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## Weekly Farm Economics: Corn-to-Soybean Yield Ratios: History and the Future

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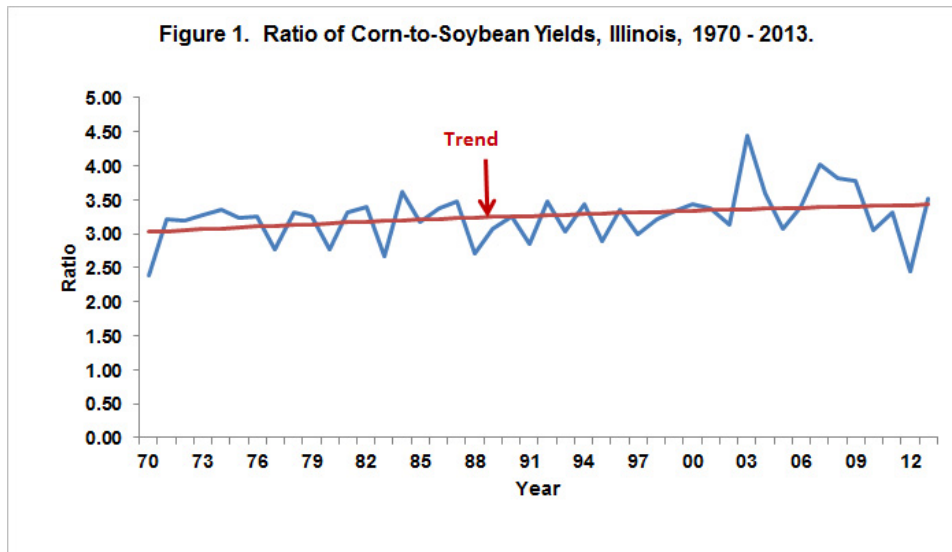
One of the more important factors determining the relative profits between corn and soybeans are relative corn and soybean yields, often measured as the corn-to-soybean yield ratio. Since 1970, the corn-to-soybean ratio in Illinois trended up, with much higher corn-to-soybean ratios during the 2000s. However, 2010 through 2012 yield ratios were considerable below the average for the previous decade. According to the National Agricultural Statistical Service (NASS), Illinois' projected 2013 yields are 165 bushels per acre for corn and 47 bushels per acre for soybeans, giving a corn-to-soybean yield ratio of 3.51 ( $3.51 = 165 \text{ bushel corn yield} / 47 \text{ bushel soybean yield}$ ). This 3.51 ratio is higher than ratios between 2010 and 2012, but below the ratio's average from 2000 to 2009. The 3.51 ratio is above the yield ratio suggested by trends.

### Historic Corn-to-Soybean Yield Ratios

Corn-to-soybean yield ratios have trended upward over time, with considerable variation around the trend (see Figure 1). The corn-to-soybean yield ratio averaged 3.12 during the 1970s, 3.16 during the 1980s, and 3.18 during the 1990s. This increasing yield trend would cause corn profitability to increase relative to soybean profitability, as corn yields increased relative to soybean yields. Obviously, other factors impact profits, either reinforcing or mitigating the impacts of yield trends.

