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2009 Final Corn and Soybean Yield Forecasts

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The purpose of this brief is to update our previous evaluation of yield potential for corn and soybeans in Illinois, Indiana, and Iowa in 2009. (Irwin, Good, and Tannura, August 2009c,d). This update makes use of a crop weather model that estimates the impact of technology (trend), state average monthly weather variables, and portion of the crop planted late on state average yield. Previously, that model was used to evaluate 2009 yield potential based on planting progress, state average precipitation through July 2009, and alternative 2009 August weather scenarios. This update incorporates preliminary state average precipitation and temperature for August, the final month used in the model.¹ The yield forecasts for the three states are then used to project the U.S. average yield. Trend yields for 2009 for each of the three states and the U.S. are also presented. It should be noted at the outset that average July temperatures for 2009 were well below the coldest July in the sample of historical observations used to estimate the crop weather model. In addition August temperatures were at the low end of historical experience. These conditions

may reduce the ability of the model to accurately reflect the impact of July and August 2009 temperatures on yield potential.

In addition to yield projections based on the crop weather model, U.S. yield projections are made based on a crop condition model that regresses time (trend), the percent of the crop planted after May 20th for corn and after May 30th for soybeans, and the sum of the percentage of the crop rated good or excellent by the USDA in the final *Crop Progress* report of the season over 1986-2008 on U.S. average yields. The corn model is specified as:

$$\begin{aligned} \text{U.S. corn yield} = & 66.3855 + 2.2851 \\ & \times \text{Time} - 0.179 \times \text{percent planted} \\ & \text{after May 20}^{\text{th}} + 0.6207 \times \text{percent} \\ & \text{rated good or excellent} \end{aligned}$$

The soybean model is specified as:

$$\begin{aligned} \text{U.S. soybean yield} = & 21.5971 + \\ & 0.4239 \times \text{Time} - 0.0068 \times \text{percent} \\ & \text{planted after May 30}^{\text{th}} + 0.1912 \times \\ & \text{percent rated good or excellent} \end{aligned}$$

¹ All monthly weather observations were obtained from the National Climatic Data Center (<http://www.ncdc.noaa.gov/oa/ncdc.html>). The values are preliminary and are not finalized by the NCDC for one to two years after release. The observations will change once final data are analyzed.

This model explained 97 percent of the variation in U.S. average corn yields and 92 percent of the variation in U.S. average soybean yields over 1986-2008. Alternative yield projections using this model are made based on crop condition

ratings as of September 6 and alternative condition ratings at the end of the season.

Finally, alternative U.S. yield forecasts are used to project the potential size of the 2009 corn harvest based on the USDA's forecast of acreage harvested for grain in the September *Crop Production* report. That report indicated that 80.007 million acres of corn grain and 76.767 million acres of soybeans will be harvested in 2009.

Results of the alternative yield and production forecasts are presented in Tables 1 and 2. Actual yields and the 2009 trend yield calculation for each state are presented in Figures 1 and 2. In addition, the estimated impact of the late planting variable and the impact of each of the weather variables to date on the deviation from the 2009 trend yield in each of the three states are presented in Figures 3 and 4.

Both the corn and soybean yield forecasts based on the crop weather model are substantially higher than the forecast made last month based on the assumption of average August weather and marginally lower than the forecast made based on the assumption of good August weather. This follows from the results in Figures 3 and 4, illustrating the positive impact of August precipitation and temperature on yield prospects for both crops.

In Table 2, yield forecasts are made using the crop condition models and USDA crop condition ratings as of September 6, 2009. As of that date 69 percent of the corn crop and 68 percent of the soybean crop was rated in good or excellent condition. Alternative forecasts based on the crop condition model are not made since substantial changes in crop ratings are not anticipated in future reports.

The two models result in a wide range in the U.S. yield forecasts for corn. The forecast based on the crop weather model is much higher than the forecast from the crop

condition model. The yield forecasts from the two models are very similar for soybeans.

U.S. corn yield forecasts range from 158.8 to 170.2 bushels. As a result, production forecasts are also in a wide range, from 12.705 billion to 13.621 billion bushels. The average yield forecast of the two models is 164.5 bushels, suggesting production potential of 13.163 billion bushels. By comparison, the USDA's September *Crop Production* report forecast the 2009 yield at 161.9 bushels and production at 12.955 billion bushels.

