

Economic Analysis of Animal Agriculture 2005-2015

MISSOURI

A Report for
United Soybean Board



September 2016



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Missouri Executive Summary

The use of soybean meal as a key feed ingredient is an important part of Missouri's animal agriculture. While the degree to which animal agriculture utilizes this versatile feed ingredient has fluctuated with time, it remains a key driver of animal agriculture's success in the State of Missouri. The success of Missouri animal agriculture in turn has a large impact on the rest of the state and regional economies. For example, in the State of Missouri during 2015 animal agriculture contributed:

- \$12.6 billion in economic output
- 72,304 jobs
- \$2.6 billion in earnings
- \$682.2 million in income taxes paid at local, state, and federal levels
- \$193.4 million in the form of property taxes

Plus, from 2005-2015 animal agriculture in Missouri has increased economic output by almost \$4.2 billion, boosted household earnings by \$859.3 million, contributed 23,487 additional jobs and paid \$226.3 million in additional tax revenues.

Missouri's animal agriculture consumed almost 1.1 million tons of soybean meal in 2015. This soybean meal was fed primarily to:

- Hogs (390.7 thousand tons)
- Broilers (344.2 thousand tons)
- Turkeys (161.0 thousand tons)

This report examines animal agriculture in Missouri over the last decade. While this analysis is certainly instructive and allows improved understanding of animal agriculture's impact during that time, as the next decade unfolds in Missouri, many opportunities and challenges will arise. It is expected that animal agriculture will continue to be a major contributor to the economic well-being of the people of Missouri and beyond.

Missouri Economic Impact of Animal Agriculture

Animal agriculture is an integral part of Missouri's economy. In 2015, Missouri's animal agriculture contributed the following to the economy:

- About \$12.6 billion in economic output
- \$2.6 billion in household earnings
- 72,304 jobs
- \$682.2 million in income taxes

And the animal agriculture sector has shown substantial growth during challenging economic times. During the last decade Missouri's animal agriculture has:

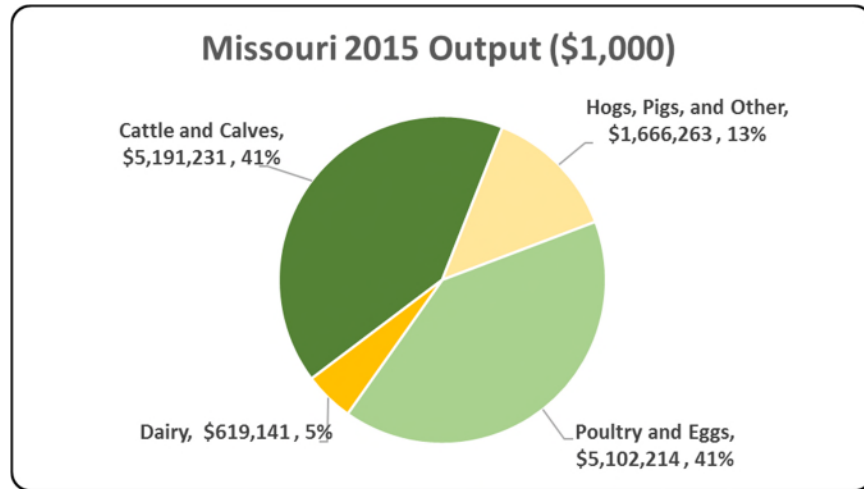
- Increased economic output by \$4.2 billion
- Boosted household earnings by \$859.3 million
- Added 23,487 jobs
- Paid an additional \$226.3 million in income taxes

Below is a table which demonstrates this decade of change.

Measure	2015	Change 2005-2015	% Change 2005-2015
Output (\$1,000)	\$ 12,578,849	\$ 4,163,609	49.48%
Earnings (\$1,000)	\$ 2,590,802	\$ 859,349	49.63%
Employment (Jobs)	72,304	23,487	48.11%
Income Taxes Paid (\$1,000)	\$ 682,158	\$ 226,266	49.63%
Property Taxes Paid in 2012 (\$1,000)	\$ 193,377		

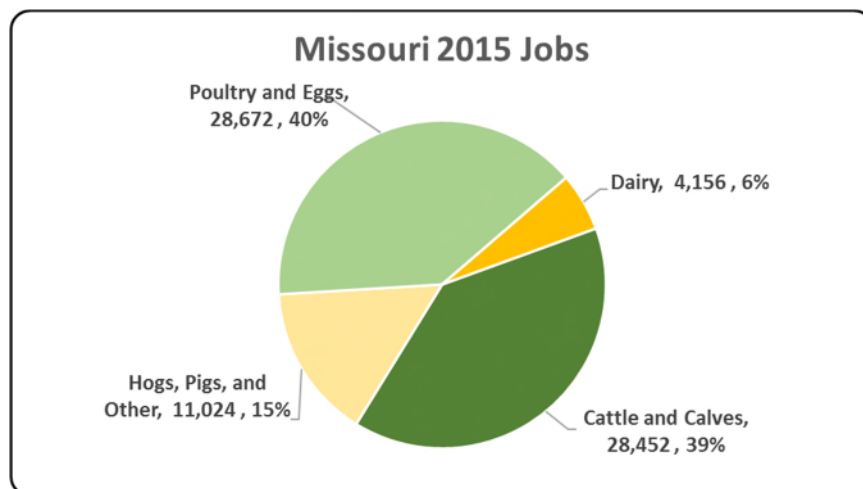
Missouri Output

“Output” refers to the total value of all the output (production or sales) of a study area and/or industry within a study area and was calculated using RIMS II multipliers. This is a gross number that does not make any deductions for the cost or origination of inputs that were used in the production process. The chart illustrates the impact of animal agriculture to the Missouri economy. Animal agriculture’s impact on Missouri total economic output is about \$12.6 billion.



