What Is Up with Soybean Yields?

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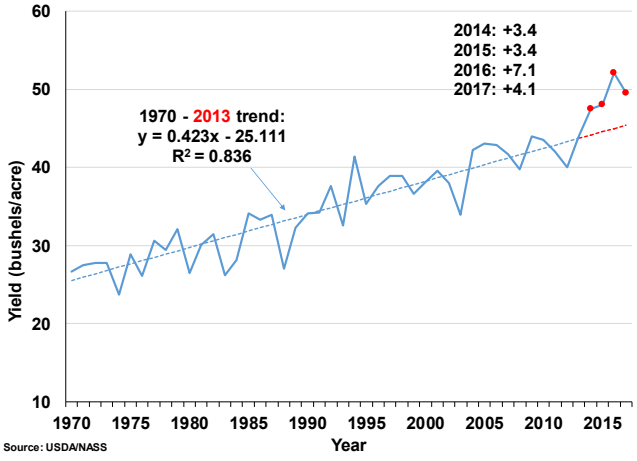
U.S. Average Yield of Soybeans, 1970-2017 (2017 = USDA Nov 1)



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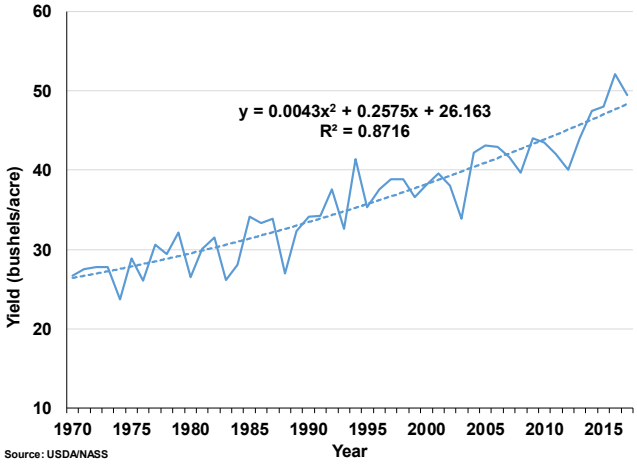

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Factors Driving Soybean Yield

Weather (W)
Genetics (G)
Management (M)

→ **Yield per acre (Y)**

$$Y = G + M + W$$

"Technology"

$$Y = G \times M + W$$

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Was it the Weather?

https://theperrynews.com/severe-thunderstorm-watch-in-effect-until-11-p-m-saturday/

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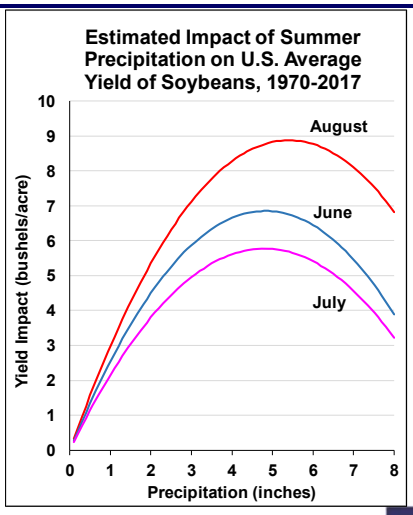
US Crop Weather Model for Soybeans

- Dependent Variable
  - US average soybean yield
- Independent Variables
  - Linear or quadratic trend for technology
  - June, July, and August precipitation and temperature
  - Weather variables are 10-stated weighted averages for Corn Belt
- Sample period
  - 1970-2017



