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The Crop Acreage Puzzle Revisited—With Implications for 2016

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Each year the USDA estimates the acreage of principal crops in the U.S. It can be a challenging exercise to understand the relatively large year-to-year variation in this acreage. In previous *farmdoc daily* articles ([April 4, 2014](#); [April 9, 2014](#); [April 2, 2015](#)), we have outlined the process of accounting for annual variations in the estimates of total U.S. crop land acreage, concluding that it is difficult to explain all the variation in total acreage from year-to-year. Last week's release of the USDA's [Crop Production 2015 Summary](#) report allows for another look at that accounting process. The 2015 crop acreage data also provides the starting point for forming expectations about principal crop acreage in 2016.

The acreage accounting process is summarized in Table 1. The process starts with the total acreage of principal crops presented in column 2. As [identified by the USDA](#):

Table 1. U.S. Principal Crops, Conservation Reserve Program (CRP), Prevented Plantings, and Double Cropped Acreage--million acres

Year	Principal	CRP*	Prevented	Double	Total
2007	320.4	36.8	1.6	5.2	353.6
2008	325.6	34.6	1.7	6.8	355.1
2009	319.0	33.7	4.2	4.6	352.3
2010	315.4	31.2	6.9	2.3	351.2
2011	314.3	31.2	9.6	4.5	350.6
2012	324.3	29.7	1.2	5.4	349.8
2013	324.9	27.0	8.3	7.7	352.6
2014	326.4	25.6	4.4	5.9	350.9
2015	318.5	24.2	6.7	5.0	344.4

* Enrolled as of October 31 in the previous calendar year

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“...principal crops include planted acres of corn, sorghum, oats, barley, rye, winter wheat, durum wheat, other spring wheat, rice, soybeans, peanuts, sunflower, cotton, dry edible beans, potatoes, canola, proso millet, and sugarbeets as well as harvested acreage for hay, tobacco, and sugarcane. The total should also include double-cropped acres and unharvested acreage of small grains planted as cover crops.” [p. 7]

For the period 2007 through 2015, that principal crop total varied by 12.1 million acres, ranging from 314.3 to 326.4 million acres. The decline in that total from 2014 to 2015 was 7.9 million acres. A summary of some of the larger acreage changes by crop and by state in 2015 are presented in Table 2. Acreage of sorghum, oats, rye, peanuts, sunflowers, and dry edible peas increased from 2014 to 2015 by a total of about 2.5 million acres. Corn acreage was down about 2.6 million acres, wheat acreage was off by 2.2 million acres, cotton acreage declined by about 2.5 million acres, and harvested acreage of hay was down by 2.6 million acres. Acreage of soybeans and rice also declined modestly. In total, acreage of these six crops declined by about 10.8 million acres. The decline in crop acreage was spread across a number of states, with the largest declines in Missouri (2 million acres) and Texas (1.9) million acres. Prevented acreage totaled 1.7 million acres and 0.8 million acres in those two states, respectively, and explains nearly all of the decline in principal crop acreage in Missouri and about half in Texas. Acreage of principal crops increased marginally in Kansas, Minnesota, Nebraska, North Dakota, and South Dakota.

Table 2. Change in Principal Crop Acreage from 2014 to 2015, by Crop and State---million acres

Crop	State		
Hay	-2.625	Missouri	-2.013
Corn	-2.598	Texas	-1.870
Cotton	-2.457	Oklahoma	-0.665
Wheat	-2.197	Montana	-0.636
Soybeans	-0.626	California	-0.418
Rice	-0.340	Illinois	-0.409
Rye	0.135	North Carolina	-0.319
Dry edible peas	0.208	Arkansas	-0.351
Peanuts	0.272	Indiana	-0.295
Sunflower	0.294	Washington	-0.246
Oats	0.335	Tennessee	-0.229
Sorghum	1.321	Iowa	-0.221

Part of the variation in the estimates of acreage of principal crops from year-to-year is thought to be associated with the varying amount of acreage enrolled in the Conservation Reserve Program (CRP), so that acreage is added to the total in column 2. Those annual totals are presented in column 3 and reflect acreage enrolled as of October 31 in the previous calendar year ([as reported by the USDA's Farm Service Agency \(FSA\)](#)). Enrollment has steadily declined from 36.8 million acres in 2007 to 24.2 million acres in 2015. A second factor that is thought to contribute to the variation in the acreage of principal crops is the variation in the amount of prevented acres ([also reported by the FSA](#)). Since 2007, that total has ranged from 1.2 million acres to 9.6 million acres. That acreage in column 4 is also added to the total in column 2.

