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Economic Impacts of Tennessee Agricultural Experiment Station Expenditures at the Research and Education Centers

For 2007, the University of Tennessee spent approximately \$12.5 million for agricultural research at nine Research and Education Centers located across the state. The centers support most of the research conducted by the University of Tennessee's agricultural researchers for the benefit of Tennessee's diversified agriculture and natural resource-based industries. At the centers, scientists and students test their ideas and hypotheses under real-life conditions. Research conducted on the centers addresses problems of significance to producers, agribusinesses, agricultural professionals, and the general public. The purpose of this study is to ascertain the economic contributions the Research and Education Centers have on the economies of the counties and surrounding counties in which they are located. Additional benefits occurring from the research conducted at the Research and Education Centers and eventually adopted in the state are beyond the scope of this analysis.

The Research and Education Centers are located throughout the state with three located in East Tennessee, four in Central Tennessee, and three in West Tennessee (Figure 1). Descriptions of what type of research occurs at each of the nine Research and Education Centers along with where each center is located are discussed in Table 1.

The impacts are measured in nine Zones of Economic Influence (ZEI). These ZEIs are defined in Table 1. This is achieved by examining Research and Education Center expenditures and applying these to IMPLAN, an input-output model that examines economic linkages between sectors of the state's economy. Direct, indirect, and induced are examined for total industry output, employment or jobs, and value-added¹. The impacts on wages paid to UT employees are separated from these that occur when purchasing other goods and services.

Annual Expenditures

Of the \$12.5 million spent each year by the Research and Education Centers, approximately 63.1 percent of the expenditures are allocated to salaries, wages and fringe benefits. The East Tennessee, West Tennessee, and Middle Tennessee Research and Education Centers report the largest overall expenditures, accounting for 52.7 percent, followed by the Plateau and Dairy Research and Education Centers (Figure 2, Table 2).

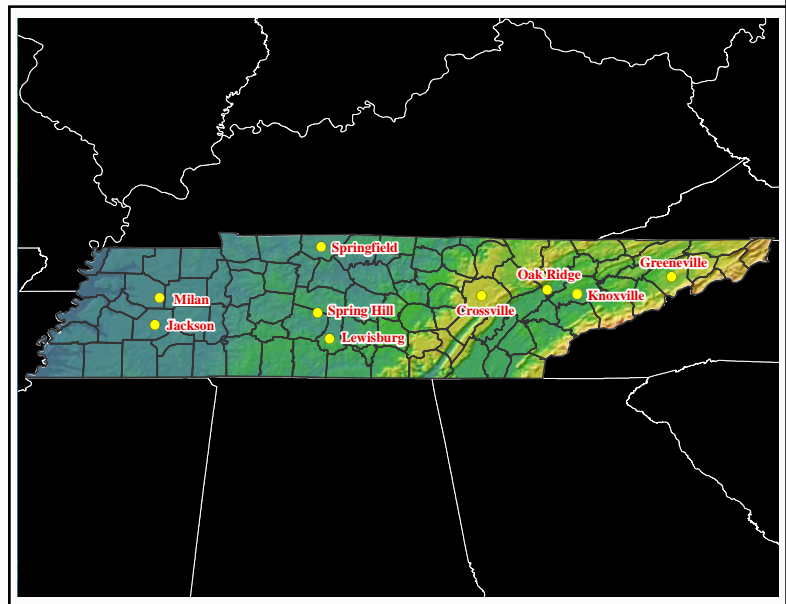


Figure 1. Location of Tennessee Research and Education Centers

Table 1. Location and Description of the Research Conducted at University of Tennessee Research and Education Centers

