CLIPPING HEIFER HAIR COATS CAN BRIEFLY REDUCE FESCUE TOXICOSIS SYMPTOMS

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ABSTRACT

A substantial challenge for many beef cattle producers is developing beef heifers into mature, productive cows in a timely and profitable manner. At the Shenandoah Valley Agricultural Research and Extension Center (SVAREC), fall-born replacement heifer candidates are artificially inseminated (AI) in December at 14-15 months of age with a target weight of 350-380 kg. Achieving this level of weight gain through the summer months has been difficult due to heat stress and the utilization of toxic endophyte-infected tall fescue. Tall fescue is the predominant species of forage found at SVAREC. The purpose of this project was to determine if clipping the hair coats of beef heifers would reduce the heat stress that the heifers experience during the summer months. Heifer hair coats were scored in the spring when they were approximately 9 months old and had an average weight of 200 kg in year one and 256 kg in year two. Heifers were scored on a five-point ranked scale, with a score of 1 indicating complete shedding of hair and a score of 5 indicating that no shedding has occurred. Heifers with a hair coat score of 4 or 5 were utilized for this project. The selected group of heifers scoring a hair coat score of 4 or 5 (32 in year one and 23 in year two) were randomly assigned to a control cohort and a clipped cohort. The heifers in the clipped treatment group were sheared with variable speed clippers along the body of the heifer, but not from under the belly or along the legs. Heifer hair coats were scored again at the end of the study on day 113. Vaginal temperature loggers were used to record core body temperatures every ten minutes during several sampling periods. At the conclusion of these 16-week trials, most of the control heifers retained their hair coats while the heifers that had been clipped regrew their hair coats. There was significant period by treatment interaction for the response of heifer average daily gains to clipping (P=0.0002). Average daily gains of the clipped heifers (0.4 kg/day) exceeded the average daily gains of the control heifers (0.1 kg/day) only in the first four-week period of each year ($P<0.0001$), but there were no differences in total seasonal average daily gain (0.3 kg/day; $P=0.1631$). There was significant treatment by hour interaction in the analysis of heifer vaginal temperatures ($P<0.0001$), with clipped heifers cooler than control heifers through most of the night and morning hours, but not in the afternoon. In conclusion, clipping heifers resulted in only short-term benefits to weight gains for heifers stocked on toxic endophyte-infected tall fescue pastures, but clipping did result in reduced core body temperatures throughout the summer months. Additional work could explore the effects of clipping heifers at regular intervals during periods of high temperatures and humidity, such as at monthly intervals.

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Introduction

Quality heifer development is an important process at the Shenandoah Valley Agricultural Research and Extension Center (SVAREC). Fall-born replacement heifer candidates are artificially inseminated (AI) in December at 14-15 months of age. The target for heifer weight is 350-380 kg at this age for optimal success in breeding. Achieving that weight through adequate nutrition including net energy and metabolizable protein is a significant component of heifer development. Some studies indicate that the time at which heifers begin to cycle relies heavily on the heifers reaching an appropriate weight and size, but also depends on the genetic makeup of the heifer among other factors (Funston & Deutscher, 2004). Achieving weight gain through the summer months is of great importance for the future of the herd.

Achieving this goal has been difficult, particularly through the summer, due to heat stress and the toxic endophyte-infected tall fescue (*Schedonorus arundinaceus* (Schreb.) Dumont.,syn. *Lolium arundinaceum* (Schreb.) Darbysh., formerly *Festuca arundinacea* Schreb.) forage base. Ingestion of this forage can result in several clinical signs collectively described as fescue toxicosis. The clinical signs in cattle include reduced rate of gain, reduced milk production, a rough hair coat, gangrene in cold weather, and fat necrosis (Roberts & Andrae, 2018). Heat stress can cause an animal to sweat more or breathe at a faster rate because of an elevated body temperature (McClanahan et al., 2008). These challenges make it difficult for heifers to reach puberty in a timely manner. To ensure that heifers have adequate time to recover for breeding success the following year, it is beneficial for heifers to cycle and conceive towards the beginning of their first breeding season (Funston & Deutscher, 2004). The purpose of this project was to determine if heat stress in the summer months could be reduced by clipping the hair coat of beef heifers. We hypothesized that by clipping heifer hair coats after weaning, heifers would have improved weight gains and lower core body temperatures.

