Economic Impacts to Tennessee Soybean Producers and Regional Economies from China's 25 Percent Tariff on Soybeans

S. Aaron Smith, Assistant Professor
Jamey Menard, Research Leader
Burton C. English, Professor
Department of Agricultural and Resource Economics

Overview

Agricultural producers face numerous production and price uncertainties. International trade disruptions can exacerbate issues for producers. In 2018, as a result of escalating trade tensions between the U.S. and China, both countries imposed tariffs on various imports. China's tariffs have largely focused on U.S. agricultural commodities and products, specifically soybeans, creating an uncertain marketing environment that affects soybean producers' income expectations for 2018. Due to tariffs on soybeans, the Trump administration announced payments to producers through the Market Facilitation Program (MFP) (Best, Smith and Muhammad, 2018). Soybean MFP payments are designed to partially offset decreases in soybean producer income as a result of the Chinese tariffs. This article estimates the economic impact of decreased soybean prices, due to tariffs, and soybean MFP payments on 2018 soybean producer income and regional economies in Tennessee.

University of Tennessee Extension Regions

West
Middle
East

0   35   70   140 Miles

N

In an effort to assist producers, UT Extension has recently published numerous trade-related bulletins: UT Extension publications *W 532*, *W 656* and *W 776*. The purpose of this publication is to further assist producers, agricultural stakeholders and local leaders in Tennessee by estimating the economic impacts to producers' income as a result of China imposing a tariff on soybeans for three regions of Tennessee using IMPLAN, an economic input-output model (IMPLAN Group LLC). The three regions analyzed are detailed in Figure 1.

Figure 1. Tennessee regions analyzed in this study.

Real. Life. Solutions.™

UT EXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

U.S. and Tennessee Soybean Production

U.S. soybean planted acres increased from 77.4 million acres in 2010 to 90.1 million in 2017, an increase in soybean acreage of 2.3 percent per year. Production from 2010 to 2017 increased an average of 4.3 percent annually from 3.3 billion to 4.4 billion bushels (USDA/NASS, 2018). Over the same time period, China increased global soybean imports from 1.923 to 3.527 billion bushels (USDA/FAS, 2018). U.S. exports of soybeans to China have increased from 893 million bushels in 2010 to 1.166 billion bushels in 2017 (USDA/FAS, 2018).

In Tennessee, for 2016, total agricultural cash receipts are estimated at $3.3 billion, with crop receipts estimated at close to $2.0 billion. For that same time period, Tennessee soybean production cash receipts contributed $680.3 million or 34.4 percent of total crop receipts. From 2010-2017, soybean cash receipts averaged 30.8 percent of Tennessee's total crop receipts (USDA/ERS, 2018). Soybean planted acreage in the state increased from 1.45 million acres in 2010 to 1.69 million acres in 2017; production increased from 43.7 million bushels to 83.0 million bushels for this same period. Increases in planted acres and production averaged 2.4 percent and 12.8 percent per year (USDA/NASS, 2018).

China and U.S. Trade Dispute

In 2018, trade tensions between the U.S. and China escalated. The 2018 trade dispute started on January 22 when the Trump Administration imposed tariffs on solar panels and washing machines, citing unfair trade practices and intellectual property theft by China as the rationale. Since then, a series of tit-for-tat tariffs have been imposed on a wide range of products. China has directly targeted many U.S. agricultural products with tariffs. Notably, on July 6, 2018, China implemented 25 percent tariffs on several U.S. agricultural commodities and goods, including soybeans, the largest U.S. agricultural export to China (Table 1). Prior to the trade war, China had a 1 percent tariff on U.S. soybean imports. Currently, total Chinese tariffs on soybeans are 26 percent.

