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TENNESSEE AND TEXAS COW-CALF PRODUCERS' PERCEPTION OF LIVESTOCK PESTS

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Introduction

Cattle producers deal with many pests affecting their cattle that negatively affect their herds and impose a variety of damages (Smith et al. 2022a; Brewer et al. 2021). Brewer et al. (2021) state that within the United States, the economic loss associated with horn flies alone is more than $2.3 billion annually. Pests of livestock can cause direct damage to animals by being a nuisance or directly blood feeding on animals. Indirectly, these pests can transmit pathogens, and some pests can cause peripheral damage via misuse of management decisions or quarantines. The most common pests of pastured cattle are lice, ticks, and flies; including horn flies (Haematobia irritans (L.)), face flies (Musca autumnalis De Geer), stable flies (Stomoxys calcitrans (L.)), house flies (Musca domestica (L.)) and cattle grubs/heel flies (Hypoderma bovis (L.) or H. lineatum (Villers)) (Williams 2009). Horn flies and stable flies will blood feed on animals, which annoys, alters grazing habits, decreases milk production and weight gains in pastured cattle and allows for transmission of pathogens causing mastitis (recently reviewed by Brewer et al. 2021, Rochon et al. 2021). House and face flies are nuisance flies that feed on host exudates, and, when bacteria are present, these flies can also transmit bacteria causing pink eye or other infectious diseases (Geden et al. 2021, Trout Fryxell et al. 2021). Many producers will use insect growth regulators to control nematodes, but non-target control of lice, cattle grubs and heel flies occurs with those products, leaving many researchers to wonder if these non-target pests are a problem for the industry (e.g., developed resistance, pest in organic operations) (Lysyk and Colwell 1996). Ticks not only blood feed on animals, but can cause anemia from feeding in high numbers, inject a toxin causing tick paralysis and transmit pathogens causing disease (Hooker et al. 1912). While all these different pests can be found in the same cattle operation, management for these pests are dependent on insecticides that often target all the pest species; notably, this is not a sustainable method and will lead to insecticide resistance.

While we know producers are managing livestock pests (Smith et al. 2022b), we are not sure which pests they consider most important. Therefore, the objective of this study was to identify the perceived impact of different livestock pests, specifically arthropods, on cattle operations. We investigated this question to document the perceptions of cow-calf producers in two different regions of the United States (Tennessee and Texas).

Survey Data

A Qualtrics survey was developed and administered to cow-calf producers in Tennessee and Texas in 2016 to examine cattle producer pest management practices. The methods and results of this survey have been previously reported (McKay et al. 2019, Smith et al. 2022a,b). Emails were sent to cattle producers who participated in the Tennessee Agricultural Enhancement Program and members of the Texas and Southwestern Cattle Raisers Association (TSCRA) to complete the survey. Of the 4,028 Tennessee producers emailed, 412 responded to a question about livestock pests and of the 3,882 TSCRA producers emailed, 252 responded to the question. Thus, the survey had a response rate of 10 percent in Tennessee and 6.5 percent in Texas. To note, 14 producers were from Oklahoma but were members in TSCRA and participated in the survey. We refer to the TSCRA sample as Texas producers throughout this study.

Of the producers surveyed in Tennessee, on average, 88 percent had primarily Angus cattle, and the average herd size was 108 head of cattle. On average, the responding Tennessee producer was 57 years of age and had about $80,000 of household income.

The responding Texas producer, on average, was 62 years of age, had about $125,000 of household income and had 162 head of cattle. On average, 63 percent of responding Texas producers had primarily Angus cattle. It should be noted that the average surveyed herd sizes for both Tennessee and Texas producers was higher than state herd averages of 49 head in Tennessee and 82 head in Texas (USDA 2017); thus, the survey responses are overly representative of larger operations than each state's average operation.

