Pakistan Journal of Nutrition 13 (11): 657-660, 2014
ISSN 1680-5194

Effect of Raising Beef Cattle in the Double Shaded House on Their Fattening Performance in Thailand

Hanchai Umpapol[1], Tharadol Jitrajak[1], Choompol Songvicha[1], Pannapa Tantisirin[2], Ruengrit Hanmontree[3], Jessada Sripandon[4] and Sumontip Umpapol[5]
[1]Program in Animal Science,
[2]Program in Science and Food Science Technology,
[3]Program in Agri-Business Industrial Management,
Faculty of Agricultural Technology, Rajabhat University, Sakon Nakhon 47000, Thailand
[4]Sakon-Nakhon Livestock Station, Department of Livestock Development, Sakon-Nakhon 47000, Thailand
[5]Sakon Nakhon Kindergarten, Sakon Nakhon-47000, Thailand

Abstract: The fattening performance of beef cattle improved by raising in double shaded house in Thailand. Eight fattening crossbred beef cattle, (50 to 75% Charolais crossbred cattle), were randomly assigned into two groups. They were raised under the management of small holders in Pon-Yang-Kham Co-operative in Sakon Nakhon, Thailand. In group 1, cattle were allocated in normal house which had one shade of zinc metal roof without ceiling and it was open house. In group 2, cattle were allocated in double shaded house which had one lower shade of zinc metal roof at the under and one upper shade of black plastic slant over the latter roof. After preliminary experimental period for 2 weeks, the temperature and relative humidity in houses were recorded and blood samples were collected on day 0, 90 and 180 of experimental duration to determine cortisol concentration. Changes in general physiology (rectal temperature, pulse rates, respiration rates, heat tolerance co-efficiency; HTC and sweating rates) and hematology (hematocrit (%), hemoglobin, blood glucose and blood urea nitrogen and cortisol concentration) were recorded through the experimental period. The temperature humidity index (THI) affected on the general physiological changes of cattle between group 1 and group 2 which were highly significant different ($p<0.01$) viz. rectal temperature (39.36 and 39.09°C), pulse rates (72.24 and 64.48 breaths/min), respiration rates (50.42 and 44.20 b/t), HTC (80.60 and 88.20%) and sweating rates (1.060 and 840 (mL/m^2/h), respectively and hematology and cortisol concentration in blood serum of fattening beef cattle in both groups were increased ($p<0.01$). The fattening performance of cattle between group 1 and group 2 were significant different ($p<0.05$) as follows; final weight (722.62 and 748.20 kg), ADG (656.15 and 732.50 g/d), dressing percentage (54.24 and 60.40%) and marbling (3.51 and 3.84%). We suggest that raising beef cattle in a modified double shaded house is capable of improving fattening performance in the semi-tropical countries.

Key words: Double shaded house, productive performance, Pon-Yang-Kham fattening beef cattle

INTRODUCTION

The raising of fattening beef cattle in Sakon Nakhon province was widely conducted for supplying many co-operatives in Sakon Nakhon province as well as for slaughtering and consuming in each local community, especially Pon-Yang-Kham Co-operative in Sakon Nakhon province has had various members which has mostly covered many provinces in the upper northeastern region of Thailand such as Udon Thani, Nongkhai, Nakhonpanom, Yasothorn, Roi-et and Kalasin provinces and from the data analysis of fattening beef marketing has found the trends of demand has been continuously increased and the satisfaction of fattening beef consumption has also been very confident for consuming good quality fattening beef.

The analyses of climatic condition and of problems of fattening beef cattle raising in Sakon Nakhon province has found that the strain of fattening beef cattle is one factor of the problems that cause the cattle can not adjust themselves in tropical climate which has high temperature and relative humidity due to the original strain of the said fattening beef cattle has characteristics genes that are suitable for temperate zone so it affects on the body adjustment, physiology changes, hematology, hormone and the productive performance of the fattening beef cattle.

Therefore, this research was conducted by applying the appropriate technology for the integration of characteristics genes of the cattle with local community context and climatic condition, for alleviating the productive performance of the cattle to be consistent with

Corresponding Author: Hanchai Umpapol, Program in Animal Science, Faculty of Agricultural Technology, Rajabhat University, Sakon Nakhon 47000, Thailand

market demand, obtaining good quality and safe fattening beef for consumption and the consumers have been confident and satisfied as well as for value-adding of beef and products.

