

# Genetic Improvement Programs in the Fescue Belt: Do Incentive Programs Raise the Bar or Just the Price?

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## Introduction

Kentucky (KY) and Tennessee (TN) are major beef producing states and rank 8<sup>th</sup> and 13<sup>th</sup>, respectively, in total beef cow numbers. However, if you view beef production in these states through a different lens, such as beef cow density (cows per square mile), then their impact is even greater (Table 1). In 2022, KY cattle cash receipts were over a billion dollars and were almost \$700 million in TN.

<b>1. Oklahoma (29)</b>	<b>8. Texas</b>
<b>2. Missouri (28)</b>	<b>9. Kansas</b>
<b>3. Kentucky (23)</b>	<b>10. Iowa</b>
<b>4. Nebraska (22)</b>	<b>11. Florida</b>
<b>5. Tennessee (20)</b>	<b>12. Virginia</b>
<b>6. South Dakota (20)</b>	<b>13. Alabama</b>
<b>7. Arkansas (17)</b>	<b>14. North Dakota</b>

Through funding provided by the Tobacco Master Settlement Agreement (MSA), KY and TN have developed and implemented programs to assist farmers in their respective states. These programs impact a wide range of agricultural commodities and beef is no exception. Within beef commodity production, programs have been developed to educate beef producers on all aspects of beef production. Furthermore, initiative-based programs have been developed to incentivize producers, encouraging them to improve their breeding and management practices. The focus of this paper will be on programs in each state that provide cost-share dollars for bull purchases; Kentucky's County Agricultural Investment Program (CAIP) and Tennessee's Agricultural Enhancement Program (TAEP).

## Kentucky Beef Cattle Genetic Improvement Program

The Beef Cattle Genetic Improvement Program started in 2001 shortly after the MSA funds were secured and was based on a grassroots, producer driven movement. The KY governor and legislature set aside 50% of the MSA funds to go back into agriculture. Thirty-five percent of these funds were directed to counties in proportion to their previous tobacco allotments. Each county could then decide how best to use these dollars for all farmers, since the funds were not restricted to former tobacco farmers. Multiple counties proposed starting a bull cost-share program that promoted better selection decisions, but there was no uniformity amongst the programs. Through cooperation with state and local Extension, beef producers and the Ag Development

Board, it was decided that a state-wide model would be developed; therefore, all counties wishing to participate would follow the same standard guidelines. This was the foundation program for what would eventually become the County Agriculture Investment Program (CAIP). With this new state-wide KY program, most counties with a significant beef population elected to offer this Beef Genetic Improvement Program to their producers.

There are many requirements to qualify for the program, such as having a breeding soundness exam done on the bulls and producers participating in multiple educational activities, but the genetic improvement portion focuses on expected progeny difference (EPD) guidelines. The first step in developing the guidelines was to determine specific categories that the bulls would qualify within based on different production needs. The initial categories were Heifer Acceptable, Balanced Trait and Terminal Sire. Based on USDA – Meat Animal Research Center (US-MARC) breed comparison data, the breeds were sorted into groups based on their birth weight (light, medium, heavy), growth (low, medium, high) and maternal weaning weight (light, medium, heavy) values. Each breed association with a National Cattle Evaluation was contacted and a consensus was reached on where to set thresholds for each trait using each breed's EPD percentile table. For example, the US-MARC data indicated that British breeds had lighter birthweights than the other breed groups and it was agreed that to meet the Heifer Acceptable category a bull would need to be in the top 25% of the breed for Calving Ease Direct (or Birthweight if the breed did not have a CED EPD) for these breeds. However, based on the US-MARC data, a breed in the Large Continental group would need to be in the top 5% of the breed to qualify for the Heifer Acceptable category. Growth and milk requirements were also established, when appropriate, in the same manner. The initial values, with adjustments made due to changes in a breed's NCE, are still the foundation for the program.

After 2 years three additional categories were added: High Productivity, Low Maintenance and Carcass Merit. Based on the years that data on bull categories was collected, the vast majority of bulls were purchased under the Balanced Trait category. The High Productivity and Low Maintenance categories were rarely used and were removed in 2020. Also in 2020, breeds with a maternal focused market and a weaning index had the option to use bulls that met the CED requirement and were in the top 50% of the breed for that index. Starting in 2020, Carcass Merit bulls had to meet a CED requirement and be in the top 50% of the breed for their breed's respective terminal index. Starting in 2021, bulls from breeds that computed Genomically Enhanced EPD (GE-EPD) were required to have GE-EPD or a minimum accuracy for Calving Ease Direct of .25 or greater, and starting in 2023 breeds that did not compute GE-EPD were excluded.

The initial cost-share was 50% up to \$1250 for bull purchases, but now it is 50% cost-share on all CAIP programs (including bull purchases) with a maximum of \$5000 annually. For current requirements please see:

[https://www.kyagr.com/agpolicy/documents/2022-Program-Guidelines-Applications/ADF\\_APP\\_animal-large.pdf](https://www.kyagr.com/agpolicy/documents/2022-Program-Guidelines-Applications/ADF_APP_animal-large.pdf)

**Tennessee Agricultural Enhancement Program**

TAEP was established in 2005 with Beef Genetics as a core component (1 of the 2 original programs) using a genetic improvement incentive program. The Tennessee governor and legislature established this program to reinvest tobacco related funds into improving Tennessee agriculture consistent with the vision of Tennessee producers. The program is administered by the Tennessee Department of Agriculture (TDA) and was rolled out as a statewide program available to all Tennessee cattlemen. TAEP Genetics has been shaped by cooperative input from University of Tennessee / Tennessee State University Extension, Tennessee beef producers, and TDA. TAEP requires a current BSE, BVD-PI negative test, 840 RFID tag, encourages Trich testing, and is also focused on genetic improvement using EPDs, Indexes, and genomic tools.