Literature Review

The benefits of tall fescue

Tall fescue is a common cool season perennial grass that persists in the southeastern United States (Eisemann et al., 2020). Tall fescue is a vigorous and hardy plant that may be successfully established in places where it is difficult to grow other grasses (Franzluebbers & Poore, 2021). This species is durable and will persist for years on minimal inputs (Franzluebbers & Poore, 2021). Tall fescue is a versatile forage and can be utilized almost year round depending on the environment (Burns, 2009). Tall fescue may be utilized for nutritious hay in the winter months, for rotational stocking in a grazing system, and for deferred grazing in a stockpile system. Stockpiling tall fescue involves keeping animals out of a field for the spring or fall months and then utilizing the forage for grazing when the growing season ends (Burns, 2009). The nutritive value of tall fescue depends on the stage of growth of the grass and management practices, but tall fescue loses nutritive value at a slower rate than most other forage species in the winter months (Burns, 2009).

The challenges of tall fescue

Fescue toxicosis is the presentation of various maladies that may be evident in cattle while they are grazing endophyte infected tall fescue (Eisemann et al., 2020). Some varieties of tall fescue, including ‘Kentucky 31,’ form a symbiotic relationship with a fungal endophyte, *Epichloë coenophialum*, which helps the plant survive during stressful environmental conditions such as drought (Roberts & Andrae, 2018). However, endophyte-infected tall fescue can also be dangerous to livestock. Ergot alkaloids produced by the common fungal endophyte present in most established tall fescue cultivars have been demonstrated to be detrimental to the productivity of cattle and the profitability of farms and ranches. Tall fescue toxicosis is estimated to cost the beef cattle industry $1 billion each year in the US (Roberts & Andrae, 2018).

Ergot alkaloids cause a decrease in blood flow through the body of the animal consuming these toxins (Aiken et al., 2011). During summer months, reduced blood flow can make it difficult for an animal to dissipate body heat. If animals are suffering from fescue toxicosis, they often exhibit signs of heat stress during periods of high temperatures and humidity (Aiken et al., 2011). Heat stress can be detected if an animal has high respiration rates and excessive salivation or if they spend a large amount of their time in ponds or in the shade (Aiken et al., 2011). Additionally, cattle suffering from fescue toxicosis will also have reductions in productivity, including reductions in birth weights at calving and lower conception rates, as well as other physical and physiological signs, including rough hair coats and low concentrations of serum prolactin (McClanahan et al., 2008). McClanahan et al. (2008) found that at high temperature (≥24.5°C) and humidity (≥74), the number of steers grazing in toxic endophyte-infected pastures went down, with the majority of the steers grazing in the mornings and the evenings when temperatures were lower (McClanahan et al., 2008). This study also indicated that during the heat of the day, a greater proportion of steers stocked on non-toxic tall fescue pastures were grazing compared to steers stocked on toxic tall fescue (McClanahan et al., 2008). Despite extended grazing times in the evenings, the steers grazing toxic tall fescue spent more time in the shade and less time grazing than steers stocked on non-toxic tall fescue (McClanahan et al., 2008).

Accelerated hair growth

The presence of thick hair coats is a common phenomenon in young beef cattle grazing endophyte-infected tall fescue. Excessive amounts of hair, once thought to be a result of a reduction in the level of hair shedding, may exacerbate heat stress (Aiken et al., 2011). The thick hair coat results in a reduced capacity for water to evaporate from the surface of the calf (Eisemann et al., 2020). McClanahan et al. (2008) found that calves that were clipped had lower rectal temperatures than calves that were not clipped at 84 days following clipping (McClanahan et al., 2008). Average hair growth during this study was 0.285 mm/d, and this level of growth was maintained through the whole study whether the cattle were clipped or not (McClanahan et al., 2008). Total hair growth through the study was 29.64 mm. with the amount of hair found on the animals being higher at the end (13.73 mg/cm^2) of the study than the beginning (11.48 mg/cm^2) (McClanahan et al., 2008). Turner (1962) found a strong relationship between the thickness of a calf's coat and body temperature. The effects of calf coat thickness influenced calf weight gain from December to March by 9 kg per one unit of coat score.

