Economic Analysis of Animal Agriculture 2004-2014

TENNESSEE

A Report for

United Soybean Board

September 2015

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Contents

Tennessee Executive Summary

The use of soybean meal as a key feed ingredient is an important part of Tennessee's animal agriculture. While the degree to which animal agriculture utilizes this versatile feed ingredient has fluctuated with time, it remains a driver of animal agriculture's success in Tennessee. The success of Tennessee animal agriculture in turn has an impact on the rest of the state and regional economies. For example, in the state of Tennessee during 2014 animal agriculture contributed:

- $3.7 billion in economic output
- 17,950 jobs
- $638.0 million in earnings
- $168. million in income taxes paid at local, state, and federal levels
- $99.2 million in the form of property taxes

Plus, from 2004-2014 animal agriculture in Tennessee increased economic output by over $432.1 million, boosted household earnings by $72.0 million, contributed 2,026 additional jobs and paid $19.0 million in additional tax revenues.

Tennessee's animal agriculture consumed about 291.7 thousand tons of soybean meal in 2014. This soybean meal was fed primarily to:

- Broilers (213.1 thousand tons)
- Hogs (22.4 thousand tons)
- Egg-Laying Hens (13.4 thousand tons)

This report examines animal agriculture in Tennessee 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 Tennessee, many opportunities and challenges will arise. And, if past is prologue, animal agriculture will continue to be a contributor to the economic well-being of the people of Tennessee and beyond.

Tennessee Economic Impact of Animal Agriculture

Animal agriculture is an important part of Tennessee's economy. In 2014, Tennessee's animal agriculture contributed the following to the economy:

- About $3.7 billion in economic output
- $638.0 million in household earnings
- 17,950 jobs
- $168. million in income taxes

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

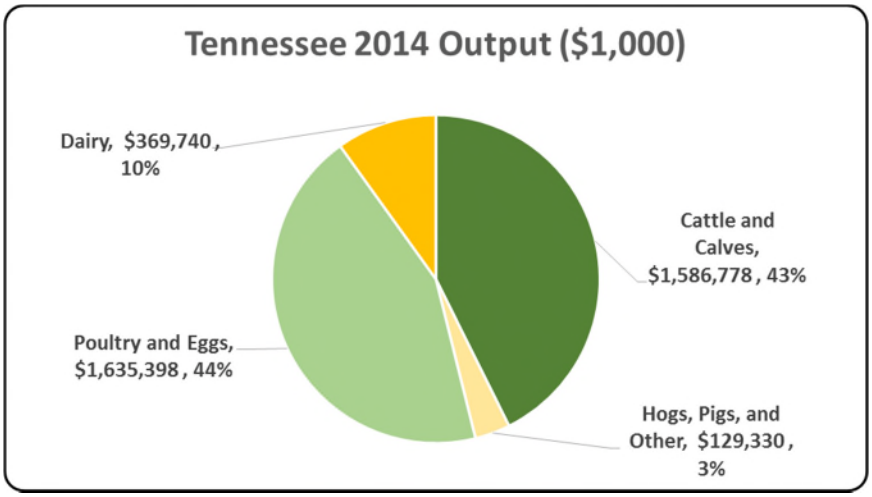
- Increased economic output by $432.1 million
- Boosted household earnings by $72.0 million
- Added 2,026 jobs
- Paid an additional $19.0 million in income taxes

Below is a table which demonstrates this decade of change.

Measure	2014	Change 2004-2014	% Change 2004-2014
Output ($1,000)	$ 3,721,246	$ 432,123	13.14%
Earnings ($1,000)	$ 638,001	$ 72,031	12.73%
Employment (Jobs)	17,950	2,026	12.72%
Income Taxes Paid ($1,000)	$ 167,986	$ 18,966	12.73%
Property Taxes Paid in 2012 ($1,000)	$ 99,159		

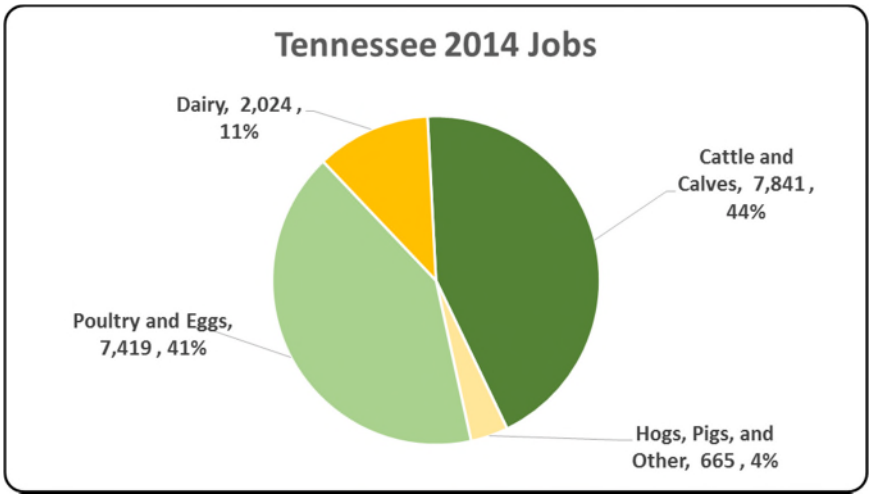
Tennessee Output

"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 Tennessee economy. Animal agriculture's impact on Tennessee total economic output is about $3.7 billion.