Requirements for the TAEP genetics program were based on EPD percentiles, breed comparison information from US-MARC and breed association input. The guidelines are updated annually to set requirement levels for each breed, with breed adjustments based on the annual US-MARC data. TAEP is similar to CAIP in that the 3 eligible TAEP bull types are similar to the original 3 CAIP bull types. TAEP has historically utilized slightly different percentile levels in some areas, which are reevaluated on an annual basis.

The current TAEP 3 category bull type model:

Calving Ease/Maternal

CED + (Maternal Index or WW or YW)

Balanced Trait/Maternal

CED + (Maternal Index or WW or YW)

End Product/Terminal

CED + (Terminal Index or WW or YW)

Suggested Milk (15%-85%) and Docility (70% or better) EPD ranges

For specific values for all breeds please see:

<https://www.tn.gov/content/dam/tn/agriculture/documents/taep/2023/FY2023-2024%20TAEP%20-%20EPD,%20Genomic,%20Index%20and%20Accuracy%20-%20breed%20minimum%20requirements.pdf>

TAEP EPD/Index qualification options for Angus are listed in the example below:

**FY2023-2024 TAEP - EPD, Genomic, Index, Accuracy - breed minimum requirements**

**British breeds - Maternal & Terminal Indexes, Genomic Enhanced EPDs (GE-EPD)**

GE-EPDs required; printed between 10/1/2023 - purchase date; All Breeds listed on this page.

35% Standard Producer / 50% Master Producer cost share up to \$2,000 reimbursement max.

Use CED from the Calving Ease/Maternal bull type for Bred Beef Heifer Service Sire.

<b>ANGUS</b>	<b>CALVING EASE</b>	+	<b>INDEX</b>	or	<b>GROWTH</b>	
<i>GE-EPDs Required</i>	<b>CED</b>				<b>WW</b>	<b>YW</b>
Calving Ease / Maternal	7	+	\$M ≥ 64	or	49	or 82
Balanced Trait / Maternal	4	+	\$M ≥ 64	or	56	or 88
End Product / Terminal	-1	+	\$B ≥ 138	or	64	or 109

Suggested Milk EPD range: 21 - 32

Suggested Docility EPD: Doc = 15 +

Some TAEP historical timeline notes of interest include:

Producers have been reimbursed either 35% (BQA only) or 50% (for those that participated in a University of Tennessee Master Producer Program) up to \$1,200 for standard eligibility bulls throughout much of the program history.

**2005-2009** programs were 2 of 4 (CE or BW, WW, YW, Milk) at the 50<sup>th</sup> percentile of their respective breed for three years and then 2 of 3 (CE or BW, WW or YW, Milk) at the 60<sup>th</sup> percentile of their respective breed in 2008-2009. These models were very useful to producers who were learning about EPDs for the 1<sup>st</sup> time. However, neither of these selection models offered any producer protection regarding minimum CED or maximum BW of the sires they selected. These models also tended to encourage more single trait-selection/pursuit of maximum EPD values.

**2010-2011** program introduced the 3 category bull type selection model, which addressed all considerations with the previous selection models. All bulls, even the End Product/Terminal bull (only recommended for use on mature cows) had a minimum CED (or max. BW). Producers were no longer reporting calving difficulty issues after this selection model had been implemented & utilized. Seemingly, more producers purchased bulls utilizing an optimal, disciplined, multi-trait, balanced approach, while being more intentional in their breeding program purpose.

**2015-2016** program conditionally increased the maximum to \$1,600 for eligible GE-EPD bulls. This offered voluntary additional incentive to producers who elected to purchase GE-EPD bulls.

**2016-2017** program required True NCE EPDs (minimum 0.15 accuracy) for all bulls. This improved the EPD accuracy across the program. Important for developing EPD requirements.

**2021-2022** program began educating producers about suggested Maternal Index values by posting suggested Maternal Index values from the 50<sup>th</sup> percentile for producers developing their own replacement heifers.

**2022-2023** program added both Maternal & Terminal Index values as qualifying options. This greatly impacted producer education and acceptance of indexes, whereas the *suggested* Maternal index values in the previous year had only slight producer impact.

**2023-2024** program requires GE-EPDs for all bulls from breeds that offer genomic evaluations. This allowed the Genetics Requirements committee to make an apples-to-apples comparison regarding accuracy level (100% of TAEP bulls from GE-EPD breeds required to have GE-EPDs) compared to only 80% of the bulls in the TAEP population having GE-EPDs in the past.) This allowed appropriate EPD/percentile adjustments.

**2024-2025** – TAEP producers will be reimbursed 50% (all UT Master certified) up to \$2,000 for eligible bulls (100% GE-EPDs for breeds that offer GE-EPDs).

