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Shearing Lambs Improves Growth Performance During Periods with Elevated Thermal Load

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Summary

The purpose of this study was to determine if average daily gain (ADG) is improved in shorn lambs versus non-shorn lambs in the summer months in the upper Midwestern United States. Forty-nine purebred Hampshire and Columbia ram (n = 10 Hampshire and 4 Columbia) and ewe (n = 22 Hampshire and 13 Columbia) lambs were grouped by breed, sex, age (104 ± 1.7 days of age), and initial weight (109 ± 3.5 lbs) into shorn (n=26) and non-shorn (n=23) groups. After shearing (3 June 2004), shorn sheep had approximately 0.1 inches of wool-cover. Lambs were weighed 1, 29, and 57 days following shearing. During the first 28 day period following shearing (period 1), there was no difference in average daily gain between shorn and non-shorn lambs (0.8 ± 0.04 vs 0.82 ± 0.04 lbs/day, respectively). In the second 28 day period (period 2), shorn lambs had a greater average daily gain than non-shorn lambs (1.02 ± 0.06 vs 0.92 ± 0.06 lbs/day, respectively). Period 2 had greater mean (68.9 vs. 63.4 ^{o}F, respectively), minimum (59.7 vs 54.1^{o}F, respectively), and maximum (78.2 vs. 73.8^{o}F, respectively) daily ambient air temperature and greater mean humidity (73.97 vs. 68.2 %, respectively) than period 1. The calculated temperature humidity index (THI) was also greater in period 2 than period 1 (66.9 vs. 62.24, respectively). These data indicate that shorn lambs grow more rapidly than non-shorn lambs during periods of elevated temperature, humidity, and THI. **Keywords: Lambs, shearing, heat stress, growth**

Introduction

Heat stress in lambs can result in reduced feed intake, feed efficiency and live weight gain. Shearing is a method by which producers attempt to reduce heat stress in growing or finishing lambs. Lambs are recommended to be shorn early in the feeding period to improve feed consumption, gain, and efficiency of feed conversion, especially in warm weather. Research has supported this recommendation, indicating shorn sheep consume more hay and concentrates than non-shorn sheep under heat stress conditions (75-111^{o}F; da Costa et al., 1992). However, early studies demonstrated minimum metabolism occurred at temperatures ranging from 75-81^{o}F in closely shorn sheep and energy retention became negative at temperatures below 59^{o}F (Graham et al., 1959). In a companion study, Blaxter et al. observed sheep with 1 inch of wool had a thermoneutral zone that ranged from approximately 54 to 88^{o}F (1959). Based on this early work lambs which are not shorn may perform better than shorn lambs at more moderate temperatures. The purpose of this study was to determine if average daily gain (ADG) is improved in shorn lambs versus non-shorn lambs in the summer months in South Dakota.

Materials and Methods

Purebred Hampshire and Columbia ram (n = 10 Hampshire and 4 Columbia) and ewe lambs (n = 22 Hampshire and 13 Columbia) at the SDSU Sheep Unit were randomly assigned to one of two treatment groups: shorn or non-shorn. Treatments were balanced for breed, sex, age (104 ± 1.7 days of age), and initial weight (109 ± 3.5 lbs). Shorn lambs (n = 26) were shorn on 3 June 2004 with a 13 tooth comb fitted on a three inch shearing machine with four point cutter (Oster Shearmaster®, Niles, Illinois, USA). After shearing, shorn lambs had approximately 0.1 inches of wool-cover. All lambs were weighed 1, 29, and 57 days following shearing (4 June 2004, 2 July 2004, and 30 July 2004, respectively). All lambs were fed a 12% crude protein lamb finishing ration consisting of 72.5% cracked corn, 15% commercial lamb protein supplement (Big Gain Lamb Finisher, Big Gain, Inc. Mankato, MN, USA), and 12.5% pelleted soybean hulls available *ad libitum* via a self feeder. Water was also available *ad libitum*. All lambs were segregated by sex, and shorn and

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non-shorn lambs of the same sex were maintained together in a dirt lot with access to shade. Climatic information was recorded every 30 minutes using a Vantage Pro Plus Weather Station equipped with WeatherLink for Vantage Pro Software (Davis Instruments, Hayward, CA) located within 500 yards of the pens where the lambs were housed. The temperature-humidity index (THI) was calculated using the equation: THI = 0.8DBT + RH x (DBT-14.4) + 46.4 where, DBT is dry bulb temperature (^{o}C) and RH is relative humidity in decimal form (Thom, 1959).

