Comparing NASS and RMA County Yields for Corn

Carl Zulauf

Department of Agricultural, Environmental and Development Economics
Ohio State University

Gary Schnitkey, **Nick Paulson**, **Jonathan Coppess**

Department of Agricultural and Consumer Economics
University of Illinois

Controversy has surrounded determination of ARC-CO (Agriculture Risk Coverage county) yields. One component of this controversy is the difference in the county yields determined by NASS (National Agricultural Statistics Service) and RMA (Risk Management Agency), both U.S. Department of Agriculture units. This yield difference is examined for the 2009-2015 corn crops. While the average NASS-RMA county corn yield difference across counties and years is relatively small, large yield differences are not uncommon for a given county across years and across counties in a given year. A regression analysis finds the absolute difference in yields is statistically larger for counties with higher expected yields, higher yield variability, and a smaller share of planted acres that are insured, but is statistically smaller for counties in Midwest states. These findings are reasonable, but the regression explains only 12% of the variation in the yield differences. Controversy is thus likely to continue since a large difference that cannot be explained will lead to questions about which yield is more accurate and thus whether payments by county commodity and insurance programs are fair.

Data: NASS and RMA yields for counties, as modified by FSA, are available on the FSA website for selected crops for the 2009-2015 crop years. By statute, NASS publishes a harvested acre yield. In contrast, ARC-CO uses a planted acre yield. Thus, FSA must modify the NASS data. To calculate a NASS-based, ARC-CO yield for a county, FSA divides NASS reported production by NASS reported planted acres for all crops except corn, barley, oats, grain sorghum, and wheat. For these 5 crops, FSA modifies the calculation to exclude acres not intended for harvest as grain, such as acres for haying, grazing and silage. Specifically for the 5 crops, FSA divides NASS reported production by (NASS reported harvested acres plus RMA reported unharvested acres).

To calculate a RMA-based, ARC-CO yield for a county, FSA divides RMA reported production by RMA reported planted acres, provided at least 5 yield observations exist for the county and these observations

---

account for more than 25% of FSA reported acres in the county. County planted yields published on the RMA website may not match FSA's RMA-based, ARC-CO yields due to the data selection criteria used by FSA or because the two yields are calculated at different times and thus may be based on different values for county production and planted acres.
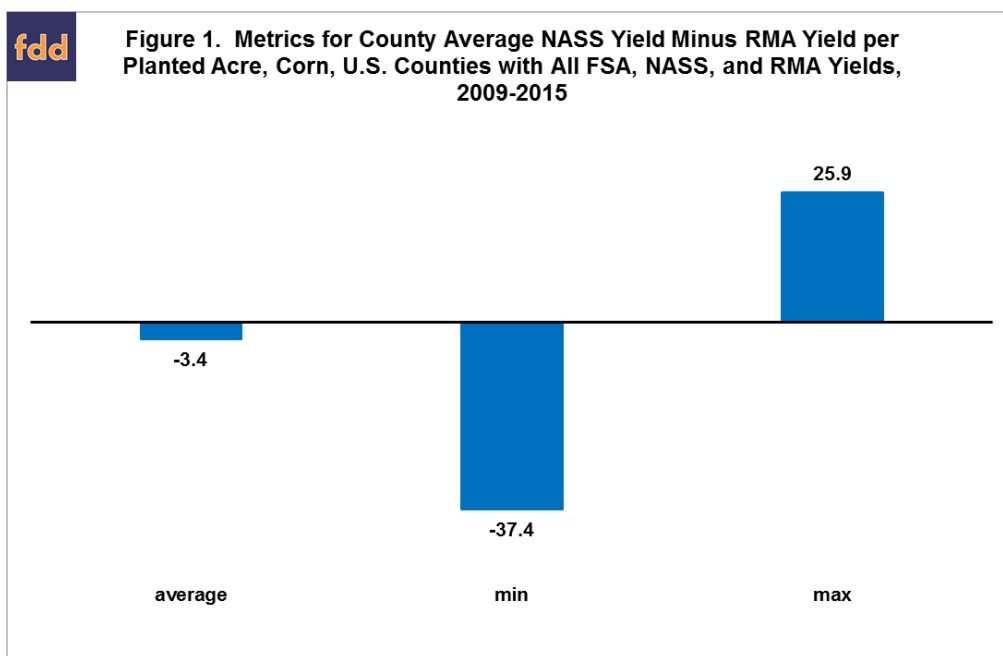
FSA also publishes the yields it used to calculate ARC-CO payments for a county and crop year. See the appendix for a discussion of the process FSA uses to determine these yields.

Availability of NASS and RMA corn yields by county: To maintain consistency, this discussion of availability is limited to counties for which FSA had determined a payment yield for corn for all 7 years from 2009 through 2015. Of these 2,624 counties, 36% had both NASS and RMA yields for all 7 years (see Table 1). Fifteen percent had no NASS and RMA yields for any year. The other 49% had various availability of NASS and RMA yields.

