ADAPTATIONAL STUDIES ON HEREFORD CATTLE IN MALAYSIA
II. Effect of Hair Coat Clipping

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RINGKASAN

Kertas ini membincangkan kesan pengurusan dan pembuangan lapisan bulu terhadap penyesuaian lembu-lembu Hereford dalam keadaan iklim di Malaysia.

18 ekor lembu yang dipilih secara rawak telah digunakan bagi tiga jenis perlakuan pengurusan di mana tiga paras pembuangan lapisan bulu telah dijalankan.


Purata suhu rektal dan RHTC yang diperolehi adalah masing-masing 40.35°C dan 63.15. Lembu-lembu yang diberi peneduhan secara pilihan didapati yang terbaik. Bagi lembu-lembu yang dibuang lapisan bulu dengan sepenuhnya, nilai-nilai suhu rektal dan RHTC adalah 40.06°C dan 68.17. Nilai-nilai ini jauh lebih baik dari nilai yang diperolehi dari kajian yang pernah dijalankan dulu dan juga yang didapati dari lembu-lembu Jersey di Malaysia.


Perbandingan denyutan jantung menunjukkan tidak ada perbezaan yang nyata. Walau bagaimanapun, lembu-lembu yang diberi peneduhan secara pilihan dan lembu-lembu yang dibuang lapisan bulu sepenuhnya memberikan kebaikan yang berkesan sekali bagi penambahan berat badan jika dibandingkan dengan lembu-lembu lain. Dalam pengambilan air didapati bahawa lembu-lembu yang diberi peneduhan secara pilihan dan yang dibuang lapisan bulu sepenuhnya meminum lebih banyak air dibandingkan dengan lembu-lembu lain. Purata air yang diminum oleh lembu-lembu yang diberi peneduhan secara pilihan adalah sebanyak 19.29 liter sehari bagi setiap ekor. Ini mungkin disebabkan keperluannya menyesuaikan pengeluaran peluh yang berlebihan untuk menyejukkan badan.


INTRODUCTION

The need for the importation of Hereford cattle into Malaysia, and their Heat Tolerance and initial adaptational ability has been discussed by PATHMASINGHAM, MURUGAIYAH and NASIR (1978). The results of that study indicated the need for improvement of conditions for these animals, so that they could settle in and perform well in the tropical environment.

Conditions could be improved by mechanical cooling of the animals. This could be done by providing better ventilation with fans, regular spraying of water onto the animals, or air-conditioning the buildings. These methods are time consuming and expensive.
The other alternative would be to effect changes or improvements on the animals themselves. Reference, in this instance, is made to the hair-coat condition of these Herefords. All the animals that were imported had thick hair coats, with the average length of hair being about 3 cm.

To improve the heat exchange mechanism and the adaptational ability of thick hair-coated animals in hot environments, YEATES (1955, 1957, 1958 and 1977), DOWLING (1956 and 1959), TURNER and SCHLEGEL (1959), and MURRAY (1965) have all resorted to hair coat clipping.

This paper presents data on the trial carried out to determine improvements in the heat tolerance and adaptability of these Herefords by clipping their hair-coats.

EXPERIMENTAL PROCEDURE

Animals

Eighteen in-calf Hereford heifers were used for the trial. The animals used were the same as the ones used in the previous study, reported by PATHMASINGHAM, et al., (1978). These animals were checked for health and condition prior to the start of the trial, which was carried out between the 8th and 22nd August 1978.

Management and Treatment

The same management treatments of \( T_1 \) (24-hour shade), \( T_2 \) (optional shade), and \( T_3 \) (day shade and night grazing) were applied in this trial, as in the previous one (PATHMASINGHAM, et al., 1978). The 18 animals were divided into the three treatments, with six per treatment.

Within each management treatment, two types of hair-coat clipping were imposed randomly, namely:

(i) Complete hair-coat clipping – hair-coat all over the body was closely clipped, using shears, to produce a sleek coated animal.

(ii) Partial hair-coat clipping – only the hair-coat of the head and neck regions, up to the shoulders, were clipped off.

In each treatment group, two animals were given complete hair-coat clipping, and another two, partial hair-coat clipping. The remaining two were left as control.

The feeding regimes, recordings taken, time of recordings, and procedures for recordings, were all identical to the previous study (PATHMASINGHAM, et al., 1978).