U.S. soybean yield forecasts range from 44.6 to 45.2 bushels, suggesting production between 3.422 billion and 3.466 billion bushels. The average yield forecast of the two models is 44.9 bushels, pointing to a crop of 3.444 billion bushels. By comparison, the USDA's September *Crop Production* report forecast the 2009 yield at 42.3 bushels and production at 3.245 billion bushels.

Formal estimates of the uncertainty in both the crop weather model and the crop condition model forecasts are also provided in Tables 1 and 2. The standard errors are based on an out-of-sample simulation of forecast errors over 1990-2008. In essence, the same procedures used here to generate the forecasts of U.S. corn and soybean yield for 2009 were applied to each of the previous 19 years. The resulting series of forecast errors were then used to compute the forecast standard errors. For the crop weather models those forecast errors are estimated to be 10.7 bushels (6.3%) for corn and 4.1 bushels (9.1%) for soybeans. A one-standard error range based on this estimate is 159.6 to 180.9 bushels for corn and 41.1 to 49.2 bushels for soybeans.² For the crop condition model

² More technically, a one-standard error range should contain the actual yield about two-thirds of the time.

those forecast errors are estimated to be 6.4 bushels (4.0%) for corn and 1.9 bushels (4.3%) for soybeans. A one-standard error range based on this estimate is 152.3 to 165.2 bushels for corn and 42.7 to 46.4 bushels for soybeans.

uncertainty in USDA September yield forecasts is similar to that of the models. The standard errors of USDA September corn and soybean yield forecasts over 1990-2008 were 5.0% and 5.6%, respectively.

While there is still a considerable amount of uncertainty in model forecasts, the

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Table 1. Trend and Crop Weather Model Forecasts of 2009 Corn and Soybean Yield in Illinois, Indiana, Iowa, and 2009 U.S. Corn and Soybean Yield and Production

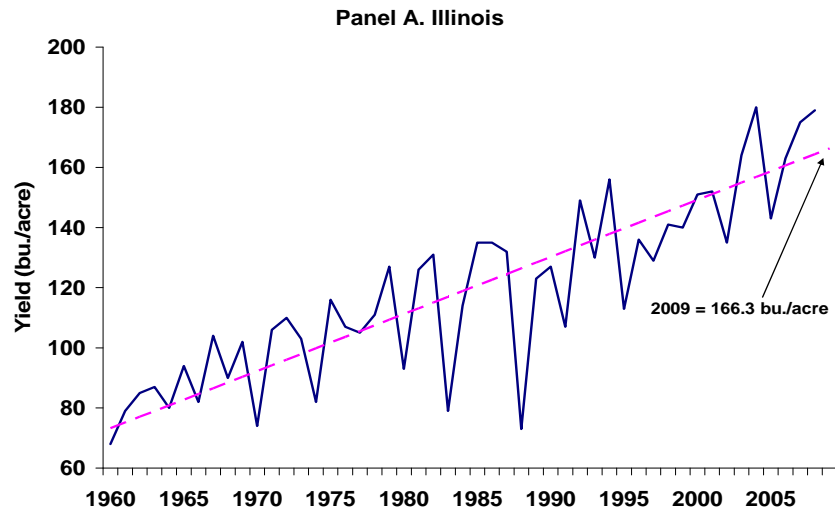
	Corn		Soybeans	
	Trend Model	Weather Model	Trend Model	Weather Model
Panel A. State Yield Forecasts				
Illinois (bu./acre)	166.3	178.0	47.4	48.9
Indiana (bu./acre)	156.8	170.6	47.4	48.8
Iowa (bu./acre)	167.9	201.0	50.0	57.4
3-State Average (bu./acre)	NA	186.6	NA	52.3
Panel B. U.S. Forecasts				
Yield (bu./acre)	154.9	170.2	42.2	45.2
Standard Error (bu./acre)	NA	10.7	NA	4.1
One Standard Error Range (bu./acre)	NA	159.6-180.9	NA	41.1-49.2
Production (mil.bu.)	12,389	13,621	3,240	3,466
Standard Error (mil.bu.)	NA	853	NA	311
One Standard Error Range (mil. bu)	NA	12,768-14,474	NA	3,155-3,777

Notes: NA denotes 'not applicable.' See MOBR 09-01 and MOBR 09-02 for a detailed explanation of each state yield forecast. The 3-state average forecasts are weighted by harvested acreage for each state as reported in USDA's September 2009 *Crop Production* report. U.S. corn and soybean production forecasts for 2009 assume 80.0 and 76.8 million harvested acres, respectively. These estimates also were drawn from USDA's September 2009 *Crop Production* report.