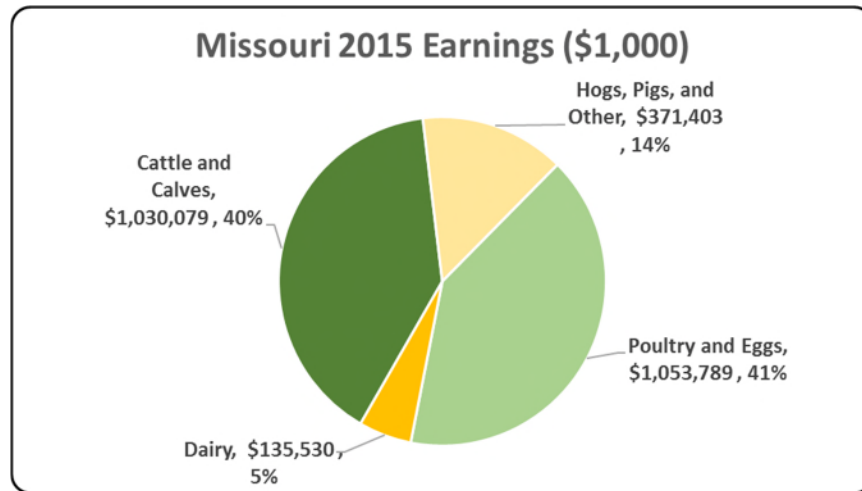
Missouri Jobs

“Jobs” represents an estimate of the number of full or part-time positions (jobs) currently filled in an area and/or industry. The chart illustrates the contribution to Missouri in terms of animal agriculture jobs. As shown, animal agriculture contributes significantly to Missouri total jobs, contributing 72,304 jobs within and outside of animal agriculture.



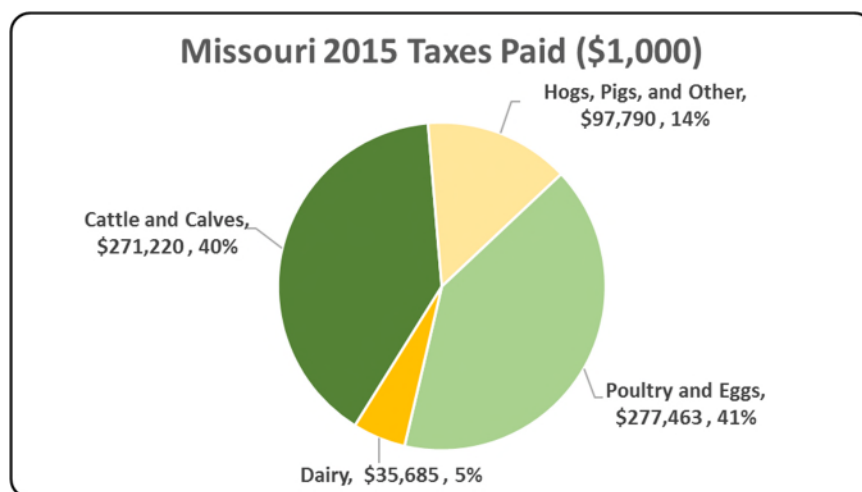
Missouri Earnings

Earnings includes wages and salaries plus proprietors' income, which is the net earnings of sole-proprietors and partnerships. The chart illustrates the impact of animal agriculture to the Missouri economy in terms of earnings. Missouri's animal agriculture contributed about \$2.6 billion to household earnings in 2015.



Missouri Taxes Paid by Animal Agriculture

Missouri's animal agriculture is also a significant source of tax revenue. In 2015, the state's animal agriculture industry paid about \$682.2 million in income taxes at local, state, and federal levels. Plus the 2012 Census of Agriculture estimated \$193.4 million in property taxes paid by all of Missouri agriculture during 2012. Estimates of income taxes paid by animal agriculture are shown in the following chart.