Environmental records were also taken. Calculations made of RHOAD's (1944) Heat Tolerance Coefficient and BENEZRA's (1954) Index of Adaptability were as described in the previous study (PATHMASINGHAM, et al., 1978).

Records of water intake and body weights were also taken daily.

Statistical Analysis

An analysis of variance, and 'F' tests were carried out on the data recorded, to determine the significance levels of the different treatments. Least Significant Difference (LSD) tests were conducted at both 0.05 and 0.01% levels.

RESULTS

The overall means of environmental records, at different times of the day, taken during the trials, is shown in Table 1.

For purpose of significance of results and practical field situation of the animals, the records for 0800 and 2000 hours were omitted in the calculation used. It was found (PATHMASINGHAM, et al., 1978) that
TABLE 1: OVERALL MEANS OF ENVIRONMENTAL RECORDS

<table>
<thead>
<tr>
<th>Time</th>
<th>Atmospheric Temperature (°C)</th>
<th>Relative Humidity (%)</th>
<th>Wind Velocity (ms⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SE</td>
<td>Mean</td>
</tr>
<tr>
<td>1130 hrs</td>
<td>33.70</td>
<td>±0.90</td>
<td>56.00</td>
</tr>
<tr>
<td>1430 hrs</td>
<td>36.27</td>
<td>±0.66</td>
<td>45.33</td>
</tr>
<tr>
<td>1630 hrs</td>
<td>32.93</td>
<td>±2.28</td>
<td>59.33</td>
</tr>
</tbody>
</table>

*SE – Standard error.

TABLE 2: MEANS OF ENVIRONMENTAL RECORDS FOR THREE DAYS AND THREE TIMES

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Relative Humidity (%)</th>
<th>Wind Velocity (ms⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>34.30</td>
<td>53.56</td>
</tr>
<tr>
<td>S.E.</td>
<td>±0.89</td>
<td>±3.13</td>
</tr>
</tbody>
</table>

at these times the animals were comfortable and not under any undue stress. Hence, for all results quoted here, only the means of records for 1130, 1430 and 1630 hours, were used.

As in the previous study, management treatments are classified as T₁, T₂ and T₃. The hair-coat clipping treatments are denoted by:

- H – head and neck hair-coat clipping
- C – complete body hair-coat clipping
- N – no hair-coat clipping

The overall means of animal parameters measured are presented in Table 3. These are means of records for the three hottest hours of the day only.

The overall analysis and 'F' values obtained for the difference parameters are shown in Table 4. As can be seen, interactions between management and hair-coat clipping treatments, for all the animal parameters recorded, gave no significant differences statistically.

Table 5 gives the details of comparisons between treatments for the different parameters recorded.

The multiple and partial correlations obtained for the effect of environmental parameters on animal parameters were all significant, except for the effect on pulse rate. All the partial correlations were insignificant, as shown in Table 6.

I. Rectal temperature

The analysis of variance gave significant differences for the effects of management treatments and hair-coat clipping within treatments.

Animals in T₁ had the lowest mean temperature of 40.10°C, which was very
### TABLE 3: OVERALL MEANS OF PARAMETERS RECORDED

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rectal Temperature °C</th>
<th>Pulse Rate</th>
<th>Respiration Rate</th>
<th>Rhoad's Heat Tolerance Coefficient</th>
<th>Benezra's Index of Adaptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁ F</td>
<td>40.27 ± 0.20</td>
<td>81.6 ± 2.60</td>
<td>99.8 ± 4.07</td>
<td>64.54 ± 3.70</td>
<td>5.39 ± 0.18</td>
</tr>
<tr>
<td>T₂ F</td>
<td>40.10 ± 0.14</td>
<td>72.3 ± 3.54</td>
<td>96.2 ± 6.45</td>
<td>67.58 ± 2.61</td>
<td>5.19 ± 0.28</td>
</tr>
<tr>
<td>T₃ F</td>
<td>40.67 ± 0.03</td>
<td>80.9 ± 2.48</td>
<td>113.7 ± 5.57</td>
<td>57.32 ± 0.47</td>
<td>6.01 ± 0.24</td>
</tr>
<tr>
<td>N</td>
<td>40.52 ± 0.12</td>
<td>78.1 ± 4.47</td>
<td>114.1 ± 5.50</td>
<td>59.96 ± 2.23</td>
<td>6.02 ± 0.24</td>
</tr>
<tr>
<td>H</td>
<td>40.45 ± 0.14</td>
<td>75.41 ± 2.26</td>
<td>99.4 ± 3.52</td>
<td>61.31 ± 2.54</td>
<td>5.38 ± 0.15</td>
</tr>
<tr>
<td>C</td>
<td>40.06 ± 0.19</td>
<td>81.3 ± 2.73</td>
<td>96.2 ± 6.64</td>
<td>68.17 ± 3.56</td>
<td>5.19 ± 0.29</td>
</tr>
</tbody>
</table>
### TABLE 4: OVERALL ANALYSIS OF VARIANCE OF THE DIFFERENT ANIMAL PARAMETERS