Table 1. 2017 U.S. Agricultural Exports To China

Product	Value ($1,000)
Total Agricultural Product Exports	$ 19,612,135
Bulk Products	
Soybeans	$12,355,952
Cotton	$976,417
Coarse Grains (except corn)	$835,688
Wheat	$348,727
Tobacco	$162,297
Corn	$142,036
Other Bulk Commodities	$56,511
Pulses	$25,056
Oilseeds (except soybeans)	$5,056
Rice	$759

Source: USDA, Foreign Agricultural Service, Global Agricultural Trade System (GATS)

The 26 percent tariff increases the price Chinese importers pay for U.S. soybeans, thus decreasing the quantity of U.S. soybeans demanded by China. Since the tariffs were announced, reduced soybean exports (July 2018 exports to China were 8.6 million bushels compared to 19.4 million in 2017 and 36.4 million in 2016; down 47 percent and 76 percent; USDA FAS GATS, 2018b) and decreased U.S./Tennessee soybean cash price occurred (Table 2). It is important to note that price declines for soybeans are not solely due to the retaliatory tariffs and the negative impact on exports. For example, weather from May through August has provided good growing conditions, leading to increased U.S. production (increased production results in a soybean price decline, ceteris paribus). Also, the long-term impacts (i.e., loss of market share) on exports

and prices for soybeans are uncertain and outside the focus of this analysis. Additional information regarding the impact on U.S. soybean exports to China is available in the UT Extension publication "Evaluating the Impact of Retaliatory Tariffs on U.S. Soybeans in China" (W 532).

Table 2. Monthly Average Cash Soybean Prices ($/bu) in Tennessee 2018 (USDA/AMS, 2018)

	Memphis	Lower-Middle	Upper-Middle	Northwest
Jan-18	$9.87	$9.45	$9.69	$9.71
Feb-18	$10.15	$9.78	$9.97	$10.00
Mar-18	$10.37	$10.06	$10.17	$10.18
Apr-18	$10.43	$10.11	$10.18	$10.22
May-18	$10.33	$10.19	$10.07	$10.11
Jun-18	$9.36	$9.25	$9.15	$9.14
Jul-18	$8.57	$8.51	$8.48	$8.39
Aug-18	$8.53	$8.90	$8.55	$8.45
High-Low	$1.91	$1.68	$1.70	$1.83
Avg. Jan-May	$10.23	$9.92	$10.01	$10.04
Avg. Jun-Aug	$8.82	$8.89	$8.73	$8.66
Change (Jan-May to Jun-Aug)	$1.41	$1.03	$1.29	$1.39

Price Response and Adjustments to Global Soybean Markets

As a result of the Chinese tariffs, global soybean markets are adjusting. In recent months, China has purchased soybeans from Brazil (and to a lesser extent Argentina), increasing soybean prices in South America (Figure 2). Partially, due to reduced soybean exports to China (the world's largest soybean purchaser), the U.S. has seen a dramatic decrease in domestic prices (Table 2; Figure 2). The price decrease in the U.S. and price increase in Brazil have resulted in smaller soybean importing nations, such as the EU, Mexico and several countries in Southeast Asia, shifting purchases from Brazilian to U.S. ports of origin, partially mitigating the exports lost to China. The purchases by other countries are small relative to China and only offset part of the loss in U.S. export business. In 2017, China imported 57.3 percent of global soybean exports; Mexico, the next largest importer, purchased 7.4 percent (USDA FAS GATS 2018b).
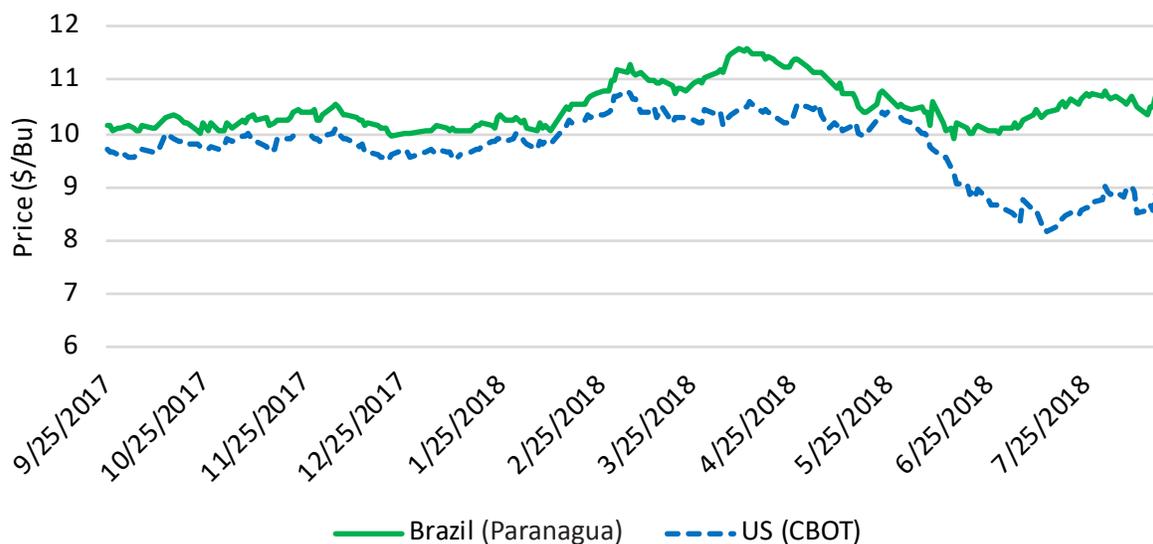