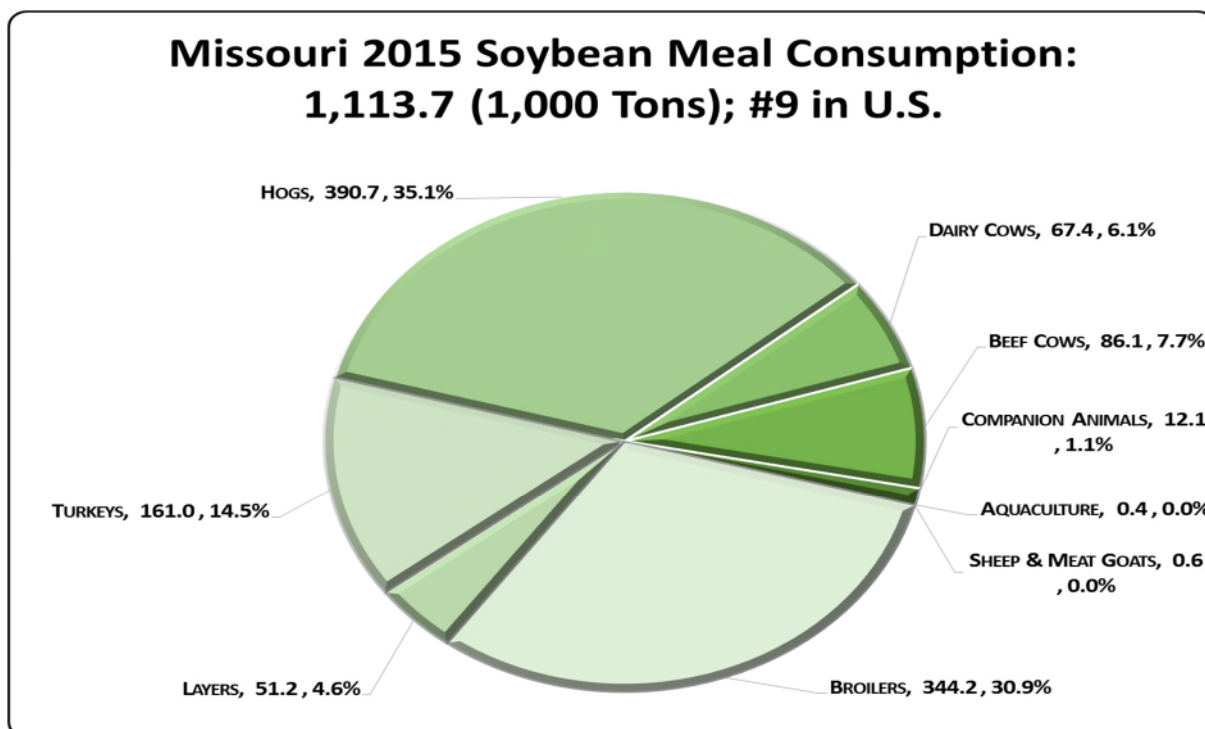
Missouri Animal Agriculture Soybean Meal Consumption

The choice to use soybean meal in animal agriculture is highly dependent upon nutritional requirements of animals (which would encompass varying life stages within an animal species), accessibility to various feed ingredients capable of competing with soybean meal (from both a nutritional and price standpoint), and consumer preferences which have influence on production practices.

Through in-depth conversations with many of the nation's top nutritionists and researchers from both private industry and public institutions, "bottom up" estimates of soybean meal usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of soybean meal used during the 2014-15 soybean marketing year by up to sixteen specific animal species has been estimated.

Missouri's animal agriculture consumed almost 1.1 million tons of soybean meal in 2015, placing the state as #9 in the nation in terms of soybean meal consumption (see figure below). The three segments of animal agriculture that led the state in estimated soybean meal consumption are:

- Hogs (390.7 thousand tons)
- Broilers (344.2 thousand tons)
- Turkeys (161.0 thousand tons)

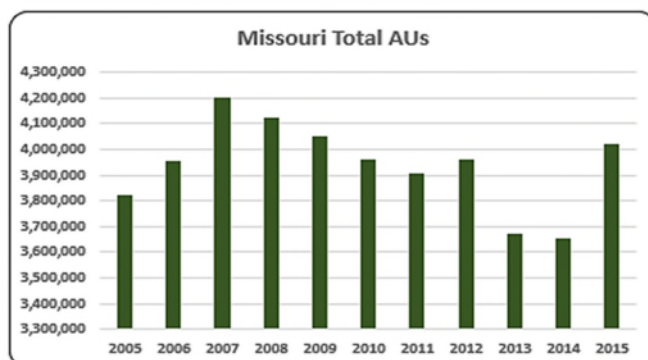
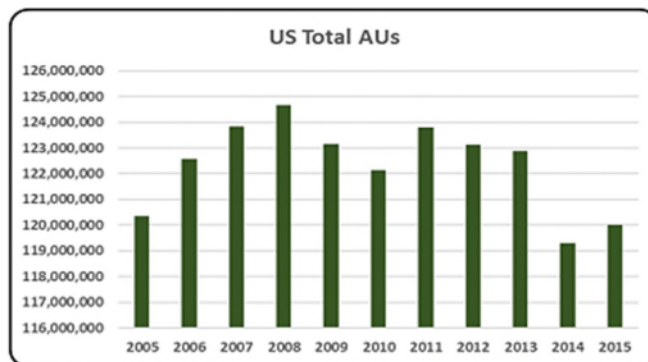


