DIVISION OF AGRICULTURE

RESEARCH & EXTENSION

*University of Arkansas System*

# Trends for Arkansas Field Crop Yields, 2011-2020

AG-2110

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# Trends for Arkansas Field Crop Yields, 2011-2020

Increasing yields are an indicator of improvements in crop production technology. Trajectories in average yields are driven by changes in crop management practices, crop genetic improvement through conventional breeding and genetic engineering, climate and interactions among these factors (Grassini, et al.). Producer profits increase as increased yields lead to greater revenue for each acre in production.

Environmental conditions in a single year may lead to deviations from a prevailing yield trend. A statistical measurement that accounts for annual yield volatility is useful for discerning long-term yield trends. This report utilizes annual crop yields in conjunction with Olympic average yields for evaluating Arkansas field crop yields during 2011-2020.

## Annual Yields for Field Crops

Annual average yields for principal field crops for the period 2011-2020 are presented in Figure 1 through Figure 6. Data are from the National Agricultural Statistics Service (USDA, NASS). Each figure includes the Olympic average for a five-year period. Olympic averages are the average of three years after excluding the highest and lowest yielding years for each five-year period. For example, the Olympic average for cotton in 2020 is the average of yields in 2017 (1177 lbs./ac.), 2018 (1133 lbs./ac.), and 2020 (1179 lbs./ac.). Yields in 2016 (1075 lbs./ac.) and 2019 (1185 lbs./ac.) are excluded from calculating the Olympic average. This method of calculating averages reduces volatility that is caused by extremely low and high yields that may be deviations from a prevailing trend.

Figure 1 shows Arkansas' Olympic average cotton yield on an increasing trend since 2012. Average annual cotton yields are also on an increasing trend over the past decade. However, yield volatility due to adverse weather over the past six years has impacted the average yield trend. The historical maximum cotton yield occurred in 2019 at 1185 lbs./ac. Figure 2 shows corn yields increasing sharply in 2012 on ideal planting conditions that year. The historical high corn yields occurred in 2013 and 2014 at 187 bu./ac. Average corn yields have been more stable, near 180 bu./ac., over the past five years. Soybean yields in Figure 3 have an increasing trend for much of the 2011-2020 period. The Olympic average yield has increased thirteen (13) bu./ac. over the past ten years. The historical high soybean yield of 51.5 bu./ac. occurred in 2020. Average rice yields in Figure 4 saw a sharp increase in 2012 with some continuation in 2013. Olympic average rice yields have flattened over the previous five years. The historical high rice yields occurred in 2013 and 2014 at 168 bu./ac. In Figure 5, the historical high wheat yield of 63 bu./ac. occurred in 2014. The Olympic average wheat yield increased from 2012 to 2014. This uptrend has reversed lower over the previous five years, declining from a peak of 59 bu./ac. in 2015 to 54 bu./ac. in 2020.