Effect of treatment, sex, and treatment by sex interaction on ADG during the 31 day period prior to shearing, the 28 day from 4 June 2004 until 2 July 2004 (period 1), the 28 day period from 2 July 2004 until 30 July 2004 (period 2), and over the entire study was analyzed by ANOVA using GLM procedures of SAS.

Results and Discussion

Period 2 had a greater daily minimum, maximum, and mean temperature of ambient air and a greater mean humidity than period 1 (Table 1and Fig. 1). In addition to ambient temperature, relative humidity can also impact animal performance and response to the environment. The THI is a derived statistic that was originally used to evaluate thermal effects in humans (Thom, 1959). A THI of 74 or less is considered normal, 75 to 78 is alert status, 79 to 83 is danger status, and a THI equal to or above 84 is an emergency (LCI, 1970). The THI was never greater than 82 in period 1 or 2 (Fig. 2). However, the mean, minimum, and maximum daily THI was greater for period 2 than period 1 (Table 1 and Fig. 2). Mean wind speed and solar radiation were lower in period 2 than period 1 (Table 1)

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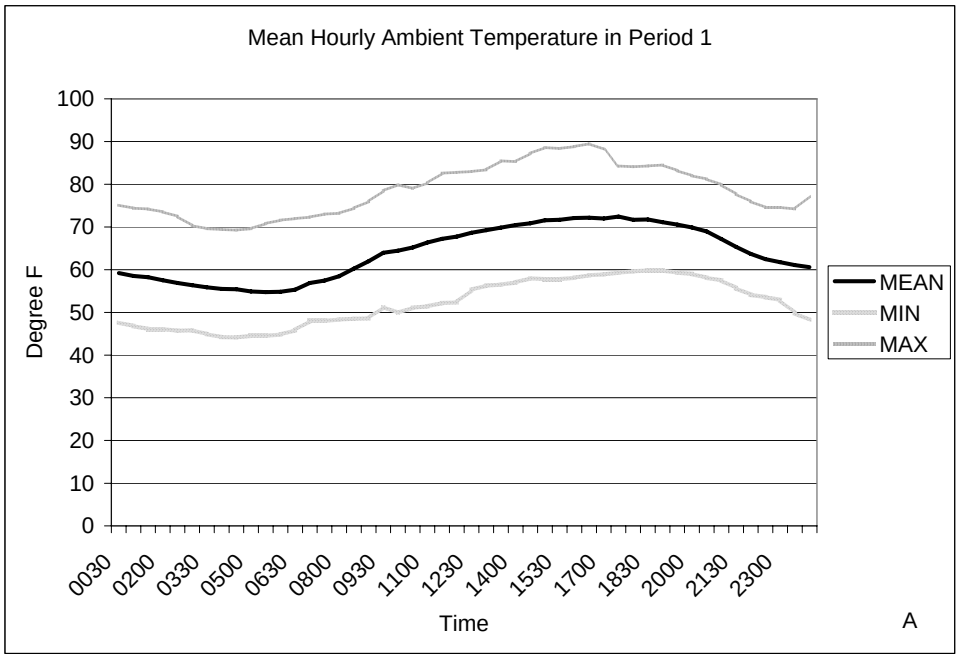