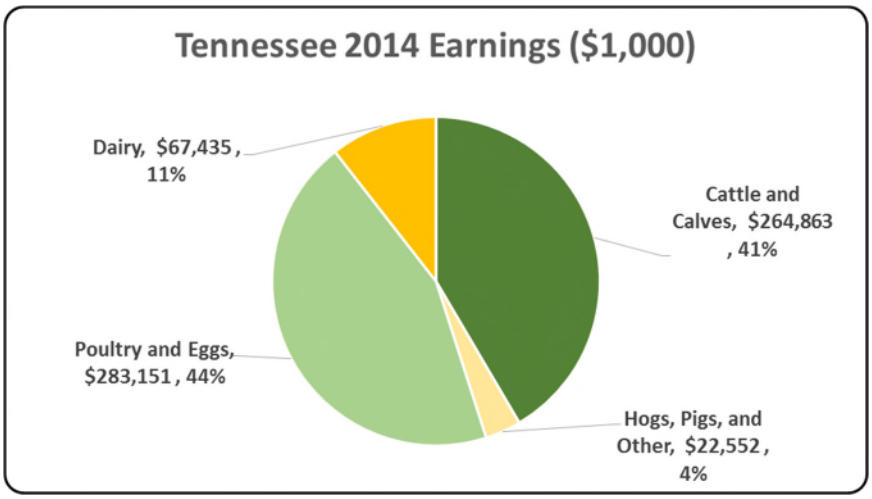
Tennessee Jobs

"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 Tennessee in terms of animal agriculture jobs. As shown, animal agriculture contributes about 17,950 jobs within and outside of animal agriculture.



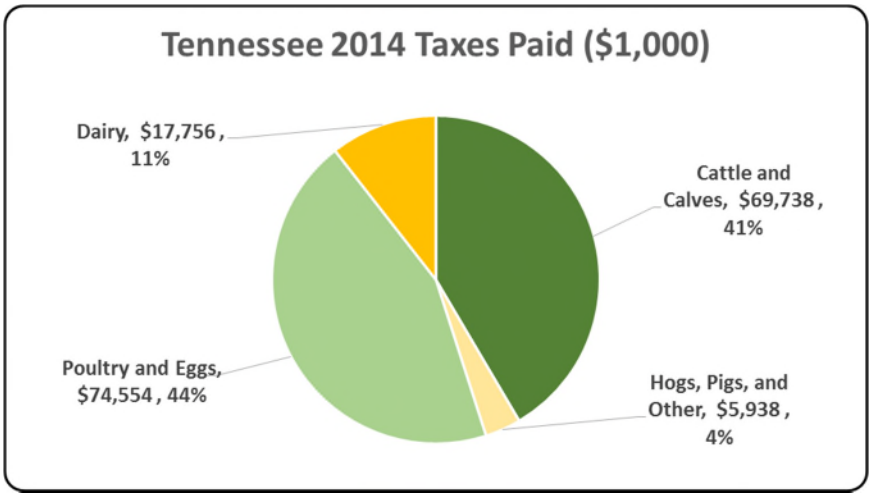
Tennessee Earnings

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 Tennessee economy in terms of earnings. Tennessee's animal agriculture contributed about $638.0 million to household earnings in 2014.



Tennessee Taxes Paid by Animal Agriculture

Tennessee's animal agriculture is also a source of tax revenue. In 2014, the state's animal agriculture industry paid about $168 million in income taxes at local, state, and federal levels. Plus the 2012 Census of Agriculture estimated $99.2 million in property taxes paid by all of Tennessee agriculture during 2012. Estimates of income taxes paid by animal agriculture are shown in the following chart.