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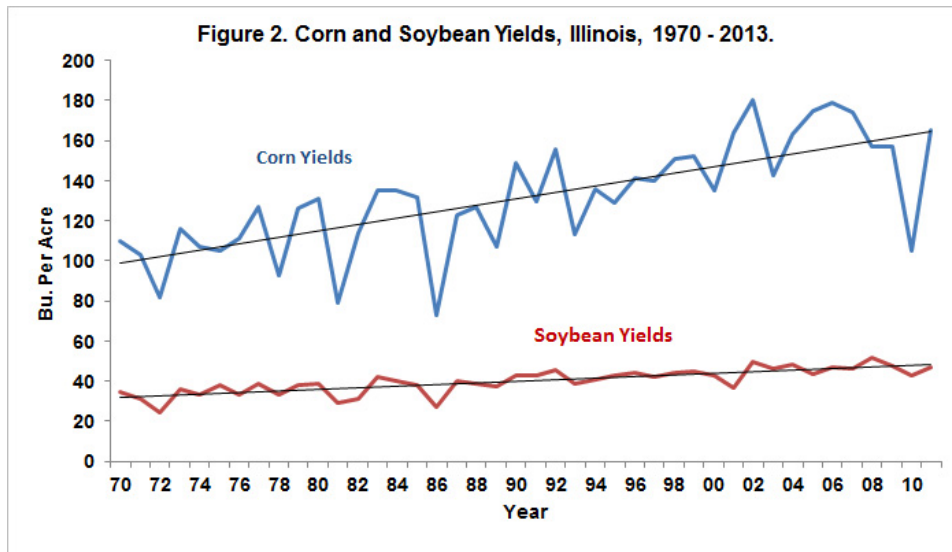
From 2000 to 2009, the corn-to-soybean yield ratio averaged 3.59, much higher than the 3.15 average from 1970 through 1999. The highest ratio occurred in 2003, when the ratio was 4.43. The high 2003 ratio largely is attributed to low soybean yields cause by aphid and other disease and pest issues. Ratios also were high in 2004 with a 3.60 ratio, 2007 with a 4.02 ratio, 2008 with a 3.81 ratio, and 2009 with a 3.78 ratio. These high ratios were associated with high corn yields. Corn yields were above 170 bushels per acre in each of these high ratio years: 180 bushels per acre in 2004, 175 bushels in 2007, 179 in 2008, and 174 in 2009. Since 2009, Illinois' state yield has not been over 170 bushels per acre.

Corn-to-soybean yield ratio between 2010 and 2012 were below the 3.59 average for the 2000s decade. The corn-to-soybean yield ratio was 3.05 in 2010, 3.31 in 2011, and 2.44 in 2012. The 2012 corn-to-soybean yield ratio was the lowest since 1970 (see Figure 1). The low 2012 yield ratio can be attributed to the 2012 drought. Other drought years also had low corn-to-soybean yield ratios: 2.68 in 1983, 2.70 in 1988, and 2.90 in 1995.

The 2013 ratio of 3.51 is higher than in recent years. The 2013 projected corn yield of 165 bushels per acre is higher than the 2010 through 2012 yields and is near the trend yield. The 2013 projected soybean yield of 47 bushels is slightly below the 2010-2012 average of 47.3 bushels.

### Commentary on Yield Ratios

From year-to-year, corn yields have been more variable than soybean yield. In years of the high corn yields, the corn-to-soybean yield ratio tended to be higher. During the 2000s decade, eight of the ten years had corn yields above trend: 2000, 2001, 2003, 2004, 2006, 2007, 2008, and 2009 (see Figure 2). This then contributed to above average corn-to-soybean yield ratios during the decade of the 2000s. Corn yields between 2010 and 2012 were below trend, leading to low corn-to-soybean yield ratios. Corn yields were at their trend yield in 2013, leading to a higher yield ratio than between 2010 and 2012.



In recent years, acreage shifts between corn and soybeans were correlated with changes in corn-to-soybean yield ratios. In the 2000s, corn acres increased in Illinois while soybean acres decreased. In more recent years, corn acres decreased while soybean acres increased. Some of this movement can be contributed to expectations on relative corn and soybean yields.

This then leads to a question: Is the decade of the 2000s a better representation of future relative yields or are more recent years a better representation? Only future observations on yields will definitively answer this question.

A belief in relative stable increases in yields leads to one answer. This belief would indicate that the trend lines in Figures 1 and 2 are relative stable and will continue in the future. This implies that the relative low corn yields in 2010 through 2012 were caused by random events similar to those during the late 1980s and early 1990s. A period of above average yields will follow sometime in the future. Predicting when that may be is difficult and error prone.

A 2014 corn-to-soybean yield ratio can be extrapolated into 2014. This extrapolation gives a 3.43 corn-to-soybean yield ratio. This 3.43 extrapolated ratio is below the 3.59 average for the decade of the 2000s, but it is above the 3.08 average from 2010 to 2013.

### Summary

The low yield ratios from 2010 through 2012 likely understate relative differences between corn and soybean yields. An expectation of a yield ratio between 3.40 and 3.45 seems reasonable for the state of Illinois. Relative yield ratios will vary across the state and across farms, with northern and central Illinois having higher ratios. Hence, farms should adjust expectations based on location and farm results. Realizations of relative yields will impact the relative profitability of corn and soybeans