Finally, total acreage of principal crops may vary due to the variation in the amount of double-cropped acreage. The predominant double-cropping is soybeans following the winter wheat harvest. While the USDA does not make official estimates of double-cropping of soybeans, some data on the percentage of soybean acres which are planted following another crop are provided for selected states and the U.S. in the annual USDA [Acreage](#) report released in June. The USDA [2015 Acreage](#) report describes those estimates as follows:

"Data as obtained from area frame samples. These data do not represent official estimates of the Agricultural Statistics Board but provide raw data as obtained from survey respondents. The purpose of these data is to portray trends in soybean production practices" [p. 16].

Here we treat those data as official estimates for analysis purposes and apply the U.S. percentage to the estimate of total soybean acreage planted. The resulting estimate of double-cropped soybean acreage in column 5 is subtracted from the totals in column 2.

The net result of adding principal crop acres, CRP acres, and prevented plant acres and then subtracting double-cropped acres is an estimate of total crop land acres. The expectation is that the total would be generally consistent from year-to-year after accounting for some price effect. That total is shown in the last column in Table 1. From 2007 through 2014 that total was relatively stable and varied only by 5.3 million acres, from 349.8 million to 355.1 million acres. The range was less than half the range in the acreage of principal crops, suggesting that CRP, prevented, and double-cropped acreage explained much of the variation in total acres of principal crops. However, the total declined to 344.4 million acres in 2015, expanding the range in total acreage since 2007 to 10.7 million acres, only marginally less than the 12.1 million acre range for principal crops.

The variation in the calculation of total crop acreage is surprisingly large for the period 2007 through 2015. As indicated in our previous *farmdoc daily* articles on this topic, there may be a number of additional factors contributing to the variation in the estimates of the total acreage of principal crops. One factor might be the impact of price levels on total acreage planted. We have not done a formal analysis of long-term relationships between crop price levels and total acreage, but there may be some impact of the level and direction of new crop prices in the run-up to planting and the magnitude of planted acreage of principal crops plus prevented acres. High and/or increasing prices tend to result in larger acreage and *vice versa*.

A second factor that may contribute to a small part of annual variation in principal crop acreage is that acreage of principal crops includes double counting of acreage of a failed crop that is replanted to a different crop. There may be small variations in that total from year-to-year.

A third factor that may contribute to annual variation is some "noise" in non-principal crop acreage. The CRP acreage used here, for example, is the acreage enrolled in the program as of October 31 in the year prior to spring planting. Actual CRP enrollment may have differed slightly from those estimates in some years. In addition, the proportion of the acreage that came out of the CRP, but was not cropped in the following year may have varied from year-to-year. Additionally, planted acreage of non-principal crops is not included in the acreage shown in Table 1. Acreage of those crops varies some from year-to-year, which could account for a very small part of the differences in total planted acreage from year-to-year. The total acreage may also vary from year-to-year due to issues associated with the estimates of prevented planted acres. Those estimates reflect mandated self-reporting by producers enrolled in federal programs and should be a near-census estimate, but the data may well reflect some level of non-sampling errors. The issue could be similar to when annual [acreage reduction programs](#) were in place. In some years when those programs were in place, the total of planted and set-aside acres did not seem completely logical.

A fourth factor that may explain a significant portion of the annual variation in the total crop land acres is that of sampling error associated with the estimates of planted acreage. The USDA's National Agricultural Statistics Service included the following statements relative to sampling error in the [2015 Acreage](#) report:

"The estimates of planted and harvested acreages in this report are based primarily on surveys conducted the first 2 weeks of June. These surveys are based on a probability area frame survey with a sample of approximately 11,000 segments or parcels of land (average approximately 1 square mile) and a probability sample of over 70,000 farm operators. Enumerators conducting the area survey contact all farmers having operations within the sampled segments of land and account for their operations. From these data, estimates can be calculated. The list survey sample is contacted by mail, internet, telephone, or personal interviews to obtain information on these operations. Responses from the list sample plus data from the area operations that were not on the list to be sampled are combined to provide another estimate of planted and harvested acreages."