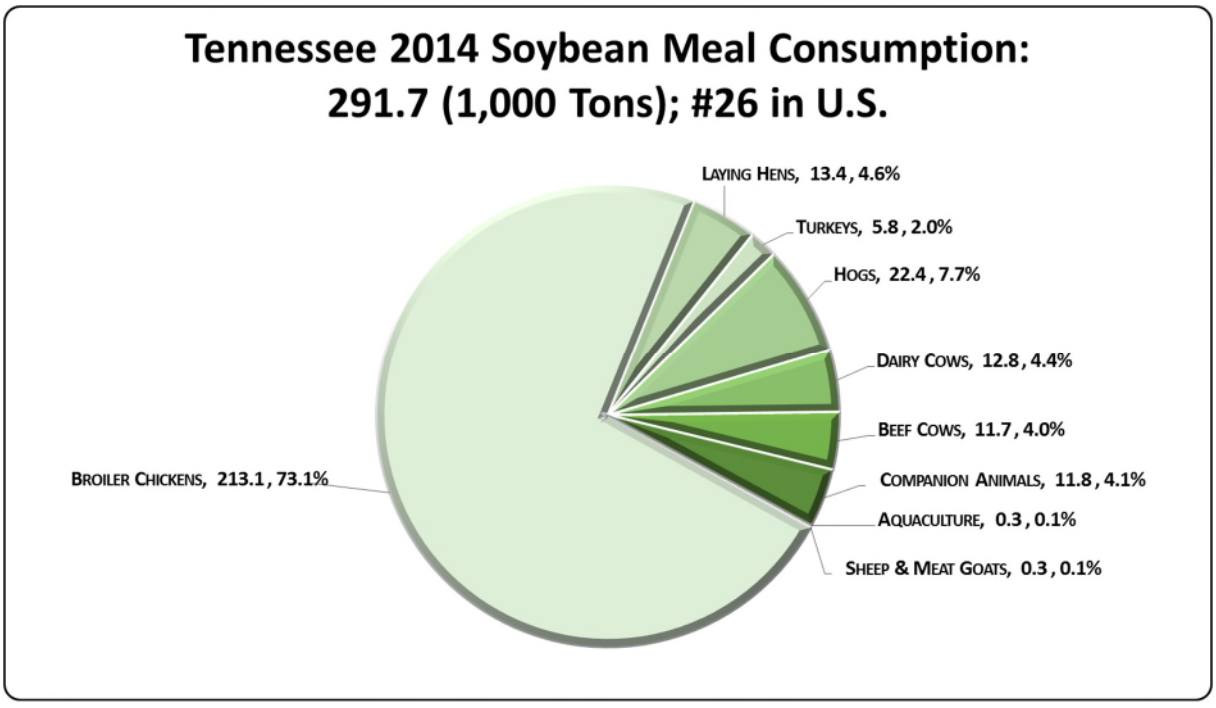
Tennessee Animal Agriculture Soybean Meal Consumption

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 2013-14 soybean marketing year by up to sixteen specific animal species has been estimated.

Tennessee's animal agriculture consumed almost 291.7 thousand tons of soybean meal in 2014, placing the state as #26 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:

- Broilers (213.1 thousand tons)
- Hogs (22.4 thousand tons)
- Egg-Laying Hens (13.4 thousand tons)

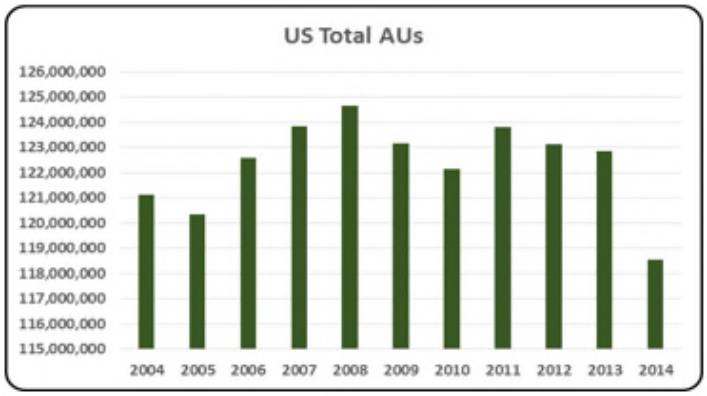


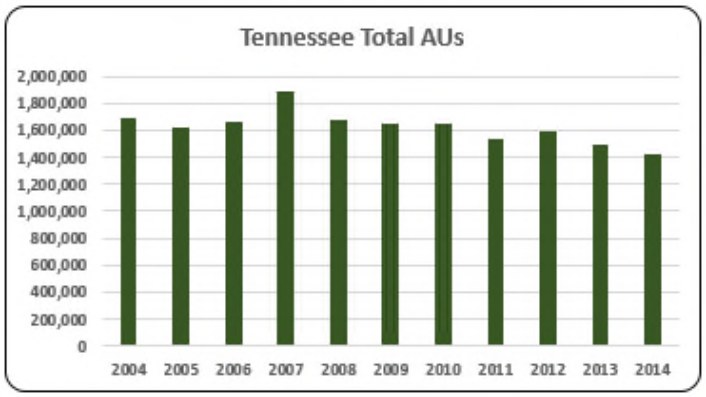
Tennessee Animal Unit (AU) Trends

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 Tennessee. 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 Tennessee and to give perspective on Tennessee'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.