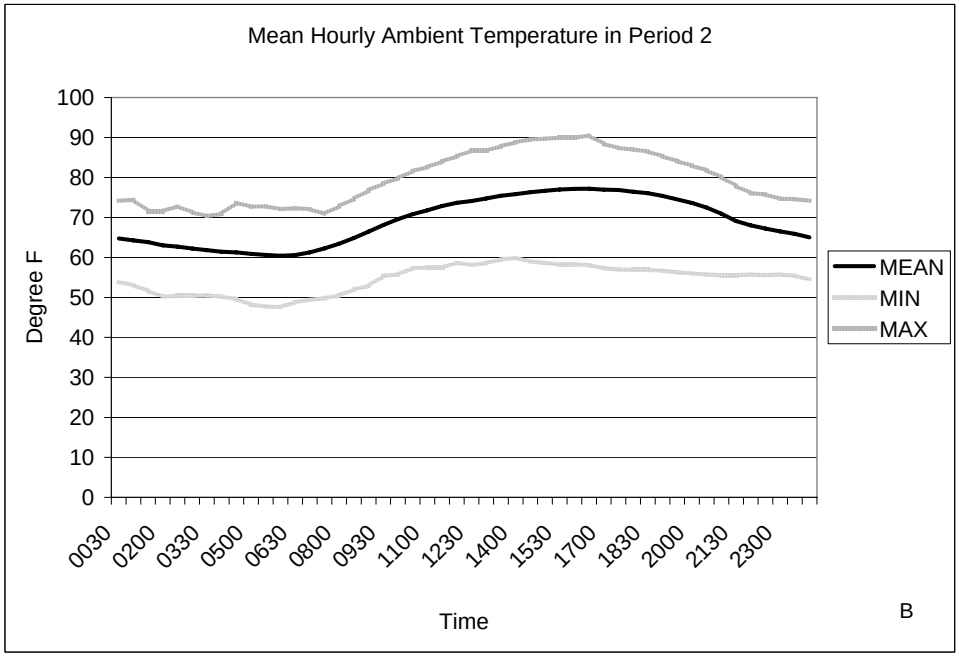
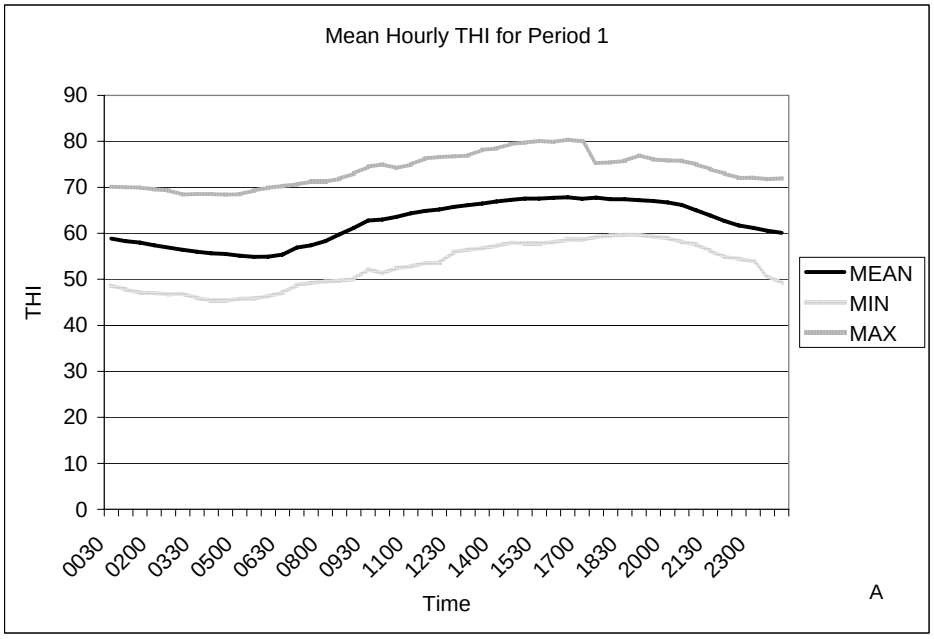


Figure 1: Mean, minimum, and maximum hourly ambient temperature for period 1 (June 4, 2004 until July 2, 2004; A) and period 2 (July 2, 2004 until July 30, 2004; B).



