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TIPS FOR MANAGING DAIRY CATTLE IN A HOT CLIMATE

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Hot weather causes heat stress in dairy cattle which in turn increases its body temperature. Lactating cows also produce large amounts of metabolic heat and accumulate additional heat from radiant energy. All these factors cause heat stress in cattle. As a result, the cows have a lower feed intake, a decline in milk yield, fertility, and growth rate. It has been estimated that at 40°C, feed intake (on a dry matter basis) is only about half of that of cows reared in their optimum temperature range. The effect of high temperatures is more marked in cows with a high milk yield.

Although effects are more severe in hot climates, dairy cattle in areas with relatively moderate climates are also exposed to periods of heat stress. The resultant decrease in milk production and reproductive efficiency can be overcome by providing shades, proper ventilation, spray, fans etc, and by modifying feeding practices. The economic benefit should be determined before installation of equipments to reduce heat stress.

Heat stress occurs when the effective temperature of environment is higher than the animal's thermo-neutral (comfort) zone ie 10-24 degree C. Four environmental factors influence the effective temperature: 1) air temperature, 2) relative humidity, 3) air movement, and 4) solar radiation. When the environmental temperature exceeds 27 degree C, even with low humidity, the effective temperature is above the comfort zone for high producing dairy cows. The temperature humidity index (THI) is used commonly to indicate the degree of stress on dairy cattle. When the THI exceeds 72, high producing dairy cows are affected adversely. Estimated milk yield reduction was 0.32 kg per unit increase in THI. Milk yield and TDN intake declined by 1.8 and 1.4 kg for each 0.55 degree C increase in rectal temperature. (Armstrong, 1994)

Heat stress can cause losses in production by 20 percent or more and reduce conception rates by 10 to 20 percent. It is demonstrated that the levels of estrogen and luteinizing hormones are lower in cows without shade compared to those which can take shelter from the sun in the shade. Heat stress at and immediately after insemination (7-10 days) result in a lower conception rate.

Strategies to minimize the effect of heat stress

Strategies to minimize the effect of heat stress are physical modification of the environment, improved feeding practices and genetic development of heat tolerant breeds.

1. Physical modification of the environment

In the short term, cows must be helped to withstand high temperatures by modifying their environment. The major objective of a cooling system is to reduce the air temperature inside the cow shed, so as to keep the cow's body temperature as close as possible to the normal (38.5 - 39.3°C). There is no single method of reducing heat stress in cattle and other animals. The only successful approach is an integrated approach.

Cattle shed design: The longer side of the cattle shed should have an east-west orientation. This reduces the amount of direct sunlight shining on the side walls or entering the house .There should be adequate facility for cross ventilation to reduce the thermal stress. An adult cow requires around 800 cubic feet of air space under tropical conditions. In a conventional cattle shed a height of 8 feet at sides and 15 feet at the ridges will be sufficient to give necessary air space. Thermal stress can be decreased by reducing reflection of heat from ground (by coverage of landscape around the shed with grass, shrubs and bushes), attached shade (projection of roof), minimizing the solar radiation (suitable method and material for roofing) etc. There are also various roof systems which give improved natural ventilation by means of roof openings, enhanced solar chimney effect,

etc.

Painting the roof white may increase the level of sunlight reflected, thus reducing the amount of absorbed solar energy (All heat at the same wave length must be either reflected or absorbed, so increasing the amount of reflected heat reduces the amount of heat absorbed).

Shade : Providing adequate shade around the cattle shed is a good way of protecting cows from direct rays of the sun during the day. The most effective shade is from trees and other vegetation. They not only protect the cows from sunlight, but also create a cooling effect by the evaporation of moisture from their leaves.

Fans : Air movement increases the rate of heat loss from the cow's body surface. But this is effective only if the air temperature is lower than the skin temperature of the cows.

Mist and Fan System : Mist particles are sprayed onto the body of the cow, to wet the hair. A fan is then used to evaporate the moisture, as a way of cooling the animal. Fans and sprinklers can be easily installed in cattle sheds. Research shows an 11% increase in milk yield when fans and sprinklers were used compared with shading alone. Fans and water sprays are much more effective when they are used together. Either kind of cooling method used on its own is not very effective.

Mist and spray systems are expensive to install. Economic analysis has shown that the breakeven point for this system is an increase in milk production of 0.81 kg/day. (Kurihara, 2003)

Night Grazing : Cattle sheds may remain hot even after the sun goes down. Letting the dairy cows graze out in the night is a good way of helping them lose heat.

2. Improved feeding practices

Energy requirement of cattle rises in hot weather, which means they need more feed for maintenance. However, feed intake tends to fall during hot weather. Effect of heat stress on thyroid gland activity reduces gut motility and rate of passage. More over under heat stress blood flow to internal organs especially to the intestine is reduced to compensate the increased flow to the peripheral organs for effective heat loss through evaporation and conduction. This causes decreased absorption of nutrients from intestine. Hence, it is important to increase the energy and protein content of diets, if dairy cows are to maintain their performance in hot environments.

During heat stress, feed intake is reduced by 8-12% or more causing a reduction of volatile fatty acid production in the rumen and decreased milk production. In order to address this problem, more nutrients must be packed into smaller volumes of feed. (Requirements for lactation do not change, but her energy needs increase). Increasing the energy in the diet can be achieved by increasing concentrates (grains) and decreasing forages in the diet. Added dietary fat is an excellent way to increase energy content of the diet, especially during summer when feed intake is depressed. Often the amount of crude protein in summer diets must be increased because of lower feed intake. Bypass protein values of 36 to 40% of total dietary crude protein are desirable. The fiber content of the ration should be reduced slightly to encourage greater intake in hot weather. Feeding good quality roughage to lactating cows is recommended in summer as it reduces heat buildup and supplies adequate long fiber in the diet. For cows under heat stress, alkaline diets are preferable. Buffers such as sodium bicarbonate and magnesium oxide should be used during hot weather, especially in low fiber, high concentrate diets. Addition of sodium bicarbonate to the diet helps to maintain pH of rumen and also increase DMI and milk yield. Provision for ad-lib water supply is an essential element of good thermal management system.

Minerals are also readily depleted during hot months through excessive water loss. Proper use of buffers in the diet can address this problem. Water requirements increase dramatically as environmental temperatures increase. Profuse sweating by heat-stressed cows results in a considerable loss of potassium. The level of potassium, and also sodium and magnesium in the diet should be increased. Increasing the concentration of dietary potassium to 1.2% or more, results in an increase of 3-9% in milk yield and also on DMI. Heat stress causes up to 30% decline in stored vitamin A in liver which necessitates its

supplementation during summer.

Heat stress generally increases the production of free radicals, leading to oxidative stress. The use of anti-oxidants such as vitamin E reduces the impact of heat stress, resulting in improved milk quality and cow's health.

3. Genetic development of heat tolerant breeds

In the long term, dairy cattle can be made more tolerant to hot and humid weather conditions by selective breeding. Colored breeds such as Jerseys and Brown Swiss seem to show greater tolerance to heat stress. Jerseys are also better producers of butter fat and protein. Holsteins are less heat tolerant and they require adequate attention in hot weather.

Conclusion

A combination of fans, wetting, shade and well-designed housing can help to alleviate the negative effect of high temperatures on dairy cows. Careful feeding and management strategies are important in achieving the optimum milk production. While there are many methods of reducing heat stress, selection of the most appropriate technique and its proper application is essential.

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