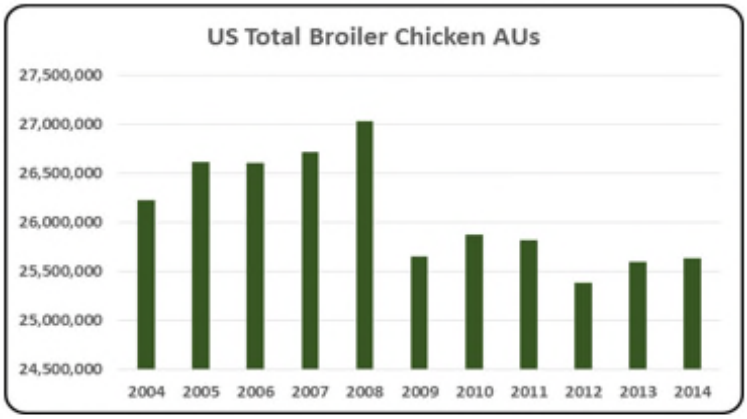
As shown in the accompanying charts and written commentary, certain components of animal agriculture are more present, and therefore more dominant than others. This is due primarily to geography (i.e., weather patterns and access to certain transportation hubs), proximity to high quality, relevant feed ingredients, and the local animal agriculture regulatory framework. In Tennessee, the largest three segments of animal agriculture in terms of AUs during 2014 were: Beef Cows (741.8 thousand AUs), Broilers (542.8 thousand AUs), and Dairy Cows (64.4 thousand AUs). Total animal units in Tennessee during 2014 were 1,428.6 thousand AUs.



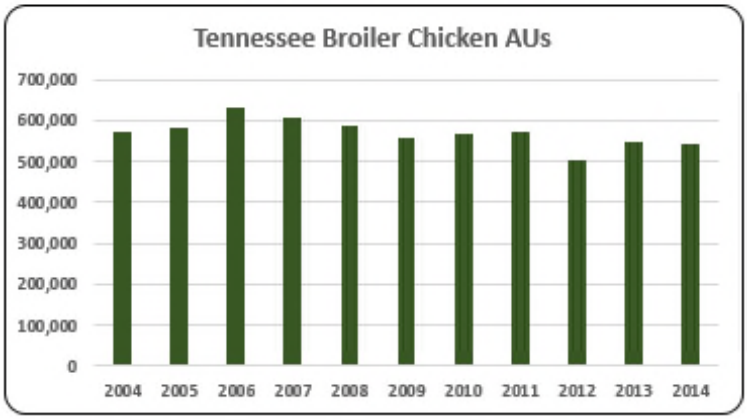


- Overall U.S. total AUs have varied from 2004 to 2014. In 2014 AUs were at an all-time low reflecting, in part, the impact of severe weather on cattle production in some parts of country. During the 2004-14 time period, total AUs in the nation peaked in 2008.

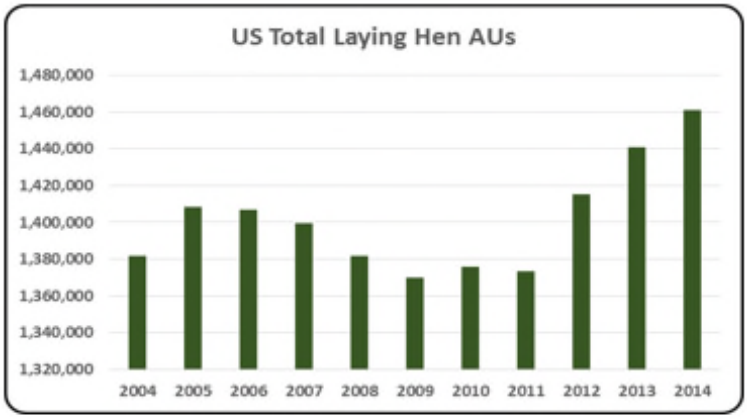
- Tennessee animal production reached a level of 1,428.6 thousand AUs in 2014. Tennessee AUs represent 1.21% of the U.S. total AUs. Animal production declined 15.8% from 2004 to 2014.



