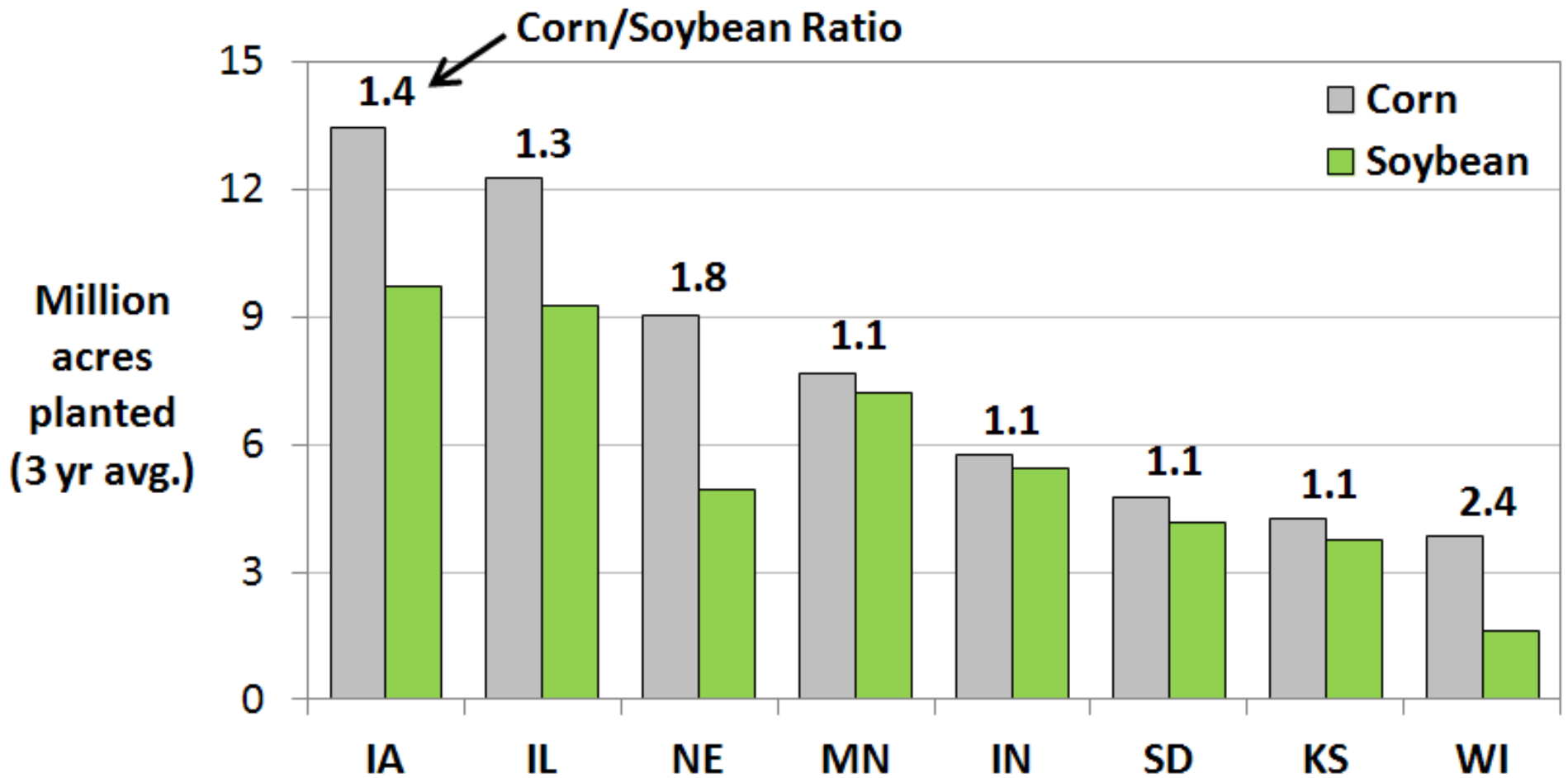
World Corn & Soybean Acreage