Research & Education Center/ Location	Zones of Economic Influence	Description
Forestry Resources Research & Education Center/Oak Ridge (Anderson County)	Anderson, Blount, Coffee, Knox, Loudon, Morgan, Union	The University of Tennessee Forest Resources Research & Education Center is a regionally recognized leader in developing new technologies applicable to modern forestry and wildlife resources management and environmental stewardship on an 11,500-acre field research laboratory.
Plateau Research & Education Center/Crossville (Cumberland County)	Bledsoe, Cumberland, Fentress, Morgan, Overton, Putnam, Rhea, Roane, Van Buren, White	The center is about equal distance from Nashville, Knoxville, and Chattanooga and is the site of research in beef, fruits and vegetables, and field crops. The center is most noted for its studies in beef, squash, muskmelons, watermelons, pumpkins, greens, cabbage, green beans, apples, blueberries, and tomatoes.
Research & Education Center at Greenville (Greene County)	Cocke, Greene, Hamblen, Hawkins, Unicoi, Washington	Known for its research on burley tobacco production and beef cow/calf production. Areas of research at the center include all aspects of burley tobacco production with emphasis on breeding and production economics, variety testing, pest management, and breeding of field crops important to the agriculture of Upper East Tennessee; and animal research in the areas of genetics, silage feeding, and grazing studies.
West Tennessee Research & Education Center/Jackson (Madison County)	Carroll, Chester, Crocket, Gibson, Hardeman, Haywood, Henderson, Madison	Known for its research on ornamentals, turf grasses, agronomic and horticultural crops, the West Tennessee Experiment Station, established in 1907, is the oldest research center outside of Knoxville in The University of Tennessee Agricultural Experiment Station (TAES) system.
East Tennessee Research & Education Center/Knoxville (Knox County)	Anderson, Blount, Knox, Loudon, Union	Known for its research on production of agronomic and vegetable crops, along with beef and dairy production. The center serves as a field laboratory providing experimental plots, lands, livestock, orchards, equipment, and other types of support for research programs. Initially established in 1869, acreage at the center now totals 2,889.
Dairy Research & Education Center/Lewisburg (Marshall County)	Bedford, Giles, Lincoln, Marshall, Maury	Known for research studies on use of forage in dairy rations, dairy cattle breeding and genetics, dairy reproduction studies, mastitis and udder health, and water quality and dairy waste. The center manages one of the largest and highest milk-producing Jersey herds in the world.
Middle Tennessee Research & Education Center/Spring Hill (Maury County)	Giles, Hickman, Lawrence, Lewis, Marshall, Maury, Williamson	Known for its research in beef and dairy cattle, commercial crops, fruit trees, and forage crops. More specifically, the center conducts research to evaluate varieties of commercial crops, management systems and weed control systems improve crop production efficiency. Additional research is conducted on the production and management of fruit and vegetable crops, including peaches, apples, grapes, and blueberries.

Table 1. Location and Description of the Research Conducted at University of Tennessee Research and Education Centers (Cont.)

Research & Education Center/ Location	Zones of Economic Influence	Description
Research & Education Center at Milan (Gibson County)	Carroll, Crockett, Dyer, Gibson, Madison, Obion, Weakley	The station is comprised of three locations, the South Tract on Tennessee Highway 104, the North Tract on US Highway 70A & 79 and the Arsenal Tract on the arsenal property. With a total 675 acres of crop land used for an array of research purposes focused primarily on no-till and dedicated energy crop production. Soil conservation research investigates the rate of erosion, soil productivity, and run-off studies. Establishment and production of switchgrass is being evaluated for use as a biofuel.
Highland Rim Research & Education Center/Springfield (Robertson County)	Cheatham, Davidson, Montgomery, Robertson, Sumner	Known for its research in cow-calf management and dark-fired and burley tobacco production efficiency. The center conducts cow-calf research emphasizing forage utilization and breeding efficiency; fire and air-cured dark and burley tobacco breeding, management, and curing.