Missouri Animal Unit (AU) Trends

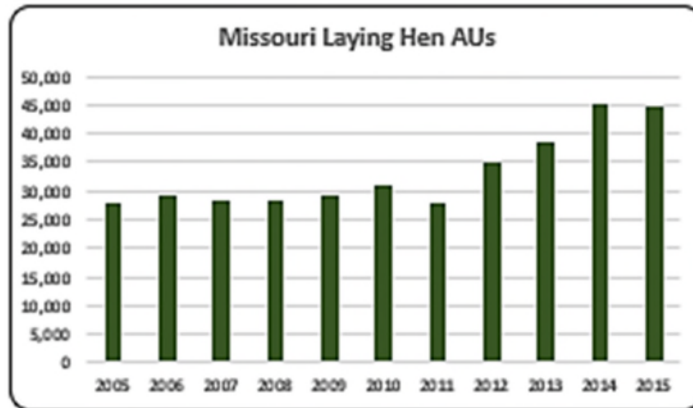
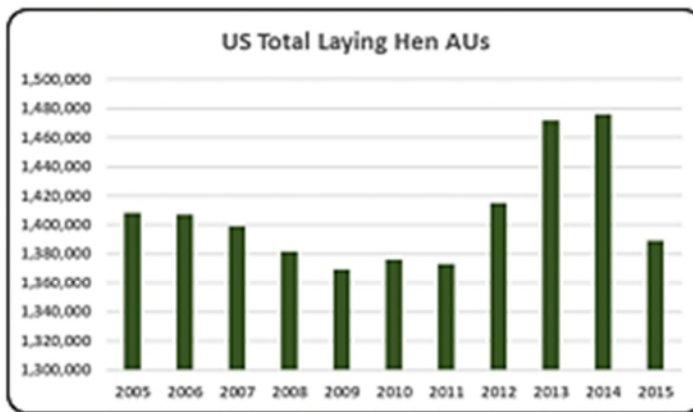
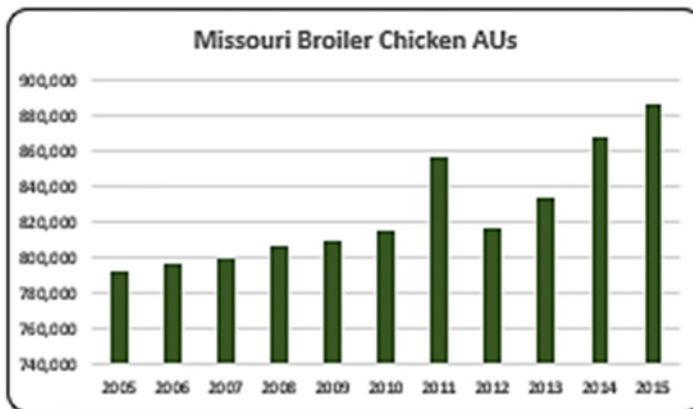
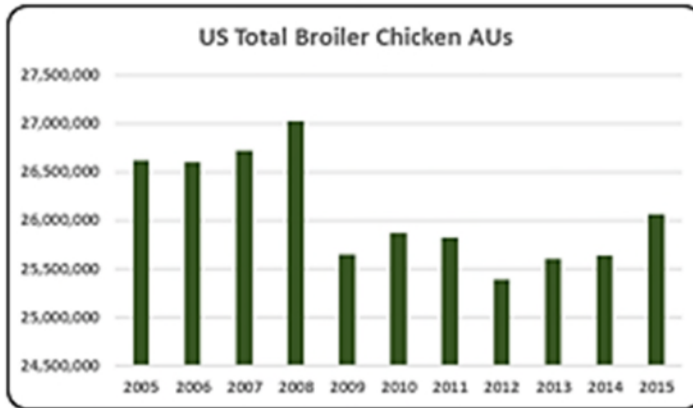
Over time, prices of feed, meat, eggs and milk, as well as levels of demand for these products in the United States and abroad have an impact on the size of animal agriculture in the State of Missouri. Due to this reality, using a single year as a measure of the presence and strength of a sector can be misleading. The use of animal units allows for a more accurate comparison of differing sizes of livestock and poultry. This section is included to bring context to the question of what animal agriculture means to Missouri and to give perspective on Missouri's contribution to the nation's animal agriculture industry and beyond.

Similar to using a single year to measure the presence and strength of a sector, in some circumstances AUs can be misleading. This is because AUs do not reflect important considerations like increased weights, improved livability, increased laying potential, etc.

As shown in the accompanying charts and written commentary, certain components of animal agriculture are more present, and therefore more dominant than others. This is due primarily to geography (i.e., weather patterns and access to certain transportation hubs), proximity to high quality, relevant feed ingredients, and the local animal agriculture regulatory framework. In Missouri, the largest three segments of animal agriculture in terms of AUs during 2015 were: Hogs (1.3 million AUs), Beef Cows (1.3 million), and Broilers (885,443 AUs). Total animal units in Missouri during 2015 were 4.0 million AUs.



- Overall U.S. total AUs have varied from 2005 to 2015. In 2014 AUs were at an all-time low reflecting, in part, the impact of severe weather on cattle production in some parts of country. During the 2005-15 time period, total AUs in the nation peaked in 2008.
- The total AUs in Missouri in 2015 was 4.0 million. Thirty-three percent of those AUs were from beef cow production whereas 33.5% were from hog production.