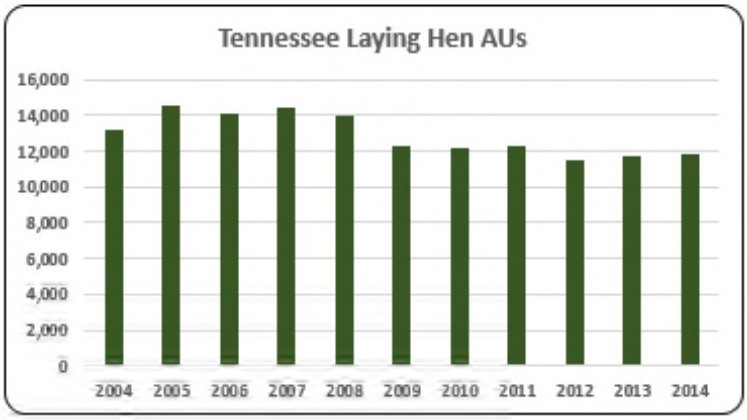
- U.S. broiler production is clustered in a number of states, with Georgia being the largest producer. On average from 2004 to 2014, broiler chicken AUs were about 26.1 million. In 2014, AUs rebounded 1% from the low AUs numbers in 2012 (25.4 million AUs).



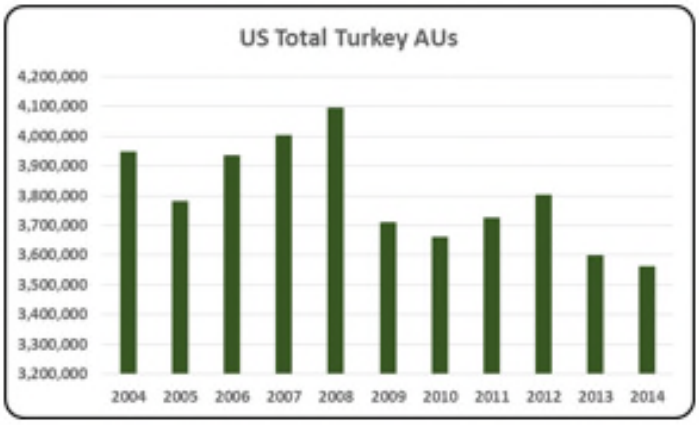
- There were 570,001 broiler AUs, on average, during the last decade. Broiler production decreased 5.4% from 2004 to 2014.



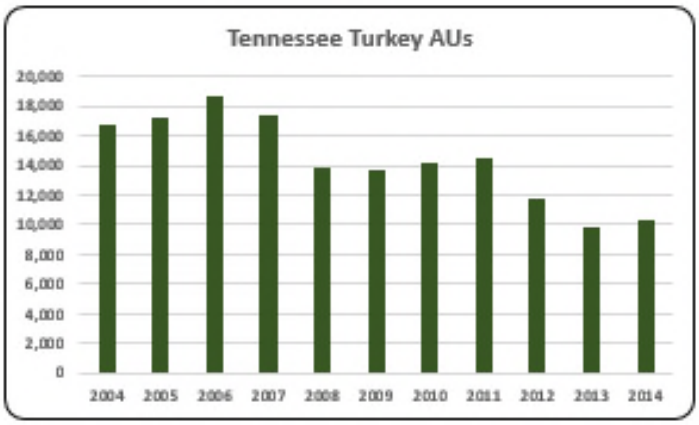
- On average, the layer AUs during 2004-2014 were 1.4 million. In 2014 layer AUs were 1.5 million, up 7% from the lowest number in 2009 (1.4 million AUs).



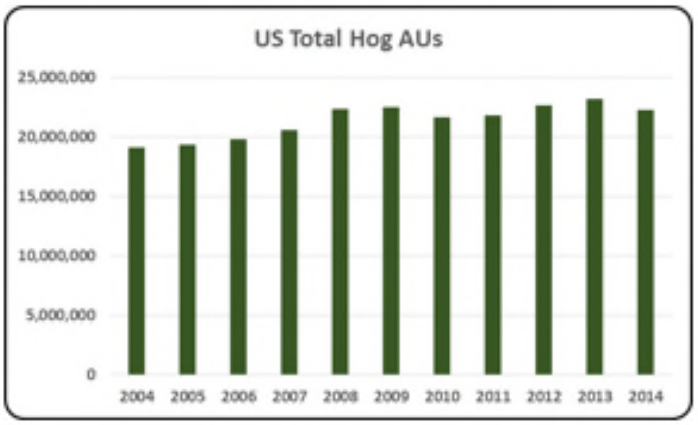
- There was a 10.4% drop in layer production from 2004 (13,239) to 2014 (11,859). The number of layer AUs in 2014 rose 1.6%% relative to 2013.