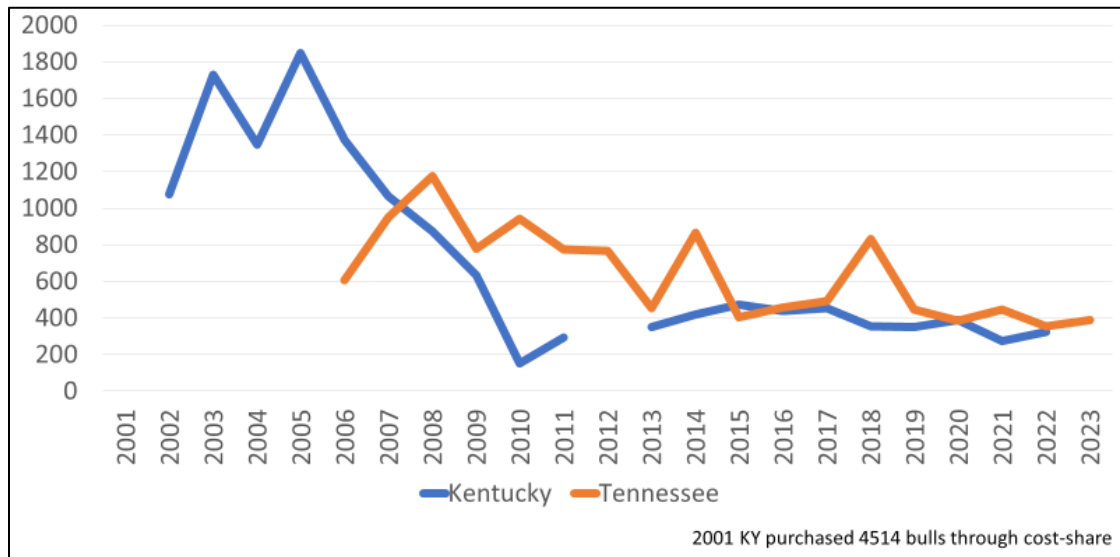
Producers have responded favorably to both Milk & Docility EPD levels being suggested only values in recent years. Milk & Doc EPD suggested ranges are developed and printed under the EPD/Index requirements, but do not act as qualification thresholds.

Kentucky and TN share a 1342-mile border and cattle transactions across that border are numerous. Neither program has implemented a requirement of in-state purchases only. This has led the facilitators in both states to collaborate on an effort to unify the guidelines for the programs or at a minimum to make them more consistent. Both programs are currently requiring GE-EPD and have made index-based qualification a priority. Efforts were taken this year to align the CED requirements in the two states and further adjustments are planned for this fall.

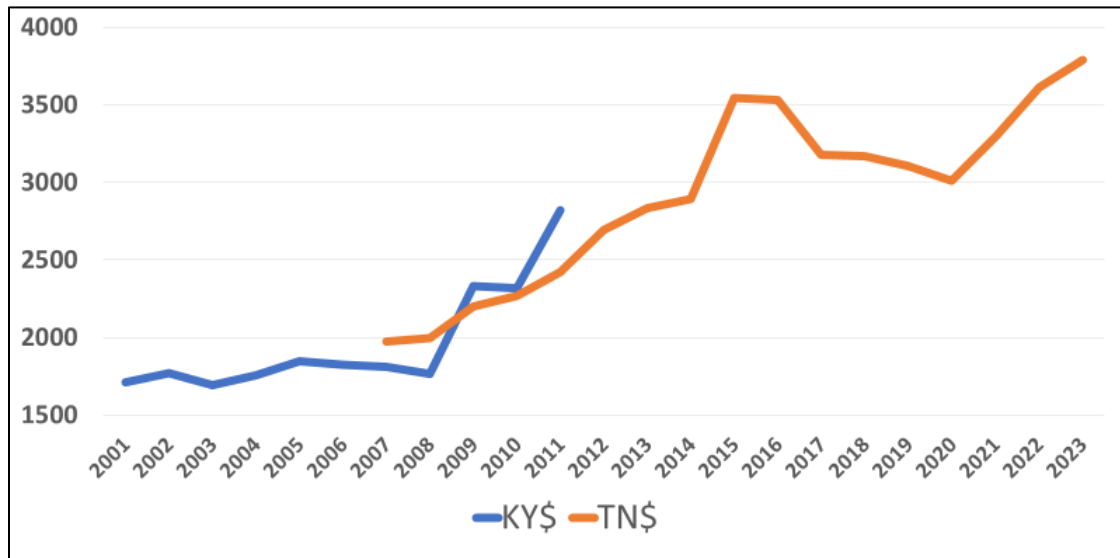
### **Program Impact**

In KY, the average number of bulls purchased each year is 893 and in TN the average number is 841 with significant fluctuations through the years (Graph 1). The average price paid for bulls in the program each year is shown in Graph 2 (there was insufficient data to determine the price for KY bulls after 2011). Based on the number of cows in KY (914,000) and TN (857,000) and assuming each bull will breed 30 cows and provide 4 years of service; the total number of bulls put into service each year would be approximately 7,600 in KY and 7,100 in TN. Based on the number of bulls purchased through the respective programs, that equates to approximately 12% of all bulls purchased in each state. The fact that most bulls do not breed 30 cows and most are not kept for 4 years, would indicate that this rate is very conservative.