The primary goal of the survey was focused on horn flies (McKay et al. 2019; Smith et al. 2022b), but producers were also asked to rank their veterinary livestock pests according to the impact they have on their operation. Specifically, producers were asked to numerically rank each pest's impact on their operation by using the numbers one through seven, with one indicating the pest has the greatest impact and seven indicating the pest has the least impact. Each of the following seven pests received a one through seven ranking of importance: horn flies, face flies, lice, stable flies, cattle grubs/heel flies, house flies and ticks. Note that no two pests could receive the same ranking/have a tied ranking. Thus, an example producer response to this question could be the following: horn flies=1, face flies=2, lice=3, stable flies=4, cattle grubs/heel flies=5, house flies=6 and ticks=7. Producers' responses to this question were averaged and analyzed through t-tests to determine if pest rankings varied significantly between Texas and Tennessee producers and whether producers considered certain pests as significantly more or less impactful than other pests.

Survey Results

Producers' ranking of the impact of these pests appears in Table 1. In both states, horn and face flies were considered to have the greatest impact on a producer's operation. Ticks and grubs/heel flies were considered the livestock pest having the least impact on Tennessee producers' operations, and house flies and ticks had the least impact on Texas producers' operations. While ticks were reported as the least impactful pest, it should be noted that this survey was administered in 2016, which was before the Theileria orientalis Ikeda and the Asian longhorned tick were identified in Tennessee, and bovine tick-borne diseases were not on the radar of many Tennessee cattle producers. Further, weather conditions and other annual factors can affect the presence of pests from year to year. Since this survey was only conducted at one time for one year (2016), it is possible that other pests were not prevalent at the time of the survey and that could contribute to the results.

Table 1.
Average rankings of seven different arthropod pests by surveyed cow-calf producers in Tennessee and Texas.

Arthropod Pest	Overall (n=664)	Tennessee (n=412)	Texas (n=252)
Horn flies	1.71	1.86*	1.48*
Face flies	2.35	1.88*	3.13*
Lice	4.42	4.35	4.52
Stable flies	4.56	4.56	4.57
Cattle grubs/heel flies	4.91	5.17*	4.48*
House flies	4.95	4.92	4.99
Ticks	5.10	5.26*	4.84*

Notes: Producers were asked to numerically rank each pest's impact on their operation by using the numbers one through seven, with one indicating the pest has the greatest impact and seven indicating the pest has the least impact.

***Indicates Tennessee and Texas cattle producer average rankings were significantly different at P < 0.05.**

Table 2 shows the relative average rankings of pests by Tennessee cow-calf producers. Producers did not rank the following pests as significantly different from one another: horn flies and face flies, cattle grubs/heel flies, ticks and stable flies or stable flies and lice. However, all other pests were ranked significantly different from one another at least at the 5 percent level of significance (Table 2).

Table 2.
Tennessee respondents' average pest rankings and associated significant differences in rankings between pests (n = 412)

Pest 1	Pest 2	Pest 1 Mean	Pest 2 Mean
Horn flies	Face flies	1.86	1.88
	Cattle grubs or heel flies	1.86*	5.17*
	House flies	1.86*	4.92*
	Stable flies	1.86*	4.56*
	Ticks	1.86*	5.26*
	Lice	1.86*	4.35*
Face flies	Cattle grubs or heel flies	1.88*	5.17*
	House flies	1.88*	4.92*
	Stable flies	1.88*	4.92*
	Ticks	1.88*	5.26*
	Lice	1.88*	4.35*
Cattle grubs or heel flies	House flies	5.17*	4.92*
	Stable flies	5.17*	4.56
	Ticks	5.17	5.26
	Lice	5.17*	4.35*
House flies	Stable flies	4.92*	4.56*
	Ticks	4.92*	5.26*
	Lice	4.92*	4.35*
Stable flies	Ticks	4.56*	5.26*
	Lice	4.56	4.35
Ticks	Lice	5.26*	4.35*

Notes: Producers were asked to numerically rank each pest's impact on their operation by using the numbers one through seven, with one indicating the pest has the greatest impact and seven indicating the pest has the least impact.