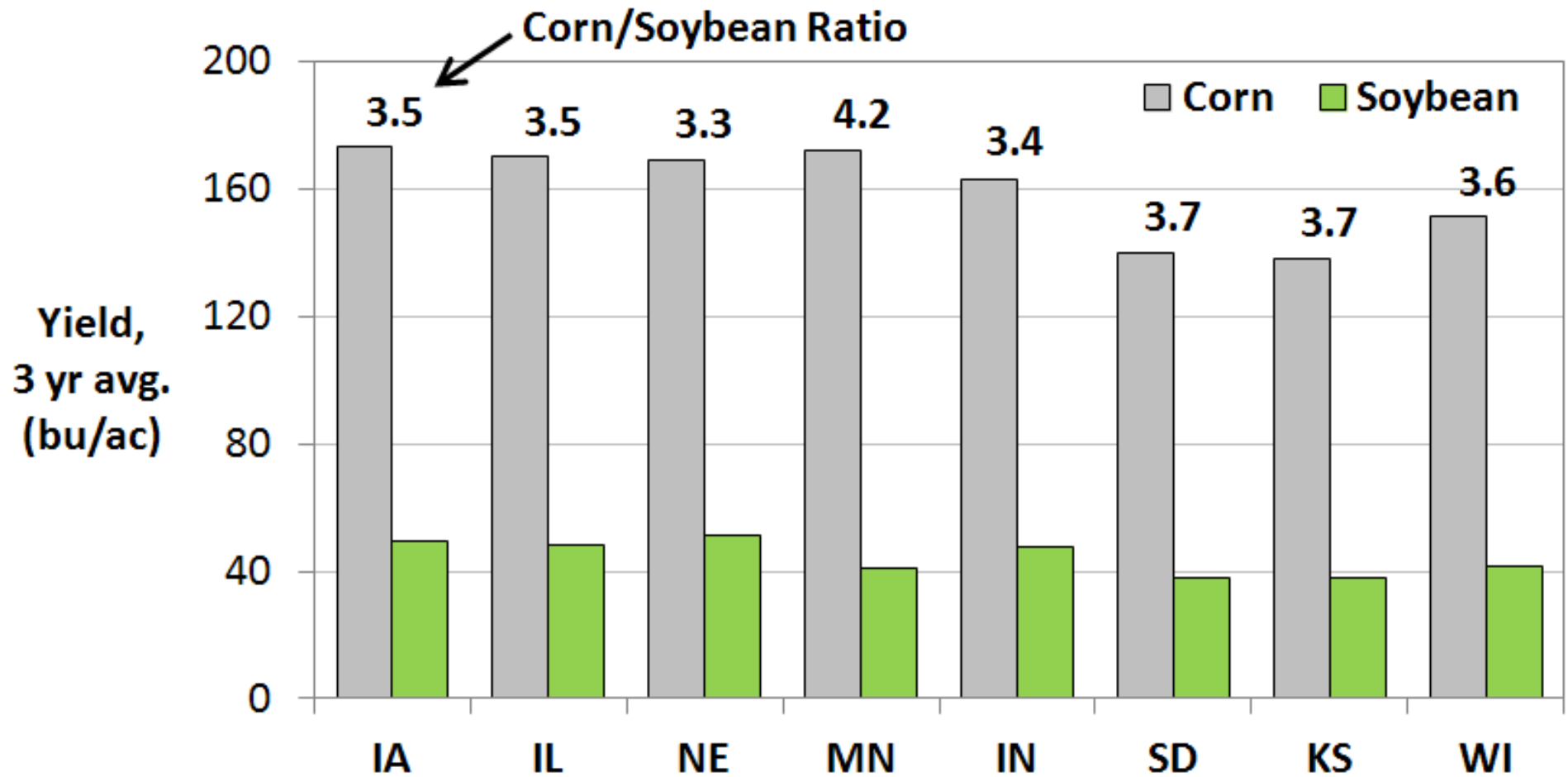
World Corn & Soybean Yields