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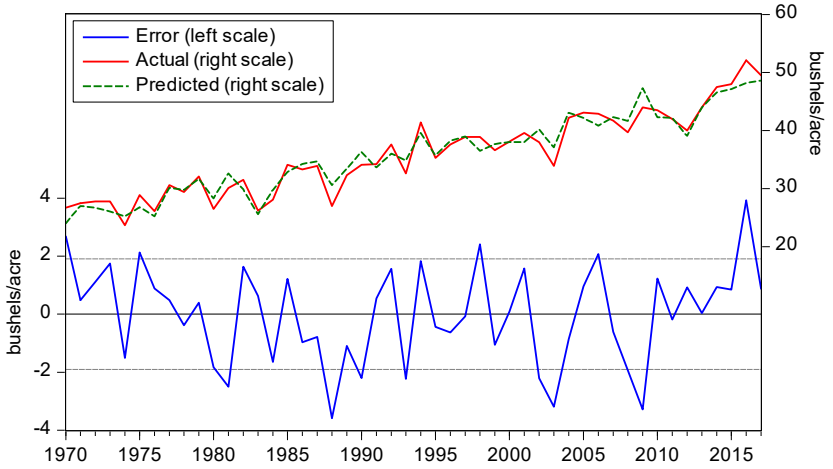
US Soybean Crop Weather Model Estimates, Linear Trend, 1970-2017 (Nov 1)



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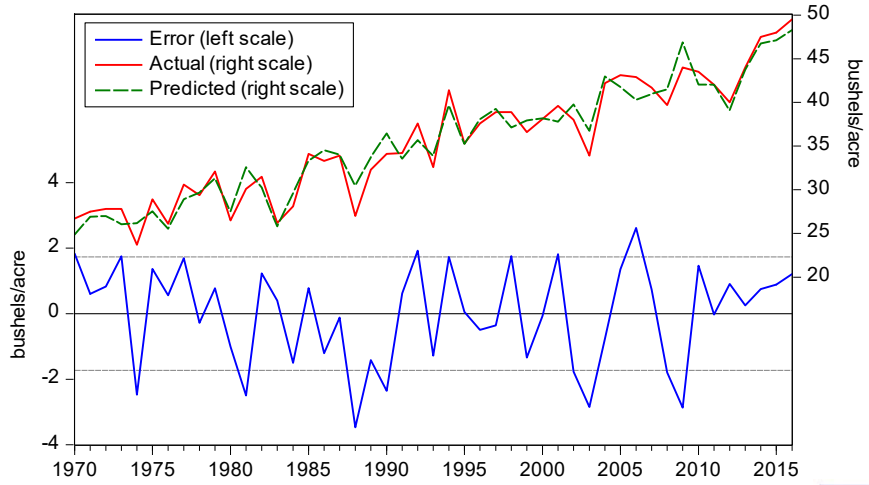
US Soybean Crop Weather Model Estimates, Linear Trend, 1970-2017 (Nov 1) Excluding 2016



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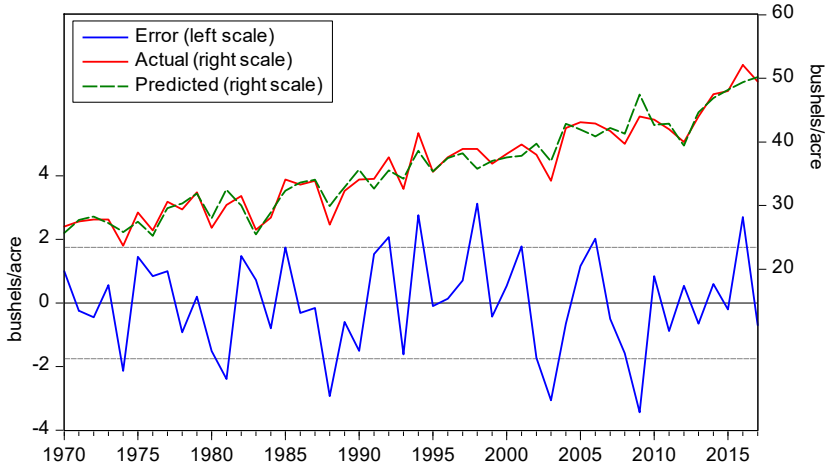
US Soybean Crop Weather Model Estimates, Quadratic Trend, 1970-2017 (Nov 1)



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Was it Genetics?