The importance of growth to beef heifer development

Heat stress negatively affects heifer growth and sexual development, resulting in challenges for producers developing replacement beef heifers, particularly in the summertime (Poole et al., 2019). Some producers breed heifers three to four weeks earlier than the mature cow herd (Larson, 2007). This is done because anestrous lasts longer in immature cows, and thus having heifers deliver their first calf earlier in the breeding season provides them with extra time to breed back. However, for this to be accomplished, heifers must be at an adequate breeding size and weight at roughly 12-14 months of age (Larson, 2007). The target-weights for heifers differs between breeds, but it has been found that breeds such as Angus, Hereford, Charolais, and

Limousin, should be at a breeding size of around 60% of adult weight (Larson, 2007). Larson (2007) found that heifers gaining 0.45 kg to 0.68 kg per day have a higher percentage of pregnancy in a 45-day breeding season than heifers not gaining at these rates of growth. In addition, early conception is directly corelated to body condition scores so that as condition increases to a point, so does conception (Larson, 2007).

Materials and Design

Site description

The work performed in this study was conducted at SVAREC in Raphine, Virginia (37.9333042, -79.2136208). This protocol was approved by the Virginia Tech Institutional Animal Care and Use Committee (Protocol #20-076). A weather station (WeatherSTEM, Tallahassee, FL) was used to record temperature and precipitation during the study. For this study, a rotational stocking system was used at the Interstate I-81 pasture system (I-81; 37.9402428, -79.2225653) and Benson Farm pasture system (BF; 37.9519398, -79.2221501). The forage base of both grazing systems consists primarily of the cool-season grass, tall fescue. Pastures were sampled and tall fescue tillers were shipped to Agrinostics, LTD. (Watkinsville, GA) for analysis of endophyte infection in 2020. All pastures were infected with an endophyte.

Animal management

Fall-born calves were weaned in late April and early May at the SVAREC through a fence line weaning process for two weeks. Heifers weighing above 168 kg were selected as replacements with an average weight 200 kg in year one and in year two any heifers above 238 kg were selected with an average weight of 256 kg.

Thirty-six and 28 heifers were available to be utilized for this project in year one and two, respectively. Heifer hair coats were scored using the American Angus Association’s Hair

Shedding Scoring Guide (American Angus Association, N.D.). Scores on a scale of 1 to 5 were assigned to heifers, with a score of 1 indicating complete shedding of hair and a score of 5 indicating that no shedding has occurred. For this project, only heifers with a hair coat score of 4 or 5 were utilized. After hair coats were scored, thirty-two heifers were utilized for this project in year one, and twenty-three heifers were utilized for this project in year two.

The heifers in the clipped treatment group were shorn using variable-speed shearing clippers with a set of Oster Pro (Atlanta, GA) Cryotech blades (78511-126). Hair was sheared from the neck along the ribs to the pins, but not from under the belly or along the legs. The length of the remaining hair after clipping was approximately six millimeters in length.

Heifer hair coats were scored again at the end of the study in both years to determine if any of the heifers in the control group had shed out naturally and to determine if any of the heifers from the clipped group had regrown their hair.

Pasture management

Heifers were grouped in a single herd during each summer grazing season. The heifers spent most of the summer months at I-81 where they were rotated consecutively through paddocks 1A, 1B, 2A, 2B, 3A, 3B, 4A, and 4B (1 ha each) every three days, then through paddocks 5 and 6 (2 ha each) for seven days each before restarting the rotation. The heifers were moved in August to BF where the project was concluded each year. The pasture rotation schedule at BF was two days in the barn lot paddock (1.2 ha), five days in paddocks 1 (3.5 ha) and 2 (3.1 ha) each, four days in paddock 3 (2.8 ha), five days in paddock 4 (2.8 ha), and seven days in paddock 5 (4.2 ha). A forage grab sample was collected when the heifers were rotated to a new pasture. The sample was split into two samples. One split sample was analyzed with Near Infrared Spectroscopy (NIRS) by Cumberland Valley Analytical Services (Waynesboro, PA) for nutritive value, and another split sample was analyzed for total ergot alkaloids (TEA) through Enzyme Linked Immunoassay (ELISA) by Agrinostics, Ltd. (Watkinsville, GA).

Animal weight gain

All heifers were weighed twice over two days (once per day) at the beginning and end of the trial and once every 28 days throughout the duration of the trial. Heifers were weighed by running them through a chute system equipped with load bars. Double weights from the beginning and end of the study were averaged for a mean start and mean end weight. Average daily gain was calculated by subtracting the previous weight from the current weight and dividing the result by 28 days. Total seasonal average daily gain was calculated by subtracting the start weight from the end weight and dividing by the total number of days of the study each year. In 2020, the project began on June 4 and concluded on September 25. In 2021, the project began on June 22 and concluded on October 13.

