International Journal of Agriculture Innovations and Research
Volume 5, Issue 4, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received: 27/12/2016 | Accepted on : 02/01/2017 | Published : 10/01/2017

Micro Climate and Body Dimension of the Bali Cattle that Reare Feed Lot at Difference Altitude

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Abstract **– Research that aim to know micro climate condition and body dimension of the Bali cattle that reared lot-fed on difference altitude of lowland, medium land and uplands. Field research was conducted at 3 locations/altitudes were Sedimara Village, Tabanan (lowland, 15 m above sea level), Sobangan Village, Badung (medium land, 255 m above sea level) and Baturiti, Tabanan (upland, 758 m above sea level). The research was conducted with direct observation (survey) at the fields. There were 20 farmers be observed in each village (replicates). Samples were taken with method of Purposive Random Sampling. The animals observed were on the same age and it could be seen on their 2 incisor (2 – 3 years old). The observation was conducted for 10 times of survey journey. Results of the research showed that air temperature, humidity and temperature humidity index of the cattle at upland was lower ($P < 0.05$) than medium land and lowlands. There was no significant difference ($P > 0.05$) on variable of the sun radiation intensity and air speed of all treatments. Body weight, chest girth, chest depth, body length, withers and hip heights of the cattle that reared at upland (T3) were higher ($P < 0.05$) than that at medium land (T2) and lowland (T1). Base on the results of the research could be concluded that shelter micro climate conditions and the cattle body dimension that reared at lowland were not as good as at medium and upland.**

Keywords **– The Bali Cattle, Altitude, Micro Climate, Body Dimension.**

I. INTRODUCTION

Superiority of the Bali cattle is able to change high crude fiber of feed i.e. native grasses and agriculture waste product to be meat, egg and milk as sources of animal protein where those are needed to increase intellectuality of Indonesia people. The Bali cattle is adaptive to its environment, so that it population spreads at lowland, medium land and upland[24]. Majority of Indonesia population (70 – 90%) live at villages that their main source of live is agriculture in wide spread in order to increase food commodity, horticulture, fish or animal [8].

Animal growth has important meaning in production process. Growth is process occurred on each of creature and can be manifested as organ weight gain or body tissues such as meat, bone and fat [5]. Body weight of a cattle can be known accurately trough weighed itself but, in certain situation and condition particularly at public farm is very rear or no balance available for cattle. So that, it needs other methods which is assumed practice to estimate body weight of the cattle. Some researchers reported that there is a relationship between body size dimensions of the cattle with its body weight and results a formula to estimate body weight on the age and certain sex [22].

The cattle as source of animal protein for public can be realized after farmers pay much more attention to environment factors (micro climate) as supporting factors for animal growth [13]. Altitude, location for rearing cattle impacts to micro climate through difference intensity of the sun radiation that received and the use of it.

In animal production process, there are some dominant elements of climate affects on it i.e. temperature, humidity, the sun radiation and air speed [14]. According to [4], those elements are more controlled by diagonal line and altitude from the sea level. [16] stated that the difference of sun radiation intensity which is received by earth is used to warm up land, air, photosynthesis etc affects to temperature and humidity. [14] reported that temperature and humidity are decided freshness level of animal which indicated from their value of Temperature Humidity Index (THI). According to [19], altitude from sea level as climate control is also affects feed quality. [12] found that the THI affects animal productivity due to differences of feed consumption. Animal that reared at environment of higher THI value compare to standard needs caused energy needs for basic live is increase, so energy that can be used to grow is decrease.

Calculated air temperature in shelter originally come from short wave radiation of the sun and long wave direct radiation of the sun, reflection and mixed radiation of atmosphere. The sun radiation that hit shelter's roof would be changed by top layer of roof to be long wave (hot) then go to inner layer conductively and broadcast to shelter rooms. Relative humidity value in the shelter depend on water sources in it, air movement in the shelter and air temperature as evaporation control factor [12]. Temperature movement from fresh to hot on cattle could be confirmed that animal would be stress (hyperthermia or hypothermia). Animal response it by controlling feed consumption. Its implication can be seen on result of body weight.