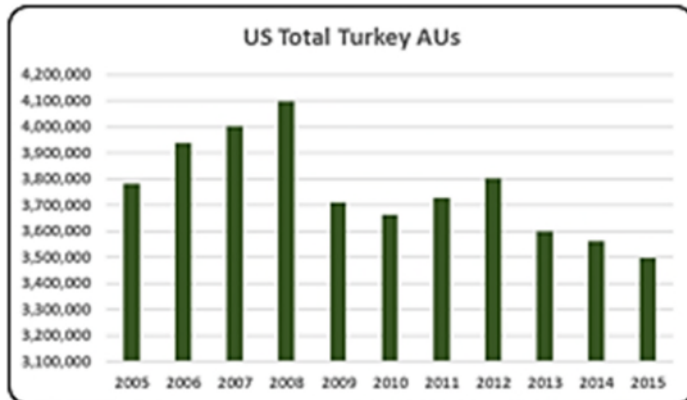


- U.S. broiler production is clustered in a number of states, with Georgia being the largest producer. On average from 2005 to 2015, broiler chicken AUs were about 26.0 million. In 2015, AUs rebounded 3% from the low AUs numbers in 2012 (25.4 million AUs).

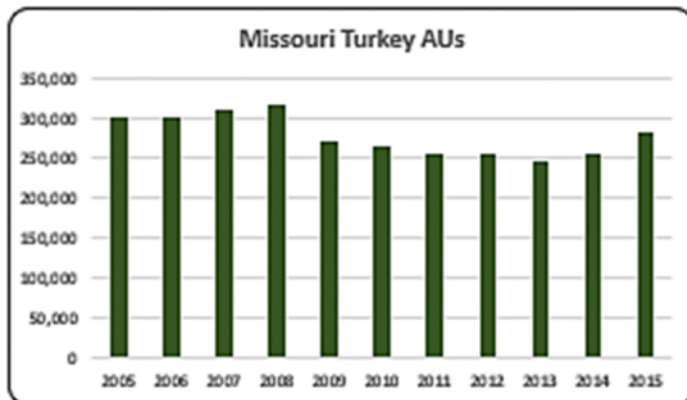
- Broiler production in Missouri comprises the third largest animal production in the state. In 2015 there were 885,443 broiler AUs and production has risen 12% since the beginning of the decade. Almost 3.4% of all broiler production in the U.S. was in Missouri in 2015.

- On average, the layer AUs during 2005-2015 were 1.4 million. In 2015 layer AUs were 1.3 million, down 6% from the 2014 decade high (1.4 million AUs). This drastic decrease in 2015 was due to the losses in major egg laying states from the avian influenza outbreak.

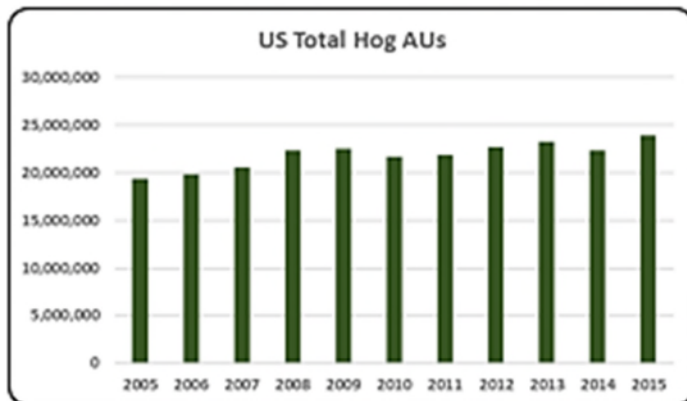
- Layer production represented less than 1% of animal production in Missouri in 2015. Layer production has grown 59% from 2005 to 2015.



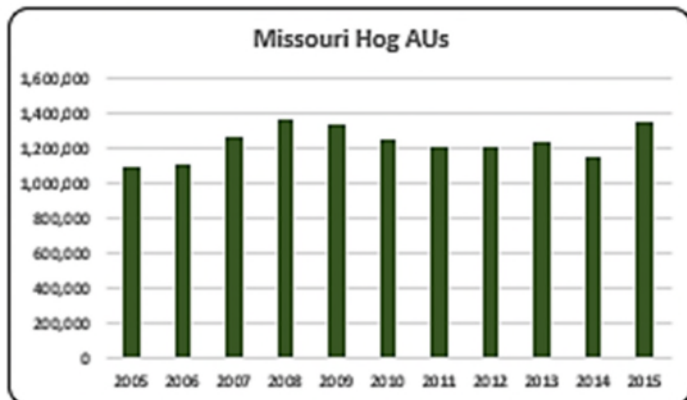
- In 2015 turkey AUs were the lowest of the decade at 3.5 million, decreasing 15% compared to 2008 (4.1 million turkey AUs) the largest turkey AUs of the decade. The most recent contributor to this decline has been avian influenza.



