farmdoc DAILY

Department of Agricultural and Consumer Economics, University of Illinois Urbana-Champaign

Have Soybean Yields Increased Relative to Corn Yields in Recent Years?

Gary Schnitkey

Department of Agricultural and Consumer Economics
University of Illinois

May 1, 2018

***farmdoc daily* (8):78**

Recommended citation format: Schnitkey, G. "Have Soybean Yields Increased Relative to Corn Yields in Recent Years?" *farmdoc daily* (8):78, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, May 1, 2018.

Permalink: http://farmdocdaily.illinois.edu/2018/05/soybean-yields-relative-to-corn-yields.html

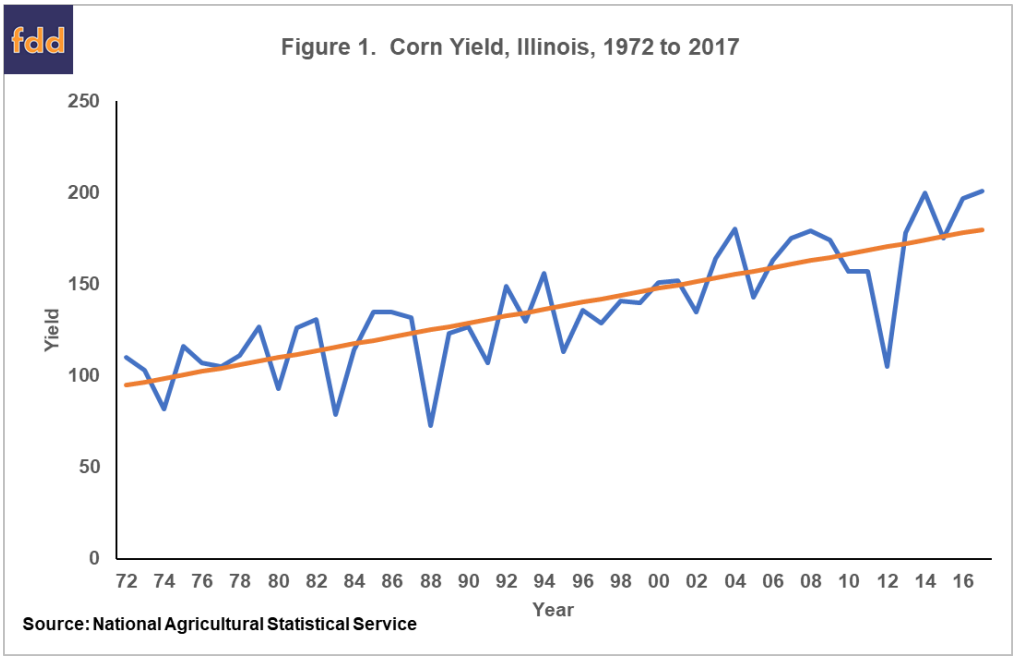
Soybean yields across much of the Corn Belt have been exceptionally high in recent years, leading to the question of whether soybean yields are increasing relative to corn yields. This issue is examined here using state-level corn and soybean yield series for Corn Belt states. When compared to 1972 to 2017 averages, recent high soybean yields have not resulted in high soybean-to-corn yield ratios. There have been mostly stable soybean-to-corn yields in the eastern Corn Belt. Many states in the western Corn Belt have declining soybean yields relative to corn yields.