Animal body temperatures

A blank controlled internal drug release (CIDR) device (Zoetis, Parsippany, NJ) was hollowed out to fit a cylindrical Star-Oddi DST micro-T temperature logger (Star-Oddi, Iceland). The temperature loggers were setup to log temperatures every ten minutes and were secured in the CIDRs with electrical tape. The CIDR and temperature loggers were inserted with an Eazi-Breed CIDR applicator and cattle lubricant using standard CIDR implant protocols. The CIDRs were inserted into six heifers randomly selected from each treatment group (12 total heifers). In year one, the devices were inserted into the heifers three different times throughout the summer for four days each. These sampling periods included: July 2 – July 6; July 31 – August 4; and August 27 – August 31. The selected data began at 9 am on the day of insertion and ended at 7 am on the day of removal. In year two, the CIDRs were inserted once for a five-day period (July 21- July 26) using the same timing schedule for the start and end times.

Statistical analysis

Heifer average daily gains and vaginal temperatures were compared with a mixed effect analysis of variance test using PROC MIXED in SAS Studio, v. 94 (SAS Inst., Cary, NC). Average daily gains and vaginal temperatures were considered a repeated measures response variable using unstructured matrices for the weight gain analysis and compound symmetry structure for the temperature analysis with individual heifer as the subject. Least Squares Means (LSM) and standard errors (SE) were reported for each treatment by period combination and treatment by hour combination due to treatment by time interaction for the weight and temperature analyses, respectively. Differences were considered significant when $P \leq 0.05$ and as trends when $0.05 < P \leq 0.10$.

Results and Discussion

Site weather

The maximum temperatures for both years was above 30 degrees Celsius, indicating conditions potential for inducing heat stress in the heifers (**Table 1**). Elevated temperatures along with thick hair coats on cattle will cause many heat stress symptoms (Poole et al., 2019).

Table 1: Reported weather data for the study periods in 2020 and 2021, including minimum, maximum, and average temperature and precipitation.

Year	Month	Min Temp -- C° --	Max Temp -- C° --	Average Temp -- C° --	Precipitation -- cm --
2020	June	7.2	31.1	20.7	5.6
	July	15.0	33.9	24.3	11.0

	August	13.9	30.6	22.1	21.7
	September	0.0	24.1	10.9	5.7
	June	7.9	31.0	20.8	8.1
2021	July	9.8	33.0	22.9	4.9
	August	11.1	34.3	22.8	27.0

Heifer hair coat scores

In the analysis of heifer hair coat scores, most of the heifers that were clipped at the beginning of the summer regrew their hair coats while the control heifers largely retained their hair coats (**Table 2**).

Table 2: Counts of heifer at conclusion of the project within a hair coat score (HCS) category by treatment (control and clip) and starting hair coat score (4 and 5).

Year 1	**Control**		**Clip**	
	Start HCS			
End HCS	*4*	*5*	*4*	*5*
1	0	0	0	0
2	0	0	1	0
3	4	0	3	2
4	1	2	2	1
5	1	8	1	6
Year 2	**Control**		**Clip**	
	Start HCS			

End HCS	*4*	*5*	*4*	*5*
1	0	0	0	0
2	0	0	0	0
3	0	0	1	0
4	0	3	0	3
5	3	5	3	5

Heifers that were clipped regrew their coats through the summer. Aiken et al. (2011) indicated similar phenomena when cattle are stocked on toxic endophyte-infected tall fescue. Rough hair coats are a sign of tall fescue toxicosis and consist of both retained hair from the winter and additional growth throughout the summer months Our study confirmed this pattern of excessive hair growth because many of the clipped heifers regrew their coats by the time, we rescored them. Despite the removal of hair from the clipped heifers in June, the hair grew back within several months.

Some of the heifers in this study with little hair shedding at the start of the study had shed out slightly by the end of the summer. Another study found little to no shedding for steers on toxic endophyte-infected tall fescue (McClanahan et al., 2008). Poole et al. (2019) found that heifers grazing toxic endophyte-infected tall fescue had little hair shedding, lower body condition scores, and reduced reproductive performance..