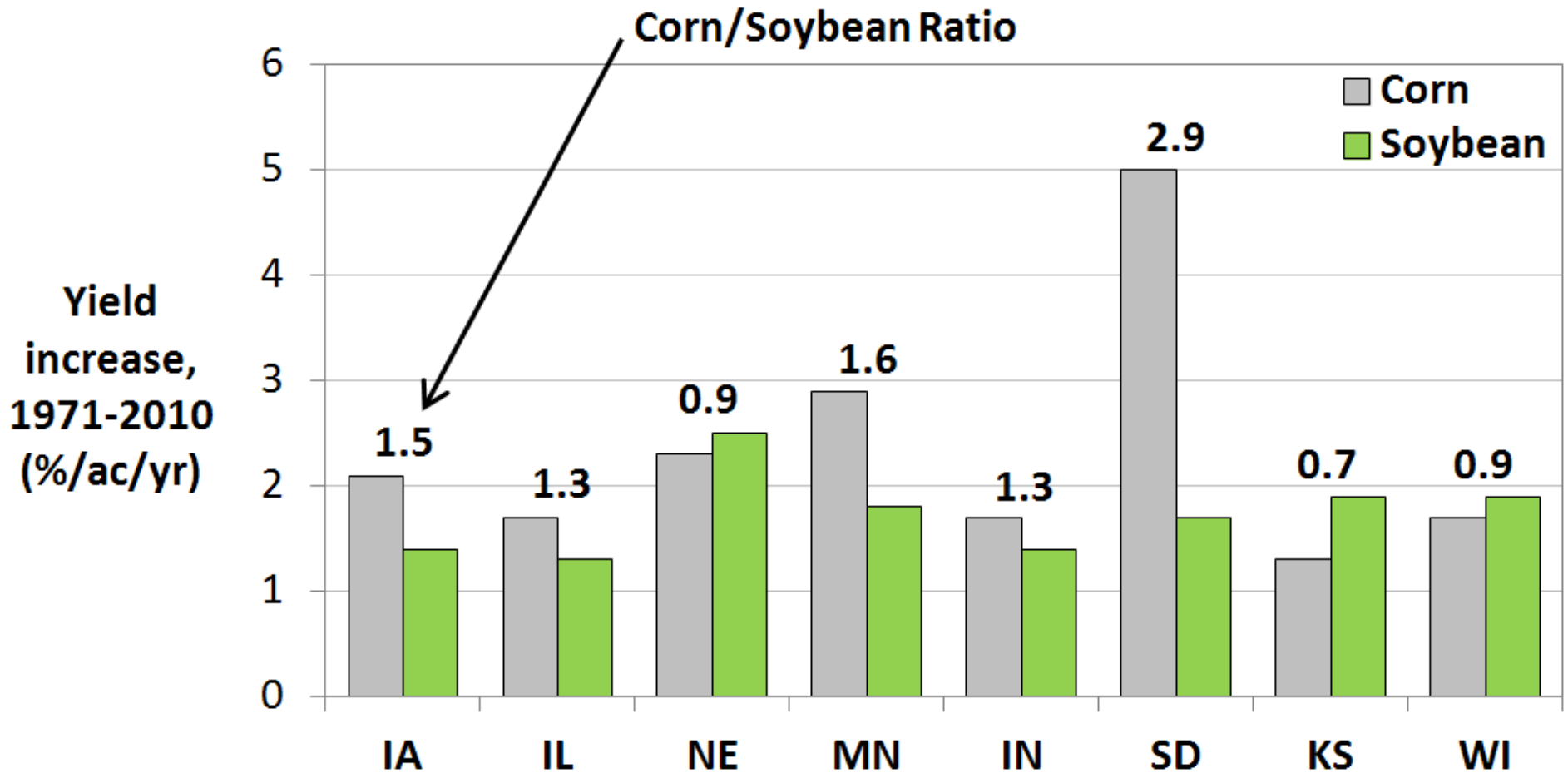
U.S. Corn & Soybean Acreage