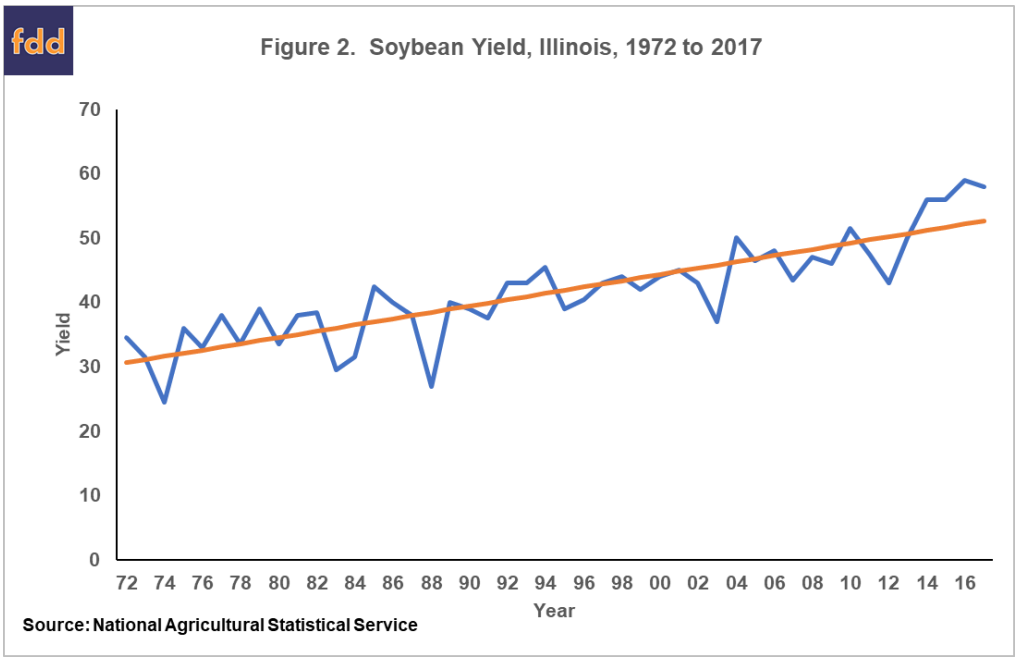
Illinois Analysis

The evaluation of soybean yields relative to corn yields begins with state-level yields for corn and soybeans. These data were obtained from the National Agricultural Statistical Service, an agency of the U.S. Department of Agriculture, through the *Quick Stats* database.

Figure 1 shows state-level corn yields for Illinois from 1972 to 2017. Over this period, corn yields increased an average of 1.9 bushels per year. The 2017 trend yield is found by fitting a line through the 1972-2017 data series and calculating trend yields for each year. The 2017 trend yield represents the expected yield for 2017. If 2017 could be repeated many times, the average of the resulting yields would come close to the 2017 trend yield. The 2017 trend yield is 179.8 bushels per acre. The 2017 yield was 201 bushels per acre, higher than the trend yield by 21 bushels per acre, and the highest Illinois state yield ever, besting the previous record yield of 200 bushels per acre set in 2014. Yields in recent years have been exceptional in Illinois, with yields exceeding trend by over 20 bushels in both 2016 (197 bushels per acre) and 2017.

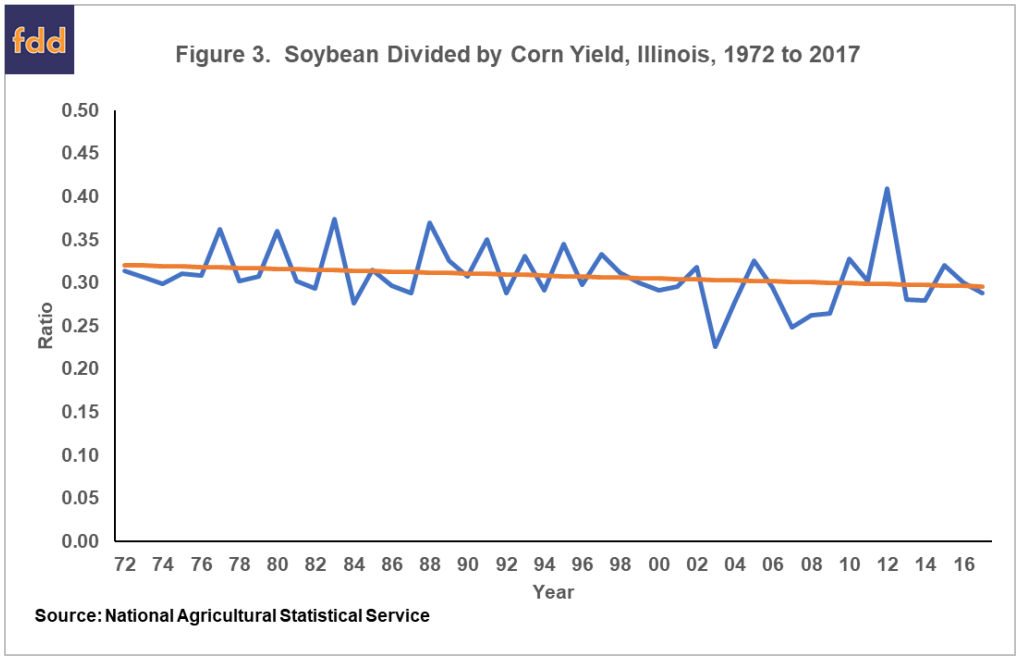
On average, soybean yields increased by .49 bushels per year from 1972 to 2017. The 2017 trend yield was 52.6 bushels per acre, with the actual 2017 yield being 58 bushels per acre. Soybeans were well above trend in each year since 2014. The 2014 yield was 56 bushels per acre (4.8 bushels above trend), the 2015 yield was 56 bushels per acre (4.3 bushels above trend), the 2016 yield was 59 bushels per acre (a recorded yield and 6.8 bushels above trend), and 2017 was 58 bushels per acre (5.3 bushels above trend). Recent high yields have led some to question whether new technologies and early planting has led to significantly higher soybean yields in Illinois.