**Figure 1. Arkansas Cotton Yields, Annual and 5-Year Olympic Average, 2011-2020.**

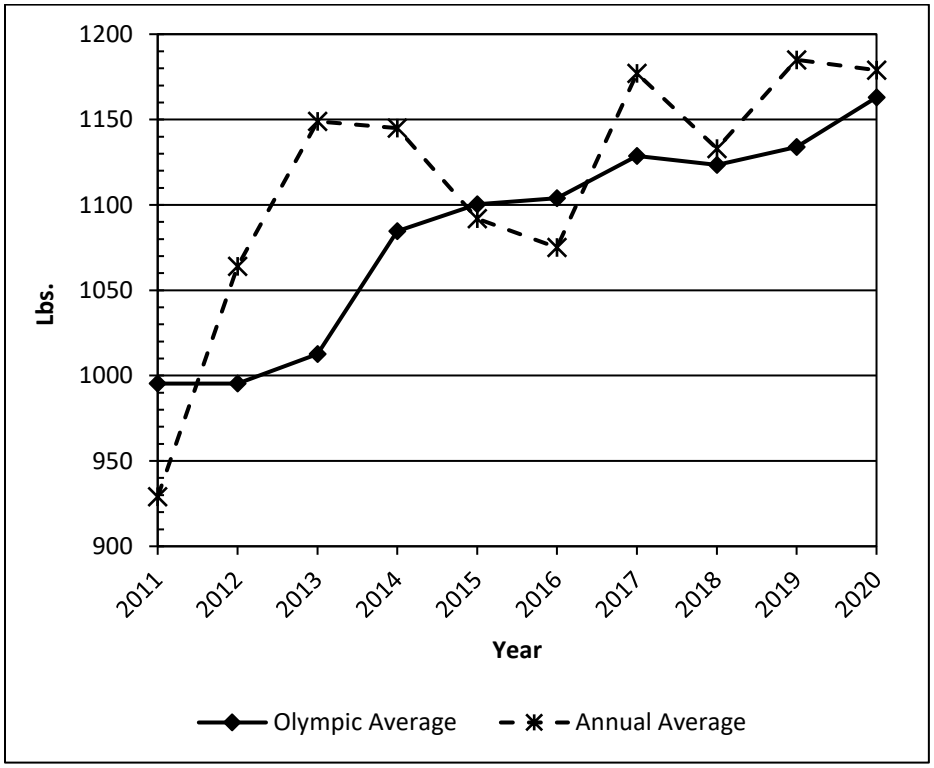



**Figure 2. Arkansas Corn Yields, Annual and 5-Year Olympic Average, 2011-2020.**

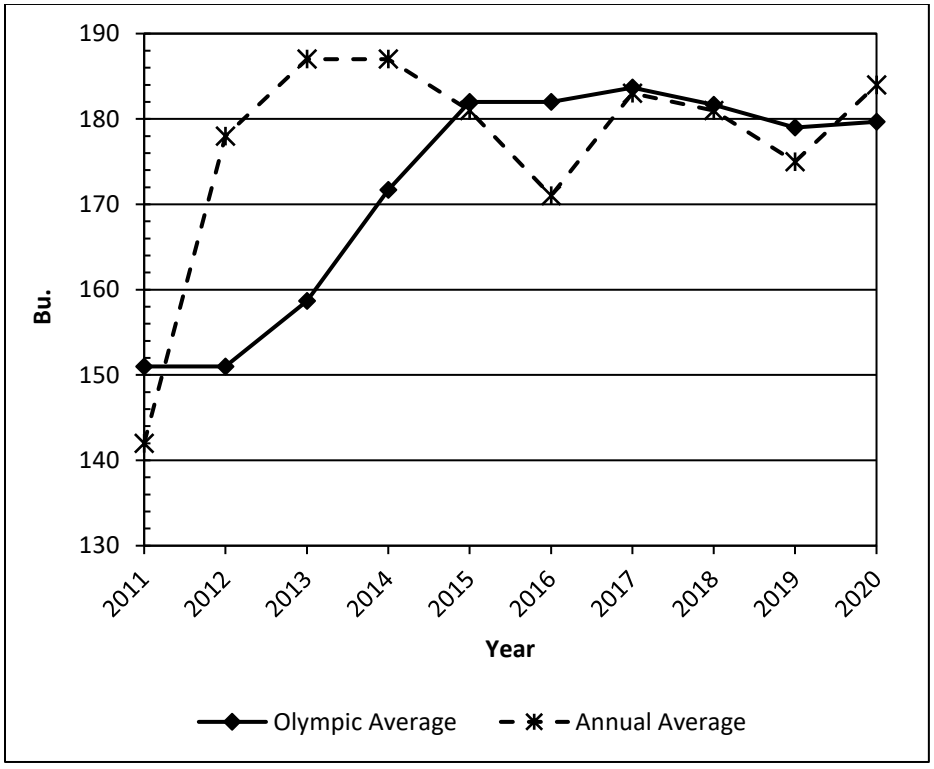


**Figure 3. Arkansas Soybean Yields, Annual and 5-Year Olympic Average, 2011-2020.**

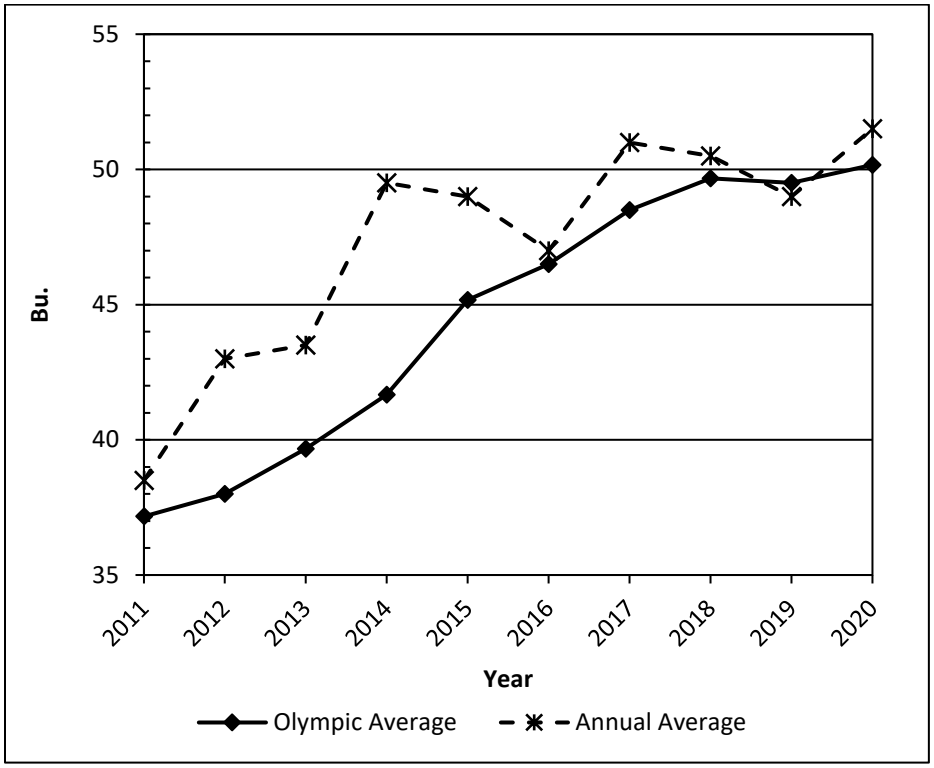



**Figure 4. Arkansas Rice Yields, Annual and 5-Year Olympic Average, 2011-2020.**

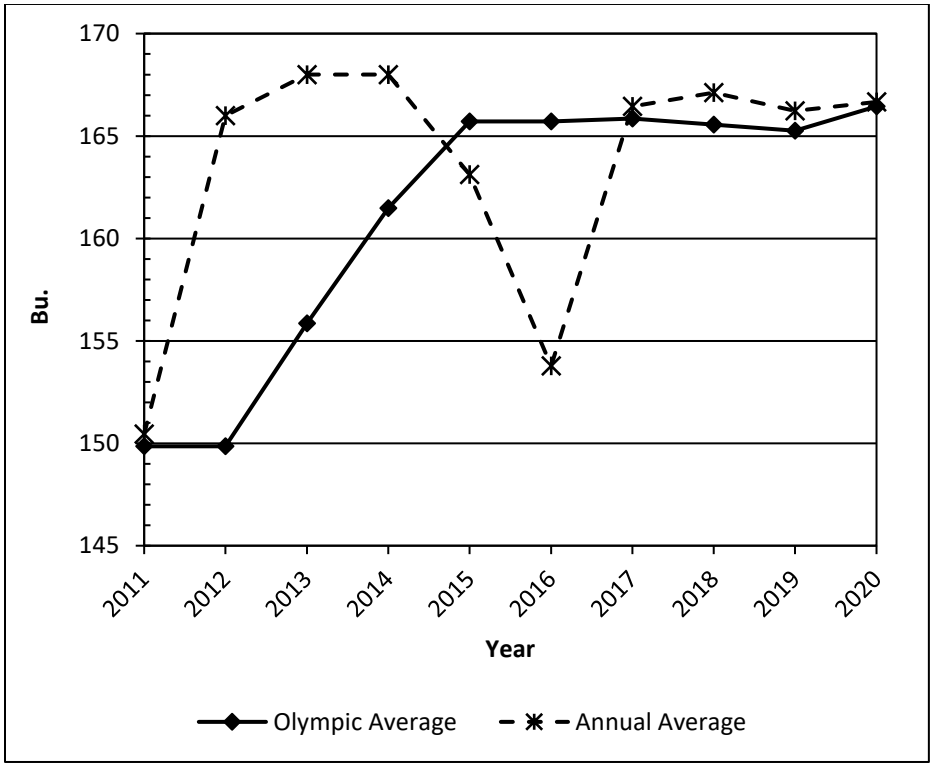
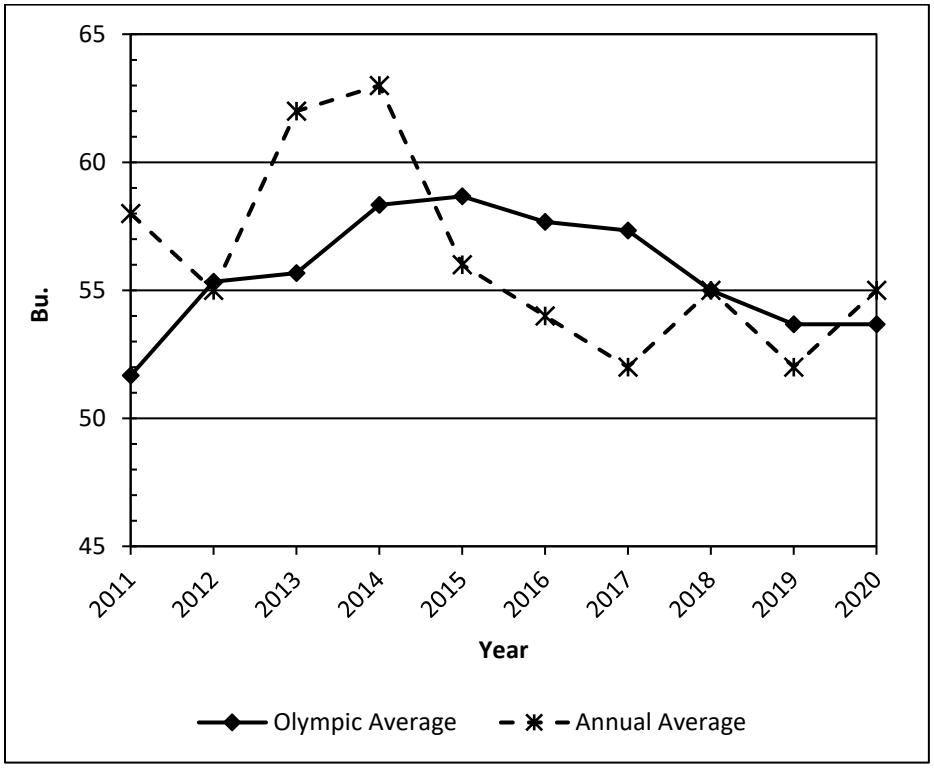


**Figure 5. Arkansas Winter Wheat Yields, Annual and 5-Year Olympic Average, 2011-2020.**




## Comparing Trends in Arkansas and U.S. Yields

Graphs in the Appendix compare Olympic average fields for Arkansas and the aggregate of other