Pasture characteristics

Total ergot alkaloid levels in the forage largely exceeded 1000 ppb, except at two points in year one (**Table 3**). However, even these lower levels exceeded the threshold of total ergot alkaloid levels which are reported to induce signs of toxicosis in cattle. This threshold has been found to be 60 ppb ergovaline, which is the main ergot alkaloid (85-97%) in toxic endophyte-infected tall fescue (Liebe & White, 2018)

Based on forage nutritive value, the expected animal gains should have exceeded 1 kg/d even when TDN was 55% (National Academies of Sciences, 2016) . With substantially lower animal weight gains realized than expected based on forage nutritive value (**Table 4**), it is likely that animal weight gains were affected as a result of heifer consumption of the ergot alkaloids produced by the endophyte in the tall fescue forage.

Table 3: Forage nutritive value and total ergot alkaloids levels from grab samples by date and paddock (CP: crude protein; NDF: neutral detergent fiber; ADF: acid-detergent fiber; TDN: total digestible nutrients; TEA: total ergot alkaloids)

Date	Paddock	CP	NDF	ADF	TDN	TEA
June 16, 2020	I-81 #1	14.6	58.1	35.5	59.8	1216
June 22, 2020	I-81 #2	13.2	56.9	35.8	59.0	1333
June 29, 2020	I-81 #3	14.2	61.5	36.0	59.7	1216
July 04, 2020	I-81 #4	14.2	58.3	34.8	61.0	420
July 09, 2020	I-81#5	17.8	55.6	32.2	61.9	585
July 17, 2020	I-81 #6	15.2	56.1	35.1	59.9	1293
July 23, 2020	I-81 #1	15.5	57.1	34.6	61.7	1583
July 29, 2020	I-81 #2	17.0	54.3	31.2	63.1	1189
August 06, 2020	I-81 #3	15.2	56.7	32.9	62.7	1007
August 13, 2020	I-81 #4	19.2	56.8	32.9	61.7	1293
August 19, 2020	I-81 #5	20.6	57.4	32.1	61.9	1182

August 25, 2020	I-81 #6	18.9	49.5	27.9	64.9	1624
September 02, 2020	Benson #1	17.2	53.2	31.4	63.4	1695
September 09, 2020	Benson #2	16.1	52.4	30.8	62.7	1895
September 12, 2020	Benson #3	17.4	57.3	32.9	62.7	1637
September 17, 2020	Benson #4	18.8	40.9	35.4	55.0	1007
June 25, 2021	I-81 #1A	12.0	61.2	34.5	61.1	1570
June 28, 2021	I-81 #1B	10.0	64.1	36.5	60.4	1761
July 02, 2021	I-81 #2B	8.9	67.6	39.2	59.0	1608
July 06, 2021	I-81 #2A	10.2	64.7	36.9	59.7	1796
July 06, 2021	I-81 #3A	10.7	59.6	33.7	61.5	1828
July 14, 2021	I-81 #3B	8.8	66.3	38.1	59.1	1749
July 14, 2021	I-81 #4A	11.6	64.9	36.6	59.7	1394
July 14, 2021	I-81 #4B	10.9	64.8	37.2	59.3	1578
July 19, 2021	I-81 #5	14.6	58.9	33.9	61.0	1771
July 28, 2021	I-81 #6	10.1	63.3	37.3	59.1	1449
August 11, 2021	I-81 #2	11.6	64.2	37.1	59.8	1904
August 11, 2021	I-81 #3	13.9	61.7	35.2	60.3	1641
August 23, 2021	I-81 #4	19.0	58.9	31.3	62.1	1772
September 03, 2021	I-81 #5	17.4	58.0	31.9	62.0	1731
September 03, 2021	I-81 #6	19.0	53.8	28.5	63.5	1945
September 20, 2021	Benson #1	17.6	58.4	32.5	61.5	1732
September 20, 2021	Benson #2	20.0	55.7	29.4	63.4	1805
September 24, 2021	Benson #3	18.3	54.5	29.4	63.6	1958