II. MATERIALS AND METHOD

Animal. Animal used in the research was the Bali cattle that were grouped base on age at 3 altitudes i.e. Sudimara Village, Tabanan District, Tabanan Regency 15 m above sea level lowland), Sobangan Village, Mengwi District, Tabanan Regency 225 m above sea level (medium land) and Baturiti Village, Tabanan Dustrict, Tabanan Regency 758 above sea level (upland).

Feed. The Bali cattle use in the research fed native grasses without extra concentrate.

Location and Length of the Research

Field research was conducted for 4 weeks with 25 times survey journey. Data were collected at 3 altitudes i.e.

Sudimara Village (lowland), Sobangan Village (medium land) and Baturiti (upland).

Experimental design. Design of the research used was Completely Randomize Design (CRD), 20 replicates. Treatments in the research were altitudes of cattle reared locations that consist of lowland (T1), medium land (T2) and upland (T3). The research was directed to 20 farmers at those altitudes (one farmer one cattle in ach village) so, total samples was 60 cattle. The samples were taken with method of Purposive Random Sampling [21]. The cattle observed were same age in each block where it could be seen on their 2 incisor (2 – 3 years old). The observations were conducted for 15 times on survey journey.

Variables Observed

1. Micro Climate of Cattle Shelter

Air temperature, humidity and THI. Data of temperature and humidity in the shelter were measured with thermo hygrometer digital type CE 11/08. Measurement was conducted for 3 times per day i.e. morning, afternoon and late afternoon at 7.30 a m, 13.30 p m and 17.30 p m respectively. Daily average temperature was obtained with formula of [4] as follows:

$$\frac{[(2 \times \text{morning temperature}) + \text{afternoon temperature} + \text{late afternoon temperature}]}{4}$$

Temperature Humidity Index (THI) was calculated with empirical formula according to [10] as follows: THI = 0.4 (DBT + WBT) + 15, where THI is Temperature Humidity Index, DBT is Dry Ball Temperature (^oF), WBT is Wet Ball Temperature (^oF)

The sun radiation intensity. Measurement of the sun radiation intensity was conducted with digital light meter Lutron LX-103 for 3 times per day at 07.30, 13.30 and 17.30 central Indonesia time.

Air movement in shelter. Air movement in each location of the research was measured with digital anemometer LM-81AM for 3 times per day at 07.30, 13.30 and 17.30 central Indonesia time.

2. *Body Dimension*.

Chest girth. It is measured at the back of elbow front leg exactly circulate to chest, upright with body axle. Measurement tool that use to measure it was tape string in meter scale.

Chest Wide. It is measured via measuring the largest distance of the left and right chest at the measurement of chest girth.

Body Length. It is measured with meter scale stick, start it from lateral *tuberosity os humerus* up to tuber *ischii.*

Withers height. It is measured upright to the highest point of withers, the 3rd or the 4th vertebrae with meter scale stick.

Hip Height. It is measured upright from the 1st sacrum up to floor surface.

Data Analysis. Data obtained from the results of the research were analyzed with Analysis of Variance. If there is significant response among the treatments, it will be continued to Duncan Multiple Rang Test on the level of 5% [20].

III. Results and Discussions

Micro Climate. Air temperature in the cattle shelter at upland (T3) was 24.89 ^{0}C, while at medium land (T2) and lowland (T1) were 4.58 % and 14.18% higher and significant difference ($P < 0.05$) than T3 as shown in Table1. Humidity of the shelters on P3 was lower for 60.34% but, on T2 and T1 were 6.65% and 14.56% higher ($P < 0.05$) compare to T3. There was no significant difference ($P > 0.05$) among treatments T1, T2, and T3 to variables of the sun radiation intensity. Table 1 showed that air movements in the cattle shelters T1, T2 and T3 were no significant different ($P > 0.05$) among them.

Animal superiority, sufficient of feed in quality and quantity would no resulted maximum performance on animal if there is no support by fresh environment factor. In other hand, fresh environment factor would not much help if it genetic potential is low and insufficient quality and quantity of feed [12]. Temperature, humidity, the sun radiation and air speed are climate elements that much affects to animal fresh in shelter [6].