http://passel.unl.edu/Image/siteImages/DSCN2538-LG.jpg

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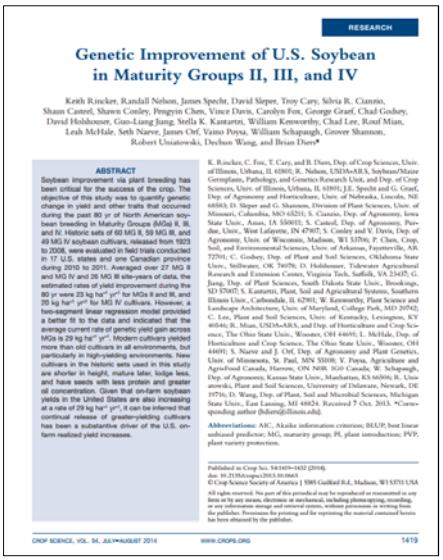
Measuring Genetic Improvement in Soybean Yields



RESEARCH

Genetic Improvement of U.S. Soybean in Maturity Groups II, III, and IV

Keith Rincker, Randall Nelson, James Specht, David Sleper, Troy Cary, Silvia R. Cianzio, Shawn Casteel, Shawn Conley, Pengyin Chen, Vince Davis, Carolyn Fox, George Graef, Chad Godsey, David Holshouser, Guo-Liang Jiang, Stella K. Kantartzi, William Kenworthy, Chad Lee, Rouf Mian, Leah McHale, Seth Naeve, James Orf, Vaino Poysa, William Schapaugh, Grover Shannon, Robert Uniatowski, Dechun Wang, and Brian Diers*

ABSTRACT

Soybean improvement via plant breeding has been critical for the success of the crop. The objective of this study was to quantify genetic change in yield and other traits that occurred during the past 80 yr of North American soybean breeding in Maturity Groups (MGs) II, III, and IV. Historic sets of 60 MG II, 59 MG III, and 49 MG IV soybean cultivars, released from 1923 to 2008, were evaluated in field trials conducted in 17 U.S. states and one Canadian province during 2010 to 2011. Averaged over 27 MG II and MG IV and 26 MG III site-years of data, the estimated rates of yield improvement during the 80 yr were 23 kg ha^{-1} yr^{-1} for MGs II and III, and 20 kg ha^{-1} yr^{-1} for MG IV cultivars. However, a two-segment linear regression model provided a better fit to the data and indicated that the average current rate of genetic yield gain across MGs is 29 kg ha^{-1} yr^{-1}. Modern cultivars yielded more than old cultivars in all environments, but particularly in high-yielding environments. New cultivars in the historic sets used in this study are shorter in height, mature later, lodge less, and have seeds with less protein and greater oil concentration. Given that on-farm soybean yields in the United States are also increasing at a rate of 29 kg ha^{-1} yr^{-1}, it can be inferred that continual release of greater-yielding cultivars has been a substantive driver of the U.S. on-farm realized yield increases.

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Abbreviations: AIC, Akaike information criterion; BLUP, best linear unbiased predictor; MG, maturity group; PI, plant introduction; PVP, plant variety protection.

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- Collected seed for 158 soybean varieties
  - Released over 1920s to 2000s
- Randomized field trials across U.S. in 2010 and 2011
  - All variables the same except genetics
- Average yields across locations for same maturity group

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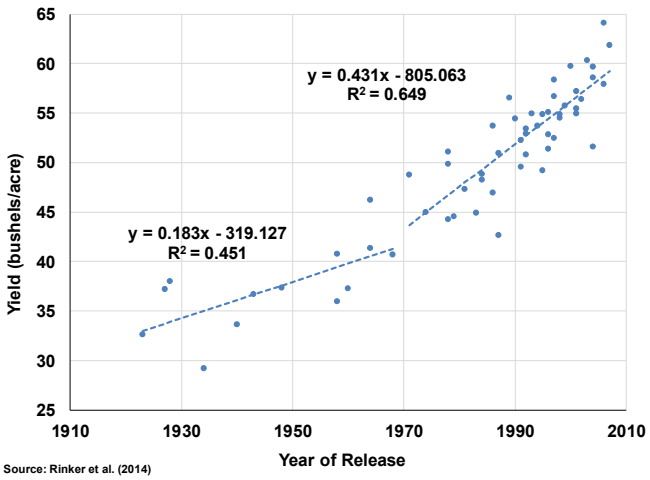
Rate of Genetic Improvement in U.S. Soybean Yields, MG III, 1923-2007