To evaluate whether relative yields have changed, soybean yields were divided by corn yields, resulting in soybean-to-corn yield ratios. If these ratios trend up over time, then soybean yields are increasing relative to corn. Conversely, if soybean-to-corn ratios are trending down then soybean yields are decreasing relative to corn yields.

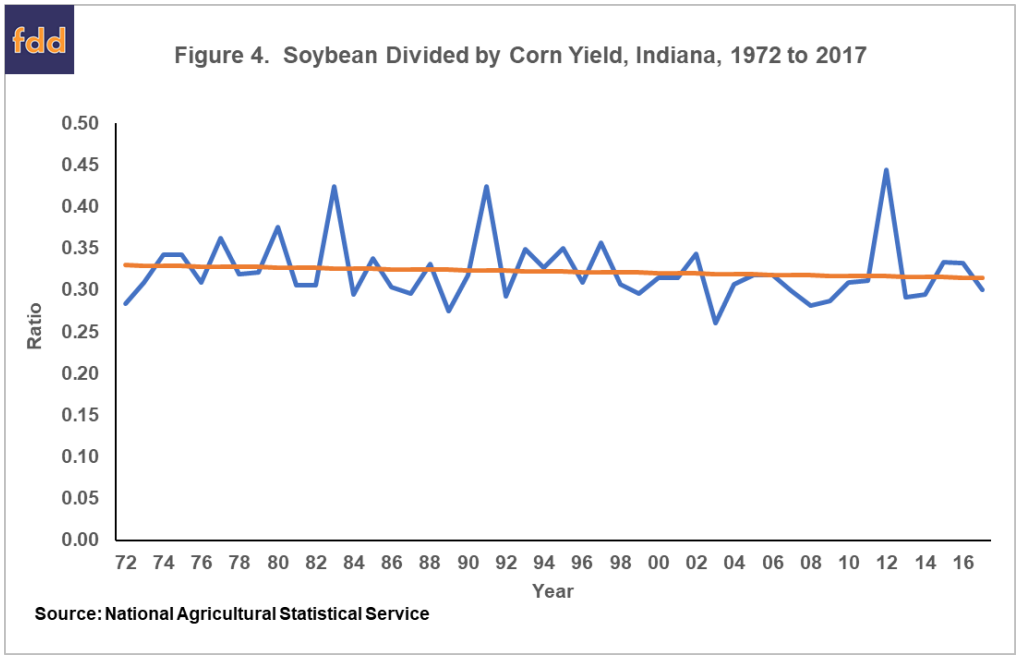
Figure 3 shows soybean-to-corn yield ratios for Illinois, along with a regression line fit through the soybean-to-corn ratios. This is the "best" fitting line through the data and is the orange line in Figure 3. Note that this line has a slightly downward trend; however, the downward trend is not statistically significant, meaning that the downward slope does not add any explanatory power. A straight line through the data would fit the data almost as well as a slightly downward sloping line.



The average soybean-to-corn ratio from 1972-2017 was .31, meaning that soybean yields were 31% of corn yields. In recent years, the soybean-to-corn ratios have been near this average. The soybean-to-corn ratio was .30 in 2016 and .29 in 2017. These recent ratios do not suggest that soybean yields are increasing relative to corn yields. Rather, recent high soybean yields have simply brought soybeans back to even relative to corn for the entire 1972 to 2017 period.