U.S. producing states (USDA, NASS). Arkansas' cotton yields shown in Appendix A follow trends similar to other U.S. yields. Since 2011, Arkansas' cotton yield averaged 277 lbs./acre, or 34%, more than other U.S. yields. Over the past decade, the percentage of cotton acres under irrigation in Arkansas expanded. In 2011, 90% of cotton acres were irrigated. By 2020, that percentage had increased to 95% (USDA, FSA). Corn yields in Appendix B show the difference between U.S. and Arkansas yields narrowing over the past five years on mostly favorable U.S. growing conditions. With consecutive state average yields of 187 bu./ac. in 2013 and 2014, Arkansas' Olympic average surpassed the U.S. average by 24 bu./ac. in 2015. However, in 2019 and 2020 the yield gap between Arkansas and U.S. corn yields had narrowed to 6 bu./ac. Arkansas' soybean yield trend closely follows that of the U.S. average. Since 2016, Arkansas' soybean yields (Appendix C) averaged .2 bu./acre more than other U.S. yields. Appendix D shows the difference between Arkansas and other U.S. rice yields tightening significantly from 2013 to 2015. An increase in Arkansas' Olympic average over that period narrowed the yield difference with the U.S. average to less than 3 bu./acre, or 1.6% less than other U.S. rice yields. Appendix E illustrates a declining trend in Arkansas winter wheat yields over past five years. In 2015, Arkansas' Olympic average yield exceeded the U.S. average by 14 bu./ac. This yield difference is now just 2 bu./acre as average yields in other U.S. states have been increasing since 2016.

