Methods of Handling Depletion in Ability of Dairy Cows Kept at High Temperatures in Summer

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Dairy cows are said to be vulnerable to hot weather. In warm areas, many effects due to high temperatures are seen on dairy cows during a long, hot summer. Shoichi Ishii [1) 2)] and Shozo Okamoto [3) 4)] have conducted a series of experimental studies at the Kyushu Agricultural Experiment Station to lessen these unfavourable effects. Although the results obtained in Kyushu are not entirely applicable to the tropical zones, they may probably be used as reference data. The results obtained are summarized as follows :

Lowered ability in economical traits of dairy cows in summer

Pertinent data for comparison such as milk yields, reproduction rate and body weight were extracted from the records of Holsteins raised at the Station and their changes in summer were investigated.

With regard to milk yields, records of summers (June 1 to Septmber 27) and winters (December 1 to March 29) were taken from 1953 to 1962. In order to eliminate the effect of lactation weeks, conception and milking frequency, cow's records in the 10th to 20th week of lactation at the onset of investigation, of less than 150 days of pregnancy age at the end of investigation and of milking frequency of twice per day were available.

The expected milk yield of each lactation week was estimated by using milk yields during a week before the investigation period on the basis of normal lactation curve of Holsteins prevailing in Japan at that time. This expected yield was compared with actual one.

The actual milk yield at each week in winter well corresponded to the expected yield within a range of 95.5% to 102.9% of the latter. Actual yields in summer were 100.0% in the first week and 97.3% in the second week, of the expected yields; During these weeks average maximum temperatures were 25.2° C and 26.3° C respectively; not high enough to affect dairy cows. But in the latter half of June when the average maximum temperature exceeded 27° C they fell to 94.6 % of the expected yields and in the first half of June when it was 28.7°C to 31.1° C they decreased to 85.6%. From the latter half of July when it exceeded 32°C to that of September when it fell to 28°C they were between 78.8% and 76.3% of the expected yields. This made it clear that day-to-day high temperature not only related to decreased milk yields but also the effects of high temperature remained until a later date, and that decreased milk yields in summer greatly affected dairy husbandry.

Another traits except milk yields was examined along the same idea. The fertility was lowest during August and September. The properties of semen did not show any sign of recovery until November. Change in body weigth before and after parturition suggested that in case of parturition in summer nourishment in body had not been accumulated sufficiently before parturition so that high milk yields were not maintained after it.

Judgement of heat tolerance of dairy cows

The investigation on lowered ability of dairy cows in summer showed that it would greatly affect the economies of their breeding. Thus the important problem in keeping dairy

cows in warm areas is how to prevent or lessen the depletion of their ability. One of the problems may be to breed dairy cows of high heat tolerance. A prerequisite to finding such cows is a judging method of heat tolerance.

A number of experiments have been conducted on heat tolerance of dairy cows in foreign countries. Among these reports Rhoad's heat tolerance test [5] was taken to examine if it would be applicable to Japan.

The experiment was conducted for four hours between 11 a.m. and 3 p.m. on fine, calm and hot summer days. The dairy cows were exposed to full sunshine. At every hour body temperature, pulsation, respiration rate, saliva dribbles, insensible perspiration, etc, were measured,

According to the results the changes in body temperature and respiration rate were suitable for indicators of heat tolerance while the changes in pulsation and other were not.

Changes in body temperature showed a definite tendency related with the passage of time with some variation among individuals. Similar variation of changes among individuals was brought out at the investigation repeated during the same summer, suggesting individual properties in change of body temperature. On the other hand change in respiration rate did not indicate any individual differences. From a physiological viewpoint of those changes respiration rate, pulsations, saliva dribbles, and others are means to prevent from high air temperature while body temperature is its consequence. Thus in judging heat tolerance the use of changes in body temperature adopted by Rhoad et al. was concluded to be reasonable.