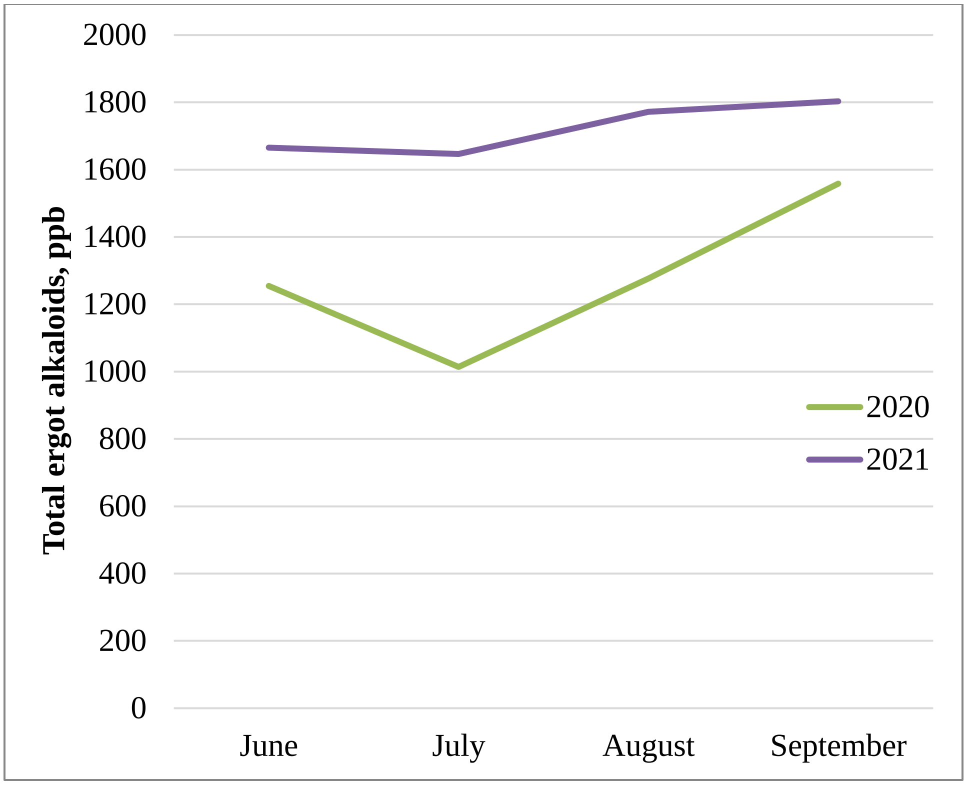

Figure 1: Concentration of total ergot alkaloids (TEA) in the forage samples collected in 2020 and 2021 during the grazing season.

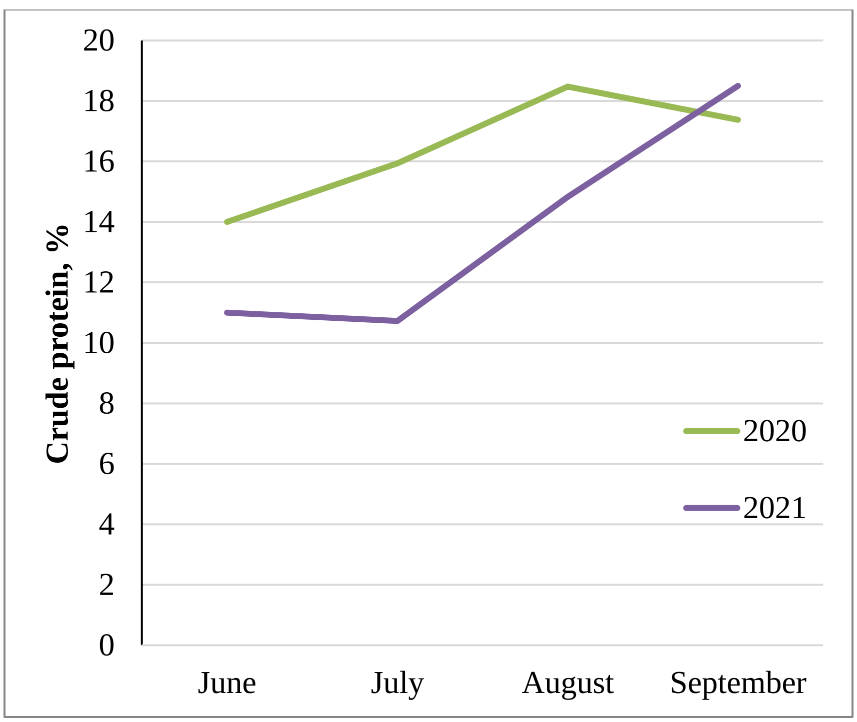

Figure 2: Concentration of crude protein (CP) in the forage samples collected in 2020 and 2021 during the grazing season.