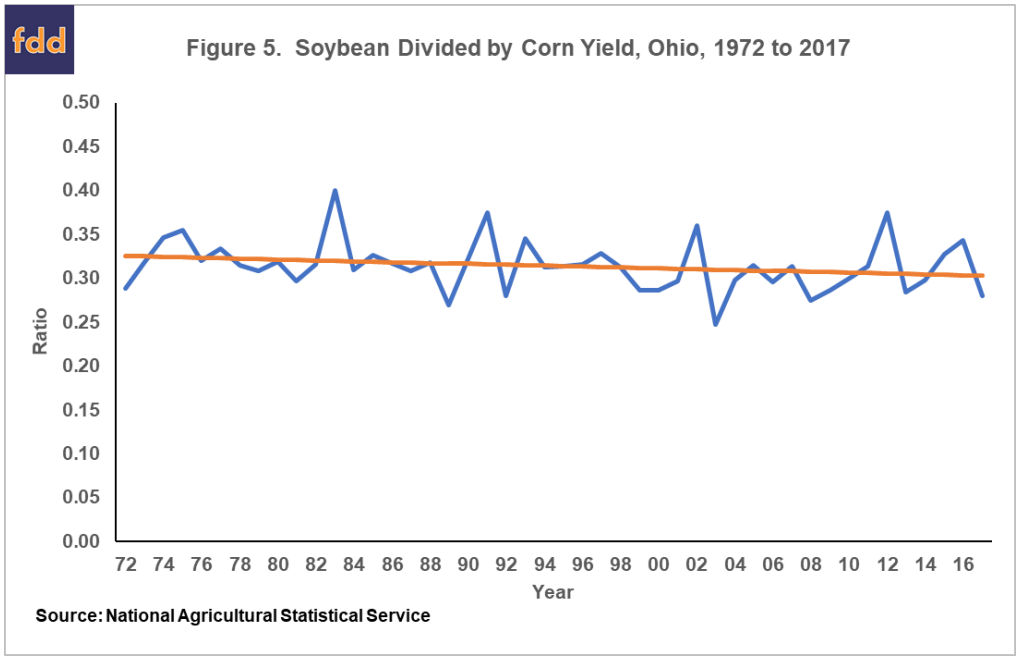
Indiana

An approach similar to that for Illinois was used for other states in the Corn Belt. For Indiana, corn yields increased an average of 1.7 bushels per year and the 2017 trend yield was 168.5 bushels per acre. Soybean yields increased an average of .49 bushels per acre and the 2017 trend yield was 52.5 bushels per acre. From a statistical standpoint, the soybean-to-corn ratio has not exhibited a trend. From 1972 to 2017, the soybean-to-corn ratio averaged .32. The 2017 ratio was above the average age at .33 and the 2017 ratio was below the average at .30. State level data in Indiana do not suggest soybean yields are changed (see Figure 4).