<table>
<thead>
<tr>
<th>Source</th>
<th>Rectal Temperature</th>
<th>Pulse Rate</th>
<th>Respiration Rate</th>
<th>Rhoad's Coefficient</th>
<th>Benezra's Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment (T)</td>
<td>6.2972*</td>
<td>2.3173NS</td>
<td>6.1871*</td>
<td>6.3558*</td>
<td>8.4985**</td>
</tr>
<tr>
<td>Haircut (H)</td>
<td>4.3618*</td>
<td>0.7597NS</td>
<td>6.6502*</td>
<td>4.4249*</td>
<td>8.8229**</td>
</tr>
<tr>
<td>T x H</td>
<td>1.4239NS</td>
<td>0.1487NS</td>
<td>2.5125NS</td>
<td>1.4721NS</td>
<td>3.1878NS</td>
</tr>
</tbody>
</table>

* - P<0.05
** - P<0.01
NS - Not significant

### TABLE 5: COMPARISONS BETWEEN TREATMENTS OF THE DIFFERENT ANIMAL PARAMETERS

<table>
<thead>
<tr>
<th>Management Treatment</th>
<th>Hair-coat Clipping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
</tr>
<tr>
<td>1) Rectal Temp. °C</td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td>0.17NS</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td>0.40*</td>
</tr>
<tr>
<td>2) Respiration/Min.</td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td>3.56NS</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td>17.48**</td>
</tr>
<tr>
<td>3) Rhoad's Coefficient</td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td>3.04NS</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td>10.26**</td>
</tr>
<tr>
<td>4) Benezra's Index</td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td>0.20NS</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td>0.62*</td>
</tr>
</tbody>
</table>

* - P<0.05
** - P<0.01
NS - Not significant
<table>
<thead>
<tr>
<th></th>
<th>Equation</th>
<th>Multiple Correlation</th>
<th>Partial correlations:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$r(x_1, x_2, x_3)$</td>
</tr>
<tr>
<td>1)</td>
<td>Body temperature</td>
<td>$y = 27.30 + 0.27x_1 + 0.05x_2 + 0.17x_3$</td>
<td>0.8277*</td>
</tr>
<tr>
<td>2)</td>
<td>Pulse rate</td>
<td>$y = 47.55 + 0.45x_1 + 0.19x_2 + 1.07x_3$</td>
<td>0.2069NS</td>
</tr>
<tr>
<td>3)</td>
<td>Respiration rate</td>
<td>$y = -225.15 + 7.15x_1 + 1.11x_2 + 4.01x_3$</td>
<td>0.8645*</td>
</tr>
<tr>
<td>4)</td>
<td>Rhoad’s coefficient</td>
<td>$y = 297.98 - 4.85x_1 - 0.95x_2 - 3.05x_3$</td>
<td>0.8277*</td>
</tr>
<tr>
<td>5)</td>
<td>Benezra’s Index</td>
<td>$y = -9.02 + 0.32x_1 + 0.05x_2 + 0.18x_3$</td>
<td>0.8645*</td>
</tr>
</tbody>
</table>

$x_1$ - Atmospheric temperature (°C)  
$x_2$ - Humidity (%)  
$x_3$ - Wind velocity (m/sec).  

* - $p < 0.05$  
NS - Not significant
significantly (P<0.01) better than those in T3. T1 animals also had significantly (P<0.05) lower temperatures than those in T3.

The effect of hair-coat clipping, for both H and C treatment animals, gave significantly (P<0.05) better temperatures over animals in treatment N. Also, animals in treatment C with a mean temperature of 40.06°C, were significantly better off than animals in treatment H.