***Indicates Pest 1 and Pest 2 average rankings were significantly different at P < 0.05.**

To exemplify how to read the table, in row one of the table, this indicates that horn flies and face flies had means of 1.86 and 1.88, respectively, and these rankings were not significantly different. In row two of the table, this indicates that horn flies and cattle grubs/heel flies had average rankings of 1.86 and 5.17, respectively, and these relative pest rankings were significantly different.

Table 3 shows the relative average rankings of pests by Texas cow-calf producers. Cattle grubs/heel flies were not ranked significantly differently from stable flies or lice, stable flies were not ranked differently than lice or ticks, and house flies were not ranked differently from ticks. All other pests were ranked significantly different from one another at least at the 5 percent level of significance (Table 3). The frequency of these rankings appears in Figure 1 and depict the distribution of rankings by producers in Tennessee and Texas of the different livestock pests.

Table 3.
Texas respondents' average pest rankings and associated significant differences in rankings between pests (n = 252)

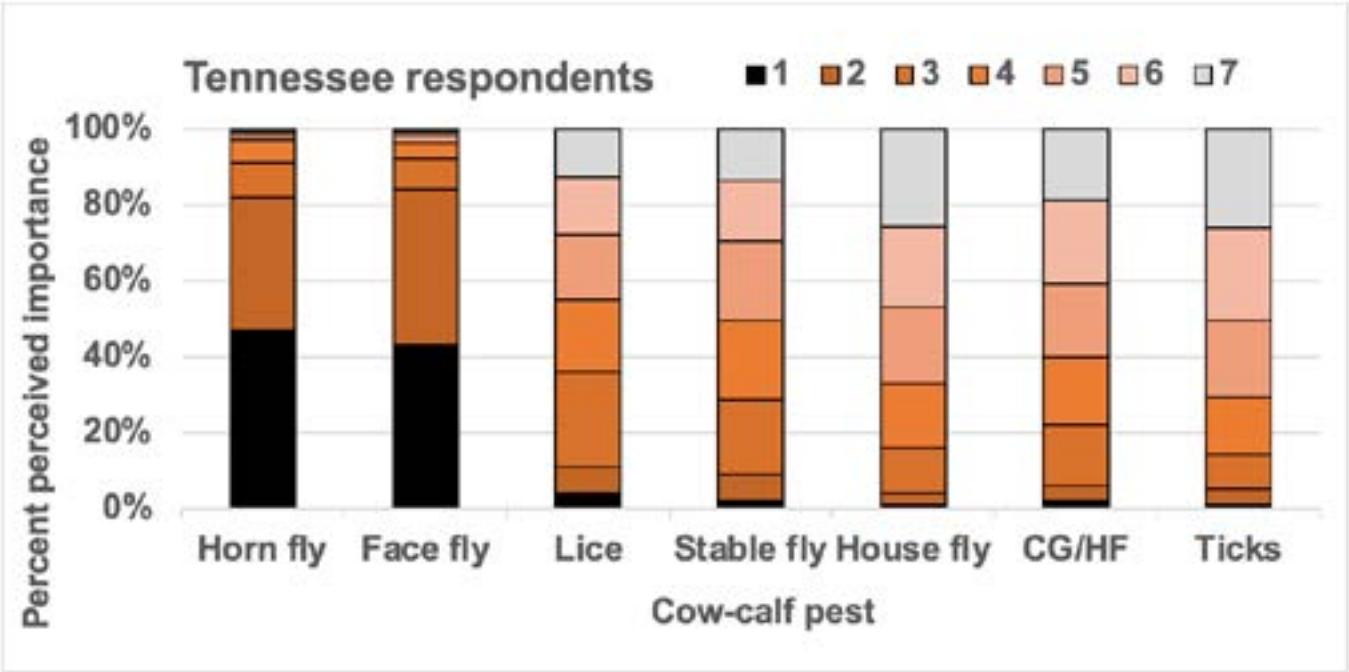
Pest 1	Pest 2	Pest 1 Mean	Pest 2 Mean
Horn flies	Face flies	1.48	3.13*
	Cattle grubs or heel flies	1.48*	4.48*
	House flies	1.48*	4.99*
	Stable flies	1.48*	4.57*
	Ticks	1.48*	4.84*
	Lice	1.48*	4.52*
Face flies	Cattle grubs or heel flies	3.13*	4.48*
	House flies	3.13*	4.99*
	Stable flies	3.13*	4.57*
	Ticks	3.13*	4.84*
	Lice	1.48*	4.52*
Cattle grubs or heel flies	House flies	4.48*	4.99*
	Stable flies	4.48	4.57
	Ticks	4.48*	4.84*
	Lice	4.48	4.52
House flies	Stable flies	4.99*	4.57*
	Ticks	4.99	4.84
	Lice	4.99*	4.52*
Stable flies	Ticks	4.57	4.84
	Lice	4.57	4.52
Ticks	Lice	4.84*	4.52*