However, judgment under exposure to full sunshine cannot be carried out at all times or places as the same conditions are difficult to reproduce. Therefore, testing in a temperature controlled roon was tried. In conducting such testing it was necessary to examine the combination of its temperature, relative humidity and housing times. As a result of the examination it was found that most optimum room temperature and relative humidity were 38 to 39°C and 50 to 60% respectively. The cows should stay in the cabinet for four hours. Their body temperature was to be measured four hours before they are taken in and after they are taken out. The coefficient to be used was calculated in accordance with the Rhoad's heat tolerance coefficient. Namely ;

$$100-(BT-101.0)$$

where BT equals to an average of the temperatures measured before taken in and after taken out, and expressed in terms of Fahrenheit.

Investigation of the judgment of heat tolerance was repeated for several years. Investigation was also carried out during these years on the same individuals and, although samples were fewer, on blood relation.

The measurements for the same Individual showed a fair consistency, but with the advancing pregnancy period and also with high milk yields, the heat tolerance coefficient of the cow became low even for the same individual. Effect of lactation on the coefficient was especially strong. Findings in the temperature controlled room also showed that when a long spell of high temperature continued the heat tolerance coefficient lowered because body temperature had risen before the cow was taken into the cabinet. Thus the coefficient would vary with cows' condition at the time of measurement. In order to compare heat tolerance among individual cows of different conditions, some correction methods to eliminate effects of various conditions must be found. This in turn would necessitate to increase the number of investigation samples. But it was found that the rate of increase in body temperature during the period of high temperature would suggest to some degree the heat tolerance.

Findings on blood relation indicated that the heat tolerance might have some inherited factor, although the limited number of samples made it impossible to conclude.

According to findings from a few samples of Jerseys their body temperature was somewhat higher than that of Holsteins at an optimum temperature, but the former's rate of increase was lower than that of the latter at high temperature, suggesting that Jerseys might have a higher heat tolerance.

Control against ambient high temperature

In order to protect dairy cows from the effect of heat they must be housed in cooler environment as possible. So, studies on the location and structure of barns keeping cool during high ambient temperature were conducted.

As a result it was revealed that the most important factors were roof structure to keep out the effects of direct rays of the sun and the width of shade to keep out those of their reflection (radiation+reflection). But these factors had their limitation in lowering air temperature during high temperature periods. In order to keep optimum ambient temperature it was necessary to have air conditioning barns and to send cooled air in. Where a supply of cool water is abundant the sending of cooled air is less expensive and therefore feasible. But both of them are generally expensive and in many cases not practicable.

However, according to studies on diurnal and seasonable changes in air temperature, those in body temperature and seasonable change in lactation, etc., if there is a fair spell of low temperature in part of day, body temperaure raised by high air temperature returns to normal. It also disclosed that when a spell of comparatively low temperature or cold nights continued during a high temperature period body temperatre declined to normal and concurrently milk yield approached the expected yield.

Therefore, the above findings showed that even if the effects of high air temperature could not be kept out from cows all through the day the effects of high air temperature could be lessened. Some hours of cold temperature kept artificially in a day, and some spell of cold temperature during a high temperature would cut off continuation of the high body temperature. And they would help to prevent depression in systemic function.

Furthermore it was found that the diurnal change of air temperature during a hot summer had a considerable difference between in doors and outdoors. Grazing immediately after sunset on to night, and hourly regulation of cow's activities are means to control heat in the process of daily management on dairy cattle. Water sprinkling on the animal body is effective in checking increase in body temperature.

References

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Edible Rice Bran Oil in Japan

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Introduction

The production of rice bran is estimated to be 1.2 million tons in our country. Rice bran is only a by-product of milling brown rice. However, since rice bran contains about 19% crude oil it is one of good potential oil sources.

Our efforts were concentrated on manufacturing rice bran oil of good quality. To reach our goal several difficulties had to be overcome and quality of our rice bran oil was under