Figure 2. Nearby Soybean Futures Price at the Chicago Board of Trade (CBOT) and Cash Price at Paranagua, Brazil, September 2017-August 2018.

The November Chicago Board of Trade (CBOT) futures contract declined from a high of $10.60 ½ per bushel on May 29 to a low of $8.26 ¼ per bushel on July 16, a price decrease of $2.34 ¼ per bushel (Barchart, 2018). The change in soybean prices cannot be entirely attributed to China's increased tariffs, as the U.S. has had a good growing season year-to-date, increasing projected production and decreasing prices. However, at the end of July 2018, soybean prices at Paranagua, Brazil, have increased to $2.15/bu over the CBOT futures price, compared to an average of $0.43/bu over the CBOT futures price from September 2017 to May 2018 (a change in price of $1.72/bu) (Figure 2; Barchart, 2018; CONAB, 2018).

This change in price cannot be attributed solely to China's increased tariff on U.S. soybeans: other factors, such as exchange rates, freight rates, seasonality of exports, etc., also contribute to changes in domestic and foreign soybean prices, but the change in Paranagua price relative to the change in CBOT futures price, 73 percent ($1.72/$2.15), can be used as a proxy for the tariff-induced price change in U.S. soybeans. Due to the uncertainty regarding the change in soybean prices from tariffs versus other factors (weather, etc.), this analysis estimates the impacts of the regional price change attributed to the Chinese tariffs at 50, 75 and 100 percent reduction in the pre-tariff soybean prices.

Tennessee Regional Soybean Price Estimates

Regional pre-tariff soybean prices are based on average cash contracts from January-May 2018 for delivery in October-November 2018 (Table 3). Per-bushel prices range from $9.75 in the eastern region of Tennessee to $9.86 in the west and $9.84 for the entire state. Likewise, per-bushel prices from June-August ranged from $8.33 in the eastern region to $8.40 in the west and $8.39 for the state.[1] Current prices were determined by taking the current harvest futures contract of $8.50 per bushel, adjusted for the typical regional basis.[2] The decline in price attributed to each region and the state would be the price change multiplied by the percent price change attributed to tariffs (50, 75 and 100 percent in Table 4). Partially offsetting the decrease in producer income is the recently announced MFP payment factor for soybeans, $1.65 per bushel on half of 2018 production ($0.825 on full production) (Best, Smith, and Muhammad, 2018).

Table 3. Estimated Regional- and State-Level Soybean Prices Per Bushel Before and After July 6, 2018, 25 Percent China-Imposed Tariff for Tennessee

	East	Middle	West	State
	\$/bushel			
Pre-Tariff	$9.75	$9.78	$9.86	$9.84
Current w/Tariff	$8.33	$8.35	$8.40	$8.39
Price Change	$1.42	$1.43	$1.46	$1.45
MFP Payment[a]	$0.825	$0.825	$0.825	$0.825

[a]Market facilitation payment factor for **full** production (Best, Smith, and Muhammad, 2018).

Changes in Producer Income and Induced Economic Impact

The estimated direct reduction in producers' incomes is shown in Table 4. The price decrease shown in Table 4 is absorbed by producer income because 2018 planting decisions and virtually all cropping expenditures have already been made: Producers have no recourse in adjusting to the decline in price by cutting expenses. Accordingly, we assume that the projected decline in price translates into a concomitant decline in producers' income (i.e., proprietors' income in our impact model). Accordingly, in terms of our input-output model, only induced economic impacts (triggered by changes to soybean producers' incomes) are accounted for in the model as no changes are assumed to occur in farm operation input purchases (as measured by indirect economic impacts in an impact model).