MATERIALS AND METHODS

The fattening beef cattle (50-75% Charolais crossbred cattle) were used as experimental animal. All cattle were uniform in body condition score and raised under the management of small holders in Pon-Yang-Kham Co-operative in Sakon Nakhon province. Eight cattle were studied and randomly assigned into two groups. Group 1 was allocated in normal house which had one shade of zinc metal roof without ceiling and it was open house so the temperature and condition inside the house was similar as the ambient temperature and relative humidity and inside this house was divided as 4 pens with separated feed trough and water container that were suitable for each individual cattle. But group 2 was allocated in modified double shade house which had one lower shade of zinc metal roof at the under and one upper shade of black plastic slant over the latter roof. Each isolated fattening beef cattle in each individual pen was fed rice straw *ad libitum* as roughage source and concentrate 1.5 percent of body weight in each day and provided freely fresh water for entire period of experiment.

The data collection was conducted in many aspects which composed of meteorological values, values of physiological changes, values of hematology, cortisol hormone level, heat tolerance co-efficiency (HTC), sweating rate and productive performance of fattening beef cattle.

These data were analyzed for comparing the differences of each studied characteristics by using T-test (Steel and Torrei, 1980). This research was conducted during October 2008, September 2009.

RESULTS

Influence of environmental condition: The results of this research found that temperature humidity index (THI) inside of each normal house (Group 1) was similarly higher than of modified double shade house (Group 2) with highly significant difference ($p<0.01$) (Table 1). The normal house could not reduce the heat radiation and temperature that affected on the general physiological changes and sweating rate of fattening beef cattle that showed higher value than those cattle in the modified double shade house ($p<0.01$). This result revealed that the fattening beef cattle in the normal house would take heat stress higher than those cattle in the modified double shade house so the cattle in group 1 had lower HTC than those cattle in group 2 ($p<0.01$) (Table 2).

Hematological changes and cortisol hormone levels: The results of this research found that the modified double shade house (Group 2) could influence on increasing of hematocrit and hemoglobin level of the fattening beef cattle with highly significant difference ($p<0.01$) when compared with those cattle in the normal house, but blood glucose and blood urea nitrogen of both groups were not significantly different ($p>0.05$). However, the cattle in the modified double shade house (Group 2) had cortisol hormone levels lower than those cattle in the normal house (Group 1) ($p<0.01$) (Table 3).

Animal welfare behaviour: The results of this research found that the modified double shade house (Group 2) could influence on reducing of animal welfare behaviour with highly significant difference ($p<0.01$) when compared with those cattle in the normal house (Group 1) (Table 4).

Productive performance of fattening beef cattle: The results of this research found that the fattening beef

Table 1: Effect of the different housing (normal house versus modified double shade house) on heat radiation reduction and meteorological values

Item	Normal house (Group 1)	Modified double shade house (Group 2)
Black globe temperature (°C)	36.24±0.32[a]	32.30±0.28[b]
Normal temperature (°C)	33.84±0.34[a]	30.62±0.24[b]
Radiation temperature (°C)	2.40±0.08[a]	1.68±0.04[b]
Mean temperature (°C)	29.80±0.30[a]	27.82±0.26[b]
Different temperature (°C)	10.74±0.12[a]	8.06±0.03[b]
Temperature humidity index (THI)	80.62±4.26[a]	76.38±2.32[b]

Means within the same row with different superscript differed significantly ($p<0.01$)

Table 2: Effect of the different housing (normal house versus modified double shade house) on general physiological changes of the fattening beef cattle

Item	Normal house (Group 1)	Modified double shade house (Group 2)
Rectal temperature (°C)	39.36±0.36[a]	39.09±0.30[b]
Pulse rates (breath/min.)	72.24±4.48[a]	64.48±1.56[b]
Respiration rates (b/t)	50.42±2.76[a]	44.20±1.50[b]
Heat terrance co-efficiency (HTC) (%)	80.60±1.82[a]	88.20±0.68[b]
Sweating rates ($m^1/m^2/h$)	1.060±42.50[a]	840±16.74[b]

Means within the same row with different superscript differed significantly ($p<0.01$)

Table 3: Effects of the different housing (normal house versus modified double shade house) on hematological changes and cortisol hormone levels