## Summary

The foundation of agricultural productivity is sustained increases in crop yields. Arkansas' rates of yield increase for cotton and soybeans are decidedly linear over the past ten (10) years. However, some deceleration was found in the relative rate of increase in average yields of corn and rice during the 2016–2020 period. There appears to be some evidence of yield decline in wheat. Challenging spring weather conditions over the past five years may be a contributing factor in the recent yield trends observed for corn, rice, and wheat, which account for 40% of Arkansas' principal crop acreage in 2020.

Average yields in Arkansas are greater than other U.S. field crop yields for cotton, corn, and wheat. Average yields for soybeans in Arkansas slightly exceed U.S. yields since 2015. This may be explained by the continued increase in irrigated soybean acres in Arkansas over the past decade. Arkansas' "All" rice yields are less than other U.S. yields by 2 to 3 bu./ac. However, U.S. "All" rice yields include significant acres of relatively higher-yielding California medium-grain rice. Approximately 90% of Arkansas' rice acreage is planted to long-grain rice.

Rigorous statistical trend analysis is the only objective method to determine the yield trends of the observed data. Analysis of crop yield trends and yield trajectories is beneficial in estimating future production and potential yield plateaus. Identifying these trends with a high degree of confidence can be useful to inform development of priorities for agricultural research.

## References

Grassini, P., Eskridge, K. & Cassman, K. Distinguishing between yield advances and yield plateaus in historical crop production trends. Nat Commun 4, 2918 (2013). https://doi.org/10.1038/ncomms3918

U.S. Department of Agriculture-National Agricultural Statistics Service (NASS). Internet site: https://www.nass.usda.gov/Statistics_by_State/Arkansas/Publications/Historical_Data/index.php