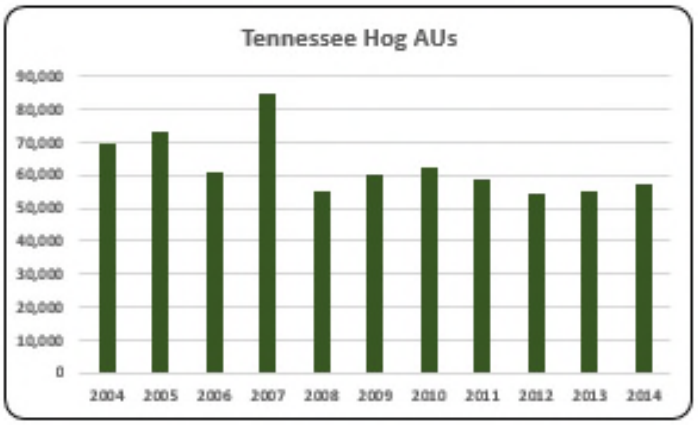
- From 2004 to 2014, the U.S. accounted for 50% of the world's turkey production. However, in 2014 turkey AUs were the lowest of the decade at 3.5 million, decreasing 13% compared to 2008 (4.1 million turkey AUs) the largest turkey AUs of the decade.



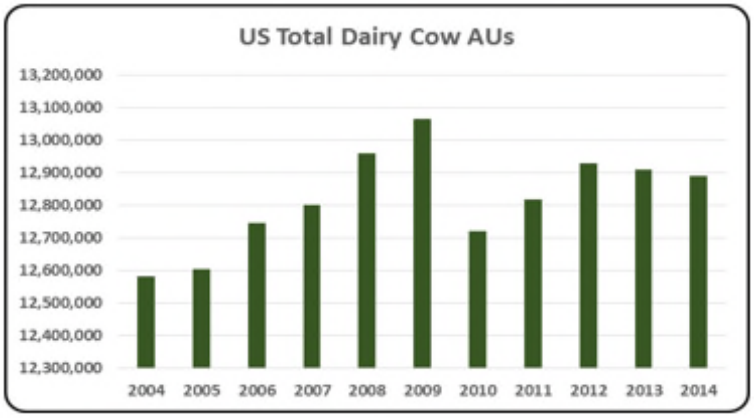
- Turkey production shrank 38.7% from 2004 (16,806 turkey AUs) to 2014 (10,294 turkey AUs).



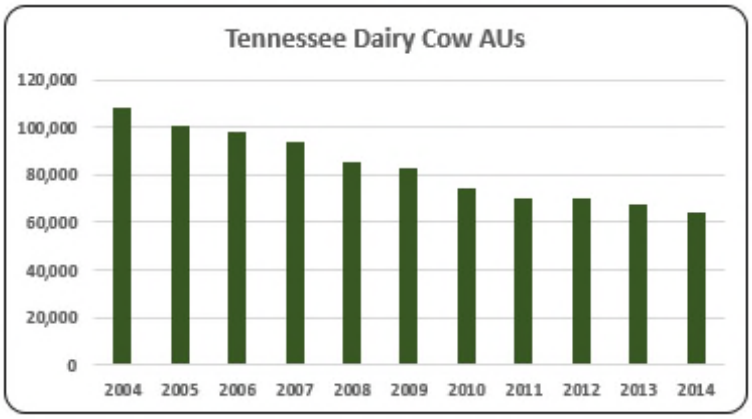
- On average from 2004 to 2014, hog AUs were about 21.4 million. In 2013 hog AUs reached a high of 23.2 million AUs as prices of main feed ingredients, particularly corn, decreased to pre-2010 price levels. Hog AUs in 2014 decreased 4.4% to 22.3 million AUs year-over-year, primarily due to the porcine epidemic diarrhea virus (PEDv) outbreak. Despite the fluctuation in AUs, the pork supply was relatively stable.



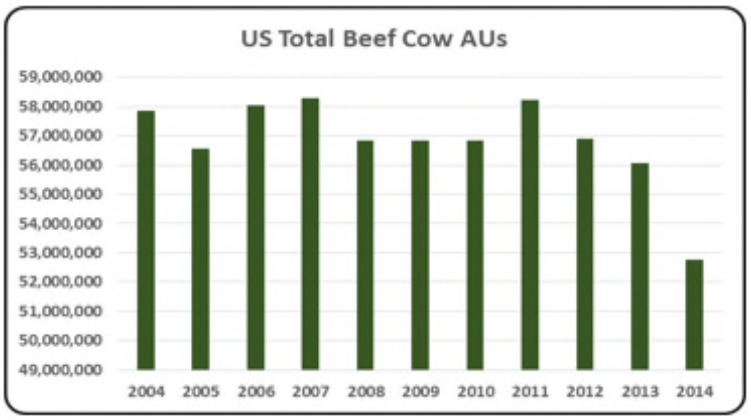
- The average number of hog AUs was 62,809 during the last decade. The number of hog AUs in 2014 (57,450) was 17.1% below the number of hog AUs in 2004 (69,300).