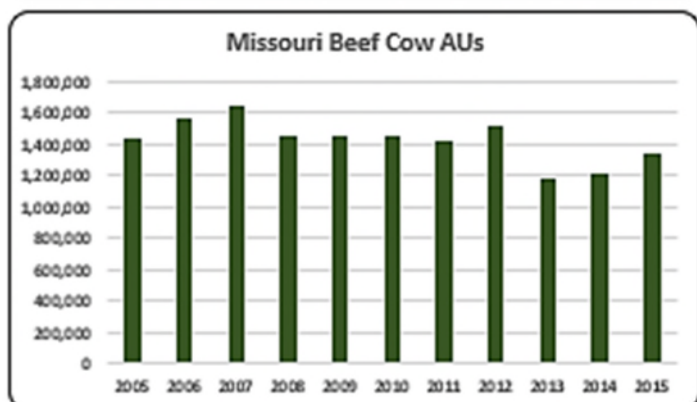
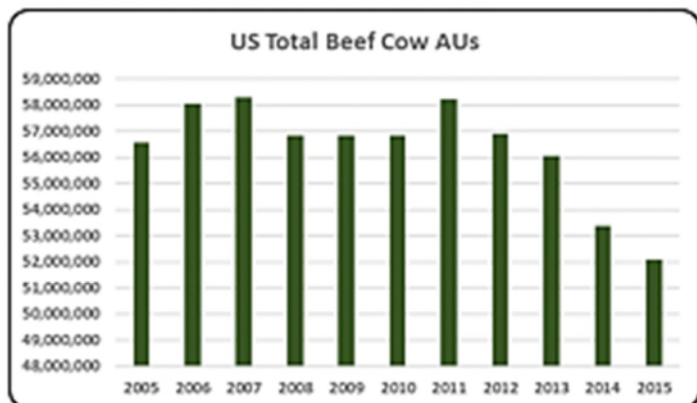
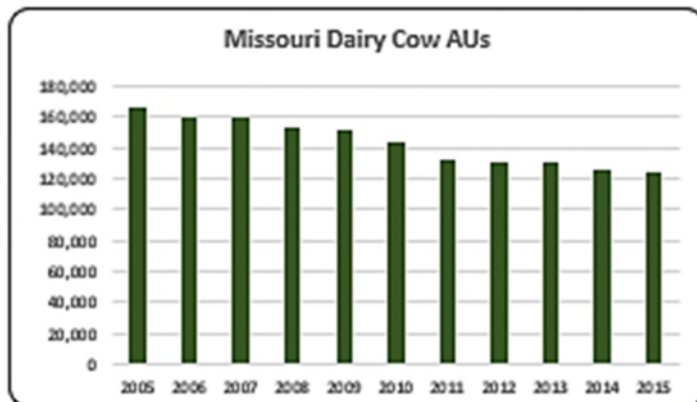
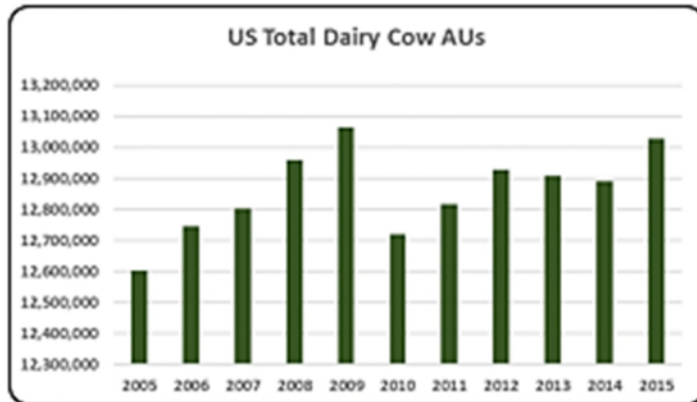
- Turkey production had been decreasing throughout the decade but in 2015 there was an increase in AUs (282,516). About 8.1% of all turkey AUs in the country were in Missouri in 2015.



- On average from 2005 to 2015, hog AUs were about 21.8 million. Hog AUs in 2015 increased 24% to 23.9 million AUs compared to the decade low in 2005 (19.4 million AUs). Despite the fluctuation in AUs, the pork supply was relatively stable.



- Hog production rose 23% from the beginning of the decade to 1.3 million hog AUs in 2015 and remained only 1% below the record high level achieved in 2008 (1.36 million hog AUs).



- From 2005 to 2015 dairy cow AUs averaged 12.8 million. In 2015, dairy cow AUs (13.0 million) finally reached near the 2009 high of 13.1 million AUs. Milk supplies have steadily risen.
- The average number of dairy cow AUs during 2005-2015 was 143,436. In general, dairy production has trended downward during the decade.
- From 2005 to 2015 beef cow AUs averaged 56.3 million. In 2015 beef cow AUs decreased to 52.0 million, the lowest of the decade. States that traditionally raise a lot of cattle like Texas and Oklahoma continue to work through the lingering effects of the drought of the last several years.
- There were 1.3 million beef cow AUs in 2015. Beef cow AUs increased have decreased 7% since the beginning of the decade.