---

1 The 25 percent increase in Chinese tariffs came into effect on July 6; however, soybean markets had priced in a portion of the tariff before the effective date.
2 Regional basis is the regional cash price less the futures price. Typically, basis is lowest during the harvest interval.

The per-bushel soybean price decrease is the current (post-tariff price) minus the pre-tariff price, adjusted for the MFP payment per bushel ($0.825), multiplied by the assumed price decrease as a result of the tariff (50, 75 and 100 percent). Regional soybean acreage calculations are based on Tennessee's 2017 regional soybean acreage proportioned by 2018-estimated 1.7 million total acreage. Yields are estimated from average regional trend-line yields from 2000 to 2017. The gain in producers' incomes as a result of the tariff (at 50 percent, with the market facilitation payment of $0.825) are estimated at $0.3 million, $2.1 million, $5.6 million and $8.1 million for the eastern, middle and western regions, and the state. Also presented are the estimated losses in producers' incomes for these regions and the state for a 75 and 100 percent price decrease from the tariff (plus the MFP payment). These estimated values are the direct impacts to the study regions for the IMPLAN analysis (IMPLAN Group LLC).

Table 4. Estimated Direct Regional- and State-Level Economic Gain/Loss in Producers' Income from the Recent 25 Percent China-Imposed Tariff on U.S. Soybeans, Plus the $0.825/bu Payment from the Market Facilitation Program

Region	Price Decrease from Tariff[b]	Price Decrease[a]	Soybean Acreage[c]	Yields[d]	Producer Income ($)
	Percent	$/bu	Number	Bu/acre	
East		$0.115	51,807	45	$268,102
Middle	50	$0.110	404,096	48	$2,146,964
West		$0.095	1,264,096	46	$5,560,128
State		$0.100	1,720,000	47	$8,084,000
East		-$0.240	51,807	45	($559,518)
Middle	75	-$0.248	404,096	48	($4,830,669)
West		-$0.270	1,264,096	46	($15,802,469)
State		-$0.263	1,720,000	47	($21,220,500)
East		-$0.595	51,807	45	($1,387,139)
Middle	100	-$0.605	404,096	48	($11,808,303)
West		-$0.635	1,264,096	46	($37,165,066)
State		-$0.625	1,720,000	47	($50,525,000)

[a]Current w/tariff minus pre-tariff $/bushel, adjusted with market payment facilitation factor (Table 2) (e.g., eastern region @ 50% [line 1]: -$1.42 x 50% + $0.825 =$0.115).
[b]Assumes 50, 75 and 100 percent price decrease, as a result of the tariff.
[c]Based on Tennessee's 2017 regional soybean acreage, multiplied by 2018 estimated harvested acreage (1.7 million).
[d]Average regional trend-line yields from 2000 to 2017.

The estimated economic impacts based on the assumptions detailed above are presented in Table 5. Using the western Tennessee region as the discussion reference and the 75 percent price change attributed to the tariff, the estimated direct and total impacts are losses of $15.8 and $28.3 million. Total labor income and value-added income losses are estimated at $20.0 million and $23.0 million. Multipliers measure the additional total industry output for an additional million dollars in economic activity. For every dollar loss in producers' incomes in the western region, an additional $0.79 in economic activity (i.e., output) was lost: a multiplier of 1.79. For the eastern and middle regions and the state, the total industry output multipliers are estimated at 1.82, 1.87 and 1.87.

Table 5. Estimated Total Regional and State-Level Economic Loss in Producers' Incomes from the Recent 25 Percent China Imposed Tariff on Tennessee Soybean Producers (2018$)