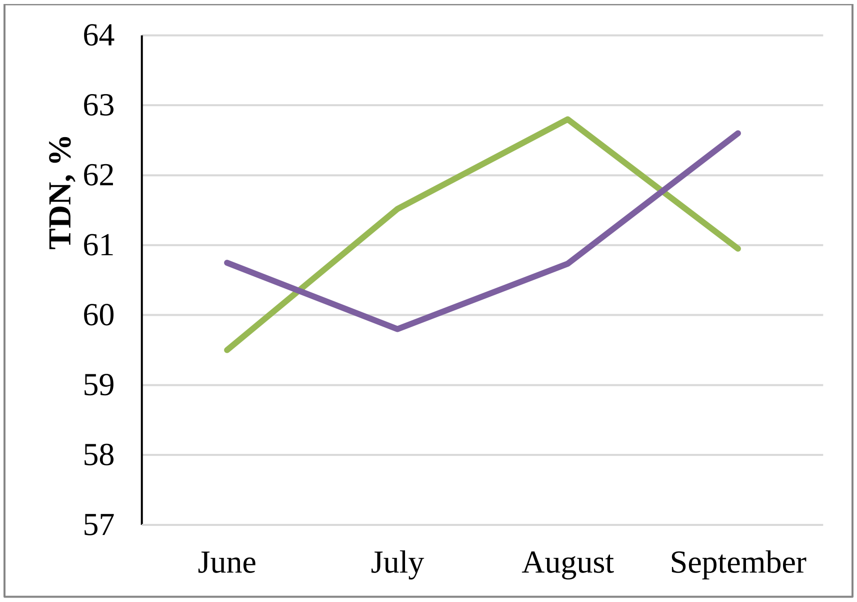

Figure 3: Concentration of total digestible nutrients (TDN) in the forage samples collected in 2020 and 2021 during the grazing season.

Heifer weight gain

Mean heifer weight at the start of the study was 243 kg in year one and 263 kg in year two. There was no treatment by year interaction for heifer average daily gains, but there was significant period by treatment interaction (P=0.0002). Average daily gains of the clipped heifers were greater than the average daily gains of the control heifers only in the first period of each year (**Table 4**). For the total seasonal average daily gains, there were no significant differences between the heifer treatments.

Table 4: Heifer average daily gain by period and season (LSM: Least Squares Means; SE: Standard Error)

Treatment	Clipped	Control		
	LSM		SE	P Value
Period	------- *kg/day* -------		--kg/day--	
1	0.4	0.1	0.0	<.0001
2	0.3	0.4	0.0	0.8975
3	0.2	0.3	0.1	0.5508
4	0.4	0.4	0.1	0.8468
Seasonal	0.3	0.3	0.0	0.1631

We saw a limited short-term benefit to weight gains after clipping the heifers. Other studies have indicated no difference when clipping steers on weight gains in the summer while grazing toxic endophyte-infected tall fescue (McClanahan et al., 2008). Clipped calves in Australia (forage type not reported) gained less than control calves in the winter, but gained 13% more than the control cattle in the summer (Turner, 1962).

Heifer body temperatures

There was no treatment by year interaction for the analysis of heifer average internal temperatures, but there was significant hour by treatment interaction. Core temperatures of the clipped heifers were lower than the core temperatures of the control heifers at 1 am, 5 am, 6 pm, 7am to noon, and 10 pm (**Table 5**). Core temperatures of the clipped heifers tended to be lower than the core temperatures of the control heifers at 12 am, 2 am to 4 am, 6 am, 1 pm, 5 pm, 8 pm, 9 pm, and 11 pm.

Table 5: Heifer mean core temperature by hour (LSM: least squares means; SE: standard error)

	Clipped	Control	

Hour	LSM ---C---		SE --C--	P Value
0	39.2	39.4	0.1	0.0622
1	39.1	39.3	0.1	0.0367
2	39.0	39.2	0.1	0.0781
3	39.0	39.2	0.1	0.0555
4	39.0	39.2	0.1	0.0502
5	39.0	39.2	0.1	0.0237
6	38.8	39.0	0.1	0.0552
7	38.6	38.8	0.1	0.0168
8	38.7	39.0	0.1	0.0142
9	39.0	39.3	0.1	0.0036
10	39.2	39.4	0.1	0.0147
11	39.4	39.6	0.1	0.0193
12	39.6	39.8	0.1	0.0457
13	39.8	40.0	0.1	0.0754
14	39.9	40.0	0.1	0.2048
15	39.9	40.0	0.1	0.2706
16	40.0	40.1	0.1	0.3142
17	39.9	40.1	0.1	0.0904
18	39.8	40.0	0.1	0.0319
19	39.6	39.8	0.1	0.1648
20	39.4	39.6	0.1	0.0603