Missouri Additional Information and Methodology

Animal agriculture is an important part of Missouri's current and future economic health. To quantify the connection between animal agriculture and local economies, the United Soybean Board commissioned [Decision Innovation Solutions](#), an economic research firm in Urbandale, Iowa, to conduct an in-depth analysis of several aspects of animal agriculture. This analysis includes the following components:

- Economic impact of animal agriculture to local (state) economies during the 2005-2015 time period
- Soybean meal usage by animal species during the 2014/15 soybean marketing year
- Animal Unit (AU) trends from 2005-2015

Given the long-term presence of animal agriculture in Missouri, of interest is the degree to which the industry impacts the Missouri economy. Estimates of output, jobs, earnings, taxes paid, and multipliers for Missouri animal agriculture are presented in this report. Methodology for this section of the report closely mirrors that followed in years' past. Also presented are estimates of the change in how animal agriculture has impacted Missouri's economy over the last decade. Differences, to the extent they are present, are noted within the larger national report which accompanies this state report.

As with any industry across the economic spectrum, there are ebbs and flows in activity that have implications for other parts of the economy. Again using the same 2005-2015 time period as with the economic impact section of this state report, the "Animal Unit Trends" seeks to quantify production changes in animal agriculture in Missouri which have occurred. As shown in this state report, Missouri has seen changes within its animal agriculture industry. Expectations are that animal agriculture will continue to evolve over the next decade.

Animal agriculture is the single largest user of soybean meal in Missouri. Through in-depth conversations with many of the nation's top nutritionists and researchers, "bottom up" estimates of soybean meal usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of soybean meal used during the 2014-15 soybean marketing year for up to sixteen specific animal species has been estimated.

Should readers have comments or questions regarding methodology, results and interpretation, please contact the authors at info@decision-innovation.com or 515.257.6077.

Missouri Multipliers

Economic multipliers give a sense for how economic activity in a given industry is related to other industries in the same study area. To estimate the impact of animal agriculture on Missouri’s economy, we applied RIMS II multipliers from the Department of Commerce, Bureau of Economic Analysis for cattle ranching and farming, dairy cattle and milk production, poultry and egg production, and other animal production (primarily hogs and pigs), where applicable.

Multipliers are generally stated in the form of “per million dollars” of output. As it relates to this analysis, multipliers are stated as the activity related to every million dollars of economic output in animal agriculture. Referring to the multipliers below, for every million dollars in output generated by the various segments of animal agriculture in Missouri, \$1.83 to \$3.06 million in total economic activity, \$0.41 to \$0.63 in household wages and 12 to 17 additional jobs are generated in the economy at large.

	Animal Type	Output(\$)	Earnings (\$)	Employment (Jobs)
RIMS II Multipliers	Cattle and Calves	\$ 2.530	\$ 0.502	13.9
	Hogs, Pigs, and Other	\$ 1.831	\$ 0.408	12.1
	Poultry and Eggs	\$ 3.057	\$ 0.631	17.2
	Dairy	\$ 2.452	\$ 0.537	16.5

Appendix

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Animal Units (AUs)	Beef Cattle AUs	1,436,700	1,567,200	1,637,700	1,456,950	1,456,950	1,456,950	1,425,450	1,522,500	1,183,050	1,205,850	1,337,850
	Hog and Pig AUs	1,097,250	1,101,300	1,264,950	1,360,800	1,329,600	1,249,290	1,208,100	1,201,575	1,238,025	1,153,125	1,347,225
	Broiler AUs	792,314	796,733	800,087	806,764	809,692	814,422	856,891	816,372	833,767	867,096	885,443
	Turkey AUs	301,584	301,653	309,534	317,039	271,084	263,316	255,619	255,635	246,209	253,272	282,516
	Egg Layer AUs	28,096	29,084	28,512	28,472	29,176	30,840	28,112	34,791	38,394	45,185	44,693
	Dairy AUs	166,600	159,600	159,600	154,000	151,200	142,800	133,000	130,200	130,200	126,000	124,600
	Total Animal Units	3,822,544	3,955,570	4,200,383	4,124,025	4,047,702	3,957,618	3,907,172	3,961,073	3,669,644	3,650,529	4,022,327
Value of Production (\$1,000)	Cattle and Calves (\$1,000)	\$ 1,499,574	\$ 1,407,082	\$ 1,320,059	\$ 1,275,340	\$ 1,166,923	\$ 1,249,386	\$ 1,573,612	\$ 1,592,860	\$ 1,569,300	\$ 2,119,651	\$ 2,051,951
	Hogs and Pigs (\$1,000)	\$ 539,175	\$ 589,434	\$ 716,030	\$ 759,846	\$ 674,301	\$ 698,685	\$ 934,293	\$ 905,013	\$ 960,080	\$ 1,200,854	\$ 894,023
	Broilers (\$1,000)	\$ 109,454	\$ 182,564	\$ 263,961	\$ 351,426	\$ 428,727	\$ 510,928	\$ 628,371	\$ 651,850	\$ 808,221	\$ 882,118	\$ 760,786
	Turkeys (\$1,000)	\$ 279,827	\$ 313,988	\$ 358,238	\$ 372,486	\$ 290,719	\$ 347,015	\$ 370,687	\$ 404,201	\$ 342,847	\$ 400,935	\$ 486,596
	Eggs (\$1,000)	\$ 74,570	\$ 74,213	\$ 128,026	\$ 173,788	\$ 133,665	\$ 160,143	\$ 173,429	\$ 173,312	\$ 225,228	\$ 302,887	\$ 421,590
	Milk (\$1,000)	\$ 290,625	\$ 244,720	\$ 325,532	\$ 305,235	\$ 203,840	\$ 239,870	\$ 287,316	\$ 264,704	\$ 276,545	\$ 340,218	\$ 252,525
	Other	\$ 12,314	\$ 12,139	\$ 12,519	\$ 12,438	\$ 13,069	\$ 14,745	\$ 14,357	\$ 14,782	\$ 15,206	\$ 15,631	\$ 16,056
	Sheep and Lambs (\$1,000)	\$ 5,170	\$ 4,958	\$ 5,302	\$ 5,184	\$ 5,778	\$ 7,418	\$ 6,993	\$ 7,381	\$ 7,769	\$ 8,157	\$ 8,545
	Aquaculture (\$1,000)	\$ 7,144	\$ 7,181	\$ 7,217	\$ 7,254	\$ 7,291	\$ 7,327	\$ 7,364	\$ 7,400	\$ 7,437	\$ 7,474	\$ 7,510
	Total (\$1,000)	\$ 2,805,539	\$ 2,824,140	\$ 3,124,365	\$ 3,250,559	\$ 2,911,244	\$ 3,220,772	\$ 3,982,065	\$ 4,006,722	\$ 4,197,427	\$ 5,262,294	\$ 4,883,527