	Normal house (Group 1)				Modified double shade house (Group 2)			
Item	Before experiment	During experiment	End experiment	Mean	Before experiment	During experiment	End experiment	Mean
Hematocrit (%)	33.26±0.72	36.40±0.68	38.46±0.74	36.04±0.69[a]	33.46±0.64	37.44±0.70	42.62±0.74	37.84±0.66[b]
H (g/100 mL blood)	9.46±0.06	10.74±0.05	12.04±0.04	10.75±0.06[a]	9.48±0.04	12.05±0.05	13.67±0.06	11.730.05[b]
BG (mg/100 mL)	56.74±0.78	58.02±0.82	59.20±0.96	57.97±0.90[a]	54.82±1.05	57.47±1.60	60.42±1.48	57.570.86[b]
BUN (mg/100 mg)	15.20±0.14	15.45±0.20	15.75±0.18	15.75±0.17[a]	15.43±0.13	15.40±0.14	15.70±0.16	15.510.16[b]
Cortisol (µg/mL)	13.41±0.12	13.50±0.14	13.67±0.18	13.53±0.15[a]	13.54±0.11	12.48±0.04	10.46±0.03	10.040.06[b]

Means within the same row with different superscript differed significantly (p<0.01). BG: Blood glucose, BUN: Blood urea nitrogen, H: Hemoglobin

Table 4: Average values of animal welfare behavior of Charolais crossbred

	Normal housing		Modified double shade house	
Item	Mean	Result	Mean	Result
Rumination	2.44±0.64[b]	low	3.74±0.72[a]	High
Panting	4.68±0.62[a]	highest	3.94±0.74[b]	High
Standing up and walking for water drinking	4.56±0.70[a]	highest	3.38±0.68[b]	Normal
Rest for sleeping	4.72±0.68[a]	highest	3.36±0.70[b]	Normal

Mean within row with different superscript differ significantly (p<0.05)

Table 5: Effects of the different housing (normal house versus modified double shade house) on productive performance of fattening beef cattle

Item	Normal house (Group 1)	Modified double shade house (Group 2)
Feed Intake		
Roughage (kg/d)	6.82±0.36[a]	7.24±0.28[b]
Concentrate (kg/d)	13.54±0.04	13.72±0.08
Growth performance		
Initial weight (kg)	486.40±7.50	484.60±8.04
Final weight (kg)	722.62±11.48[a]	748.20±6.80[b]
ADG (g/d)	656.15±9.60[a]	732.50±7.80[b]
Dressing (%)	54.24±0.80[a]	60.40±0.74[b]
Marbling (%)	3.51±0.02[a]	3.84±0.02[b]

Means within the same row with different superscript differed significantly (p<0.05). ADG: Average Daily Gain

cattle in the modified double shade house (Group 2) had voluntary roughage intake, average daily gain in weight, dressing percentage and marbling percentage higher than those cattle in the normal house (Group 1) (p<0.05) (Table 5).

DISCUSSION

The results of the present study showed that the fattening beef cattle in the normal house (Group 1) had the general physiological changes such as rectal temperature, pulse rate, respiration rate and sweating rate values which were all increased and the sweating was an important mechanism for regulating body temperature by secreting sweat and excretion for over body heat exhaust. The process of sweat secretion and excretion for body temperature regulation needed more energy so the fattening beef cattle in the normal house (Group 1) faced more heat stress and they were affected to energy utilization for maintenance (Johnson, 1985; Umpapol *et al*., 2010) that caused to reduce the hematocrit and hemoglobin levels due to the mechanism of body temperature regulation by sweat secretion and excretion would need more volume of water in body of the cattle so caused anemia condition in circulatory system and caused the increasing of the plasma volume that could relate to the increasing of broken red blood cell but reducing the hematocrit and hemoglobin levels (Ei-Masry and Marai, 1991; Umpapol *et al*., 2011).

Then the process of body heat building would reduce continuously when the fattening beef cattle stayed in high temperature condition for long time, the main cause was from the reducing of feed intake so the cattle body could obtain low net energy for their bodies. The environmental condition with high ambient temperature could affect directly to the function process of hypothalamus and anterior pituitary gland and caused the secretion of cortisol hormone from adrenal in increasing level than norm, but when the fattening beef cattle remained in high temperature condition continuously for long time the cortisol hormone level would reduced that might be the mechanism for body temperature regulation by preventing body heat building from food metabolism or might be the adjustment of cortisol hormone metabolism by suppressing 17-Hydroxylase in adrenal to function or might be the elevating Theshold level or set point sensitivity of adrenal (Yates *et al*., 1961; Umpapol *et al*., 2011).