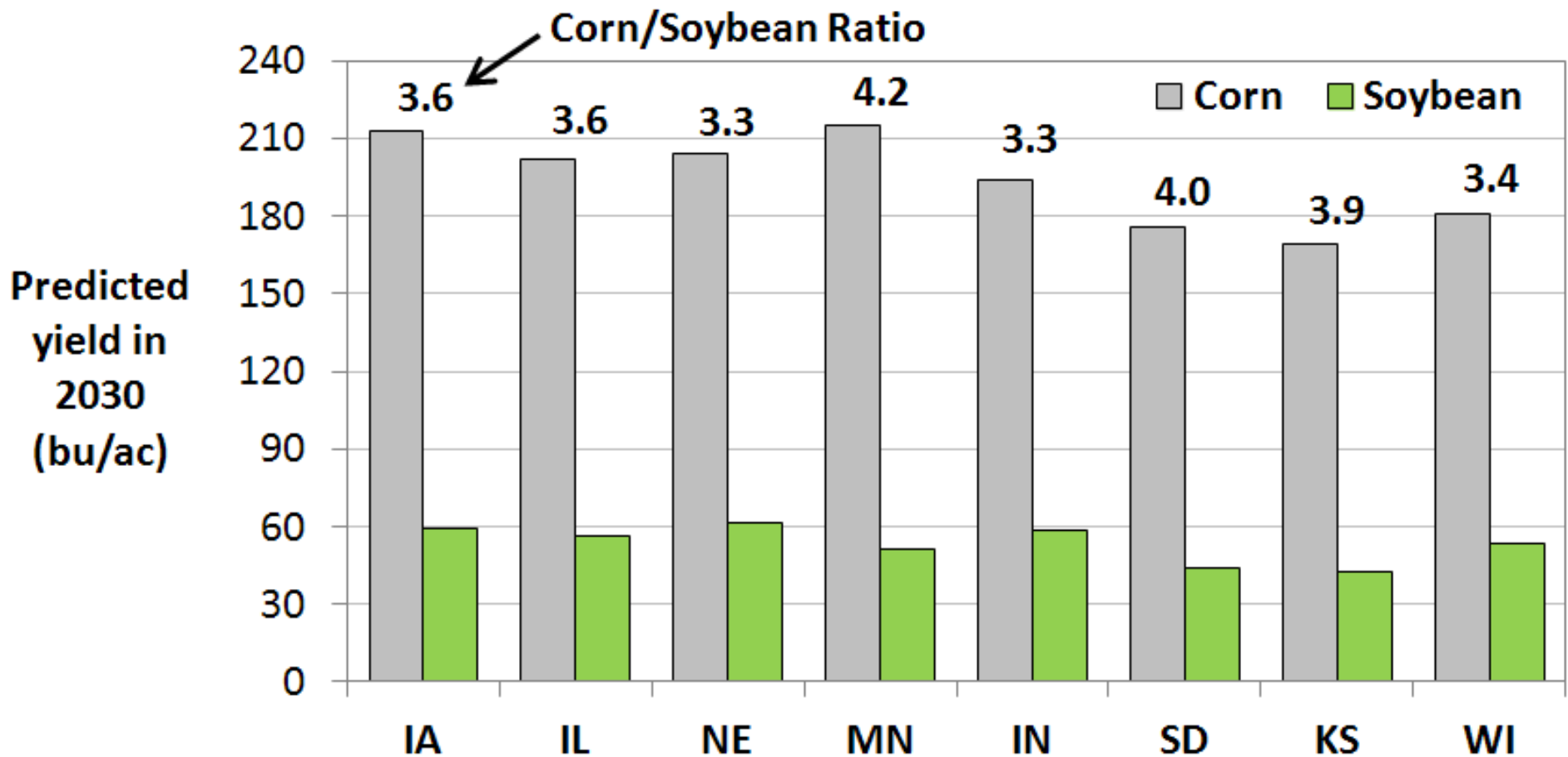
U.S. Corn & Soybean Yields



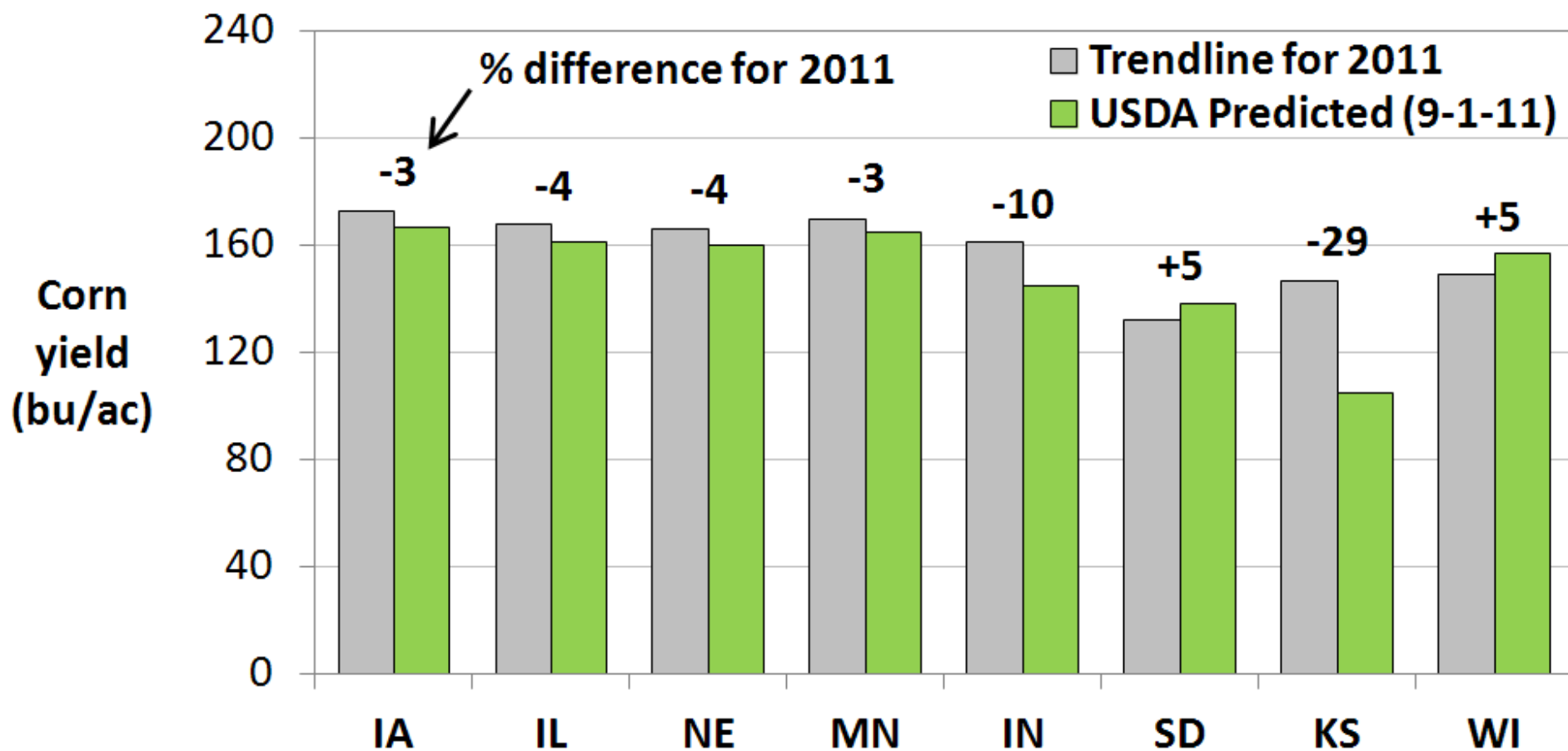
U.S. Corn & Soybean Yield Increases Over the Last 40 Years