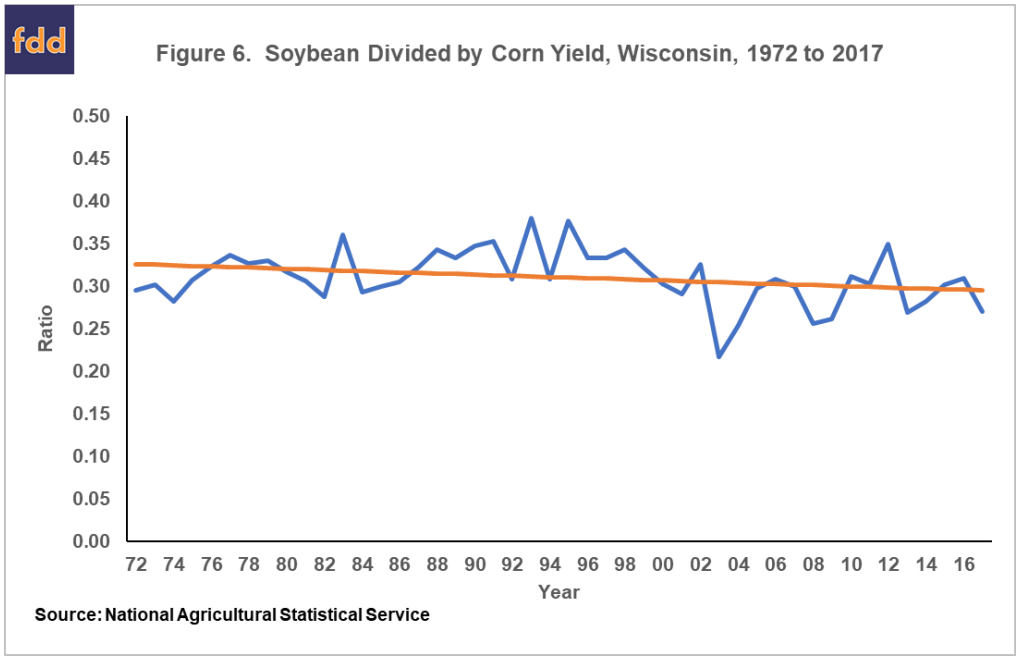
Ohio

Ohio's corn yield increased an average of 1.7 bushels per year and the 2017 trend yield was 164.8 bushels per acre. Soybean yields increased by .47 bushels per year and the 2017 trend yield was 49.8 bushels per acre. Soybean-to-corn yield ratios averaged .31 and did not exhibit a trend up or down.



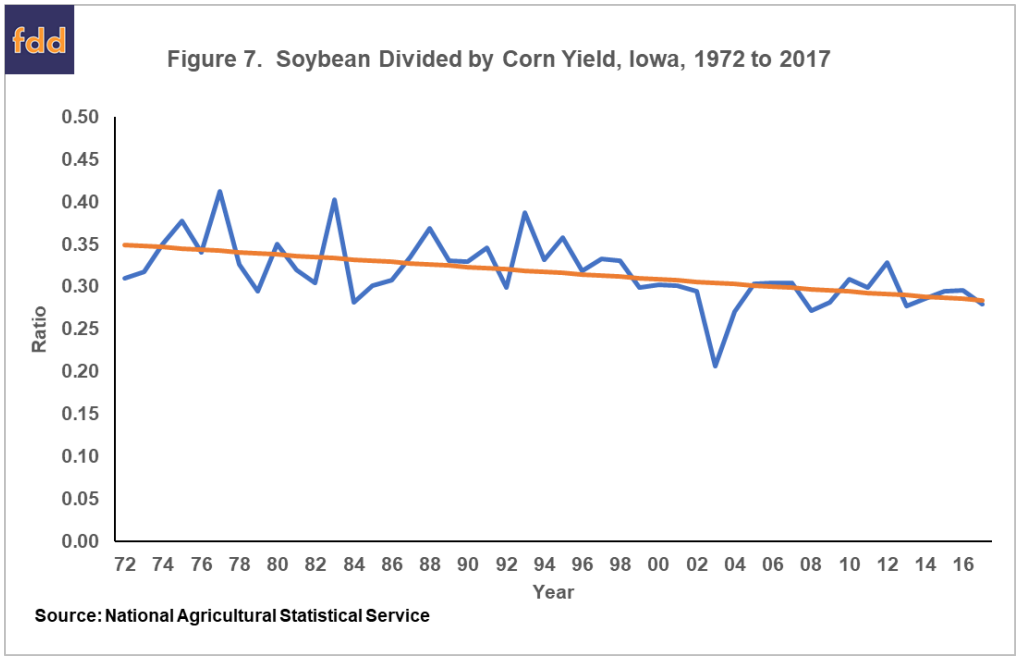
Wisconsin

Wisconsin's corn yields increased by 1.8 bushels per year and the 2017 trend yield was 161.4 bushels per acre. Soybean yields averaged 45 bushel increase per year and the 2017 trend yield was 47.5 bushels per acre. Wisconsin's soybean-to-corn yield ratios did not have a statistically significant downward trend. Over the 1972 to 2017 period, soybean-to-corn yield ratios averaged .31. Soybean-to-corn ratios were .31 in 2016 and .27 in 2017 (see Figure 6).