**Graph 1.** Number of bulls purchased through the genetic improvement programs of Kentucky and Tennessee.



**Graph 2.** Average price paid for bulls in the Genetic Improvement Programs of Kentucky and Tennessee.



### Tracking Changes in Producer Behavior

The goal of these incentive-based programs was to encourage changes to improve management; specifically, to improve selection practices in KY and TN beef herds. Some of the direct objectives, which have evolved over time, were to:

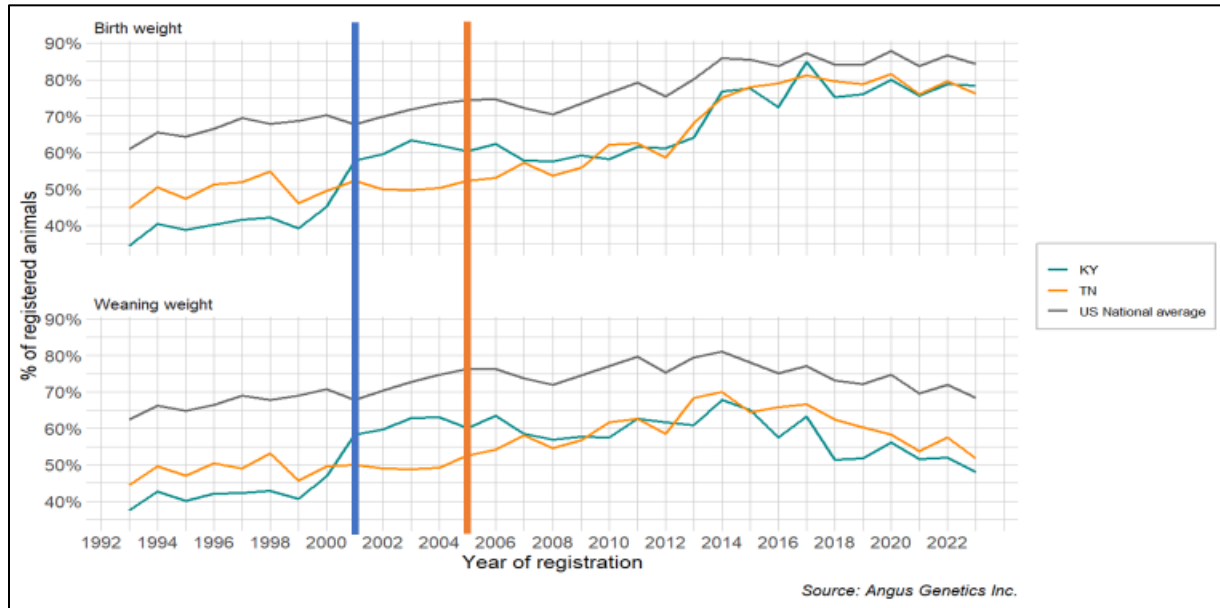
- Increase registrations and data submissions with registration at the seedstock level
- Improve understanding and use of Expected Progeny Differences (EPD)
- Improve the use of genomics and increase the availability of GE-EPDs
- Increased educational programming on beef cattle best management practices

- Improve other associated management practices
  - Breeding Soundness Exams
  - Crossbreeding
  - Proper Vaccinations
- Ultimately improve producer profitability

For the purpose of this paper, our goal is to provide evidence of improvements initiative by the programs that directly impacted reporting and selection practices at the seedstock level.

Graph 3 shows the percentage of registered animals that submitted actual birth weight and weaning weight records to the American Angus Association (AAA) in KY and TN compared to the national average. For birth weight records, KY producers were well below the national average prior to the start of the genetic improvement program, but immediately made significant gains and continue to submit at a rate just below national average. Tennessee producers were also well below the national average and made significant gains once their program began. For weaning weight, initial gains were observed in both states at the onset of their respective programs, but over time those gains began to diminish. It is concerning that since about 2014 the percentage of data submissions has gone down nationally, as well as in both states. It is possible that this trend is reflective of changes to AAA policy in 2017 that no longer required a weaning weight submission to use birthweight data in their national cattle evaluation. However, if this reduction is due to the incorrect assumption that with genomics, we no longer need phenotypic data then we need to redouble our efforts to educate producers on the importance of both phenotypes and genotyping.

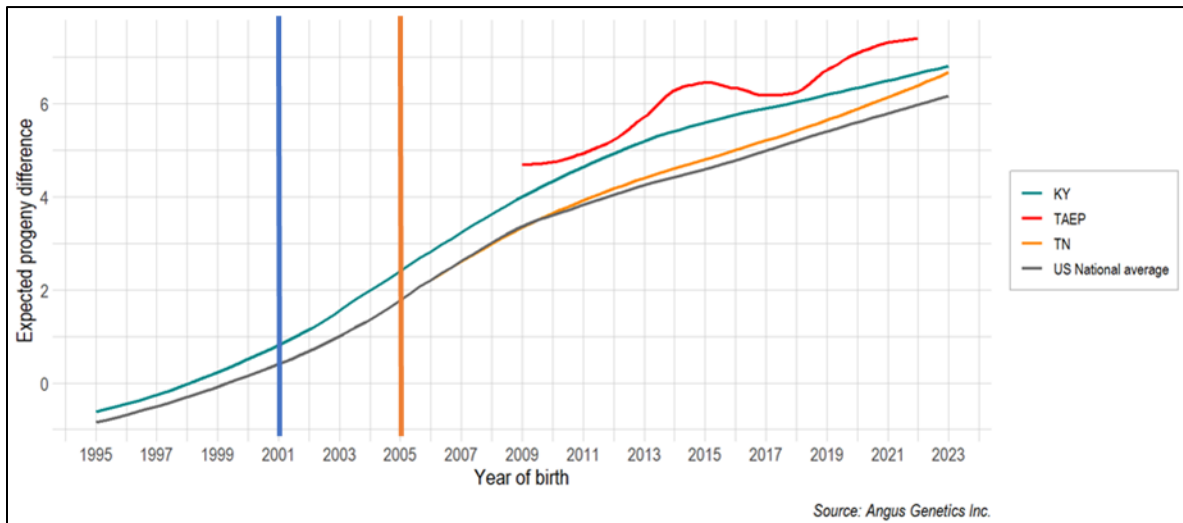
**Graph 3.** Proportion of registered animals with phenotype submitted for Birth Weight and Weaning Weight. Dark blue line indicates start of program in Kentucky and dark orange indicates the start of the program in Tennessee. Data provided by Angus Genetics Inc.