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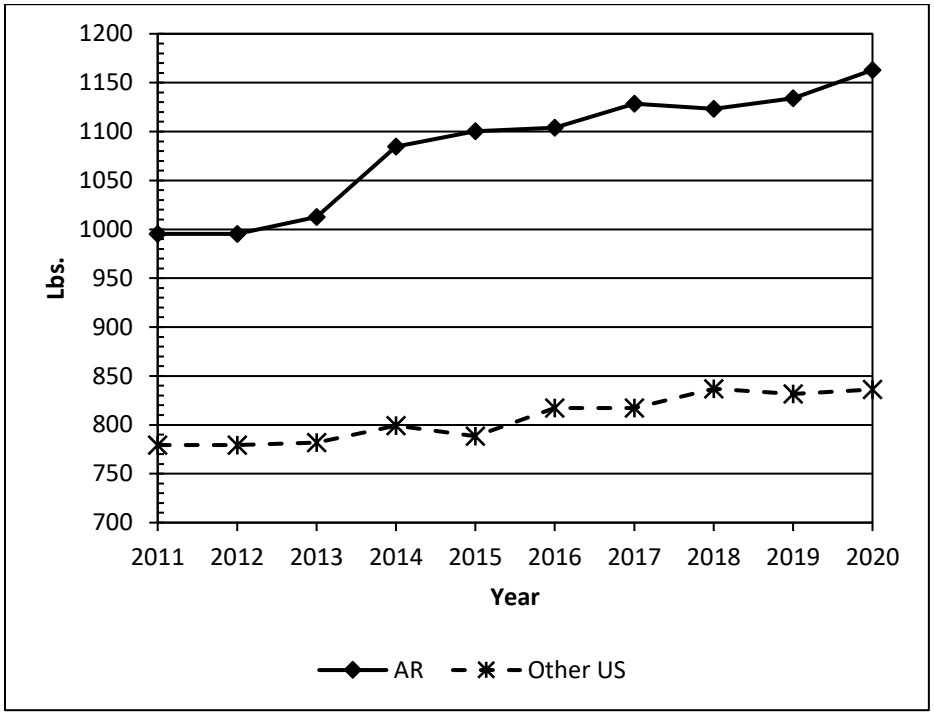
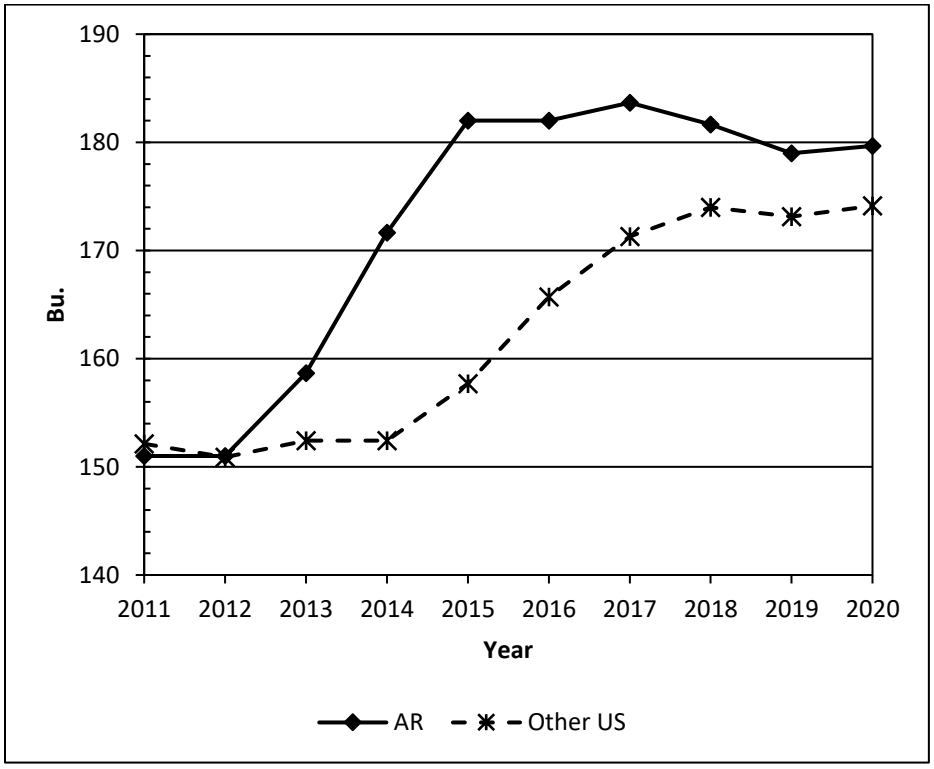
U.S. Department of Agriculture-Farm Service Agency (FSA). Internet site: https://www.fsa.usda.gov/news-room/efoia/electronic-reading-room/frequently-requested-information/crop-acreage-data/index