Source: <http://taes.tennessee.edu/centers/>

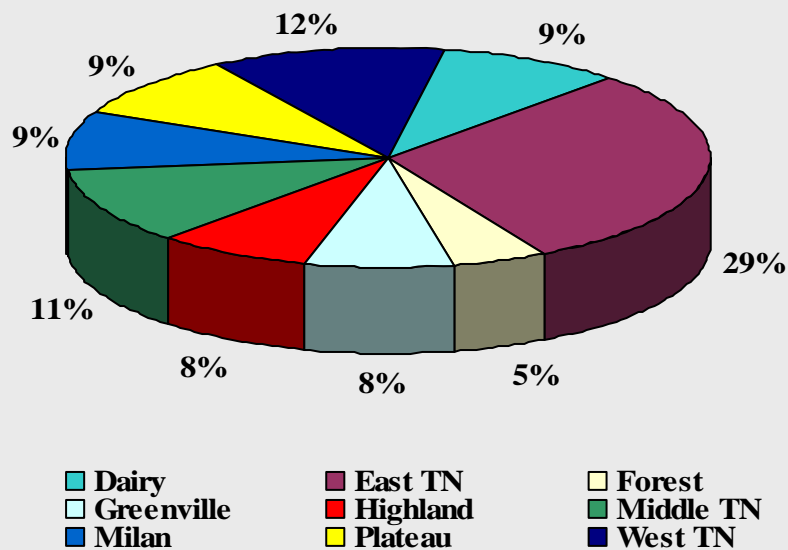


Figure 2. Proportion of total expenditures to Research Centers

Table 2. Typical Annual Expenditures by Research and Education Centers

Center	County Location	Total Operating & Maintenance	Wages	Total Expenditures
Dairy	Marshall	\$429,800	\$722,600	\$1,152,400
Forest	Anderson	\$73,000	\$509,200	\$582,200
Highland Rim	Robertson	\$293,200	\$668,000	\$961,200
East Tennessee	Knox	\$1,652,400	\$2,113,300	\$3,765,700

Table 2. Typical Annual Expenditures by Research and Education Centers (Cont.)

Center	County Location	Total Operating & Maintenance	Wages	Total Expenditures
Middle Tennessee	Maury	\$479,150	\$904,800	\$1,383,950
Milan	Gibson	\$513,700	\$600,300	\$1,114,000
Plateau	Cumberland	\$400,950	\$759,400	\$1,160,350
Greenville	Greene	\$304,400	\$636,600	\$941,000
West Tennessee	Madison	<u>\$463,600</u>	<u>\$995,500</u>	<u>\$1,459,100</u>
	Total	\$4,610,200	\$7,909,700	\$12,519,900

Estimated Economic Impacts of the Annual Expenditures**Durable and nondurable goods and services**

Expenditures when used to purchase inputs and labor at the Research and Education Centers result in additional economic activity. Individuals are employed and purchase goods and services within the regions. Durable and nondurable inputs are ordered and transported to the center for use in production of agricultural commodities as well as in support of ongoing research effortsⁱⁱ. The \$4.6 million spent on operations and maintenance, excluding wages and salaries, result in an estimated \$7.5 million impact in the Zones of Economic Influence. Of this \$7.5 million, the purchase of inputs result in an estimated \$1.0 million of additional economic activity within the zones and induced another \$1.8 million (Table 3). These expenditures result in an additional 51 jobs above the number employed directly by the Research and Education Centers. These employment impacts, along with proprietor profits resulting from sales to the research center, result in increased value-added within the ZEI's of nearly \$3.8 million.

Table 3. Impacts of TAES Research and Education Center Expenditures on Total Industry Output (TIO), Jobs, and Total Value Added (TVA) in the Zones of Economic Influence

Center	Direct	Indirect	Induced	Total
Dairy				
TIO (million \$)	\$429,800	\$84,519	\$93,425	\$607,744
Jobs (number)	1.2	0.6	0.8	2.6
TVA (million \$)	\$156,887	\$40,146	\$48,183	\$245,216
Forest				
TIO	\$73,000	\$16,612	\$45,702	\$135,314
Jobs	0.5	0.1	0.5	1.1
TVA	\$44,166	\$8,990	\$28,278	\$81,434
Highland Rim				
TIO	\$293,200	\$86,939	\$189,996	\$570,135
Jobs	2.3	0.6	1.7	4.6
TVA	\$173,722	\$48,472	\$118,762	\$340,956
East Tennessee				
TIO	\$1,652,400	\$374,133	\$910,431	\$2,936,964
Jobs	8.7	2.8	9.0	20.5
TVA	\$901,345	\$194,860	\$557,221	\$1,653,426
Middle Tennessee				
TIO	\$479,150	\$118,573	\$147,878	\$745,601
Jobs	1.9	0.8	1.3	4.0
TVA	\$178,488	\$60,995	\$85,521	\$325,004

Table 3. Impacts of TAES Research and Education Center Expenditures on Total Industry Output (TIO), Jobs, and Total Value Added (TVA) in the Zones of Economic Influence (Cont.)