Another important statistic to track is to monitor genetic trends for some of the economically important traits that the two programs provide thresholds for. Graph 4 illustrates the

genetic trends for Calving Ease in Angus for KY, TN, nationally and for the bulls purchased through TAEP. At the inception of the program Kentucky slightly above national average and has progressively improved calving ease at a rate higher than the national average. Tennessee saw their genetic trend for CE improve from the same as national average prior to implementing their program to their current level above national average. The bulls purchased through the TAEP program are clearly above the national average.

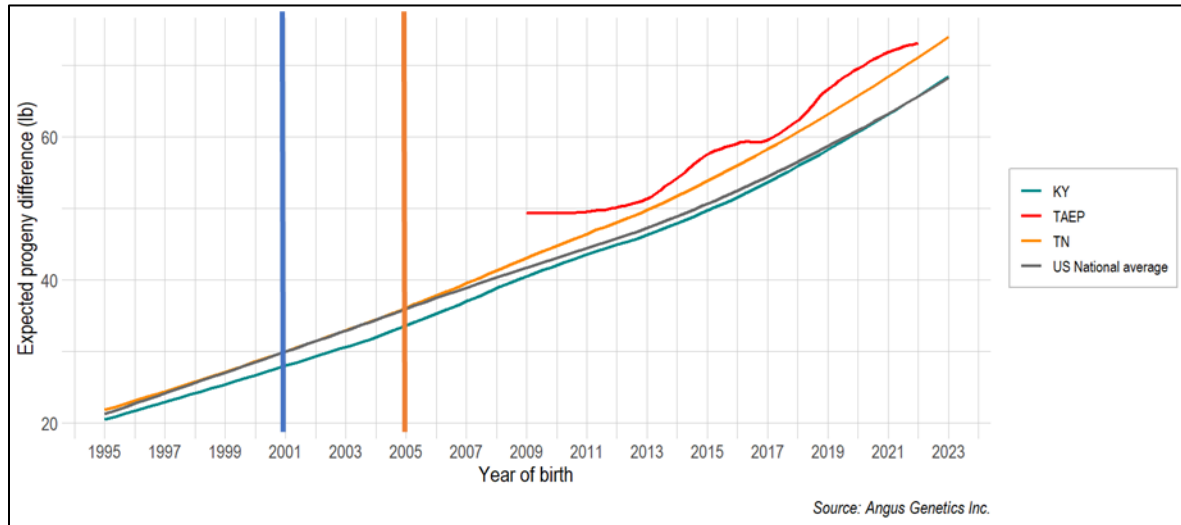
**Graph 4.** Genetic trend for Calving Ease Direct of Angus. Dark blue line indicates start of program in Kentucky and dark orange indicates the start of the program in Tennessee. Data provided by Angus Genetics Inc.



The most impactful growth trait for KY and TN cow/calf farmers is weaning weight since most calves are sold at weaning or shortly after. At the beginning of the program KY was below national average for weaning weight EPD but has gradually elevated to about equal with national average. The KY program has a cap on the growth traits for bulls in the Balanced Trait category, the most popular category for bull purchases. This cap could limit WW EPD. Tennessee started very close to the national average and has gradually increased at a rate higher than the national average. Again, the bulls represented in TAEP are at a level higher than the average TN bull in the Angus genetic evaluation.

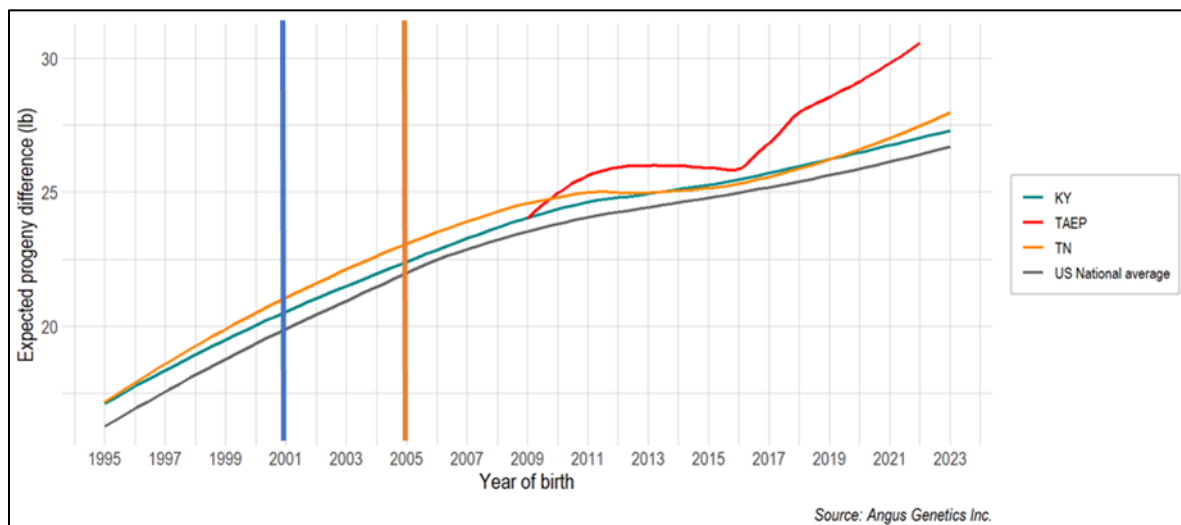


**Graph 5.** Genetic trend for Weaning Weight of Angus. Dark blue line indicates start of program in Kentucky and dark orange indicates the start of the program in Tennessee. Data provided by Angus Genetics Inc.