Table 2. Alternative Crop Conditions Model Forecasts of 2009 U.S. Corn and Soybean Yield and Production

	September 6th Ratings	
	Corn	Soybeans
Yield (bu./acre)	158.8	44.6
Standard Error (bu./acre)	6.4	1.9
One Standard Error Range (bu./acre)	152.3-165.2	42.7-46.4
Production (mil.bu.)	12,705	3,422
Standard Error (mil.bu.)	516	143
One Standard Error Range (mil. bu)	12,189-13,220	3,278-3,565

Notes: U.S. corn and soybean production forecasts for 2009 assume 80.0 and 76.8 million planted and 80.1 million harvested acres, respectively. These estimates are drawn from USDA's September 2009 *Crop Production* report.



September 6th Ratings

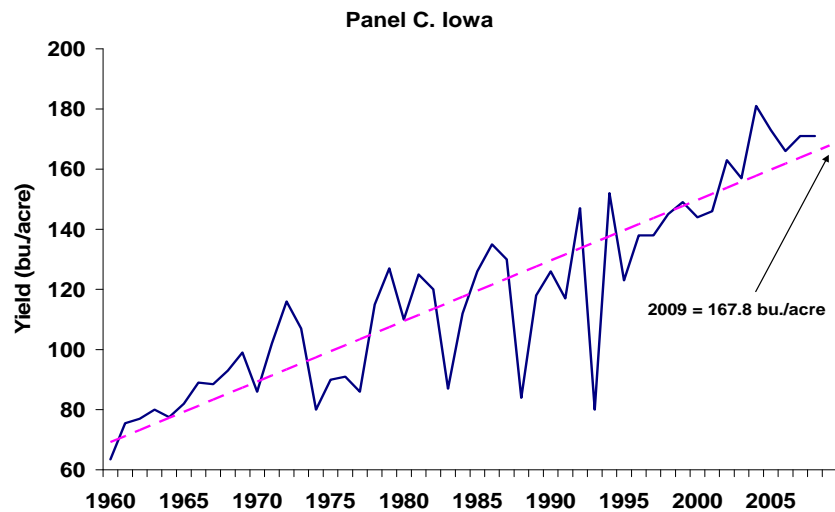
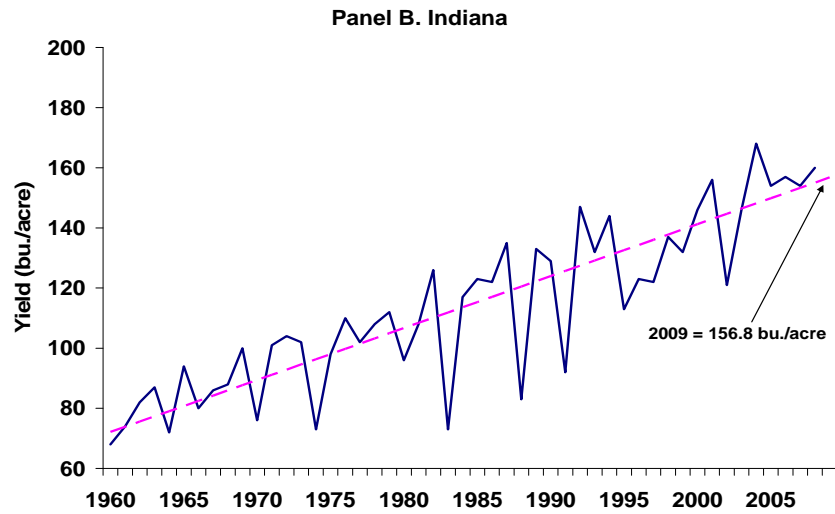


