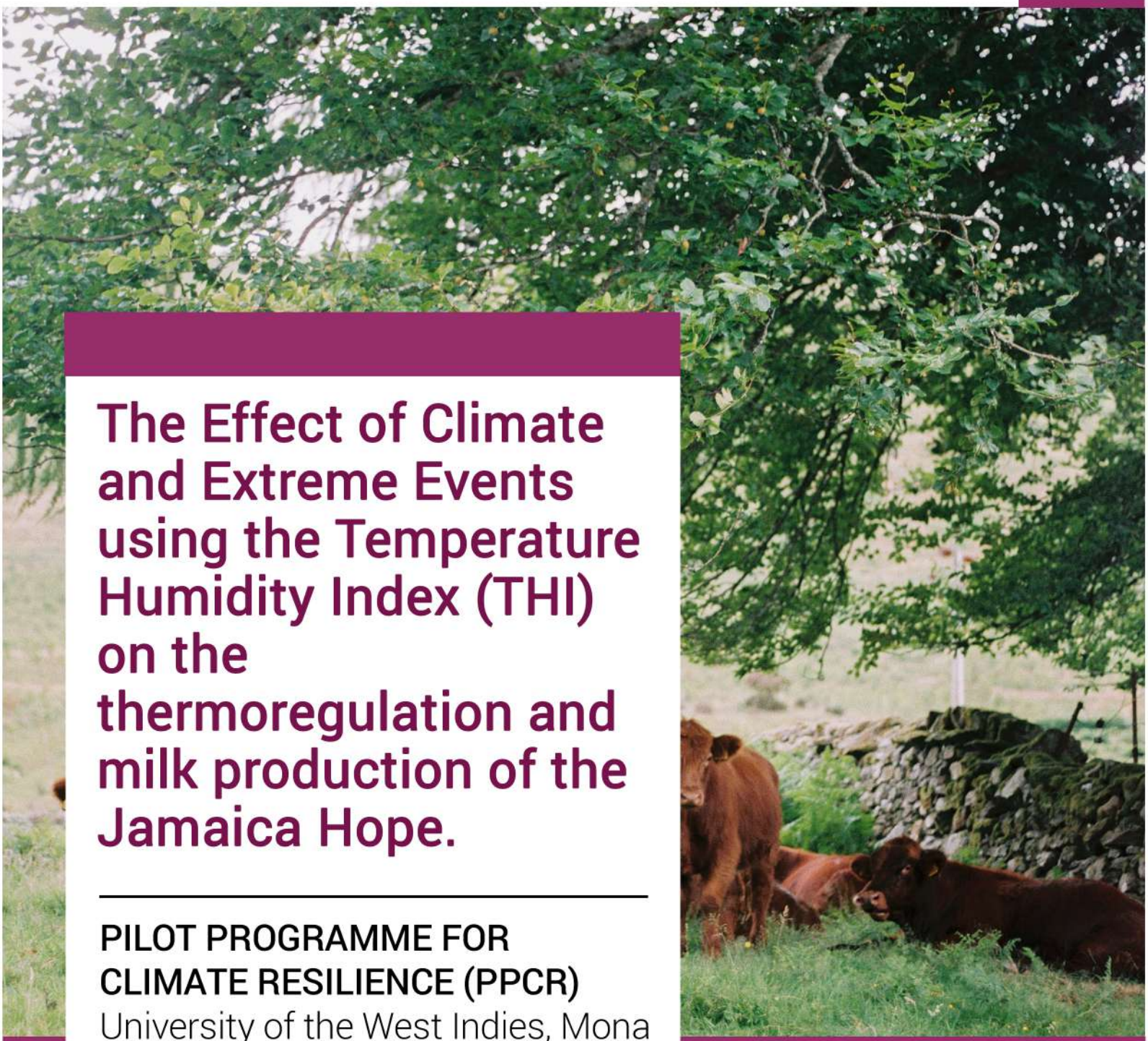


The Effect of Climate and Extreme Events using the Temperature Humidity Index (THI) on the thermoregulation and milk production of the Jamaica Hope.

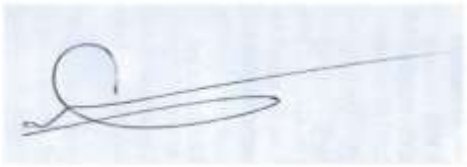
PILOT PROGRAMME FOR CLIMATE RESILIENCE (PPCR)

University of the West Indies, Mona

THE EFFECT OF CLIMATE AND EXTREME EVENT USING TEMPERATURE HUMIDITY INDEX (THI) ON THERMOREGULATION AND MILK PRODUCTION OF THE JAMAICA HOPE

DRAFT THERMOREGULATION STUDY

JUNE REPORT



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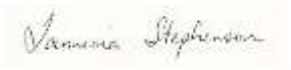

Tannecia Stephenson

12/08/2019

1.0 Activities Accomplished

1. Serge Island thermoregulation study ran for a period of five weeks and started in mid-May ending on 16 June 2019. Ten Holstein and ten Jamaica hope dairy cattle were randomly selected for the study. The physiological parameters measured were rectal temperature, respiration rate and heart rate.
2. Bodles study started on 15 April and was completed on 24 May, 2019. Similar physiological parameters were measured as for serge dairies.
3. Over the month of June/July data entry for both studies and data analysis were done.
4. Paper for publication is being written entitled: **The Effect of Climatic Season on milk Production from Jamaica Hope Dairy Cattle in Two Agro-ecological Zone in Jamaica**. Current stage of completion - discussions section being worked on.
5. Currently working on collating milk production and THI data for regression analysis.