For Maternal Milk (Milk) EPD, KY and TN have remained slightly above breed average since the start of their respective programs. Since 2016 the TAEP bulls had a significant increase in Milk which may have impacted their state average Milk EPD recent upswing. As with the growth traits, the KY program limits the level of Milk EPD in the Balanced Trait category.

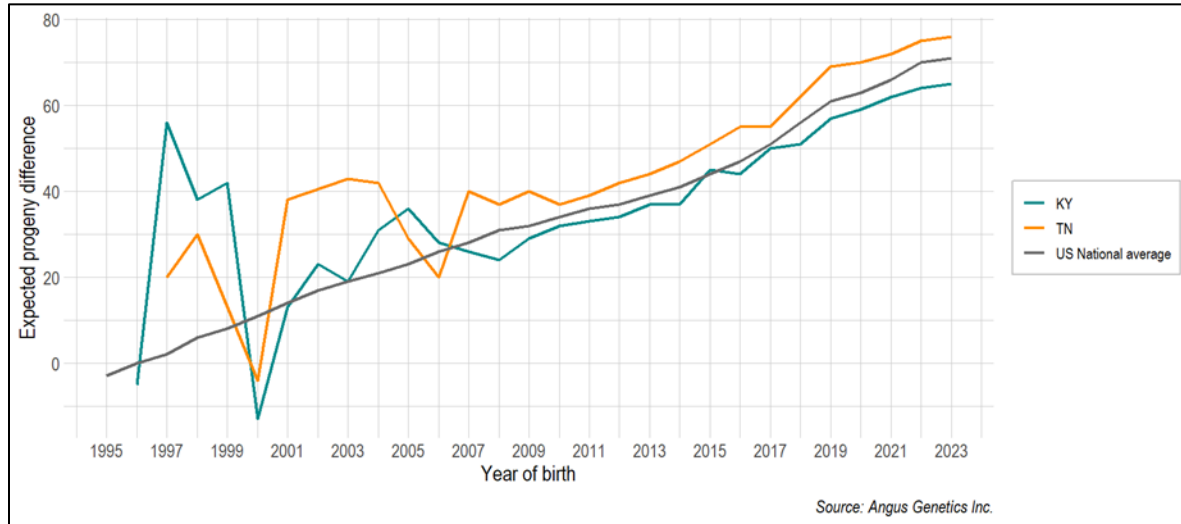
**Graph 6.** Genetic trend for Maternal Weaning Weight (Milk) of Angus. Dark blue line indicates start of program in Kentucky and dark orange indicates the start of the program in Tennessee. Data provided by Angus Genetics Inc.



Mature weight has great importance due to its association with cow nutrient intake, which is a significant cost factor. The primary reason for the KY program limiting growth in the Balanced Trait category was to try and mitigate the impact on mature weight. Although it is difficult to determine by observing Graph 7, it appears that KY was near or perhaps slightly above breed

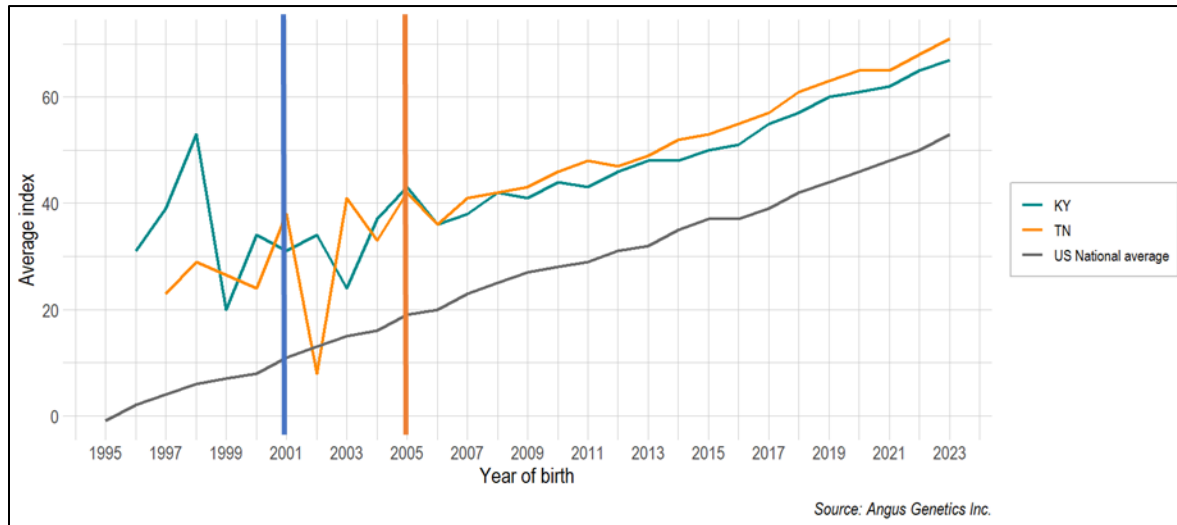
average at the onset of the program, but has increase mature weight at a slower rate than nationally to the current level of slightly below breed average. The fact that weaning weights increased at a slightly higher rate than nationally while mature weight increased at a slightly slower rate is encouraging. Tennessee has maintained the same relative distance from the national average while their weaning weights have increased at a much higher rate.

**Graph 7.** Genetic trend for Mature Weight of Angus. Dark blue line indicates start of program in Kentucky and dark orange indicates the start of the program in Tennessee. Data provided by Angus Genetics Inc.