"The survey used to make acreage estimates is subject to sampling and non-sampling type errors that are common to all surveys. Both types of errors for major crops generally are between 1.0 and 6.0 percent. Sampling errors represent the variability between estimates that would result if many different samples were surveyed at the same time. Sampling errors cannot be applied directly to the acreage published in this report to determine confidence intervals since the official estimates represent a composite of information from more than a single source. The relative standard errors from the 2015 area frame survey for United States planted acres were: barley 8.9 percent, corn 1.1

percent, Upland cotton 3.4 percent, sorghum 4.8 percent, soybeans 1.1 percent, other spring wheat 3.8 percent, and winter wheat 1.9 percent.” [p. 39]

Similar statements are included in the USDA's annual [Crop Production Summary](#) reports. Since sampling errors of some unknown magnitude may be reflected in estimates of acreage of principal crops, the true value may differ from the point estimates that are published. With a sampling error of as little as two percent, for example, the 95 percent confidence interval for the estimate of acreage of principal crops would be 6.0 to 6.5 million acres. The presence of sampling errors in the estimates of planted acreage and planting intentions means that one should be cautious in drawing conclusions when comparing acreage in one year to acreage in the previous year(s).

Even considering all of the factors described above, the sharp declines in principal crop acreage (7.9 million) and computed total crop land area (6.1 million) for 2015 are somewhat puzzling. A combination of three factors may have been at work in 2015. First was the large decline in harvested acreage of hay. Any decline that was the result of excessive early summer rainfall could not be offset with prevented acreage as would have been the case for annually planted crops. Second, the sampling error for acreage estimates may have been larger than usual. Third, there may have been a large negative price effect on planting decisions in 2015 as crop prices were generally low and declining in the spring.

2016 Projections

Forming crop acreage expectations for 2016 is made difficult by large annual variations in total acreage estimates and by the unexplained large decline in total acreage in 2015. As a starting point, we assume that much of the decline in crop acreage in 2015 resulted from low and declining prices. With low prices in place as the 2016 spring planting season approaches, a similar price effect might be expected this year. That suggests starting with an expectation of total crop land acreage for 2016 near the 2015 total of 344.4 million acres. CRP acreage as of October 31, 2015 was reported at 23.4 million acres, 0.8 million fewer than a year earlier. We assume that prevented acreage (PP) will be near 2.0 million, well below that of 2015 and near the low end of that experienced since 2007. Finally, we project double-cropped (DC) soybean acres at 4.5 million to reflect the decline in soft red winter wheat seedings last fall. These assumptions result in a projection of principal crop acreage of 323.5 million acres:

$$[344.4 \text{ (total)} - 23.4 \text{ (CRP)} - 2.0 \text{ (PP)} + 4.5 \text{ (DC)} = 323.5].$$

At that level, principal crop acreage in 2016 would be 5.0 million acres larger than in 2015. It could be argued that current low prices and prospects for negative returns in some areas might result in a larger price effect on acreage in 2016 than in 2015. If so, principal crop acreage might rebound only to around 321 million acres.

Beyond the total crop acreage in 2016, the allocation of that acreage to individual crops will also be very important. The USDA's December 2015 survey indicated that winter wheat seedings have been reduced by 2.85 million acres. If acreage of all principal crops increases by 2.5 million acres in 2016 (321.0-318.5), acreage available for crops other than winter wheat would be 5.35 million larger (2.5 + 2.85) than in 2015. Increased harvested acreage of hay may capture some of that increase, but acreage available for spring planted crops might be 3.0 to 3.5 million larger than acreage planted in 2015. Under that scenario, corn acreage might increase by about 1.0 million acres to 89 million (equal to planting intentions reported in June 2015). Similarly, soybean acreage might increase as much as 2.0 million acres to 84.65 million (0.5 million less than planting intentions reported in June 2015).

Implications

An important and often under-appreciated factor when anticipating acreage of crops planted each year is the total acreage base, or the size of the “acreage pie.” We find that variation in the calculation of total crop acreage is surprisingly large. Specifically, over 2007 through 2015, total acreage varied by 10.7 million acres, ranging from 344.4 to 355.1 million acres. While several factors may account for the annual variation in total crop land acres, the most significant portion is likely due to price effects and sampling errors associated with the estimates of planted acreage. Forming expectations about corn and soybean acreage in 2016 is complicated by the historic variation in total crop acreage, by the sharp decline in total acreage in 2015, by the decline in winter wheat seedings for harvest in 2016, and by current low crop prices. Our initial analysis, however, suggests there could be a modest increase in the planted acreage of both crops. The USDA will release the results of the March planting intentions survey on March 31.

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