Region	Direct	Induced[a]	Total[b]
	50 Percent		
East			
Employment	0	1.7	1.7
Labor Income	$268,102	$72,500	$340,602
Value Added	$268,102	$122,537	$390,639
Output	$268,102	$219,350	$487,452
Middle			
Employment	0	12.7	12.7
Labor Income	$2,146,964	$693,447	$2,840,411
Value Added	$2,146,964	$1,134,780	$3,281,744
Output	$2,146,964	$1,874,773	$4,021,737
West			
Employment	0	34.2	34.2
Labor Income	$5,560,128	$1,460,497	$7,020,625
Value Added	$5,560,128	$2,517,748	$8,077,876
Output	$5,560,128	$4,391,279	$9,951,407
State			
Employment	0	50.9	50.9
Labor Income	$8,084,000	$2,415,632	$10,499,632
Value Added	$8,084,000	$4,071,274	$12,155,274
Output	$8,084,000	$6,999,262	$15,083,262
	75 Percent		
East			
Employment	0	-3.6	-3.6
Labor Income	($559,518)	($151,304)	($710,822)
Value Added	($559,518)	($255,730)	($815,248)
Output	($559,518)	($457,775)	($1,017,293)
Middle			
Employment	0	-28.6	-28.6
Labor Income	($4,830,669)	($1,560,255)	($6,390,924)
Value Added	($4,830,669)	($2,553,254)	($7,383,923)
Output	($4,830,669)	($4,218,240)	($9,048,909)
West			
Employment	0	-97.3	-97.3
Labor Income	($15,802,469)	($4,150,887)	($19,953,356)
Value Added	($15,802,469)	($7,155,705)	($22,958,174)
Output	($15,802,469)	($12,480,477)	($28,282,946)

State			
Employment	0	-133.5	-133.5
Labor Income	($21,220,500)	($6,435,533)	($27,656,033)
Value Added	($21,220,500)	($10,687,096)	($31,907,596)
Output	($21,220,500)	($18,373,063)	($39,593,563)

100 Percent

East			
Employment	0	-8.8	-8.8
Labor Income	($1,387,139)	($375,108)	($1,762,247)
Value Added	($1,387,139)	($633,958)	($2,021,097)
Output	($1,387,139)	($1,134,900)	($2,522,039)
Middle			
Employment	0	-69.8	-69.8
Labor Income	($11,808,303)	($3,813,958)	($15,622,261)
Value Added	($11,808,303)	($6,241,288)	($18,049,591)
Output	($11,808,303)	($10,311,253)	($22,119,556)
West			
Employment	0	-228.9	-228.9
Labor Income	($37,165,066)	($9,762,272)	($46,927,338)
Value Added	($37,165,066)	($16,829,158)	($53,994,224)
Output	($37,165,066)	($29,352,233)	($66,517,299)
State			
Employment	0	-317.9	-317.9
Labor Income	($50,525,000)	($15,322,698)	($65,847,698)
Value Added	($50,525,000)	($25,445,466)	($75,970,466)
Output	($50,525,000)	($43,745,389)	($94,270,389)

a As discussed in the text, only induced economic impacts (soybean producers' incomes) are reported in this analysis; changes in input purchases (indirect economic impacts) are not applicable.
bState total impacts exceed the sum of the regional impacts because leakages from each region remain within the state boundaries (intraregional impacts). This analysis evaluated the change in producers' incomes.

The top 10 industries negatively impacted for the state for total industry output at the 75 percent price change are detailed in Table 6 (along with their North American Industry Classification Code). Economically, the following sectors were most negatively affected: owner-occupied dwellings (12.7 percent of total [-$18.3 million]), real estate (6.3 percent), hospitals (6.0 percent), wholesale trade (4.3 percent), medical-related industries (3.4 percent), restaurants (5.3 percent), insurance (2.2 percent) and telecommunications (2.2 percent). The results reflect the projected reduction in spending by farm households based on projected reductions in farm income. In other words, these monies are not being recirculated through the economy, thereby reducing local economic activity.

> **IMPLAN Metrics: *Total Industry Output*** — an economic activity measure that represents the estimated annual dollar value of production summed across all industries. ***Employment*** — the estimated number of total wage and salary employees (both full– and part-time), as well as self-employed. ***Labor Income*** — employee compensation (wages and benefits) and proprietor's income (self-employed income). ***Total Value Added*** — the estimated dollar values of wages and salaries, including benefits, proprietor's income (self-employed income), interests, rents, royalties, dividends, profits, plus excise and sales taxes. Equivalent to gross regional product.
>
> **Impact Types: *Direct Impacts*** — the estimated economic impacts of activities resulting from implementing the tariff. ***Total Impacts*** — the sum of direct impacts plus the estimated economic impacts from household income expenditures (***Induced Impacts***).