Ag Census Data Category	Animal Type	1997	2002	2007	2012	
Number of Farms by NAICS	Beef cattle ranching and farming (112111)	49,947	48,441	44,336	40,724	
	Cattle feedlots (112112)	2,024	3,029	1,300	730	
	Dairy cattle and milk production (11212)	2,599	2,664	1,705	1,153	
	Hog and pig farming (1122)	2,444	1,469	1,056	689	
	Poultry and egg production (1123)	1,162	1,362	2,245	1,645	
	Sheep and goat farming (1124)	646	922	1,595	2,086	
	Animal aquaculture and other animal production (1125,1129)	3,859	8,047	9,216	7,265	
Value of Sales (\$1,000)	Cattle and Calves	1,143,320	1,285,288	1,676,632	1,968,617	
	Hogs and Pigs	841,644	570,551	725,738	882,526	
	Poultry and Eggs	755,708	784,986	1,265,166	1,441,676	
	Milk and Other Dairy Products	293,411	300,460	302,684	246,358	
	Aquaculture	5,374	11,107	9,506	10,256	
	Other (calculated)	36,613	38,417	38,262	25,866	
	Total	3,076,070	2,990,809	4,017,988	4,575,299	
Input Purchases	Livestock and poultry purchased	(Farms)	29,162	30,120	25,620	27,112
		\$1,000	574,610	546,196	761,333	906,474
	Breeding livestock purchased	(Farms)	<i>n/a</i>	19,512	17,469	18,367
		\$1,000	<i>n/a</i>	97,217	142,362	209,880
	Other livestock and poultry purchased	(Farms)	<i>n/a</i>	14,508	11,591	12,517
		\$1,000	<i>n/a</i>	448,979	618,971	696,594
Feed purchased	(Farms)	61,570	69,368	59,938	63,616	
	\$1,000	1,056,896	1,136,939	1,383,506	1,989,225	

	Animal Type	Output (\$1,000)	Earnings (\$1,000)	Employment (Jobs)	Taxes Paid (\$1,000)
2015 Animal Agriculture	Cattle and Calves	\$ 5,191,231	\$ 1,030,079	28,452	\$ 271,220
	Hogs, Pigs, and Other	\$ 1,666,263	\$ 371,403	11,024	\$ 97,790
	Poultry and Eggs	\$ 5,102,214	\$ 1,053,789	28,672	\$ 277,463
	Dairy	\$ 619,141	\$ 135,530	4,156	\$ 35,685
	Total	\$ 12,578,849	\$ 2,590,802	72,304	\$ 682,158
Change from 2005 to 2015	Cattle and Calves	\$ 587,091	\$ 116,495	3,218	\$ 30,673
	Hogs, Pigs, and Other	\$ 440,861	\$ 98,266	2,917	\$ 25,873
	Poultry and Eggs	\$ 3,381,276	\$ 698,354	19,001	\$ 183,877
	Dairy	\$ (245,619)	\$ (53,766)	(1,649)	\$ (14,157)
	Total	\$ 4,163,609	\$ 859,349	23,487	\$ 226,266
RIMS II Multipliers	Animal Type	Output(\$)	Earnings (\$)	Employment (Jobs)	
	Cattle and Calves	\$ 2.530	\$ 0.502	13.9	
	Hogs, Pigs, and Other	\$ 1.831	\$ 0.408	12.1	
	Poultry and Eggs	\$ 3.057	\$ 0.631	17.2	
	Dairy	\$ 2.452	\$ 0.537	16.5	
Tax Rates	Federal effective income tax rate				12.7%
	Federal Social Security tax rate				7.7%
	State Effective Rate				6.0%
	Total				26.3%

Sources: 1997, 2002, 2007 and 2012 Census of Agriculture, USDA/NASS Survey Data, RIMS II Multipliers (U.S. Bureau of Economic Analysis), Tax Policy Institute and Tax Foundation.