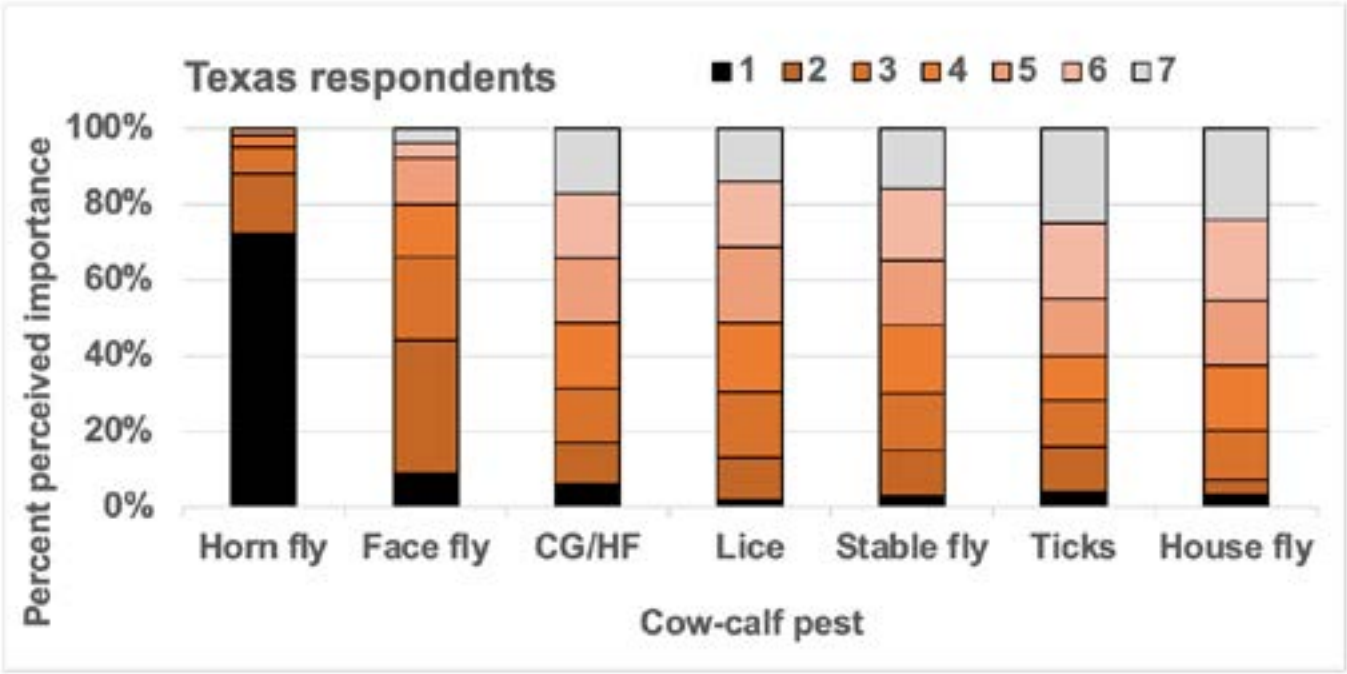
Notes: Producers were asked to numerically rank each pest's impact on their operation by using the numbers one through seven, with one indicating the pest has the greatest impact and seven indicating the pest has the least impact.