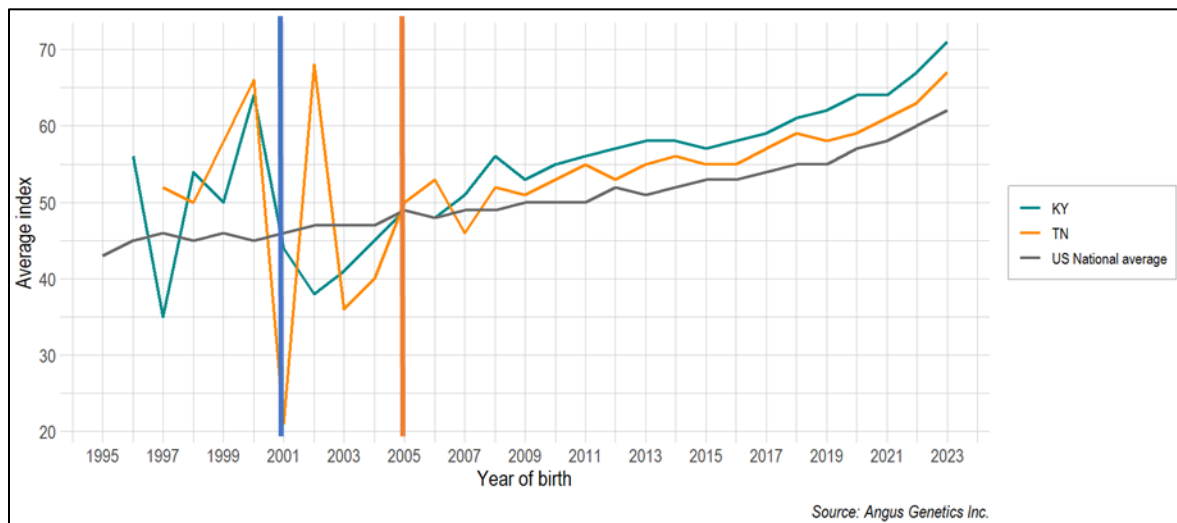


The best indicator of the success of the programs is determining if profitability has been positively impacted. One way to determine that is through comparing state trends against the national average for the economic indexes that are the closest associate with how cattle are managed and marketed in KY and TN. Of the indexes provided by AAA, the two that best fit are Weaned Calf Value \$W (Graph 8) and Maternal Weaned Calf Value \$M (Graph 9). For \$W, KY and TN are clearly above the national average with TN having a slight advantage. For calves born in 2023, TN had an almost \$20 and KY a \$15 per head advantage over the national average. For \$M, KY saw greater improvements going from about breed average to approximately \$9 above. Tennessee also saw some improvement in \$M going from breed average to approximately \$5 above. Based on these increases and the fact that approximately 1.4M head of feeder calves are marketed in KY and TN annually, that improves profitability by almost \$10M.

**Graph 8.** Trend for \$W index of Angus. Data provided by Angus Genetics Inc.



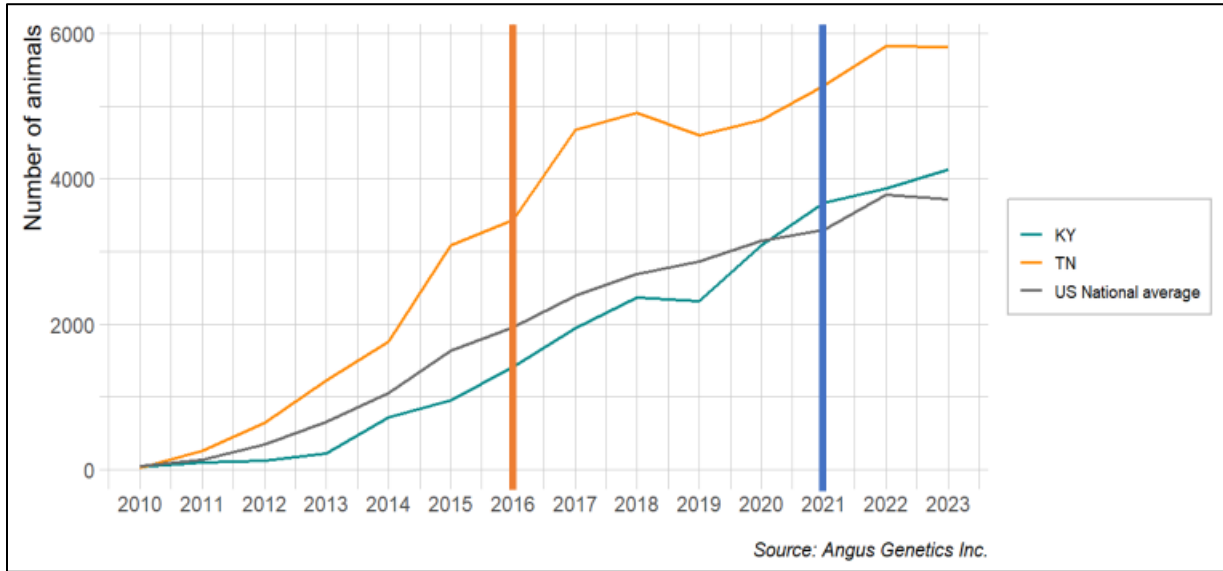
**Graph 9.** Trend for \$M index of Angus. Data provided by Angus Genetics Inc.