Figure 1. Actual and Trend Corn Yield in Illinois, Indiana, and Iowa, 1960-2008

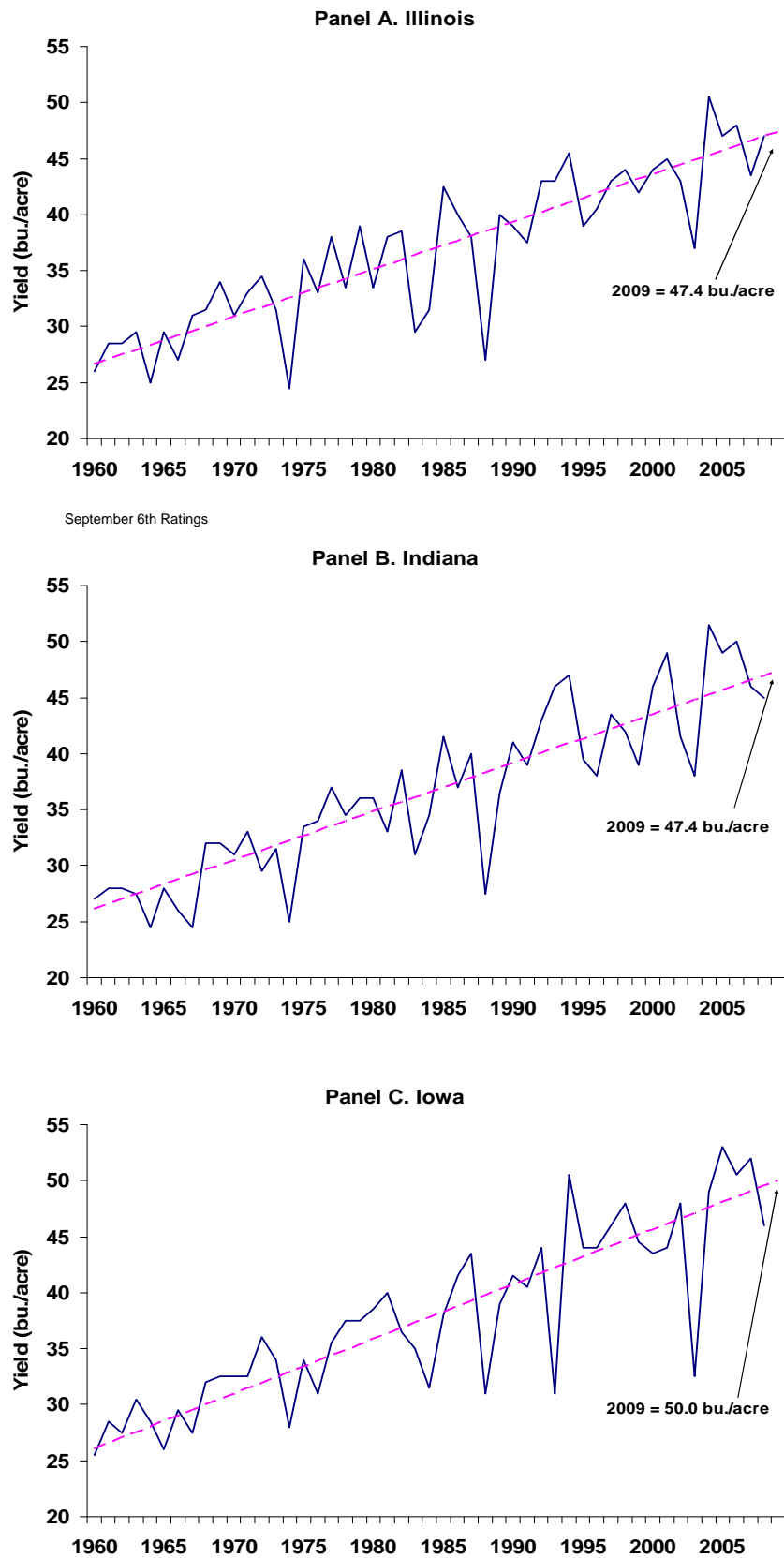
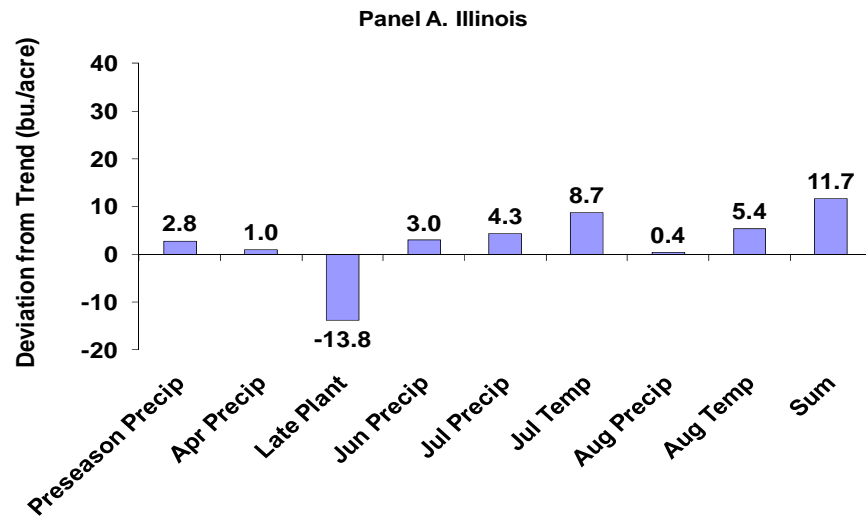