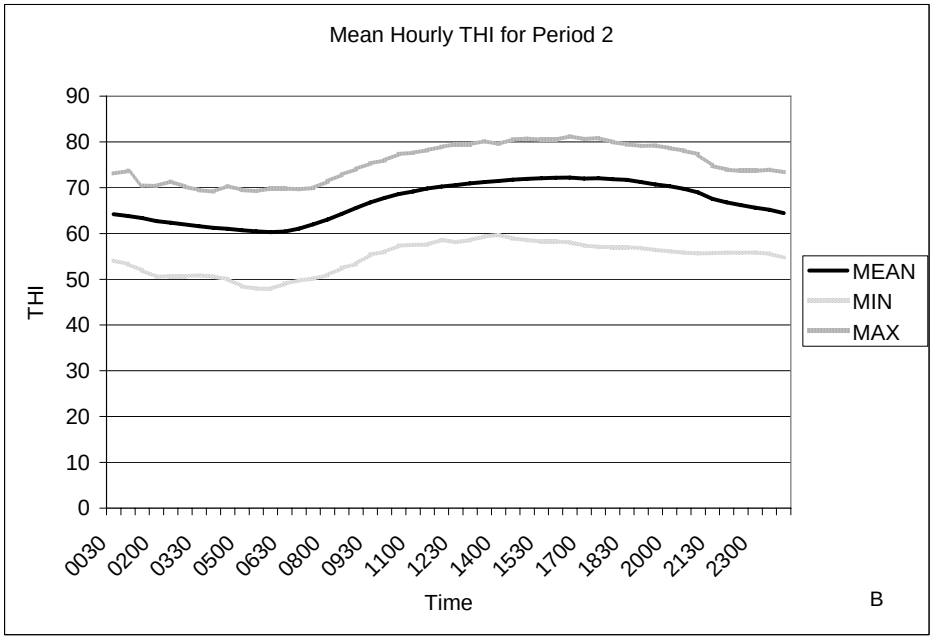


Figure 2: Mean, minimum, and maximum hourly THI for period 1 (June 4, 2004 until July 2, 2004; A) and period 2 (July 2, 2004 until July 30, 2004; B).

Table 1: Mean climatic data for period 1 and 2.

	Dates	Ambient Temperature (^{o}F)	Relative Humidity (%)	THI	Windspeed (miles/h)	Solar radiation (W/m^{2})
		Mean ± std dev	Mean ± std dev	Mean ± std dev	Mean ± std dev	Mean ± std dev
Period 1	6/4/04-7/2/04	64.0 ± 9.3	68.2 ± 19.7	62.24 ± 7.04	3.68 ± 3.54	194.42 ± 203.59
Period 2	7/2/04-7/30/04	69.0 ± 8.5	73.97 ± 16.99	66.9 ± 6.71	2.95 ± 2.82	192.27 ± 202.81
Overall	6/4/04-7/30/04	66.7 ± 9.2	71.28 ± 18.53	64.73 ± 7.25	3.32 ± 3.22	193.27 ± 203.14

Climate data was recorded every 30 minutes using a Vantage Pro Plus Weather Station equipped with WeatherLink for Vantage Pro Software (Davis Instruments, Hayward, CA) located within 500 yards of pens where the lambs were housed. THI (Temperature-humidity index) = 0.8DBT + RH x (DBT-14.4) + 46.4 where, DBT is dry bulb temperature (^{o}C) and RH is relative humidity in decimal form (Thom, 1959).

In the 31 days prior to shearing, there was no difference in ADG among treatment groups (Fig. 3; *P* = 0.3915). During period 1, there was no difference in ADG between shorn and non-shorn lambs (Fig. 3; *P* = 0.8289). Mean maximum daily air temperature in period 1 (73.8 ± 1.4°F) approached temperatures at which shorn sheep have been observed to have increased feed intake relative to non-shorn sheep (75-111°F; da Costa et al., 1992). However, the mean minimum daily temperature in period 1 (54.1 ± 1.16°F) was well below the temperature of minimum metabolism (75-81°F) and also below the temperature at which energy retention becomes negative (59°F) in closely shorn sheep (Graham et al., 1959). In the present study shorn lambs likely had an advantage in heat tolerance during peak temperatures in period 1, but negative energy retention which likely occurred during the coldest part of the day resulted in no advantage for shorn sheep in terms of average daily gain during period 1