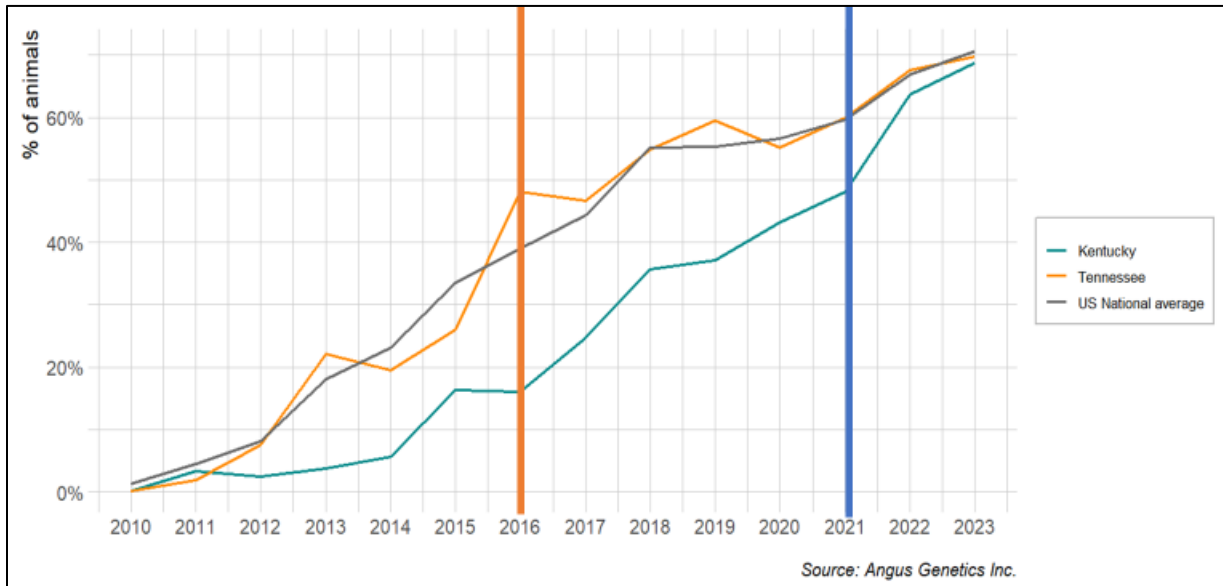
Genomically enhanced EPDs (GE-EPDs) increase accuracy compared to non-tested bulls, giving commercial buyers greater confidence in their bull's expected performance. Graphs 10 and 11 show the impact of providing incentives in the case of the TN program 50% cost-share up to \$1250 requiring genomic tests in the KY program. Graph 10 shows the number of animals tested within one year of registration, which is likely an indication of the immediate impact of the program. Tennessee was already well above the national average but made significant increases to total number of animals tested within one year of registration when the incentives were added (Graph 10). Prior to mandating all bulls be genomically tested to qualify for the program, KY went from below national average to above average in the first year and has maintained that advantage. Graph 11 illustrates the genomic tests submitted as a percentage of total registrations annually, which would include older animals, that have been registered for over a year. Tennessee has mirrored the national average since the initiation of genomic testing and remains on par with the

national percentage. Kentucky improved from far below the national average to only slightly below the national average in just two years of implementation.

**Graph 10.** Animals with genomics test requested within one year of registration in Angus. Dark blue line indicates start of program in Kentucky and dark orange indicates the start of the program in Tennessee. Data provided by Angus Genetics Inc.



**Graph 11.** Animals with genomics test relative to total annual registrations in Angus. Dark blue line indicates start of program in Kentucky and dark orange indicates the start of the program in Tennessee. Data provided by Angus Genetics Inc.



Most encouraging, not only to TN & KY producers, but potentially to Ag producers from other states, is a statistic generated by the University of Tennessee Agri-Industry Modeling &

Analysis Group. They determined that for each TAEP dollar invested, there was a \$6.55 return to the local economies.

## **Summary**

Cost-share incentive programs, derived from the Tobacco Master Settlement funds, have been used in KY and TN to promote better selection practices in bull purchases. These programs have used science and technology to develop guidelines using EPD, and more recently GE-EPD, information from the US-Meat Animal Research Center breed comparison studies and producer/breed associations input. These programs have also included an educational component that promotes best management practices for beef producers, including selection decisions. An initial concern was that the program would only increase the price of bulls without improving performance or profitability. Although it is impossible to determine, the program probably slightly increased bull prices for some bulls (qualifying bulls), but likely decreased the price of others (nonqualifying bulls). One interpretation may be that tools and education provided to producers helped them to more appropriately and accurately evaluate their genetic options; manifesting in their re-allocation of financial resources accordingly. Data provided by the AAA, and compiled by Angus Genetics Inc., indicate that both performance and profitability were positively impacted by these programs. Additionally, a study conducted by the University of Tennessee concluded that for every dollar spent on TAEP, \$6.55 was returned to the local economy.

Another benefit clearly demonstrated was the improved use of genomic testing to provide GE-EPD to commercial producers, thereby improving the reliability of their purchases. GE-EPDs required prior to purchase should positively impact the decision-making ability regarding profitability of producers. Examples replicated numerous times have shown bulls with interim accuracies can regularly fluctuate one or two and rarely three standard deviations away from parent average YW EPD after genomic information is included in the EPD calculation. Genomic testing also has similar effects on other economically important traits (currently 22 EPDs and 9 Economic Indexes, reported by AAA). But more importantly, genomic testing young breeding bulls increases the reliability of a young sire's EPD/\$Value profiles giving beef producers greater confidence in their genetic decisions and investments.

It is the opinion of the authors that incentive programs based on science and combined with a robust educational program can have positive impacts on the beef industry.