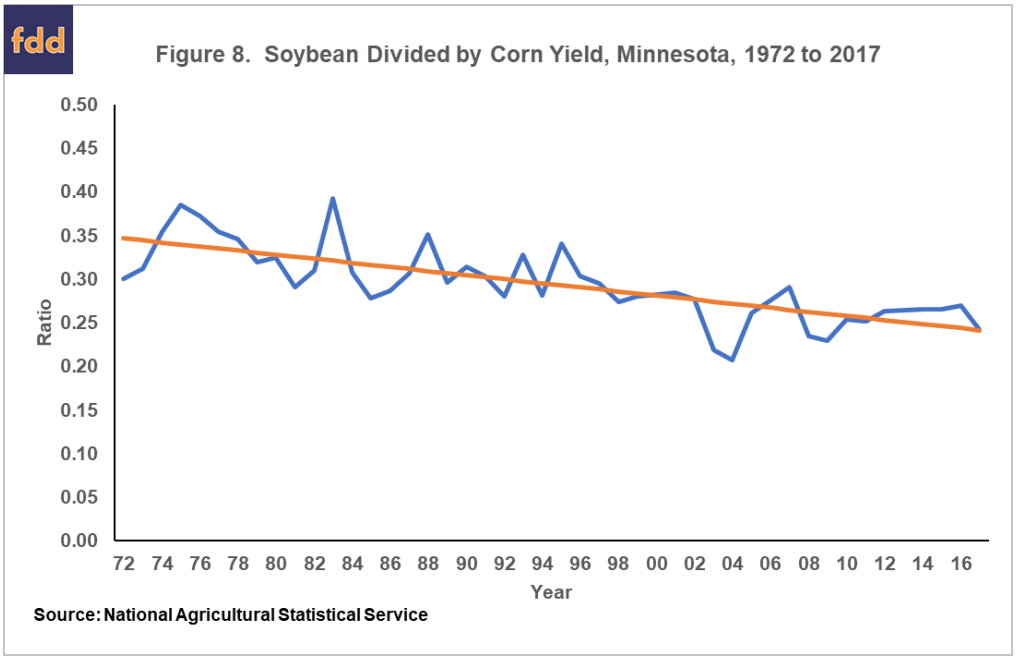
Iowa

Iowa corn yields increased an average of 2.1 bushels per year and the 2017 trend yields was 186.0 bushels per acre. Soybean yields have trended up .48 bushels per year and the 2017 trend yield was 53.6 bushels per acre. Unlike states in the eastern Corn Belt, Iowa's ratio of soybean-to-corn yield ratios has a statistically significant downward trend down over time (see Figure 7). In 2017, the expected soybean-to-corn yield ratio was .28. Actual soybean-to-corn ratios were .30 in 2016 and .28 in 2017.