Source: Rinker et al. (2014)

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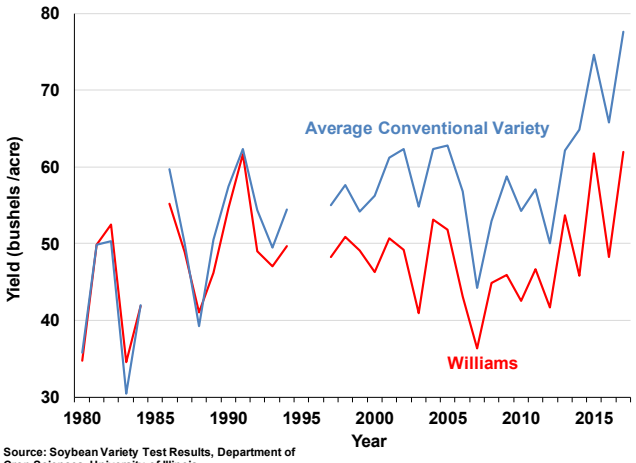
Average Yield of Conventional Soybean Varieties and Williams at Three Illinois Locations, 1980-2017



Source: Soybean Variety Test Results, Department of Crop Sciences, University of Illinois

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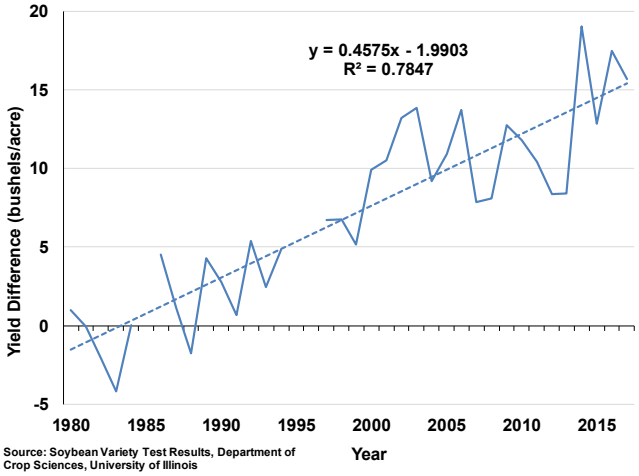
Difference between Average Yield of Conventional Soybean Varieties and Williams at Three Illinois Locations, 1980-2017



Source: Soybean Variety Test Results, Department of Crop Sciences, University of Illinois

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Was it Management?

https://i.ytimg.com/vi/xlUJADMEUIw/maxresdefault.jpg

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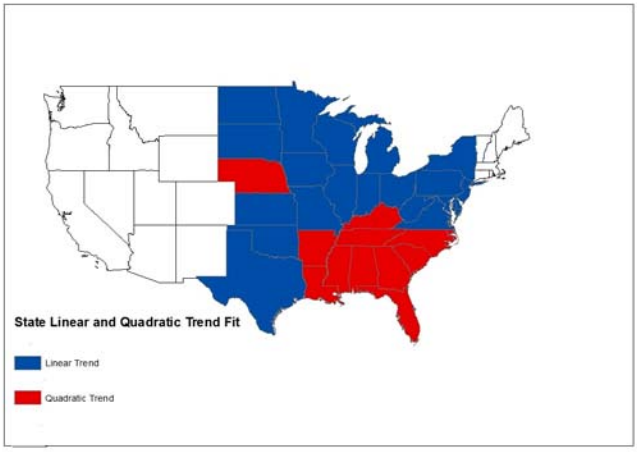
Linear vs. Quadratic Soybean Trend Yields by State