***Indicates Pest 1 and Pest 2 average rankings were significantly different at P < 0.05.**

To exemplify how to read the table, in row one of the table, this indicates that horn flies and face flies had means of 1.48 and 3.13, respectively, and these relative pest rankings were significantly different.

Figure 1.
Percent of Tennessee (n = 412) and Texas (n = 252) cow-calf producers selecting each arthropod as the most to least significant pest (1 = greatest impact on their operation; 7 = least impact on their operation).





Conclusions

A 2016 survey of Tennessee and Texas cow-calf producers indicated horn flies and face flies were considered by producers as the most important pests of cattle, whereas house flies and ticks were perceived as the least impactful pests in Texas; cattle grubs/heel flies and ticks were the least impactful pests in Tennessee. We recognize that horn flies were the primary pest targeted in this survey, which likely influenced the horn fly responses seen here; however, this limitation should not have had influence on the remaining livestock pests. On-farm surveillance with expenditures, losses and health-associated scores is the only way to know what really is impacting their operations.

In general, it is possible that some of the pest ranking results aligned with the idea that producers' perceived impact of pests increased when they could visually see the pest compared to intermittent pests that might be more difficult to see. Additionally, it is possible that producers indicated different pests were significant when they may be misidentifying those arthropods. This is most apparent as face flies were identified as a significant problem in Texas where they do not occur (Krafsur and Moon 1997; Trout Fryxell et al. 2021). From this, we conclude that additional education is warranted including teaching producers how to identify pests on their animals.

These survey results support the findings from Oklahoma, where cow-calf producers were aware of ticks on their animals but most did not think they were a problem (Noden et al. 2020). In that survey, producers indicated they used one or more methods for tick control on cattle (e.g., pour-on, spray, ear-tags) and that information for tick management came from University Extension and veterinarians. Oklahoma producers (and likely Tennessee and Texas producers) indicated limited tick preventative behaviors (Noden et al. 2020), which is concerning with Texas cattle fever to Oklahoma's south and theileriosis to Oklahoma's east. Specifically in Texas, cattle fever remains a constant threat to the cattle industries as Texas producers have battled Texas cattle fever ticks for nearly 75 years (León et al. 2012; USDA, Animal Plant Health Inspection Service, 2013). While Texas producers might be aware of these ticks, producers in this survey indicated that ticks are not currently a problem which could be due to the eradication program. Awareness and preventative behaviors for ticks and their pathogens should increase with the confirmation of Asian longhorned ticks and Theileria orientalis Ikeda causing bovine theileriosis, both representing a new and emerging disease and pest threat (Oakes et al. 2019, Dinkel et al. 2021). We expect that, with the westward expansion of Asian longhorned ticks and T. orientalis Ikeda across Tennessee, producers' perceptions of tick importance will increase.

For many vector-borne diseases, management is centered upon excluding and/or preventing the vector from establishing on properties, while management options for pest suppression are reliant on monitoring and use of chemical insecticides and/or acaricides (León et al. 2012, Smith et al. 2022b). While horn flies are the most economically important pests of pastured cattle causing losses estimated at greater than $2 billion dollars annually in the US (Brewer et al. 2021, Smith et al. 2022a), tick-borne diseases affect 80 percent of the world's cattle population, and outdated global cost estimates are between $13.9 and $18.7 billion US dollars (De Castro et al. 1997). Current surveillance and management methods for veterinary pests can be labor intensive as personnel must be trained, so they are often not conducted. Thus, our findings that while Tennessee and Texas producers perceive horn and face flies as significant pests impacting their operations, the need to educate producers about additional pests that they cannot see is also critical. Often people perceive problems that they can either see or are reminded about; pests that are elusive may cause damage because they may be ignored and/or forgotten, which can lead to undetected problems with significant consequences. Educating producers about different arthropods, how to monitor arthropods and how to assess animals for damage will be vital as invasive and exotic pests become a larger biosecurity threat than was perceived at the time of the study.

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