Table 1. Micro Climate of Cattle Shelter at Difference Altitude

Variable	T1	T2	T3	SEM
Air Temperature (^oC)	28, 42[a]	26, 03[b]	24,89[c]	1,02
Relative humidity (%)	69,12[a]	64,35[b]	60,34[c]	2,54
Temperature Humidity Index (THI)	73,24[a]	70,06[b]	68,04[c]	2.02
sun radiation intensity (lux)	44,08[a]	43,3[a]	38,74[a]	0,86
Air velocity (m/dt)	2,43[a]	0,88[a]	2,63[a]	0,52

1) T1 : Lowland 15m above sea level
   T2 : Medium land 225m sea level
   T3 : Upland 758m sea level
2) Value with the same superscript in the same rows means no significant (P>0,05)
3) SEM : " Standard Error of The Treatment Means"

Air Temperature in the cattle shelter at upland (T3) was lower than medium land (T2) and lowland (T1). This condition was due to the sun radiation intensity that enters into shelter T3 was lower compare to T2 and T1 (Table 1). [10] said that lower the sun radiation intensity caused hot (long wave radiation) to be lower too in the shelter. This opinion was supported by [4] and [18] who said that elements of climate were controlled by latitude and altitude of sea level. This statement supported by [9] who said that environment temperature of the cattle sheltered is lower (75.9°F) than grassing (77.2°F). Parks (2013) stated that air temperature maximum is 25 – 26°C. Base on data air temperature, the cattle shelter at upland is fresh condition.

Relative humidity is the presentation of water steam contents in the air factually compare to satiated water vapor in percent [4]. Humidity in the cattle shelter at lowland was higher than medium land and upland. The sun radiation intensity in the cattle shelter at lowland (44.08 lux) was higher compare to medium land (43.30 lux) and upland (38.74 lux) as shown in Table 1.

Higher air temperature caused evaporation process increase, so water steam at the air increase. This condition caused humidity in the shelter at lowland to be the lowest. This opinion was supported by [15] who stated that acceleration of evaporation is linear with air temperature and air acceleration. Same opinion is also said by [11] that grand humidity relative scaled in the shelter depend on source of water steam in the shelter, air speed and air temperature as control factor of evaporation acceleration.

Difference results were found by [9] that humidity around animals sheltered (76.5%) was no significant to humidity of the animals where they grassed (75.6%). Data difference was caused by measurement of the same farm area in the same altitude.

The sun radiation intensity that entered into the shelter at difference altitude was around 38.74 – 44.08 lux. At lowland it was 44.8% while at medium land it was 38.74 lux (see Table 1). Atmosphere of upland is more polluted than medium land and lowland. This condition causes more the sun radiation absorbed and reflected by the atmosphere, therefore radiation intensity that accepted by the earth become lower. [4] stated that the higher the intensity of the sun received by the earth, the lower the use of it to latent hot and photosynthesis and this would impacts condition where the use of the sun radiation to warm up the earth and the atmosphere is higher. The partition use of the sun radiation to worm up atmosphere and the earth would be measured as air temperature in the cattle shelter.

The difference altitude for rearing animals is not affects significantly to air speed that entered into shelter. [4] reported that medium land and upland have higher scour layer to delay air flows. The cattle shelter that observed at 3 difference altitudes, all of them be in field surroundings pens, so that air flows could be stand.

Base on calculation value of the THI, the cattle shelter condition at upland (THI: 68.04) and medium land (THI: 70.86) were healthy but, at lowland (73.24) was unhealthy. [1] stated that among elements of micro climate affects to animal productivity are air temperature, relative humidity (Rh), the sun radiation and ventilation or air velocity. Interaction between temperature and humidity resulted temperature humidity index (THI).

Data in Table 1 shown that average difference temperature and humidity of the cattle shelter at lowland were higher than at medium land and upland. This condition caused the THI of the cattle shelter at lowland was higher than that medium land and upland.[12] said that the THI is one of indicator of animal healthy levels. The higher the THI value (optimum ranging), the higher hot stress levels would experienced by the animals.