Center	Direct	Indirect	Induced	Total
Milan				
TIO (million \$)	\$513,700	\$116,298	\$104,508	\$734,506
Jobs (number)	1.5	0.9	1.1	3.5
TVA (million \$)	\$136,531	\$54,919	\$63,310	\$254,760
Plateau				
TIO	\$400,950	\$94,650	\$158,818	\$654,418
Jobs	4.2	0.9	1.9	7.0
TVA	\$218,855	\$51,562	\$102,629	\$373,046
Greenville				
TIO	\$304,400	\$60,031	\$97,077	\$461,508
Jobs	1.6	0.5	1.1	3.2
TVA	\$151,521	\$30,652	\$59,116	\$241,289
West Tennessee				
TIO	\$463,600	\$101,603	\$120,733	\$685,936
Jobs	2.3	0.8	1.4	4.5
TVA	<u>\$179,398</u>	<u>\$45,201</u>	<u>\$74,559</u>	<u>\$299,158</u>
Total TIO	<i>\$4,610,200</i>	<i>\$1,053,358</i>	<i>\$1,868,568</i>	<i>\$7,532,126</i>
Total Jobs	<i>24.2</i>	<i>8.0</i>	<i>18.8</i>	<i>51.0</i>
Total TVA	<i>\$2,140,913</i>	<i>\$535,797</i>	<i>\$1,137,579</i>	<i>\$3,814,289</i>

Wages and Salariesⁱⁱⁱ

Over \$7.9 million is spent on wages and salaries at the Research and Education Centers. These expenditures also impact various sectors of the economy within the regions where the centers are located. For instance, the \$2.1 million spent at the East Tennessee Research and Education Center has over a \$3.0 million total impact within its ZEI creating an additional 8.5 jobs beyond those hired directly by the East Tennessee Research and Education Center (Table 4). Statewide, an estimated \$3.6 million is added to the ZEI's in value-added as a result of consumption activities of those employed and paid \$7.9 million in wages and salaries by the TAES.

Table 4. Impacts of TAES Research and Education Center Wage and Salary Expenditures on Total Industry Output, Jobs, and Total Value Added in the Zones of Economic Influence

Center	Direct	Indirect	Induced	Total
Dairy				
TIO (<i>million \$</i>)	\$722,600	\$54,833	\$112,708	\$890,141
Jobs (<i>number</i>)	15.8	0.6	1.1	17.5
TVA (<i>million \$</i>)	\$177,553	\$29,360	\$62,493	\$269,406
Forest				
TIO	\$509,200	\$65,068	\$155,575	\$729,843
Jobs	9.0	0.5	1.5	11.0
TVA	\$147,663	\$36,070	\$95,564	\$279,297
Highland Rim				
TIO	\$668,000	\$81,750	\$189,308	\$939,058
Jobs	15.8	0.6	1.7	18.1
TVA	\$193,993	\$45,247	\$116,438	\$355,678

Table 4. Impacts of TAES Research and Education Center Wage and Salary Expenditures on Total Industry Output, Jobs, and Total Value Added in the Zones of Economic Influence (Cont.)