II. Rhoad’s Heat Tolerance Coefficient (RHTC)

Since RHTC is directly derived from rectal temperatures, the significant differences obtained were identical to those for rectal temperatures.

Animals in T1 had RHTC of 67.58 and those with complete hair-coat clipping (C) had RHTC of 68.17, which were both significantly higher than their respective comparative treatments (P<0.05).

III. Pulse Rate

The pulse rate comparisons for management and hair-coat clipping treatments, gave no significant differences.

IV. Respiration Rate

A similar trend of significance was seen when respiration rates were compared between management treatments and hair-coat clipping treatments. Animals in T1 had very significantly (P<0.01) lower respiration rates of 96.2, whilst those in the C treatment for hair-coat clipping had very significantly (P<0.01) lower respiration rates of 96.2 also.

V. Benezra’s Index of Adaptability (BIA)

For BIA, both the effects of management and hair-coat clipping were highly significant (P<0.01). The T3 animals had very significantly (P<0.01) better BIA of 5.19, than animals in the other two treatments. And, in the comparison for hair-coat clipping, animals in treatment C had a BIA figure of 5.19, which was very significantly (P<0.01) lower than the other two treatments.

VI. Correlations

The multiple correlations for the effect of environmental parameters on animal parameters were all significant except for the effect on pulse rate. All the partial correlations were insignificant (Table 6).

VII. Hair-Coat Clipping

An overall comparison of animals in the three hair-coat clipping treatments gave no significant differences. As presented previously, the effect of hair-coat clipping was obvious only when management treatment effects were also considered. However, the rectal temperature, respiration rate, RHTC and BIA for animals with complete hair-coat clipping (C) were the lowest. The values were, respectively, 40.06°C, 96.20, 68.17 and 5.19 (Table 3).

VIII. Water Intake and Body Weight Changes

Animals in T1 were found to consume the most amount of water during the trial period of 0800 to 1630 hours. They consumed an average of 19.29 litres per animal, as compared to T2 and T3 animals, which consumed 11.67 and 12.86 litres respectively.

Weights of all animals were recorded in the mornings and evenings during the trial. The weight changes of animals in T1, T2 and T3 were, -1.25 kg, +1.25 kg and +3.75 kg per animal per day. The values obtained for animals in N, H and C treatments were +0.83 kg, +0.83 kg and +2.08 kg per animal per day.

DISCUSSION

Heat tolerance studies on Hereford cattle in Malaysia (PATHMASINGHAM, 103
MURUGAIYAH and NASIR, 1978) showed that these animals did not initially settle in comfortably to the hot, humid tropical environment in Malaysia. This initial study led to a further study on the effects of hair-coat clipping on the adaptational ability of the imported Herefords.

Besides improvements produced by the different management treatments, in this study, the two levels of hair-coat clipping, H and C, within the management treatments, have led to a general overall improvement in adaptability and comfort of these animals, to the local environment. These improvements showing only the more obvious differences are illustrated in Figures 1, 2, 3 and 4.

In this second study, the overall mean rectal temperature of all the animals was 40.35°C, which was very much lower than the 41.24°C reported by ParHnansrNGHAM, MURUGAIYAH and Nasrn, (1978). This was despite the environmental factors being almost similar during the duration of the two studies. Together with a lowering of the rectal temperature, there has been an improvement in RHTC, to 63.15, compared to the 45.96 produced in the first study (PATHMASINGHAM, MURUGAIYAH and NASIR, 1978). Both the rectal temperature and RHTC values were significantly better in the second study.

In the effects of hair-coat clipping, significant (P<0.05) differences between treatments were observed. Animals with their hair-coat completely clipped off had a lower rectal temperature of 40.06°C and better RHTC of 68.17. These results are superior, when compared with those for Jerseys, which had 40.28°C for rectal temperature and 65.90 for RHTC (NORDIN YUSOF, 1978). The results were also comparable to the 40.30°C produced by clipped Herefords (YEATES and PARTRIDGE, 1975).

A comparison of effects of management treatments showed that the animals in T, were better adapted. These results were superior to the respective values obtained for all the animals. This is in contrast to the first study reported, where animals in T, responded best. However, this is not a significant difference, because treatments T, and T, do not vary in the basic effects they produce. Both treatments allow for shade in the day, and grazing at night. The difference lies in the fact that T, animals are forced into shade during the day, whereas T, animals have voluntary access to shade at all times. Thus, T, is in fact a better all round management treatment as the animals voluntarily choose their own shade requirements.