# Appendix

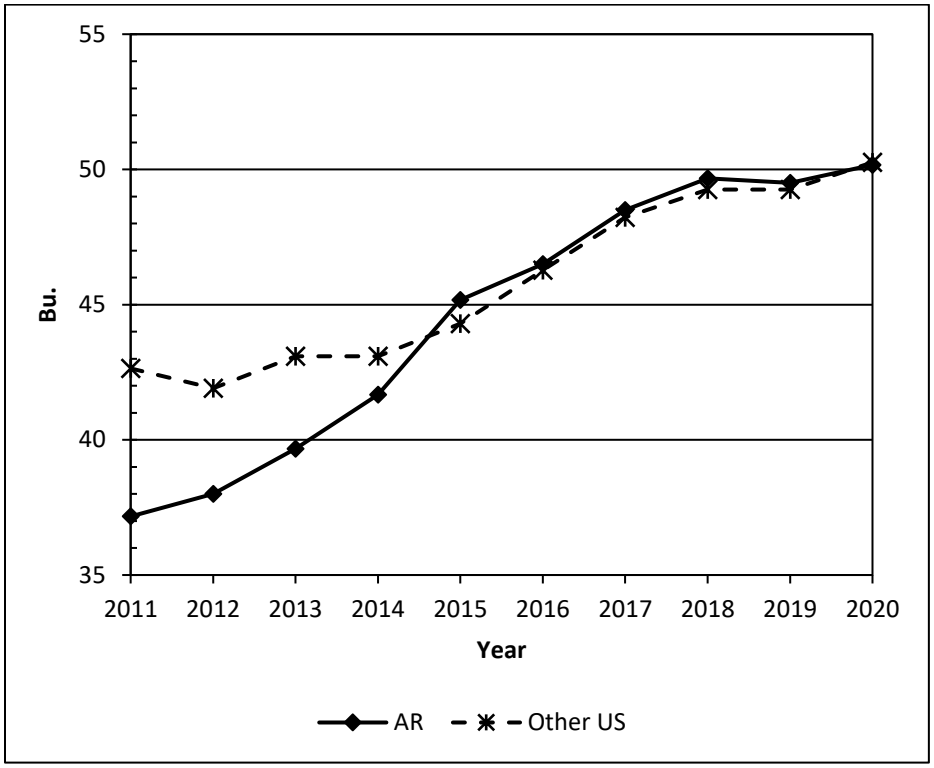
## Appendix A. Arkansas and Other U.S. 5-Year Olympic Cotton Yields, 2011-2020.



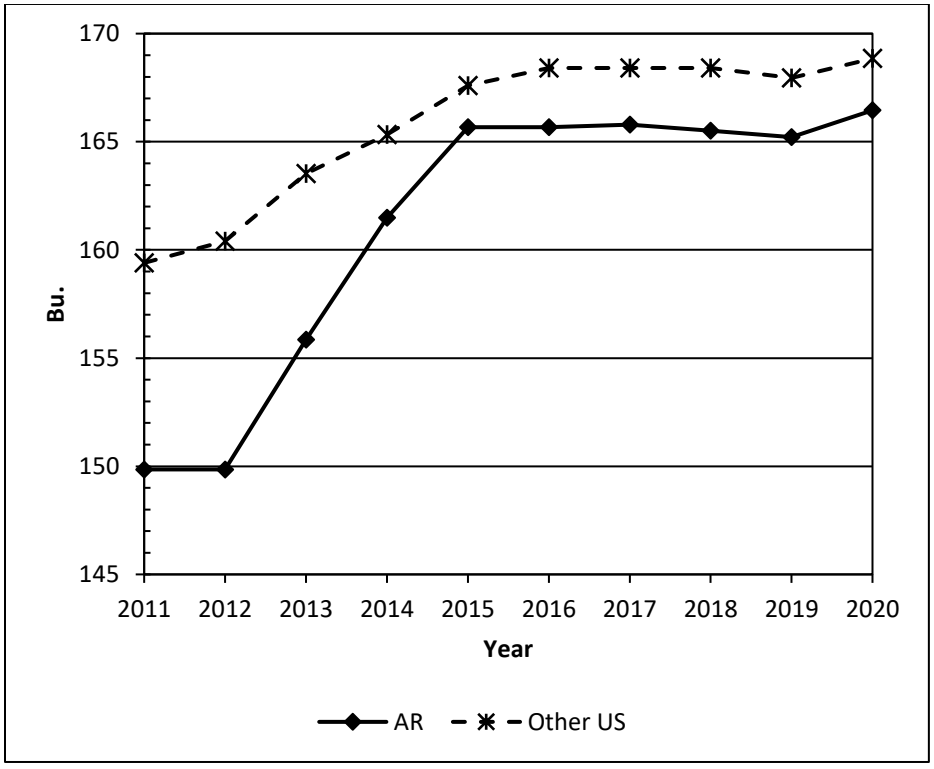

## Appendix B. Arkansas and Other U.S. 5-Year Olympic Corn Yields, 2011-2020.



**Appendix C. Arkansas and Other U.S. 5-Year Olympic Soybean Yields, 2011-2020.**




**Appendix D. Arkansas and Other U.S. 5-Year Olympic Rice Yields, 2011-2020.**



**Appendix E. Arkansas and Other U.S. 5-Year Olympic Winter Wheat Yields, 2011-2020.**