At point of view in this study could conclude that THI was very high for the entire period of the experiment so the fattening beef cattle faced actually the heat stress which affected on the general physiological changes such as rectal temperature, pulse rate, respiration rate and sweating rate values which were all increased that caused to reduce the hematocrit and hemoglobin levels which these indicators revealed that HTC was reduced and it affected on the function of endocrine gland especially the concentration of cortisol hormone level was higher for reducing body heat building by feed intake reduction (NRC, 2002; Wanapat, 1999; Vajrabukka, 1996) and later on the fattening beef cattle would adjust themselves for body temperature regulation and reduced the cortisol hormone secretion and finally the fattening beef cattle had lower ADG for the

norm of body condition under high temperature environment (Johnson, 1985; Vajrabukka and Thawailes, 1984).

The fattening beef cattle that faced heat stress would be affected on physiological changes, hematological value and function of endocrine glands that caused on the reducing of roughage feed intake to respond to body temperature regulation (Johnson, 1985; Umpapol *et al.*, 2011), so it was an important cause that affected on lower ADG of the fattening beef cattle in the normal house (Group 1) than of those cattle in the modified double shade house (Group 2) including beef marbling genesis was affected directly because of energy imbalance due to energy utilization for over body heat exhaust (Hefez, 1968) and related to fat synthesis for beef marbling of the fattening beef cattle in the normal house (Group 1) became lower than of those cattle in the modified double shade house (Group 2), (Umpapol *et al.*, 2010, 2011)

Conclusion:

1: In general condition, the modified double shade house which had one lower shade of zinc metal roof at the under and one upper shade of black plastic slant over the latter roof could reduce heat radiation and THI was lower than general normal house
2: The fattening beef cattle in the modified double shade house had more positive physiological changes than those cattle in the normal house which had higher sweating rate but lower in HTC
3: The fattening beef cattle in the modified double shade house where had cool condition and effected on hematological values such as hematocrit and hemoglobin levels were higher than those cattle in the normal house, but there was no inferior affect on blood glucose and blood urea nitrogen levels
4: The fattening beef cattle in the normal house would face the heat stress which caused on the increasing of cortisol hormone level when compared with those cattle in the modified double shade house
5: The productive performance of the fattening beef cattle such as ADG, dressing percentage and marbling percentage of the cattle in the modified double shade house were higher than those cattle in the normal house

REFERENCES

Ei-Masry, K.A. and I.F.M. Marai, 1991. Comparison between Friesians and Water Buffaloes in Growth Rate, Milk Production and Some Blood Constituents during Winter and Summer Conditions of Egypt. Anim. Prod., 53: 39-43.

Hefez, E.S.E., 1968. Adaptation of Domestic Animals. Philadelphia: Lea and Febiger.

Johnson, H.D., 1985. Physiological Responses and Productivity of Cattle. Ed. By Mohamed K. Yousef. Stress physiology ing livestock (vol.2) C.R.C. Press Inc, Boca Raton, Florida, U.S.A.

National Research Council, 2002. Nutrient Requirements of Beef Cattle. 7th rev.ed. Natl. Acad. Sci., Washington, DC.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedure of Statistic. 3rd ed., New York: Macmilland Publishing Co., Inc., 521.

Umpapol, H., T. Jitrajak, C. Songvicha, P. Tantisirin, R. Hanmontree, J. Sripandon and S. Umpapol, 2010. Participatory research for sustainable grading up quality Pon-Yang-Kham Fattening Cattle, Sakon Nakhon Province (1) A study of Pon-Yang-Kham Fattening Cattle Performance Production. Thailand Res. Exp., 2008.

Umpapol, H., T. Jitrajak, C. Songvicha, P. Tantisirin, R. Hanmontree, J. Sripandon and S. Umpapol, 2011. The Utilization of Whole Cotton Seed as a Substitute in Diets on General Changes, Animal Welfare Behavior and Productivity of Fattening Beef Cattle in Thailand. Pak. J. Nutr., 10: 229-232.

Vajrabukka, C., 1996. Physiology of Environment for Animal in Tropical Zone. Department of Animal Husbandry, Faculty of Agriculture, Kasetsart University. Bangkok, 347.