The above results express the need for clipping the hair-coat of Herefords imported into Malaysia. The significance of clipping the wooly hair-coats is in improving the sweating rate (TURNER, 1962) of these animals. MCLEAN and CALVERT (1972), reported that in increasingly hot environments, the percentage of heat lost from the skin, as compared to percentage of heat lost from respiration, increased significantly to 62 and 38% at 35°C, respectively. Thus, to increase the efficiency of heat loss from animals in a hot environment, the skin surface, as opposed to hair-coat, of the animal must be exposed as much as possible. In this instance, by clipping off all the hair-coat, the skin is exposed, thereby increasing the heat loss to the surrounding environment. It also reduces the stress due to high humidity, and increases the cooling effects of increased wind velocity of ventilation. The undesirability of wooly-coated Herefords is further stressed by the findings of YEATES (1977) who reported that the Herefords full coat has very high heat retaining properties.

All these factors put together, stress the need for hair-coat clipping to be practised initially on importation, and then, if necessary, at regular intervals, until the animals have at least adapted to a certain level. The hair-coat of these animals has got to be clipped mechanically from the
Figure 1. Rectal temperature: Comparative improvements produced by the different treatments.
Figure 2. Rhoad's Heat Tolerance Coefficient: Comparative improvements produced by the different treatments.
Figure 3. Respiration rate: Comparative improvements produced by the different treatments
Figure 4. Benzer's Index of Adaptability: Comparative improvements produced by the different treatments.
animals, as they will not effectively shed their own coat even in the tropical environment. This is because hair-coat shedding is primarily influenced by day-length changes (YEATES, 1955), and secondarily by nutrition (YEATES, 1958), and temperature (MURRAY, 1965). YEATES (1957) has further stressed that the equatorial photoperiod eliminates the natural seasonal effects on hair-coat shedding of Bos taurus cattle. Instead, the equatorial light environment retains the heat-retaining type of coat, which is obviously nonconducive to the tropical environment.

The comparison for respiration rate and BIA gave highly significant (P<0.01) differences for T2 animals against T1 and T3 animals. The animals in T2, as opposed to those in T3 in the previous study, have responded better. As previously discussed, the treatment difference is only voluntary, and therefore of not much consequence. However, the presence of hair-coat clipped animals has probably influenced the improvement in response in T2 animals.

A similar situation presents itself for the comparison of BIA, where T2 animals again perform significantly (P<0.01) better than animals in T1 and T3. The value was superior to the BIA value for T3 animals in the previous study.

Using the first study as a base for comparison, the values obtained in that study for respiration rate and BIA were, respectively, 149.2 and 7.55. This was, again, despite the similar environmental conditions. There is, thus, a markedly significant improvement shown in this second study. Obviously, this improvement is influenced to a great extent by the presence of animals with clipped hair-coats. Further comparisons with the values obtained for Jerseys, of 132 for respiration rate and 6.71 for BIA (NORDIN YUSOF, 1978) and YEATES’ (1977) respiration rates of 136 for smooth-coated and 156 for wooly-coated Herefords, shows the significance of hair-coat clipping.

In fact, the comparison of the three hair-coat clipping treatments shows that animals in treatment C had respiration rate and BIA values of 96.2 and 5.19 respectively. This shows markedly better results than those for the Jerseys in Malaysia (NORDIN YUSOF, 1978), and the smooth-coated Herefords in Fiji (YEATES, 1977).

The extra environmental stress, and increased respiration rate, also resulted in the animals panting and salivating as in the previous trial. The panting rate, however, was observed to be much lower, especially on the hair-coat clipped animals. Because the animals experience less heat stress due to hair-coat clipping, they pant less, and this in turn reduces further heat stress, as heavy panting further increases the animals’ heat production due to the effort itself (BIANCA, 1965).

This is, therefore, a very significant overall improvement in the response of these Herefords to the hot, humid environment, by having the hair-coat clipped, to produce smooth, sleek-coated animals.