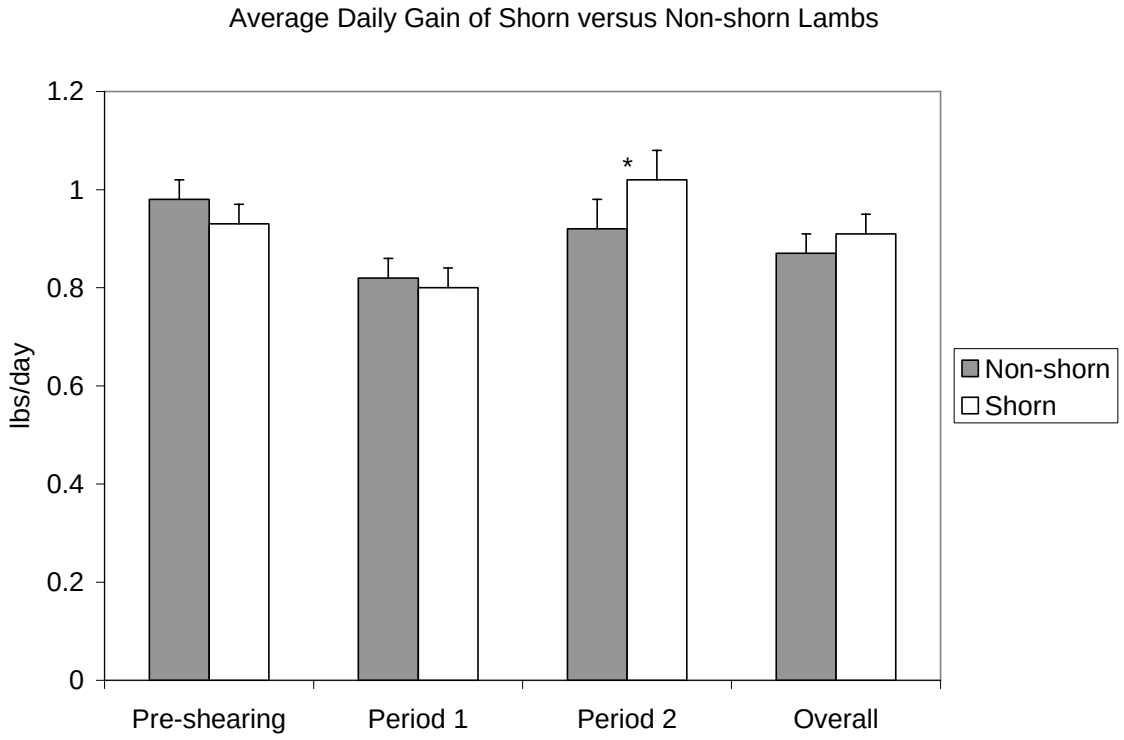


Figure 3: Average daily gain of shorn and non-shorn lambs in pre-shearing (May 4, 2004 until June 4, 2004), period 1 (June 4, 2004 until July 2, 2004), period 2 (July 2, 2004 until July 30, 2004), and overall (June 4, 2004 until July 30, 2004). * indicates non-shorn versus shorn differs; *P* = 0.0362.

In period 2, shorn lambs did have a greater ADG gain than non-shorn lambs (Fig. 3; *P* = 0.0362). Elevated ambient temperatures in period 2 compared to period 1 could contribute to this difference in growth performance. Mean maximum daily temperature (78.3 ± 1.3°F) was within the temperature range at which shorn sheep have been observed to have increased feed intake relative to non-shorn sheep (75-111°F; da Costa et al., 1992) and also within the temperature of minimum metabolism (75-81°F) for closely shorn sheep (Graham et al., 1959). The mean minimum daily temperature (59.7 ± 1.3°F) was also just above the temperature at which energy retention becomes negative (59°F) in closely shorn sheep (Graham et al., 1959). The shorn lambs likely had an advantage in heat tolerance during the hottest part of the day, which resulted in greater ADG gain than non-shorn lambs in period 2.

Additionally, the small amount of wool re-growth which would have occurred in the shorn lambs could have increased the shorn lambs' ability to tolerate cooler temperatures. Although wool growth would be expected to vary by breed, wool growth of 0.03 to 0.07 inches per day has been reported (Donnelly et al., 1974). At that rate of wool growth, shorn lambs in this study would have had 0.15 and 0.26 inches of wool cover at the beginning of period 2. This amount of additional wool cover may have allowed the shorn lambs in period 2 to better tolerate minimum temperatures during the coldest part of the day.

Although wind speed and solar radiation were lower in period 2 than period 1, these two factors likely did not influence ADG. Both the shorn and non-shorn lambs had free access to covered shelter, which would negate the impact of intense solar radiation. This shelter likely also would have reduced an impact of wind speed on animal performance.

Overall ADG did not differ between treatments (0.87 ± 0.04 lbs/day for non-shorn lambs vs. 0.91 ± 0.04 lbs/day for shorn lambs; $P = 0.21$). As anticipated, males had greater overall ADG than females (1.04 ± 0.04 vs. 0.83 ± 0.03 lbs/day respectively; $P = 0.0002$). There was no treatment by sex interaction for any of the time periods ($P > 0.36$).

In summary, shorn lambs had greater growth rates than non-shorn lambs during periods with higher temperatures. However, there was no difference in growth rate between shorn lambs and non-shorn lambs during periods of mild temperatures.

Implications

This research suggests that shearing lambs would increase average daily gain during the summer months when ambient temperatures and THI values are elevated. Under moderate climatic conditions, performance responses indicate no additional advantages. Additionally, producers need to consider if the advantage in average daily gain of shorn lambs would be sufficient to offset the cost of shearing.

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