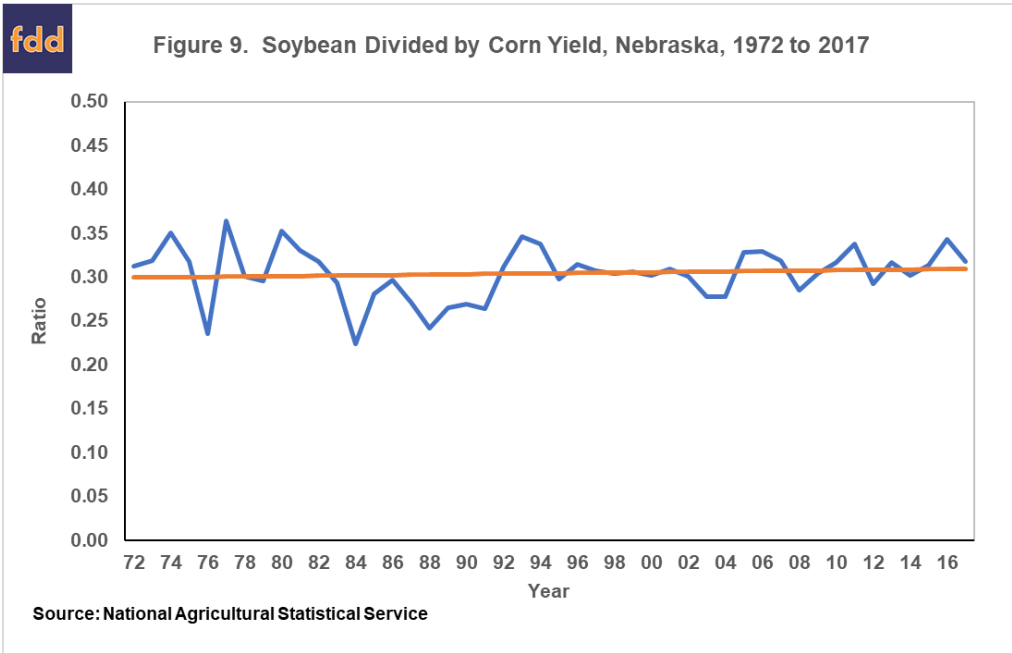
Minnesota

Minnesota's corn yields have increased an average of 2.4 bushels per year and the 2017 trend yield is 182.0 bushels per acre. Soybean yields increased .41 bushels per year and the 2017 soybean yield was 45.9 bushels per acre. Soybean-to-corn yield ratios have trended down (see Figure 8). Over the 1972 to 2017 period, soybean-to-corn ratios averaged .29. The ratio was .27 in 2016 and .24 in 2018.



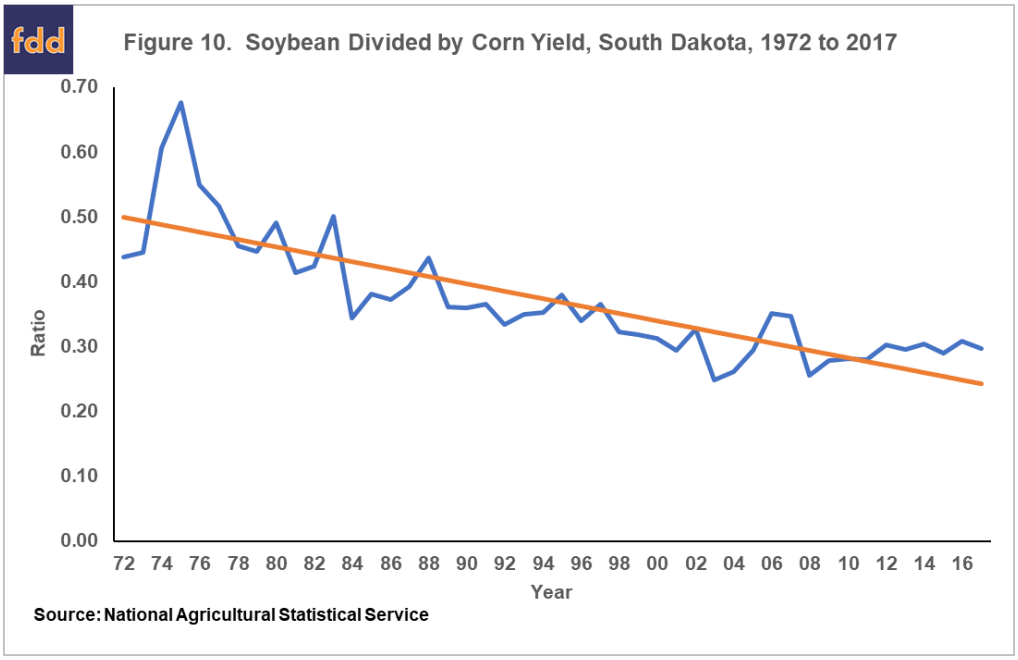
Nebraska

Nebraska's state corn yields increased an average 2.0 bushels per year and the 2017 trend yield was 177.3. Soybean yields increased by .65 bushels per year and the 2017 trend yield was 55.1 bushels per acre. Soybean-to-corn yields ratios did not exhibit trends. The soybean-to-corn yield ratio averaged .30 from 1972 to 2017 (see Figure 9). The soybean-to-corn ratio was .34 in 2016 and .32 in 2017.