Table 1. Counties with FSA Yield in All Years by NASS and RMA Yield Availability, Corn, U.S., 2009-2015		
	count	share
counties with all NASS and RMA yields	932	36%
counties with all RMA yields but not all NASS yields	743	28%
counties with no NASS yields but some RMA yields	276	11%
counties with some NASS and some RMA yields	170	6%
counties with no RMA yields but some NASS yields	93	4%
counties with all NASS yields but not all RMA yields	16	1%
counties with no NASS and RMA yields	394	15%
TOTAL	2,624	100%

Average NASS-RMA yield difference by county: Across the 932 counties with all FSA, NASS, and RMA yields over 2009-2015; the average NASS-RMA yield difference is 3.4 bushels per planted acre, with RMA yield being larger (see Figure 1). While this difference is relatively small, average NASS-RMA yield difference varies notably across the 932 counties. The range is 63 bushels between the highest and lowest average yield difference [26 – (-37)].

Figure 1. Metrics for County Average NASS Yield Minus RMA Yield per Planted Acre, Corn, U.S. Counties with All FSA, NASS, and RMA Yields, 2009-2015
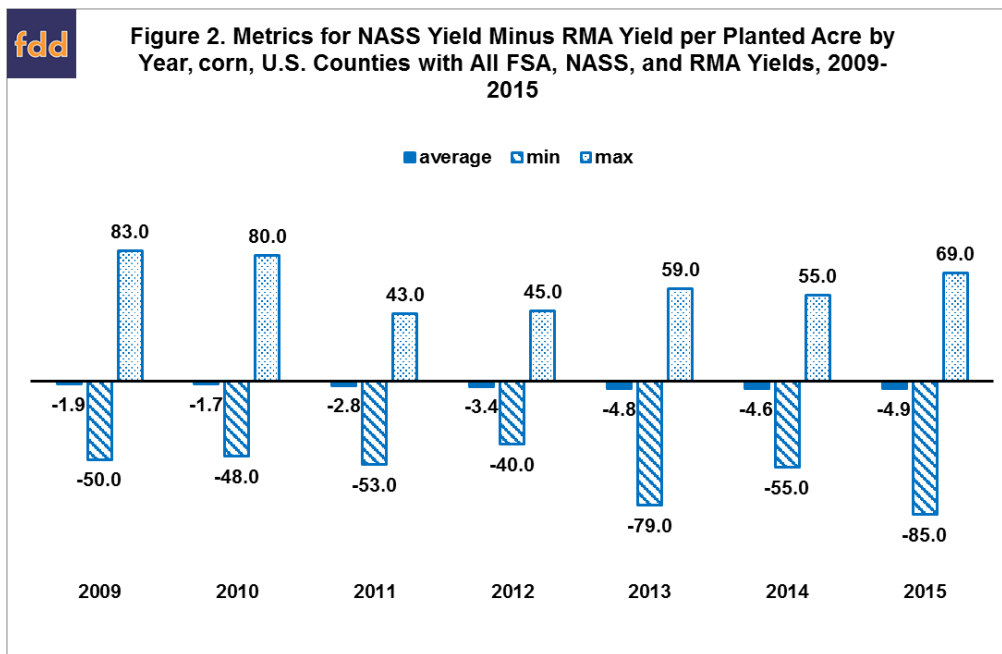
farmdoc daily November 2, 2017

NASS-RMA yield differences are skewed toward negative values (RMA yield is higher than NASS yield). For example, 9% of observations have an RMA yield that is 15 or more bushels higher than the NASS yield compared with 3% of observations having a NASS yield 15 or more bushels higher than the RMA yield (see Table 2). The same skewness exists for the 5 to 14 bushel category.

| Table 2. Distribution of NASS Minus RMA Yields, Individual Year Observations, Counties with all FSA, NASS, and RMA yields, Corn, U.S., 2009-2015		
	count	share
25 or more	69	1%
15 to 24	152	2%
5 to 14	789	12%
-4 to 4	2,607	40%
-5 to - 14	2,278	35%
-15 to - 24	475	7%
-25 or less	154	2%
Total	6,524	100%
NOTE: highest difference is +83; lowest difference is -85		

NASS-RMA yield difference by year: The year-by-year distributions of NASS-RMA yield difference also have a small average difference and a large range (see Figure 2). Minimum difference in each year is at least -40 (2012). Maximum difference is at least +43 (2011). Smallest minimum and largest maximum differences are -85 (2015) and +83 (2009).