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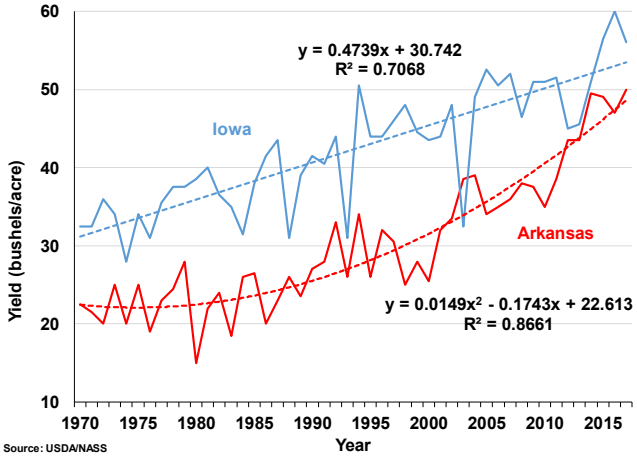
Average Yield of Soybeans in Iowa and Arkansas, 1970-2017 (2017 = USDA Nov 1)



Source: USDA/NASS

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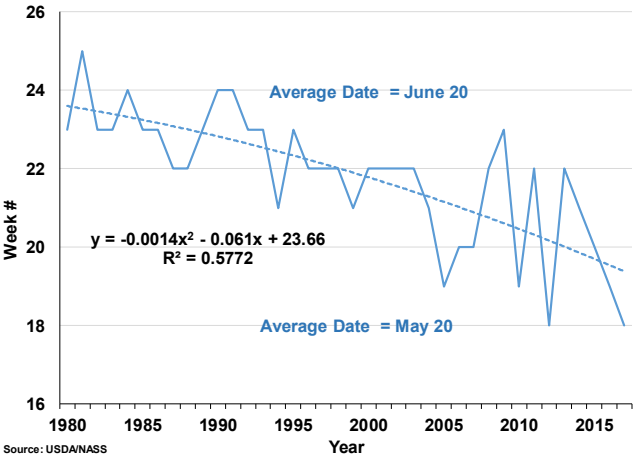
Week When Soybean Planting Progress in Arkansas Reaches 50 Percent, 1980-2017



Source: USDA/NASS

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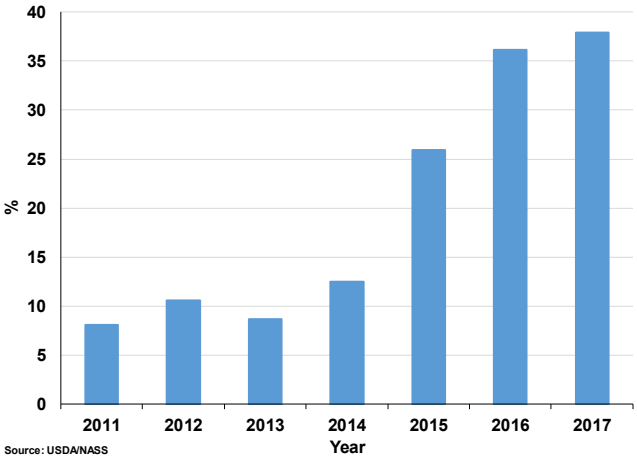
Soybean Row Width of 34.6 Inches or Greater in Arkansas, 2011-2017



Source: USDA/NASS

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Twin-Row Raised-Bed Soybean Production in Mississippi

http://www.mississippi-crops.com/2017/03/28/you-dont-need-to-push-soybean-seeding-rates/

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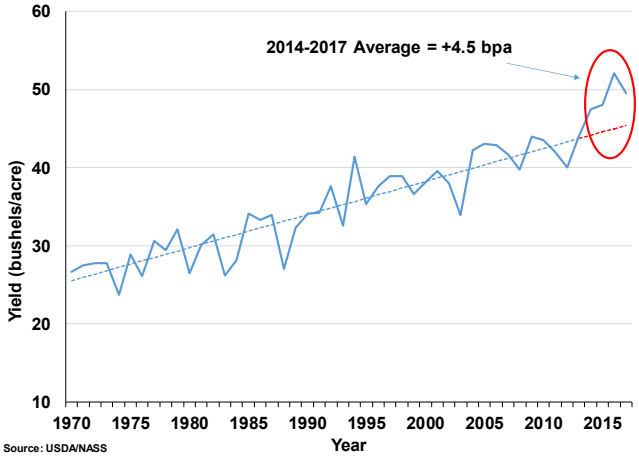
So, What is Up with U.S. Soybean Yields?



Source: USDA/NASS

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