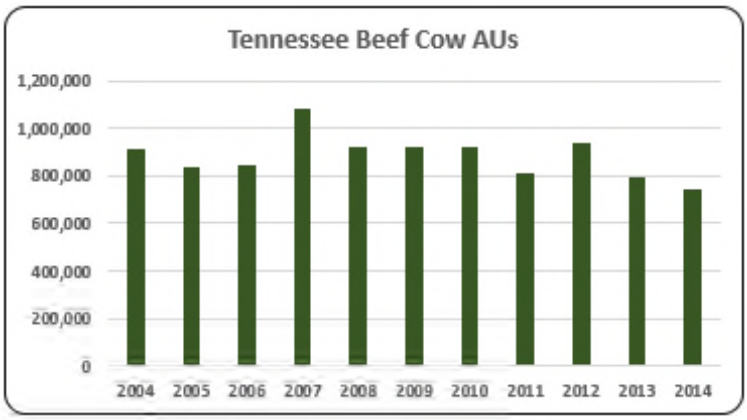
- From 2004 to 2014 dairy cow AUs averaged 12.8 million. In 2014, dairy cow AUs (12.9 million) remained about the same as the previous year but still below the high of 13.1 million AUs, the level in 2009. Despite the fluctuation in AUs, milk supplied has steadily risen.



- Dairy cow production consistently declined from 2004 (107,800) to 2014 (64,400). The decline represented a 40.3% drop in the level of dairy cow AUs.



- From 2004 to 2014 beef cow AUs averaged 56.8 million. In 2014 beef cow AUs decreased to 52.8 million, the lowest of the decade. States that raise a large number of cattle and calves like Texas and Oklahoma were plagued with drought conditions during 2014.



- Beef cow production was the number one animal production in Tennessee with 51.92% of all AUs in the state in 2014. The 2014 beef cow production was 741,750 beef cow AUs, dropping 19.0% compared to 2004 (915,900 beef cow AUs).

Tennessee Additional Information and Methodology

Animal agriculture is an important part of Tennessee'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 2004-2014 time period
- Soybean meal usage by animal species during the 2013/14 soybean marketing year
- Animal Unit (AU) trends from 2004-2014

Given the long-term presence of animal agriculture in Tennessee, of interest is the degree to which the industry impacts the Tennessee economy. Estimates of output, jobs, earnings, taxes paid, and multipliers for Tennessee 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 Tennessee'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 2004-2014 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 Tennessee which have occurred. As shown in this state report, Tennessee 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 Tennessee. 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 2013-14 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.

Tennessee 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 Tennessee'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 Tennessee, $1.684 to $2.387 million in total economic activity, $0.294 to $0.413 in household wages and 9 to 11 additional jobs are generated in the economy at large.

	Animal Type	Output($)	Earnings ($)	Employment (Jobs)
RIMS II Multipliers	Cattle and Calves	$ 2.0507	$ 0.3423	10.1
	Hogs, Pigs, and Other	$ 1.6837	$ 0.2936	8.7
	Poultry and Eggs	$ 2.3871	$ 0.4133	10.8
	Dairy	$ 1.9108	$ 0.3485	10.5

Appendix

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Animal Units (AUs)	Beef Cattle AUs	915,900	837,450	847,650	1,078,950	922,350	922,350	922,350	807,450	934,050	796,050	741,750
	Hog and Pig AUs	69,300	73,050	60,750	84,900	54,750	60,300	62,250	58,500	54,300	55,350	57,450
	Broiler AUs	573,527	579,577	628,914	605,565	588,834	558,175	568,256	571,761	504,070	548,531	542,799
	Turkey AUs	16,806	17,236	18,729	17,390	13,900	13,616	14,182	14,435	11,815	9,856	10,294
	Egg Layer AUs	13,239	14,580	14,069	14,411	14,000	12,245	12,164	12,235	11,496	11,674	11,859
	Dairy AUs	107,800	100,800	98,000	93,800	85,400	82,600	74,200	70,000	70,000	67,200	64,400
	Total Animal Units	**1,696,571**	**1,622,693**	**1,668,113**	**1,895,016**	**1,679,234**	**1,649,286**	**1,653,402**	**1,534,382**	**1,585,731**	**1,488,661**	**1,428,553**
Value of Production ($1,000)	Cattle and Calves ($1,000)	$ 494,640	$ 532,514	$ 519,164	$ 514,160	$ 450,099	$ 441,237	$ 503,087	$ 568,034	$ 594,656	$ 548,543	$ 773,774
	Hogs and Pigs ($1,000)	$ 38,314	$ 46,135	$ 38,924	$ 50,213	$ 42,010	$ 36,343	$ 52,823	$ 60,198	$ 54,349	$ 59,395	$ 70,078
	Broilers ($1,000)	$ 439,604	$ 431,376	$ 392,004	$ 451,543	$ 468,510	$ 442,148	$ 475,589	$ 454,226	$ 436,000	$ 576,043	$ 598,207
	Turkeys ($1,000)	$ 15,593	$ 16,535	$ 19,542	$ 20,055	$ 18,774	$ 12,591	$ 16,868	$ 18,919	$ 17,136	$ 11,285	$ 18,894
	Eggs ($1,000)	$ 35,511	$ 34,478	$ 33,642	$ 46,602	$ 42,815	$ 38,665	$ 43,922	$ 59,717	$ 55,816	$ 61,387	$ 67,997
	Milk ($1,000)	$ 194,040	$ 176,320	$ 148,958	$ 202,797	$ 191,496	$ 128,169	$ 152,150	$ 175,770	$ 157,780	$ 164,475	$ 193,500
	Other	$ 2,078	$ 2,513	$ 2,817	$ 3,315	$ 3,835	$ 4,110	$ 5,123	$ 5,305	$ 5,782	$ 6,259	$ 6,735
	Sheep and Lambs ($1,000)	$ 1,063	$ 1,227	$ 1,260	$ 1,487	$ 1,737	$ 1,741	$ 2,483	$ 2,395	$ 2,601	$ 2,807	$ 3,012
	Aquaculture ($1,000)	$ 1,015	$ 1,286	$ 1,557	$ 1,828	$ 2,098	$ 2,369	$ 2,640	$ 2,911	$ 3,181	$ 3,452	$ 3,723
	Total ($1,000)	**$ 1,219,780**	**$ 1,239,871**	**$ 1,155,051**	**$ 1,288,685**	**$ 1,217,539**	**$ 1,103,263**	**$ 1,249,562**	**$ 1,342,169**	**$ 1,321,519**	**$ 1,427,386**	**$ 1,729,185**