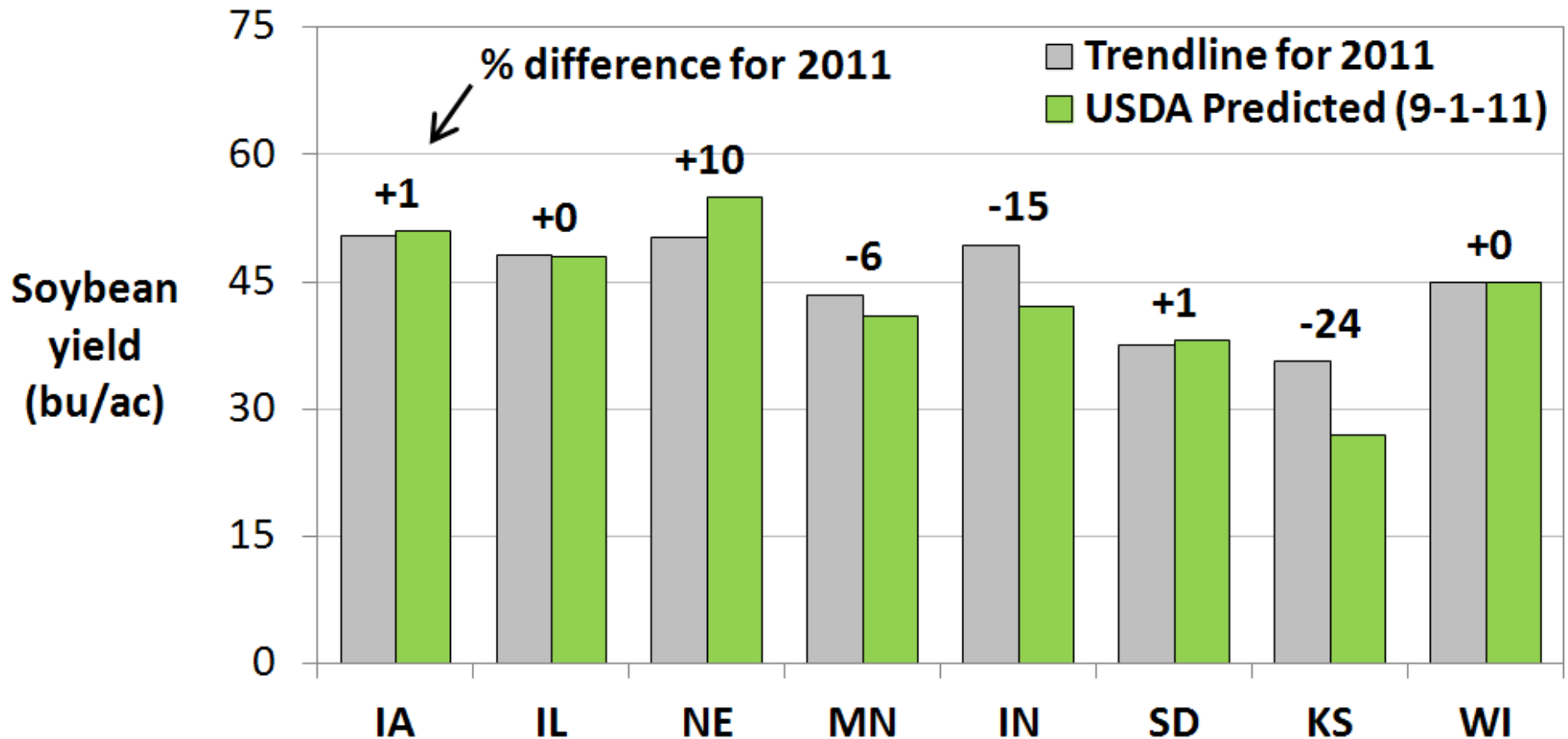
Predicted yields in 2030, assuming the 1971-2010 rate of yield increase



Trendline vs. USDA Predicted Corn Yields for 2011



Trendline vs. USDA Predicted Soybean Yields for 2011



12 site-years in northern & central IL (2004-2007)

Crop and rotation		Yield (bu/ac)
Corn	Corn-soy	197
	1st-year corn in corn-corn-soy	196
	2nd-year corn in corn-corn-soy	184 (-7%)
	Continuous corn	178 (-10%)
Soybean	Corn-soy	54.9
	Corn-corn-soy	58.3 (+6%)

Yield & Net Return in Southern MN (2008-2010)

Crop and rotation	Fields/year (#)	Crop yield (bu/ac)	Net return (\$/ac)
Corn after soybean	914	185	157
Corn after corn	367	182	151
Soybean after corn	1267	48.5	145