21	39.3	39.5	0.1	0.0666
22	39.3	39.5	0.1	0.0420
23	39.3	39.5	0.1	0.0614

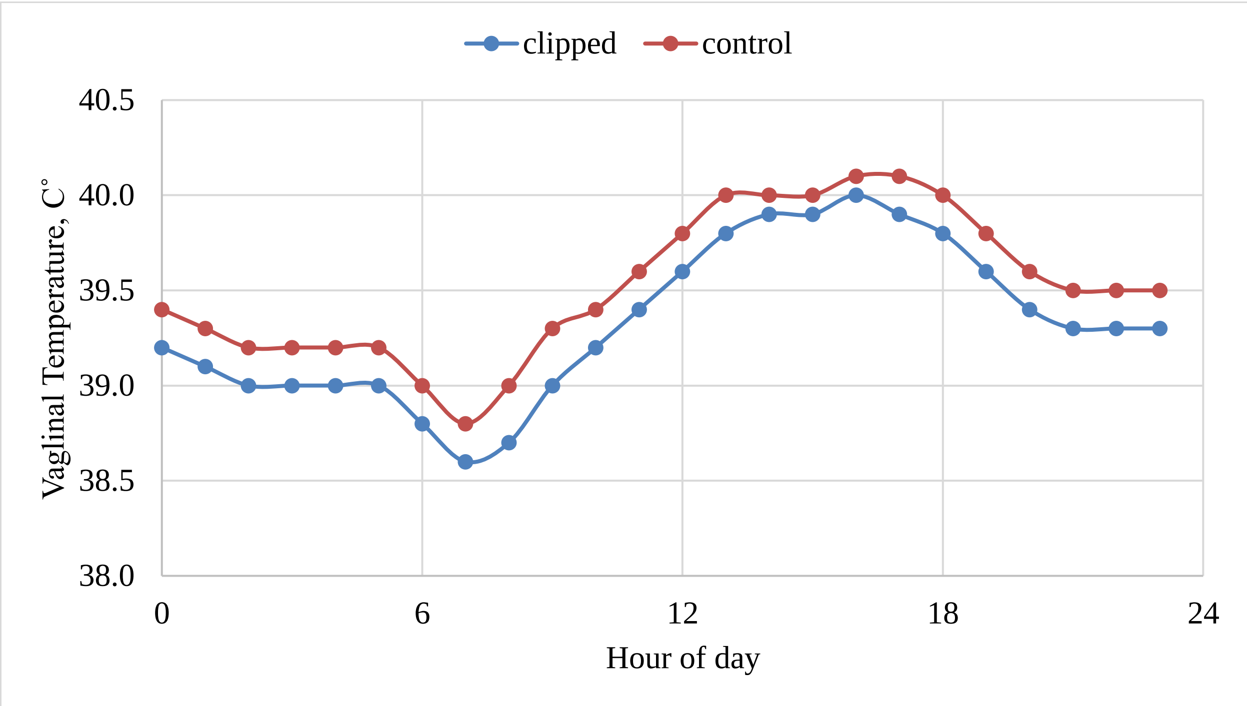

Figure 4: Heifer vaginal temperature by hour of day for clipped and control heifer groups.

Poole et al. (2019) found that heifers on toxic endophyte infected fescue with long hair had higher vaginal temperatures in the second period of the study using modified CIDRs with loggers to measure temperature. They also found that heifers with rough coats eating toxic endophyte-infected tall fescue had a higher surface temperature (Poole et al., 2019). In a yearlong study where the calves were clipped several times (forage type not reported), clipped cattle had lower respiration rates and lower skin and rectal temperatures, but there was no effect of clipping on sweating (Turner, 1962).

Conclusion

Clipping heifers resulted in a short-term benefit on weight gains when heifers were stocked on toxic endophyte-infected tall fescue pastures. Although clipping may have reduced heat stress, it did not result in any appreciable differences in weight gain. With an estimated time of clipping of around five minutes per heifer once the heifers have been restrained, this practice will likely not be practical or profitable for most farmers. Heat stress is a major issue for livestock producers, but clipping hair coats of cattle on tall fescue pastures may only be a strategy to provide short-term relief for cattle.

Additional work could explore the effects of clipping heifers at regular intervals during periods of high temperatures and humidity, such as at monthly intervals. Regular clipping may help improve weight gain throughout the whole summer. Providing shade may also reduce the effects of heat stress on growing cattle, and it is not clear what interaction there may be between the effects of clipping and the effects of providing shade to young cattle.

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