Figure 2. Metrics for NASS Yield Minus RMA Yield per Planted Acre by Year, corn, U.S. Counties with All FSA, NASS, and RMA Yields, 2009-2015

Analysis of NASS-RMA yield differences: The large variation in yield difference by county and year prompted a regression analysis to assess whether the variation can be explained. For this analysis, the observations were all county-year combinations for which both a NASS and an RMA yield existed, regardless of whether the 2 yields existed for all years for the county. A broader criterion was used to determine the data set for the regression analysis in order to include all available variation in the analysis. County-year observations totaled 10,409.

NASS-RMA yield difference is measured as an absolute value. Absolute value converts negative yield differences to positive values. This conversion is appropriate when magnitude, not direction, of a

difference is the variable of interest. In this analysis, the difference between NASS and RMA yield is the variable of interest, not which one is larger. Average absolute NASS-RMA yield difference was 9 bushels/planted acre, but many absolute differences are smaller (see Figure 3).

Figure 3. Historgram of Absolute Differences in RMA Minus NASS yields
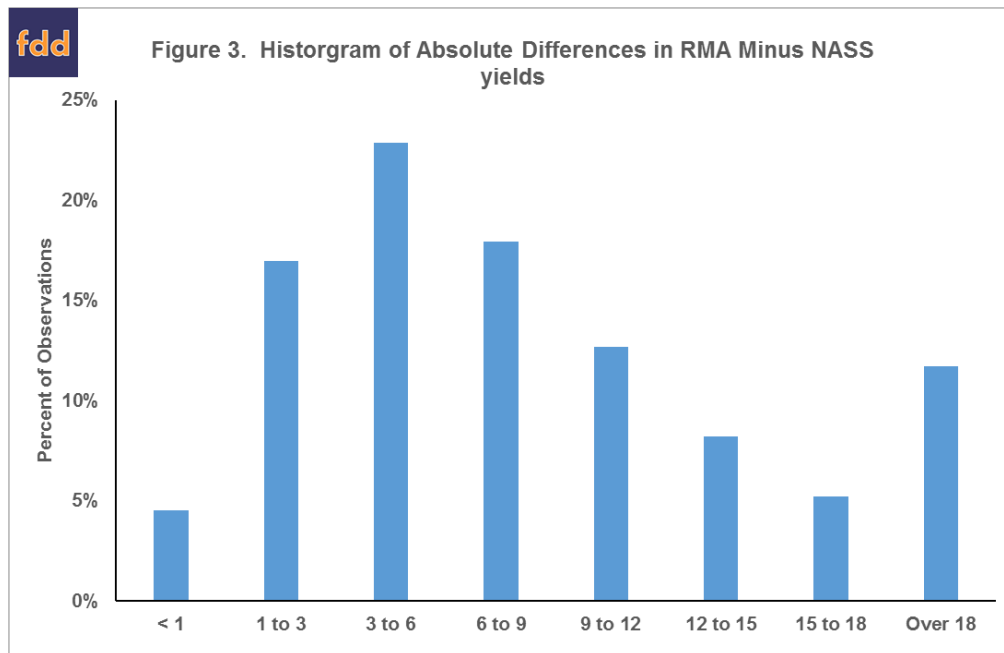
A regression analysis does not explain much of the variability in the absolute difference between NASS and RMA yields. Still there are variables that statistically explained some of the variability. All variables included in the regression equation are shown in Table 3. Variables significant at the 95% level of statistical confidence include:

- Trend yield is calculated for each county using data from 1972 to the present. Counties with higher trend yields had higher absolute NASS-RMA yield differences.

- Standard deviation of trend yields was calculated after detrending NASS county yields from 1972 to the present. This is a commonly-used procedure. Counties with higher yield variability had higher absolute differences.

- NASS harvested acres were divided by NASS planted acres to calculate the share of planted acres harvested for grain. As share of acres harvested for grain approaches 100%, absolute NASS-RMA yield difference declines. Acres of corn harvested for grain can vary from acres planted to corn for several reasons including prevented planting and acres of corn harvested for silage.

- Insured acres as a percent of planted acres equals RMA insured acres divided by NASS planted acres. A higher percent of insured acres is associated with a smaller absolute yield difference.

- Location has an impact. Absolute difference is statistically smaller in (1) Illinois and Iowa, (2) Ohio and Indiana, and (3) Minnesota, Wisconsin, and Michigan.

- NASS-RMA absolute yield differences are higher in 2013, 2014, and 2015. This finding seems reasonable as yield differences are likely to be smaller in some year and larger in others due to factors unique to that year, such as weather.

Somewhat surprisingly, number of acres planted to corn in a county did not impact the absolute yield difference.

The variables included in the regression equation explained 12% of the total variation in NASS-RMA yield difference (R^2 = 12%). Thus, the variables in this regression do not explain 88% of the variation, implying that other factors, including random error, are important.