Ag Census Data Category	Animal Type		1997	2002	2007	2012
Number of Farms by NAICS	Beef cattle ranching and farming (112111)		39,017	42,602	41,886	34,457
	Cattle feedlots (112112)		1,183	31	37	37
	Dairy cattle and milk production (11212)		1,183	947	893	472
	Hog and pig farming (1122)		751	400	504	251
	Poultry and egg production (1123)		875	1,320	1,694	1,480
	Sheep and goat farming (1124)		560	1,633	2,023	2,139
	Animal aquaculture and other animal production (1125,1129)		4,993	10,731	9,010	6,769
Value of Sales ($1,000)	Cattle and Calves		444,707	499,143	633,303	735,511
	Hogs and Pigs		76,745	42,632	33,797	48,245
	Poultry and Eggs		321,790	359,286	572,866	552,015
	Milk and Other Dairy Products		207,296	173,410	180,503	145,445
	Aquaculture		3,901	4,799	4,893	withheld
	Other (calculated)		34,822	47,996	44,246	8,906
		Total	1,089,261	1,127,266	1,469,608	1,490,122
Input Purchases	Livestock and poultry purchased	(Farms)	20,054	21,962	16,930	17,664
		$1,000	148,848	175,145	213,700	283,304
	Breeding livestock purchased	(Farms)	*n/a*	12,957	10,548	10,870
		$1,000	*n/a*	32,136	47,611	62,754
	Other livestock and poultry purchased	(Farms)	*n/a*	11,274	8,552	9,202
		$1,000	*n/a*	143,009	166,089	220,551
	Feed purchased	(Farms)	42,712	57,492	49,442	48,003
		$1,000	312,849	386,790	547,993	679,459

	Animal Type	Output ($1,000)	Earnings ($1,000)	Employment (Jobs)	Taxes Paid ($1,000)
2014 Animal Agriculture	Cattle and Calves	$ 1,586,778	$ 264,863	7,841	$ 69,738
	Hogs, Pigs, and Other	$ 129,330	$ 22,552	665	$ 5,938
	Poultry and Eggs	$ 1,635,398	$ 283,151	7,419	$ 74,554
	Dairy	$ 369,740	$ 67,435	2,024	$ 17,756
	Total	$ 3,721,246	$ 638,001	17,950	$ 167,986
Change from 2004 to 2014	Cattle and Calves	$ 315,550	$ 52,671	1,559	$ 13,868
	Hogs, Pigs, and Other	$ 44,100	$ 7,690	227	$ 2,025
	Poultry and Eggs	$ 167,397	$ 28,983	759	$ 7,631
	Dairy	$ (94,924)	$ (17,313)	(520)	$ (4,558)
	Total	$ 432,123	$ 72,031	2,026	$ 18,966

	Animal Type	Output($)	Earnings ($)	Employment (Jobs)
RIMS II Multipliers	Cattle and Calves	$ 2.0507	$ 0.3423	10.1
	Hogs, Pigs, and Other	$ 1.6837	$ 0.2936	8.7
	Poultry and Eggs	$ 2.3871	$ 0.4133	10.8
	Dairy	$ 1.9108	$ 0.3485	10.5

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.