Figure 2. Actual and Trend Soybean Yield in Illinois, Indiana, and Iowa, 1960-2008



September 6th Ratings

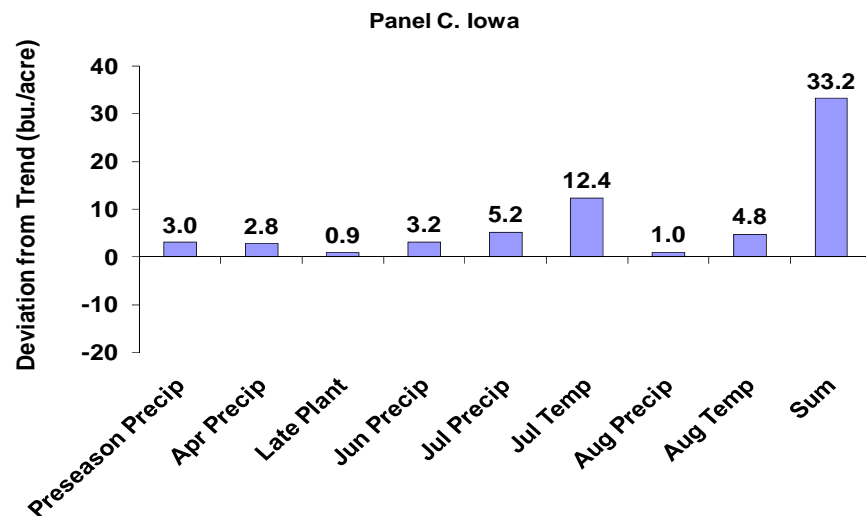
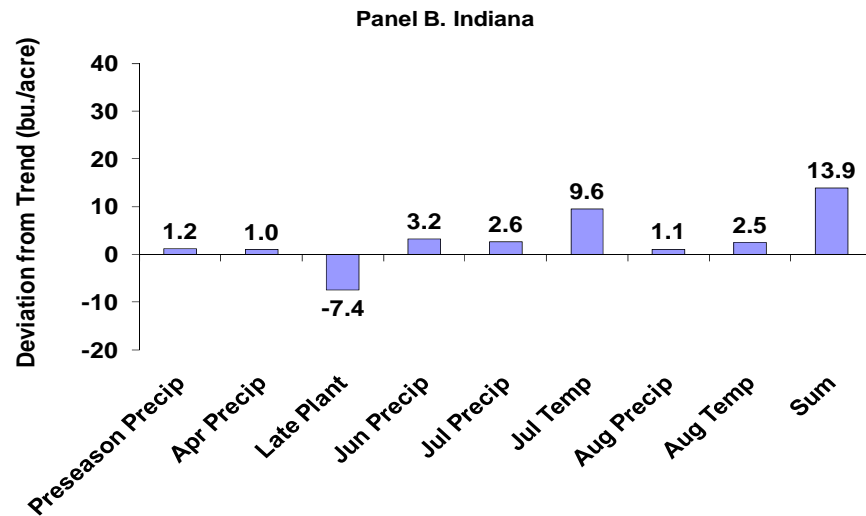