With such a significant response produced by clipping the hair-coat, selection for Bos taurus temperate animals for use in tropical countries, like Malaysia, must be critically carried out. Selection must be made for sleek or smooth-coated animals. The advantages of such animals in hot environment have been amply discussed. In relation to this, coat-scoring – for sleekness or smoothness – has been found to be well correlated with body temperature and respiration rate (TURNER and SCHLEGER, 1960). Further, it is reported that, coat-score and post-weaning growth rate are so closely correlated that coat-score can be superior to records of body weight as an estimate of growth capacity (TURNER and SCHLEGER, 1960). The results of this same study by TURNER and SCHLEGER (1960) indicates that a sleek coat is not only important in favouring heat dissipation, it also has great significance as an indicator of metabolic efficiency, and the capacity to react favourably to heat stress.
A study of pulse rates, gave no significant advantage for either management or hair-coat clipping treatments. Generally, pulse rate increases in animals that have become hyperthermic due to heat stress (Whittow, 1971). Since no significant differences were seen between treatments this parameter becomes non-practical in application, and consideration for improving or altering this cannot be made.

The multiple correlations obtained showed a very significant effect produced by all the environmental factors on all the animal parameters, except pulse rate, indicating a combined effect of environmental factors is significant, as opposed to the individual factors, since the partial correlations were all insignificant.

The study of water intake, though not critically carried out, only goes to further emphasize the need for clipping the animals' hair-coat. The animals in treatments T₂ and C have obviously sweat more, and have had a greater water intake to compensate for this sweating loss. Sufficient water must, therefore, be provided to prevent dehydration and possible death.

The change in body weights of the animals in the trial was recorded to give an indication of the daily responses to the effects of heat. The animals in T₂ and T₃ showed positive weight changes, whilst those in T₁ had a negative response. This is again related to a combination of the effects of management and hair-coat clipping treatments. The weight changes produced by animals in the N, H and C treatments were +0.83 kg, +0.83 kg and +2.08 kg per animal per day, respectively. This is a significant effect produced by complete hair-coat clipping, which obviously allows the animals to be adapted and comfortable enough to perform positively despite the hot environments.

The overall evaluation of the results of this study shows that wooly-coated animals, like the Herefords, can be made comfortable and adaptable to our hot, humid environments, by clipping off their hair-coats. This clipping must be carried out to maintain a sleek coated appearance, until the animals have had time to either shed their hair-coats, or generally get adapted to this environment. Thus, within practical limitations, thick-coated Bos taurus temperate animals can be imported and used in our environment effectively. The obvious way, however, to overcome this basic adaptational problem of these temperate animals would be to select strains that are already naturally sleek-coated, and thus able to withstand heat stresses and still produce and perform well.

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SUMMARY

The paper discusses the effects of management and hair-coat clipping on the adaptability of woolly-coated Herefords, to the Malaysian environment.

Eighteen animals were randomly allocated to three management treatments. Within these treatments, three levels of hair-coat clipping were applied on the animals.

Adaptational ability was assessed by rectal temperature, Rhoad's Heat Tolerance Coefficient, respiration rate, Benezza's Index of Adaptability, and pulse rate. Body weight changes and water intake were used as additional parameters for comparison between treatments.
The overall rectal temperature and RHTC obtained were 40.35°C and 63.15 respectively. Animals with optional shade were found to adapt best. Animals with complete hair-coat clipping gave respective values of 40.06°C and 68.17 for rectal temperature and RHTC. These values were superior to those obtained in the previous study, and also to those obtained for Jerseys in Malaysia.

The overall values obtained for respiration rate and BIA were 103.2 and 5.53, respectively. These show a marked improvement over values obtained in the first study. Again, animals with optional shade performed best. The animals with complete hair-coat clipping were superior to those without, and had values of 96.2 and 5.19 for respiration rate and BIA. These were also much better than those shown by Jerseys in Malaysia.

The pulse rate comparisons showed no significant differences. However, animals with optional shade and with complete hair-coat clipping had significant positive weight gains over the other animals. In terms of water intake, it was found that animals in optional shade and those with complete hair-coat clipping drank a significantly greater amount of water as compared to the others. Animals in optional shade drank 19.29 litres per day per animal, to probably compensate for the extra sweating to cool them down.

An overall evaluation of the results obtained is discussed. It is concluded that both the optional shade treatment and complete hair-coat clipping are very significant methods to improve the adaptability of wooly-coated Herefords in Malaysia. It is recommended that future importation of such animals should be done after careful selection, preferably for sleek-coated animals that would adapt and perform better.

REFERENCES


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