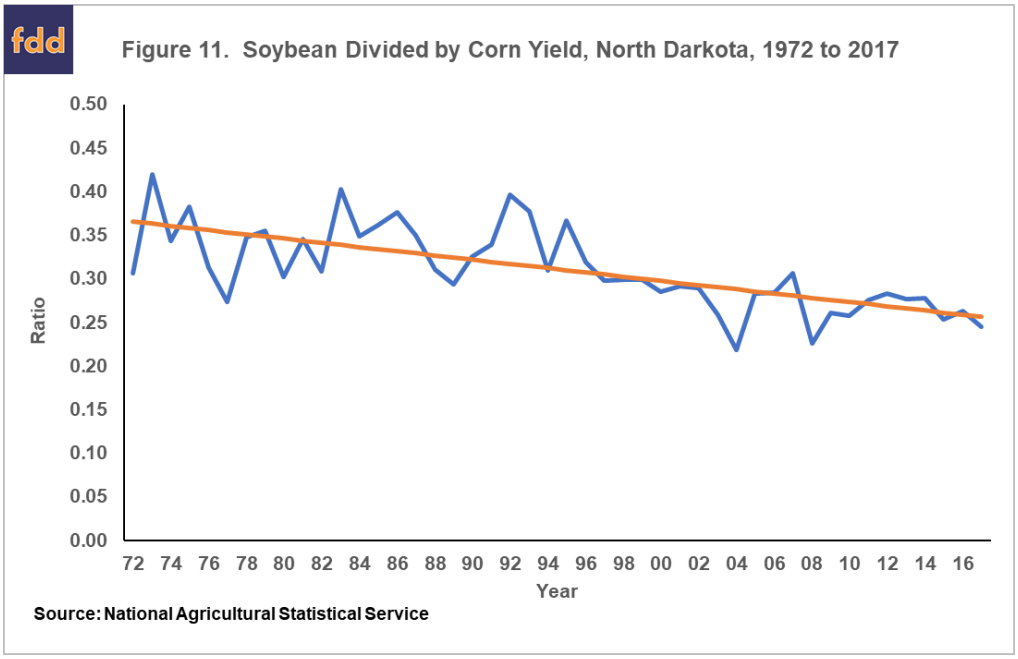
South Dakota

South Dakota's corn yields increased an average of 2.4 bushels per year and the 2017 trend yield was 147.4 bushels per acre. Soybean yields increased an average of .40 bushels per year and the 2017 trend yield was 41.3 bushels per acre. In South Dakota, soybean-to-corn yield ratios trended down from 1972 to 2017 (see Figure 10). For the entire 1972-2016 period, the average soybean-to-corn ratio averaged .37. The ratios were .31 in 2016 and .30 in 2017. The downward trend in yield ratios may have stopped in recent years. Since 2000, the soybean-to-corn yield ratio has been relatively stable at a .29 level.



North Dakota

North Dakota's corn yields have increased an average of 1.9 bushels per year and the 2017 trend yield was 135.5 bushels per acre. Soybean yields increased an average of .34 bushels per year and the 2017 trend yield was 35.5 bushels per acre. Soybean-to-corn yield ratios have trended down over the 1972-2017 period (see Figure 11). Over the entire 1972-2017 time period, soybean-to-corn yield ratios averaged .31. The ratio was .26 in 2016 and .24 in 2018.



Summary

None of the state yield series indicated that soybean-to-corn yields have changed in recent years. There is a marked difference in soybean performance relative to corn performance across the Corn Belt (see Table 1). States in the eastern Corn Belt (Ohio, Indiana, Illinois, and Wisconsin) had stable soybean-to-corn yield ratios across the 1972 to 2017 period. Recent yield ratios were near the 1972-2017 averages. Except for Nebraska, states in the western Corn Belt (Iowa, Minnesota, Nebraska, South Dakota, and North Dakota) had decreasing soybean-to-corn yield ratios. Except for South Dakota, recent yield ratios do not appear to be reducing the yield ratio declines.

Table 1. Average Trends and Soybean-to-Corn Ratios, 1972 to 2017

State	Corn Trend[1]	Soybean Trend[1]	Averaged Soybean-to-Corn Ratio[2]	Statistical Trend in Ratios[3]
Ohio	1.7	0.47	0.31	No
Indiana	1.7	0.49	0.32	No
Illinois	1.9	0.49	0.31	No
Wisconsin	1.8	0.45	0.31	No
Iowa	2.1	0.48	0.32	Yes
Minnesota	2.4	0.41	0.29	No
Nebraska	2.0	0.30	0.30	Yes
South Dakota	2.4	0.40	0.37	Yes
North Dakota	1.9	0.31	0.31	Yes

[1] Average increase in yields from 1972 to 2017.
[2] Average from 1972 to 2017.
[3] Do trends have a statistically trend down.

YouTube Video: Discussion and graphs associated with this article at: https://youtu.be/N-AJAViy3NI