Figure 3. Estimated Impact of Monthly Weather and Late Planting Variables on Deviation from Trend Corn Yield in Illinois, Indiana, and Iowa in 2009

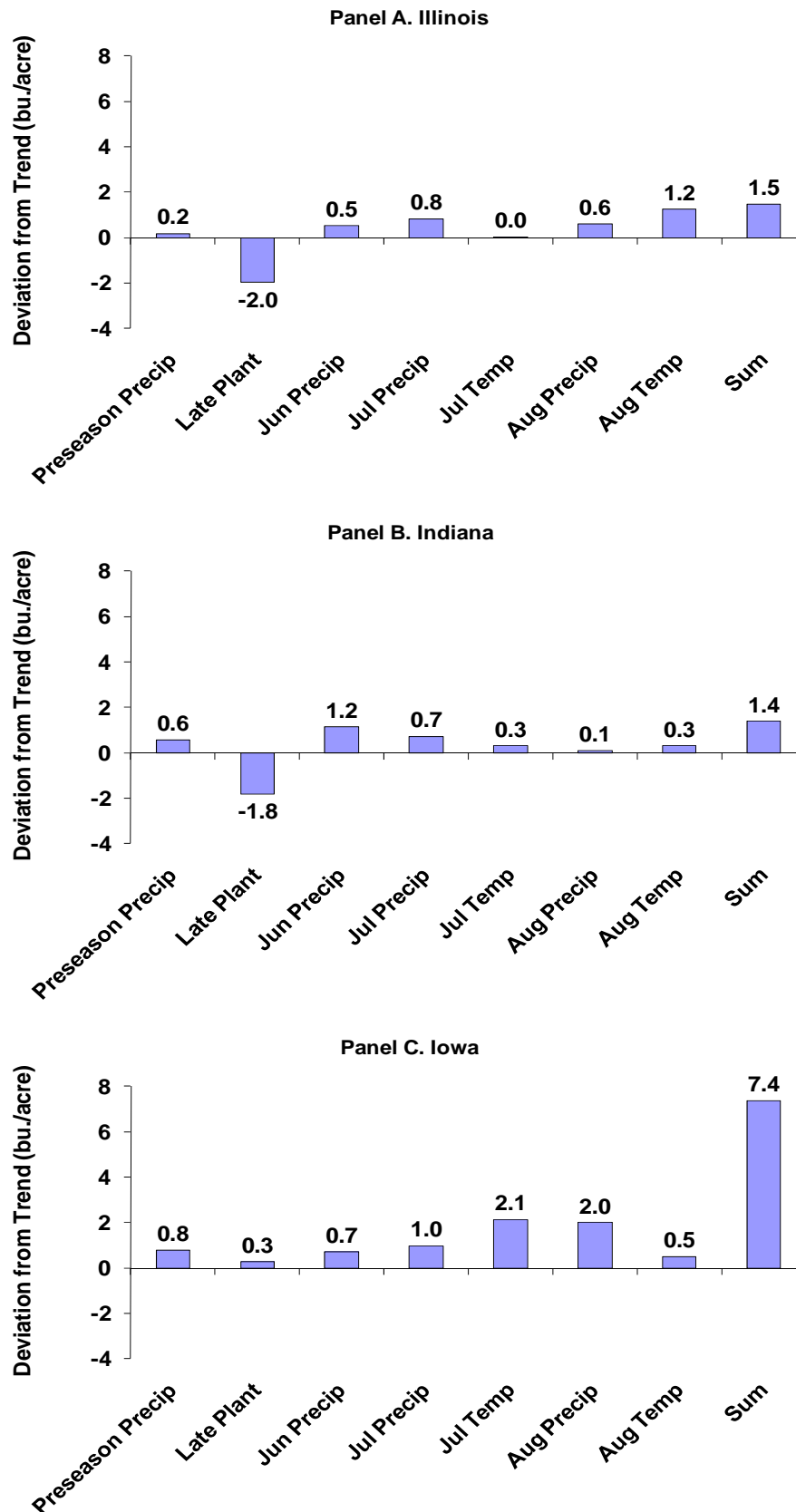


Figure 4. Estimated Impact of Monthly Weather and Late Planting Variables on Deviation from Trend Soybean Yield in Illinois, Indiana, and Iowa in 2009