2.0 Thermoregulation

The daily physiological parameters assessment ideally were to be analysed using repeated measure analysis using Genstat. Alternatively data were aggregated for individual animal so that standard ANOVA technique can be used (Morris 2006). Results of analysis for Bodles and Surge Island are given in Tables I and 2, respectively.

Daily rectal temperature was derived by the average of the AM and PM temperature, similar computation was done for daily respiration and heart rate. Heat stress cause homeostasis to be displaced from its resting state and can be quantified by measuring physiological variables such as rectal temperature, respiration rate, heart rate and hormone concentration. Daily rectal temperature (RT) between genetic lines showed no differences ($p=0.200$) for Jamaica Hope (JH)

dairy cattle at Bodles. This value ranged from 37.2 to 37.3 ^{0}C, while the AM values for design, count and chief in the AM period was 37.3, 37.2 and 37.3 ^{0}C, respectively. Whereas in the afternoon similar values were 37.9 ^{0}C for each genetic lines.

Table 1 Physiological parameters for thermoregulation study at Bodles Research Station St .Catherine

Genetic Lines	Daily RT ^{0}C	RT AM ^{0}C	RT PM ^{0}C	Daily RR (Br/Min).	RR AM (Br/Min).	RR PM (Br/Min).	Daily HR (Hr/Min.)	HR AM	HR PM
Design	37.3	36.6	37.9	36	37	41	59	58	60
Count	37.2	36.7	37.9	36	36	41	59	59	60
Chief	37.3	36.6	37.9	36	37	41	59	58	60
±SEM	0.03	0.03	0.03	0.3	0.3	0.5	0.13	0.2	0.13
p-Value	0.200	0.086	0.407	0.968	0.787	0.971	0.997	0.608	0.615

Similar values for JH at This is to be expected since Serge Island Dairies Table 2 daily rectal temperature was 38.8 ^{0}C, whereas the morning value was 38.4 and the afternoon was 39.2 ^{0}C. Holstein cows when compared to JH had higher daily rectal temperature 39.1^{0}C but was not significant (p=0.148). This is to be expected since of all the dairy breed (Guernsey, Jersey, Ayrshire, Brown Swiss) the Holstein is the least heat tolerant (Legate et al. 1991) being a *Bos taurus* cow. The Rectal temperature values obtained at Bodles for JH were much lower than at Serge, however one physiological response to heat stress is the animal attempt to reduce heat

production through reduced feed intake (Wheelock et al. 2010) and thyroid hormone production (Aggarwal and Upadhyay 2013) and consequently a reduction in milk production (Wheelock et al. 2010; Polsky and Keyserlingk 2017; Adebayo A A and Oseni S O 2016). Core temperature in mammals can range from 36.4 to 40.1 ^{0}C (Spiers 2012), and that of dairy animal from 37.8 to 39.2 ^{0}C further under tropical condition RT for non-stressed cow was considered to be 39.1 ^{0}C (Dalcin et al. 2016). Kumar et al. (2018) reported RT for dairy animal kept under different housing conditions to be 38.3 and 38.5 ^{0}C. The lower RT may also be explained by lower milk production level at Bodles compared to Serge (reported in previous report).

Respiration and heart rate

RR in non-stress animal can range from 26-40 br/min, however for non- heat stressed cows in the tropics the norm is considered to be 40 br/min (Dalcin et al. 2016). Similarly HR can range from 48-84 but in the tropics the norm is considered to be 60 beats /min. (Dalcin et al. 2016).

Table 2 Physiological parameters for thermoregulation study at Serge Island Dairies in St. Thomas.

Breed	Daily RT ^{0}C)	RT AM 0C	RT PM ^{0}C	Daily RR	RR AM	RR PM	Dail HR	HR AM	HR PM
Holstein	39.1	38.7	39.5	72	65	81[a]	66	62	71
J H	38.8	38.4	39.2	70	64	76[b]	65	63	68
±SEM	0.04	0.03	0.06	0.18	0.18	0.3	0.13	0.13	0.16
p-Value	0.148	0.091	0.218	0.002	0.157	0.002	0.115	0.775	0.004

Daily RR for JH at Bodles was 36 br/min for all three genetic lines which was 59.99% of the norm and 48.57% of the value obtained at Serge Island (70 br /min). Holstein cattle at Serge Island daily RR was 72 br/min which was 20% above the norm. RR for the AM and PM at Bodles was 59 beats/min for the genetic lines and AM ranged from 58-59 and PM was 60 for all genetic lines. Similar values for JH and Holstein at Serge Island was AM 63 and 62, and PM 68 and 71, respectively. These, values would tend to suggest that these animal were experiencing very little heat stress. Animals at Bodles had minimal level of shade but had water at pasture. Further, animal were observed grazing at high-noon Plate 1. Animal at Serge Island had access to shade and water plate 2. One observation noted was that Holstein cattle were standing in pools of water plate 3.

Plate 1 Jamaica hope Cattle at Bodles Grazing at high-noon

Thus, these observation and environmental management practice may be responsible for the results obtained.

Plate 2 JH at serge in shade

Pate 3 JH cattle at Serge grazing in the evening

Plate 4 Holstein Cattle at Serge Island Standing in pool of water

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