Vajrabukka, C. and C.J. Thwailes, 1984. The relative influence of exercise and coat type on the thermoregulatory response of cattle. Int. J. Biometer, 28: 9-15.

Wanapat, M., 1999. Feeding of Ruminants in the Tropics based on Local Feed Resources. Khon Kaen Publishing Company Ltd. Khon Kaen. Thailand, 236.

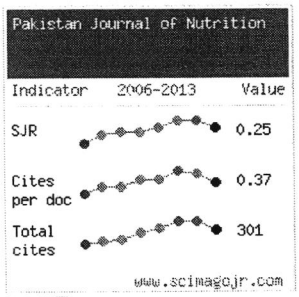
Yates, F.E., S. Leeman, D.W. Glenister and M.F. Dallmam, 1961. Interaction between Plasma Corticosterone Concentration and Adreno-corticotropin Releasing Stimuli in the Rat: Evidence for the rest of endocrine feedback control. Endocrinol., 69: 67-82.

SJR SCImago Journal & Country Rank

EST MODUS IN REBUS
Horatio (Satire 1,1,106)

Home
Journal Rankings
Journal Search
Country Rankings
Country Search
Compare
Map Generator
Help
About Us

Show this information in your own website



Display journal title

Just copy the code below and paste within your html page:
<a href="http://www.scimagojr.com

Related product

SCIMAGO INSTITUTIONS RANKINGS

@scimago

SJR is developed by:

Scimago Lab

Powered by Scopus

Journal Search

Search query

in Journal Title Search

Exact phrase

Pakistan Journal of Nutrition

Country: Pakistan

Subject Area: Agricultural and Biological Sciences | Nursing | Medicine

Subject Category:

Category	Quartile (Q1 means highest values and Q4 lowest values)														
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Public Health, Environmental and Occupational Health					Q4	Q4	Q4	Q4	Q3	Q3	Q3	Q2	Q3	Q3	Q3
Food Science					Q4	Q4	Q4	Q4	Q3	Q3	Q3	Q3	Q3	Q3	Q3
Nutrition and Dietetics					Q4	Q4	Q3	Q4	Q3	Q3	Q3	Q3	Q3	Q3	Q3

Publisher: Asian Network for Scientific Information. **Publication type:** Journals. **ISSN:** 16805194

Coverage: 2002, 2005-2013

H Index: 17

Scope:

Pakistan Journal of Nutrition is a broad-based peer-reviewed, open access scientific journal publishes significant research findings in the wide area [...]
Show full scope

Charts Data

Indicators	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
SJR	-	-	-	-	0,101	0,108	0,158	0,103	0,174	0,202	0,206	0,248	0,308	0,319	0,249
Total Documents	-	-	-	-	0	0	17	132	145	168	302	227	210	201	117
Total Docs. (3years)	-	-	-	-	31	31	31	17	149	294	445	615	697	739	638
Total References	-	-	-	-	0	0	472	2.856	3.453	3.873	7.331	5.753	5.887	5.762	3.126
Total Cites (3years)	-	-	-	-	0	4	8	2	38	82	216	331	485	485	301
Self Cites (3years)	-	-	-	-	0	0	0	0	12	11	34	33	46	30	27
Citable Docs. (3years)	-	-	-	-	31	31	31	17	149	294	445	615	697	739	638
Cites / Doc. (4years)	-	-	-	-	0,00	0,13	0,26	0,25	0,26	0,28	0,50	0,58	0,77	0,68	0,56
Cites / Doc. (3years)	-	-	-	-	0,00	0,13	0,26	0,12	0,26	0,28	0,49	0,54	0,70	0,66	0,47
Cites / Doc. (2years)	-	-	-	-	0,00	0,13	0,00	0,12	0,26	0,26	0,45	0,42	0,65	0,56	0,37
References / Doc.	-	-	-	-	0,00	0,00	27,76	21,64	23,81	23,05	24,27	25,34	28,03	28,67	26,72
Cited Docs.	-	-	-	-	0	4	6	2	30	57	143	212	275	296	197
Uncited Docs.	-	-	-	-	31	27	25	15	119	237	302	403	422	443	441
% International Collaboration	-	-	-	-	0,00	0,00	5,88	3,79	7,59	9,52	5,30	5,73	7,14	8,46	4,27