Body Dimension

Base on body dimension and chest girth, the Bali cattle at upland (T3) reached the highest body weight for 230.02 kg, while at medium land (T2) and lowland (T1) was 18.50% and 22.09% each lower ($P < 0.05$) than T3 (see Table 2). Chest girth of the Bali cattle at T3 was the highest i.e. 149.83 cm, while at T2 and T1 was 7.46 % and 8.89% each lower ($P < 0.05$). Treatment P1 caused chest depth of the Bali cattle was the lowest (23.67 cm) while T2 and T3 was 31.69% and 52.81% each higher (Table 2). The Bali cattle at T3 reached body length for 92.5 cm but, T2 was 1.81 % lower ($P > 0.05$), and T1 was 5.41 % lower ($P < 0.05$) as presented in Table 2. Withers and hip height of the Bali cattle at T3 were higher than T2 and T1 ($P < 0.05$) as shown in Table 2.

Tabel 2. Body weight and Body Dimension (2-3 year of age) at Different Altitude

Variable	T1	T2	T3	SEM
Body weight (kg)	179,20^{b}	187,46^{b}	230,02^{a}	15,74
Chest girth (cm)	136,50^{b}	138,66^{b}	149,83^{a}	4,13
Chest dept (cm)	23,67^{c}	31,17^{b}	36,17^{a}	3,62
Body length (cm)	87,5^{b}	90,83^{a}	92,5^{a}	2,02
Withers height (cm)	103,33^{c}	109,50^{b}	112,66^{a}	2,74
Hip Height (cm)	103,83^{c}	110,66^{b}	116,0^{a}	3,52

1)T1: Lowland 15m above sea level
T2: Medium land 225m sea level
T3: Upland 758m sea level
2) Value with the same superscript in the same rows means no significant (P>0,05)
3) SEM : " Standard Error of The Treatment Means"

Words growth can be implemented on a sell, organ, tissue of an animal or animal population. According to [5] that growth is change of form or size an animal that can be stated with long, volume, or mass. Furthermore, [23] and [2] that growth can be valued as height increase, long, girth and weight that occurred on young, healthy where an animal is feed, drink, and sheltered. Little increase of body size would caused increase body weight, because body weight functions of volume. Growth has 2 aspects i.e. mass increases per unit time and growth including form changed and compositions as consequences of differential components of growth.

[7] stated that interaction between temperature and air humidity resulted the THI. This indicates healthy level of animal in a shelter. Mount (1977) and [10] stated that environment factor affects feed efficiency and animal growth. Healthy level of the cattle at T3 was higher compare to T2 and T1. Healthier environment condition at upland is indicated by temperature, air humidity and lower of the THI. According to [12] that lower temperature and air humidity where animal is, it would easier to release its body energy to environment where it was. Homeostasis via thermoregulation would occur more effective in healthy condition compare to stress condition. This condition caused the cattle on the same age and reared lot-fed native grasses at upland resulted higher body weight than that medium land and lowland.

According to [2] that growth can be valued as increases of height, length, girth and weight that occur on healthy young animal that feed and drink sufficiently, and obtain shelter accordingly. A little increasing of body size would increase body weight proportionally, because body weight is function of volume. Growth has 2 aspects i.e. increasing mass in certain time, and growth including change of form and composition as results of differential body components. Results data of the research in Table 2 showed that body dimension of the cattle at upland was better than at lowland. This due to healthy level of the shelter at upland was better than at medium land and lowland. The better healthy level at upland was indicated with lower temperature, air humidity and the THI compare to medium land and lowland (Table 1). [22] stated that there is a correlation between animal body weight with body dimension. The cattle reared at upland heavier than that at medium land and lowland. The cattle with higher growth rate level directly needs better body components that indicated by better body dimension [3].

IV. Conclusions and Suggestion

Conclusions

1. Micro climate of the cattle shelter at upland was better than that at medium land and lowland.
2. Body dimension of the Bali cattle that reared at upland was better than that at medium land and lowland.

Suggestion

Breeding and fattening of the Bali cattle should be developed at upland.

V. Acknowledgments

I would like to thank to the Rector of Udayana University, the Dean of Faculty of Animal Science Udayana University and LPPM Udayana University for their financial help via Research Scheme of *Pascasarjana* Udayana University that funded by BOPTN in 2015, so the research could be conducted and match with my expectations.

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