Center	Direct	Indirect	Induced	Total
East Tennessee				
TIO (<i>million \$</i>)	\$2,113,300	\$268,055	\$636,599	\$3,017,954
Jobs (<i>number</i>)	42.3	2.2	6.3	50.8
TVA (<i>million \$</i>)	\$608,267	\$148,673	\$391,430	\$1,148,370
Middle Tennessee				
TIO	\$904,800	\$89,481	\$190,352	\$1,184,633
Jobs	20.5	0.8	1.7	23.0
TVA	\$246,018	\$49,571	\$111,744	\$407,333
Milan				
TIO	\$600,300	\$44,596	\$100,246	\$745,142
Jobs	11.9	0.4	1.1	13.4
TVA	\$149,845	\$23,702	\$61,598	\$235,145
Plateau				
TIO	\$759,400	\$58,212	\$118,655	\$936,267
Jobs	22.4	0.5	1.4	24.3
TVA	\$192,875	\$31,801	\$75,129	\$299,805
Greenville				
TIO	\$636,600	\$47,541	\$96,649	\$780,790
Jobs	19.6	0.5	1.1	21.2
TVA	\$152,650	\$24,698	\$59,317	\$236,665
West Tennessee				
TIO	\$995,500	\$69,901	\$152,598	\$1,217,999
Jobs	37.3	0.7	1.7	39.7
TVA	\$246,428	\$36,286	\$94,475	\$377,189
Total TIO	\$7,909,700	\$779,437	\$1,752,690	\$10,441,827
Total Jobs	194.6	6.8	17.6	219.0
Total TVA	\$2,115,292	\$425,408	\$1,068,188	\$3,608,888

Total Impact of TAES Expenditures

Tennessee Research and Education Centers expenditures in excess of \$12.5 million at the Research and Education Centers result in an estimated total impact of over \$17.9 million, with over \$1.8 million indirect and another \$3.6 million induced (Table 5). An estimated \$7.4 million in value-added or 41.3 percent of the total impact to the Tennessee economy occurs as a result of Tennessee Agricultural Experiment Station expenditures at the research and education centers.

Please note that this does not include the impact of the research conducted at the research and education centers. Therefore, these number likely underestimate the overall economic impact of TAES research. Those potential benefits include adoption of output enhancing and/or cost reducing technologies. Minimum tillage farming systems conserve energy and reduce erosion while maintaining output. Other benefits include safer, less costly food supplies. While these benefits were not measure as part of this study, it has been estimated that annual rates of return range from 30 to 60 percent (Lyu, White, and Liu, 1984; Norton and Ortiz, 1992; as reported in Norton; available at <http://www.nal.usda.gov/pgdic/Probe/v2n2/bene.html>). Using estimated annual rate of returns estimated in previous studies, the \$12.5 million in Research and Education Center expenditures increases the annual impacts estimated in this study by an estimated \$3.8 to \$7.5 million.

Table 5. Accumulated Annual Impacts within in the Zones of Economic Influence of the Tennessee Agricultural Experiment Station's Expenditures at Nine Research and Education Centers

Center	Total Industry Output			Total
	Direct	Indirect	Induced	
Dairy	\$1,152,400	\$139,352	\$206,133	\$1,497,885
Forest	\$582,200	\$81,680	\$201,277	\$865,157
Highland Rim	\$961,200	\$168,689	\$379,304	\$1,509,193
East Tennessee	\$3,765,700	\$642,188	\$1,547,030	\$5,954,918
Middle Tennessee	\$1,383,950	\$208,054	\$338,230	\$1,930,234
Milan	\$1,114,000	\$160,894	\$204,754	\$1,479,648
Plateau	\$1,160,350	\$152,862	\$277,473	\$1,590,685
Greenville	\$941,000	\$107,572	\$193,726	\$1,242,298
West Tennessee	<u>\$1,459,100</u>	<u>\$171,504</u>	<u>\$273,331</u>	<u>\$1,903,935</u>
Total	\$12,519,900	\$1,832,795	\$3,621,258	\$17,973,953

ⁱ Economic impacts result because the Tennessee Agricultural Experiment Station Research Centers purchase goods and services from other industries (Direct impacts). In turn, those industries would need to purchase goods and services from other industries (Indirect impacts). In addition, household and institutional spending would increase due to the added industry activity (Induced impacts) resulting from the initial TAES expenditures. The Total Industry Output (value of production by industry) measures the impact of the expenditure, while Value-Added measures changes to employee compensation, proprietor income, indirect business taxes, and other property income. The numbers of jobs created are an estimate of the number of full and part time positions required to meet the change in demand for goods and services.

ⁱⁱ These impacts are measured through IMPLAN.

ⁱⁱⁱ The methodology used to estimate the annual impacts of wages and salaries for the Research and Education Centers on Tennessee's economy has changed from the previous analysis. A revised document for the 2003 study now exists at <http://aimag.ag.utk.edu/pubimpact.html>.