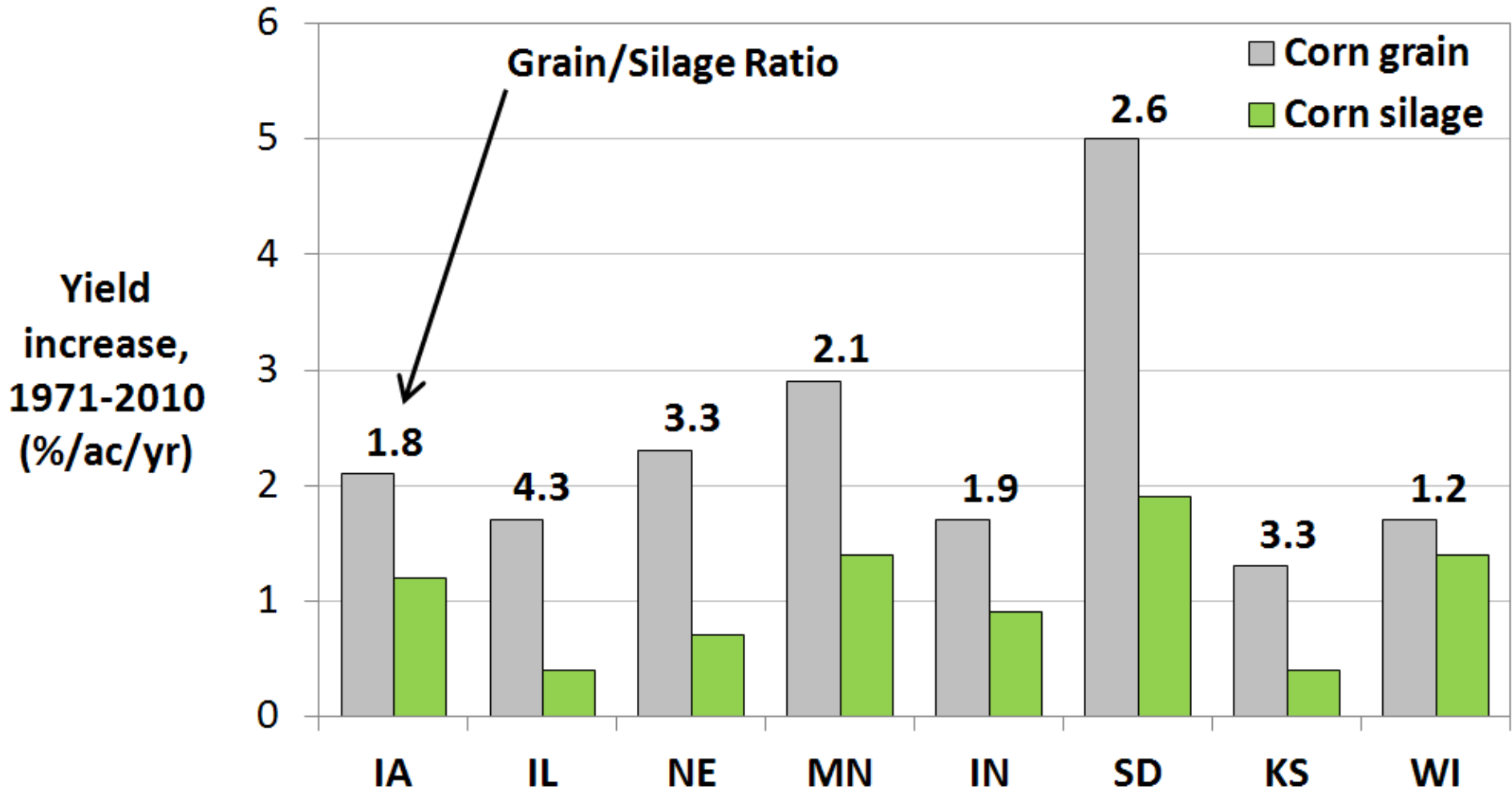


Data from U of M FINBIN Farm Financial Database

What about corn silage?



U.S. Corn Grain & Silage Yield Increases Over the Last 40 Years



**Silage hybrids differ from grain hybrids.
Differences may be greater in the future.**

Grain Hybrid

Silage Hybrid



Brown Midrib (BMR) Hybrids Have Improved Considerably Since the 1990s

Hybrid type	DM Yield (tons/ac)	Quality (%)				Milk Yield	
		CP	NDF	NDFD	Starch	(lb/ton)	(lb/ac)
Dual Purpose Avg: DeKalb DKD61-69 DeKalb DKC63-42 Pioneer 33T55 Pioneer 34A89	9.9 a	8.4 b	40 b	58 b	34 a	3370 b	33,400 a
Brown Midrib Avg: Mycogen F2F566 Mycogen F2F610	9.2 b	8.6 a	42 a	73 a	32 b	3650 a	33,600 a
Difference:	-7%	+2%	+5%	+26%	-6%	+8%	+0%
Notes on BMR:	-20% in 1990s			Similar in 1990s			

Improvements in BMR and Leafy Hybrids

- In the past, BMR & leafy hybrids were less tolerant to high plant populations & dry conditions than grain hybrids.
- Recent research from New York demonstrated that the response of corn growth, silage yield, & silage quality to plant population was similar for grain, BMR, & leafy hybrids.