Table 6. Top IMPLAN Sectors Negatively Impacted from 25 Percent China-Imposed Tariff on Tennessee Soybean Producers at the State Level and 75 Percent Price Change by North American Industry Classification (NAICS) Code

Sector	NAICS Code	Value (2018 $)	Percent
Owner-Occupied Dwellings*	N/A	($2,325,180)	12.7%
Real Estate	531	($1,154,877)	6.3%
Hospitals	622	($1,104,651)	6.0%
Wholesale Trade	42	($789,034)	4.3%
Office of Physicians	6211	($617,899)	3.4%
Limited-Service Restaurants	722513	($600,637)	3.3%
Insurance Carriers	5241	($403,080)	2.2%
Wireless Telecommunications Carriers (Except Satellite)	51721	($402,581)	2.2%
Monetary Authorities & Depository Credit Intermediation	521; 5221	($380,822)	2.1%
Full-Service Restaurants	722511	($371,667)	2.0%
	Total	($18,373,063)	

*A sector created in input-output modeling, representing what owner/occupants would pay in rent if they rented rather than owned their homes. By creating this sector, it represents a production function for home maintenance and repair (IMPLAN Group LLC).

Summary and Conclusions

Trade tensions between China and the U.S. have impacted soybean prices and projected producer income for the 2018 crop and regional economies in Tennessee. MFP payments have mitigated a portion of the adverse impact on producer income. However, our analysis indicates the loss of producer income (when considering the MFP payments to producers) for Tennessee (with 75 percent of the decline in soybean prices being attributed to tariffs) to be $21.2 million, with an induced economic impact of $18.4 million—a total economic loss for the state of $39.6 million. These losses are for the 2018 crop only and do not reflect long-term reductions in producer income and state economic activity.

Study Limitations

It is important to note the limitations of this study. First, assumptions used to derive the results are based on information and cost estimates available at the time of the analysis. The results are specific to the assumptions stated. Deviation from the underlying assumptions would result in changes to the economic impacts estimated. As more accurate information becomes available and/or trade policies change or become more defined, the results could change. Second, the total net effects of the economic impacts are difficult to capture and may be over or understated. For example, the scenarios were based upon specified soybean price decrease percentages from the tariff and yields at both the regional and state level. Third, the analysis was modeled as a reduction in proprietor's income. For farms organized as corporations, a decline in other property income, an IMPLAN value-added component, may also occur. Finally, the estimated economic impacts do not take into account spillover effects that could occur outside the study region (i.e., the state of Tennessee or regions analyzed) or to neighboring states. Third and reiterating, these are very much short-run or "one planting season" type impacts. Assuming that the tariffs are in place for longer than one season, impacts would change because farmers would have the flexibility to react in terms of planting and other decisions.

References

Barchart. 2018. Historical Daily Futures Price History Data (CBOT Data ZSX18). Available at https://www.barchart.com/futures/quotes/ZSX18/price-history/historical.

Best, S.E., S.A. Smith, and A. Muhammad. 2018. *USDA Trade Retaliation Programs: Overview for Tennessee Producers*. University of Tennessee Extension Publication, W776, September.

Companhia Nacional de Abastecimento (CONAB). 2018. Agricultural Prices. Available at http://sisdep.conab.gov.br/precosiagroweb/.

IMPLAN Group LLC, IMPLAN System (2015 data and V. 3 software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078. Availabale at http://www.implan.com/.

United States Department of Agriculture (USDA), Economic Research Service (ERS). 2018. Farm Income and Wealth Statistics. Available at https://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics/data-files-us-and-state-level-farm-income-and-wealth-statistics/.

United States Department of Agriculture (USDA), Foreign Agricultural Service (FAS). 2018a. Production Supply and Distribution (PS&D). Available at https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery.

United States Department of Agriculture (USDA), Foreign Agricultural Service (FAS). 2018b. Global Agricultural Trade System (GATS). Available at https://www.fas.usda.gov/databases/global-agricultural-trade-system-gats.

United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). 2018. Economics, Statistics and Market Information System. Crop Production Annual Summary. Available at https://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1047.

INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE
Real. Life. Solutions.™

AG.TENNESSEE.EDU