Table 3. Coefficients for Explanatory Variables of Regression Analysis of Absolute Value of NASS Minus RMA Yield Difference

	value	statistical significance at 95% confidence
Intercept	14.657	
Trend yield for county	0.015	yes
Standard deviation of detrended yield	0.090	yes
Planted acres	0.000	
Harvested acres as a percent of planted acres	-4.362	yes
Insured acres as a percent of planted acres	-6.715	yes
Observation		
in 2010	-1.555	
in 2011	-0.648	
in 2012	-0.375	
in 2013	1.022	yes
in 2014	1.313	yes
in 2015	1.946	yes
County in:		
Illinois, Iowa	-1.276	yes
Ohio, Indiana	-2.348	yes
Minnesota, Wisconsin, Michigan	-1.208	yes
North, South Dakota	-0.410	
Nebraska, Kansas, Oklahoma, Texas	-0.420	

Summary Observations

- Differences between yields published by NASS and RMA are a point of discussion, especially in the context of county yields for the ARC-CO farm program.

- For the 932 counties with all FSA, NASS, and RMA corn yields between 2009 and 2015; RMA yields on average exceed NASS yields by 3.4 bushels. These 932 counties are relatively large corn producing counties.

- A policy proposal by Senators Joni Ernst and Heidi Heitkamp would make RMA yields instead of NASS yields the first choice for calculating ARC-CO yields (see Good).This proposal is likely to increase ARC-CO benchmark yields for the 932 counties noted in the previous bullet point. Their 5-year Olympic average of yields for 2013-2015 average roughly 3 bushels higher on average when RMA instead of FSA yields are used. Whether payments will be higher requires a more complete analysis that considers relative variability of the different yields, interaction between yield and price in ARC's revenue formula, and ARC's 10% per acre cap.

- Use of RMA yields may reduce but is not likely to solve all issues surrounding ARC-CO yields. For example, across the 932 counties that have FSA corn yields in all years from 2009-2015, 26% have no NASS yields while 19% have no RMA yields (see Table 1). The need to consult yields from other sources will continue.

- Moreover, large differences between NASS and RMA yields occur. A regression analysis explains only 12% of the variation in NASS-RMA yield differences. A large difference that cannot be explained will prompt the question, "Which yield is more accurate?" and will likely led to someone feeling slighted.

- Given the previous bullet point, it is important to note that the policy proposal by Senators Ernst and Heitkamp also provides discretion to the FSA state committee to adjust yields to help reduce variation in yields and payments across neighboring counties (see Good).

- Taken as a group, findings of this analysis suggest (1) that large NASS-RMA yield differences will likely remain an issue and (2) that the only way to resolve the issue is to create a single USDA yield that applies to all USDA programs.

Appendix - FSA Procedures for ARC-CO Yields: Determination of ARC-CO's payment rate for a county and crop requires (a) historical yields for the 5 immediate prior crops to calculate the benchmark yield (high and low yields are dropped) and (b) actual yield for the year. According to FSA, approximately 100,000 separate crop/county yields are used across all program commodities in any given year to compute ARC-CO payment rates. To determine ARC-CO county yields, FSA uses the following "cascade" approach:

(1) NASS county data are used if the county data set contained at least 30 observations with yields that account for 25% or more of the acres harvested in the county.

(2) If NASS data are unavailable, RMA county data are used, provided at least 5 yield observations exist for the county and account for more than 25% of FSA reported acreage in the county. RMA provides FSA a data file during late summer in the year following the year the crop is harvested.

(3) If neither NASS nor RMA data are available, yields are determined by FSA State Committees using a variety of sources, including NASS crop reporting district data and extension specialists.

According to FSA, NASS and RMA yield data covered approximately 90% of the base acres on which payments were made for the 2014 and 2015 crops. The remaining payments were based on State Committee determined yields.

References and Data Sources

Good, Keith. "Farm Bill: 'Technical Adjustment,' and 'Tweaks.'" *Farm Policy News*, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, October 31, 2017. http://farmpolicynews.illinois.edu/2017/10/farm-bill-technical-adjustments-tweaks/

U.S. Department of Agriculture, Farm Service Agency. ARC/PLC Program Data. "Agriculture Risk Coverage (ARC) County Yields: Background Information for Use of the Detailed ARC-CO Yield File." October 2017. https://www.fsa.usda.gov

U.S. Department of Agriculture, Farm Service Agency. ARC/PLC Program Data. "Detailed ARC-CO NASS and RMA County Yields – 2009 -2015 – for Soybeans, Corn, and Wheat." October 2017. https://www.fsa.usda.gov

U.S. Department of Agriculture, National Agricultural Statistical Service. *Quick Stats*. October 2017. https:///quickstats.nass.usda.gov

U.S. Department of Agriculture, Risk Management Agency. Summary of Business. October 2017. http://www.rma.usda.gov