(Cox & Cherney, 2011 – *Agronomy Journal*)



Photo credit: Dave Hanson



Future Corn Hybrid Improvements

- Yield
- Standability
- Emergence / early-season cold tolerance
- Disease resistance (gray leaf spot & Goss' wilt)
- Tolerance to more herbicides
- Enhanced insect resistance



Drought Tolerant Hybrids

- Improved drought tolerance, especially for grain hybrids grown in the western Corn Belt under dryland conditions.

Drought
tolerance
study in
Illinois



Hybrids with Greater Nitrogen Use Efficiency

- Increased yield under normal soil N levels.
- Maintain yield under low soil N levels.

Nitrogen Use Efficiency Study at Waseca, MN



Hybrid testing will become more important.



Current Impact of Agronomic Decisions on Grain Yield in Southern MN

- **37-64% = hybrid selection (best vs. worst)**
- **10% = corn after soybean vs. corn after corn**
- **7% = tillage system for corn after corn**
- **6% = uniform emergence vs. not**
- **2% = planting in late April vs. mid-May**
- **2% = 103- to 107-day vs. 98- to 102-day hybrid**
- **1-2% = final stand of 34,000 vs. 30,000 plants/acre**
- **1-2% = uniform within-row plant spacing vs. not**
- **0-3% = narrow or twin rows vs. 30-inch rows**



Weather will continue to be the major determinant on corn yield.

- **Is variable & challenging weather the new normal?**
- **2009 MN growing season:**
 - Unusually cool - much of the corn in MN froze before maturity; mold on kernels.
 - Exceptionally wet fall & late harvest.
- **2010 MN growing season:**
 - Earliest planting on record.
 - Late spring freeze.
 - Warm growing season & early harvest.



Is variable and challenging weather the new normal?

- **2011 MN growing season:**
 - Wet spring & late planting (few days for planting).
 - Excessive rain early in the season & nitrogen loss.
 - Strong winds & stalk breakage.
 - Heat stress around silking.
 - Drought in August & September.
 - Frost on September 15 (3 weeks early).



Impact of Early Frost on Corn



Corn kernel stage	Grain yield loss		Test weight of grain	Grain moisture
	Leaves + stalk froze	Only leaves froze		
	----- % -----		lb/bu	%
R4 (dough)	66	41	---	70
R5 (dent)	55	23	47	60
R5.25 (75% milk)	35	18	50	52
R5.5 (50% milk)	10	5	53	40
R5.75 (25% milk)	3	2	54-55	37
R6 (mature)	0	0	56	32

Take Home Points

- Based on yield, the U.S. has an advantage over other countries for corn production, but not over Argentina, Brazil, or the E.U. for soybean production.
- If corn acreage increases at the expense of soybean in the U.S., states with high corn/soybean yield ratios should see the biggest shift in acreage (MN, SD, KS).
- If current yields increase at the same rate as in the last 40 years, yields in 2030 in MN would be #1 for corn (215 bu/ac) and #7 for soybean (51 bu/ac) out of the current top 10 corn producing states.



Take Home Points

- A 3-yr corn-corn soybean rotation would accommodate more corn, increase soybean yield, & reduce the yield penalty for corn following corn.
- Corn silage yields have increased half as fast as grain yields (improvements have focused more on quality).
- Brown midrib hybrids have much greater silage yield & stress tolerance than in the past.



Take Home Points

- Hybrids will continue to improve agronomically, with emphasis on drought tolerance and nitrogen use efficiency.
- Improved hybrids may respond differently to agronomic practices. Hybrid x management research may become increasingly important.
- Weather will continue to be the major determinant in corn yield, & will continue to cause challenges.





Thanks!



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