Cooling Dairy Cattle in a Hot Climate

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Introduction

Summer depression in milk production and reproductive performance is a serious problem to the dairy industry in the southern United States. In the southwestern United States the high daily temperatures exceed 100°F with the relative humidity less than 20% almost every day from May through September, except for short periods of rain when the relative humidity will exceed 40–50%. These conditions place the high producing dairy cow in an adverse environment with a temperature humidity index (THI) above 71. This is above the comfort zone for milk production suggested by Bianca,[3] Hahn,[5] and Sainsbury.[9]

A high producing dairy cow exposed to long periods above the comfort zone reacts with several measures to retain comfort. She will (1) increase water intake, (2) seek out shade, (3) reduce feed intake, (4) stand rather than lie down (unless wet ground is available), (5) increase respiration rate, (6) produce excess saliva, and (7) increase body temperature.

During the last 25 years, several methods to reduce summer heat stress in dairy cattle have been attempted. Mechanical refrigeration has proved successful in improving milk yield, fat percentage, and conception rate.[12,7] However, under current economic conditions in the United States, the investment and operating costs of this type of air conditioning equipment cannot be covered by the improvement in animal performance. Evaporatively cooled cattle shades were developed and tested by Wiersma and Stott in 1966. A horizontal pad design used to cool dairy cows in Arizona during the summer months improved milk production 6.5% and increased pregnancy rate by 23%.[11]

Cooling the Milking Herd

Holding Pen Cooling

Milking time is an opportunity to cool cattle for 15 to 60 minutes two or three times a day while cows are waiting to be milked. Holding pens in southwestern U.S. dairy farms simulate steam baths during the summer months because cows are crowded and washed from below to clean udders in a closely confined area with limited ventilation. To change the environment in the holding pen from one contributing to heat stress to one which provides a period of substantial relief, overhead sprinklers and large fans that bring in drier outside air are installed. The sprinklers (not foggers) wet the cows from above for approximately 30–45 seconds of every five minutes. In some dairies the sprinkler and fans run continuously. The flow of dry air evaporates the moisture from the cow's hair and skin. Fans which move approximately 1000 cfm per cow are mounted overhead and set at a 30° angle from vertical.

Cow body temperature is reduced to approximately normal. In trials in Arizona involving 2000 Holstein cows, milk production averaged 1.75 lb per day more for cows cooled in the holding pen during the summer months.[13]

Exit Lane Cooling

To further prolong the cooling period, parlor exit lane sprinklers have been used to wet the cow automatically as she returns to the corral. This prolongs the cooling effect of evaporation by 12–16 minutes depending upon the weather conditions. Cows which have been cooled with holding pen and exit lane sprinklers will usually go to the feed manger after each milking instead of directly to the shade area on hot days.

Feed Manger Shade

Shading the feeding area for dairy cattle in the southwestern United States is not new. In the early 1950's, feed mangers were shaded even before the present practice of providing shade in the center of the corral was common. If feed manger shade is the *only* shade available in hot weather, cows will spend essentially all of their time on the cow platform, resulting in excessively dirty cows, an increase in mastitis and reduction in milk quality.

In trials by Wiersma and Armstrong[14] on dairy farms with both feed mangers and center corral shade, both feed intake and milk production were increased. East to west feed manger orientation is preferred, as the shaded area will be over the cow for longer periods of the day.

Corral Manger Misting

Field trials on several California dairies indicated that utilizing a mist at the manger area to cool cows was cost effective.[10] In the San Joaquin Valley milk production during the hot days of the summer did not drop for the misted cows while non-misted cows dropped 8%. Misted cows also had a 9% higher first service conception and a reduction of 12 days open. Effective application of a fine mist where the wind does not have a prevailing direction is difficult, but if a dairy has flush lanes a nozzle which has a larger water droplet size can be used.

Evaporatively Cooled Shades

Improving the environment in the corral with evaporatively cooled shades proved economically feasible in the mid–1960's. The need for daily maintenance was a disadvantage. A new design developed in 1983—a fog generated at high pressure combined with fans to blow air on the cattle—has been effective. Research conducted for two summers in Arizona[2] and three summers in Saudi Arabia[1] have shown an increase in milk production of 6–7 lbs per cow per day and a 50% increase in reproductive efficiency in early lactation dairy cows. In a trial with pregnant cows in late lactation under extremely hot-arid conditions (temperatures 110°F), milk production increased 4–5 lbs.[1]

The use of fogging systems under corral shades have been used in Arizona, but there is no available documented data to evaluate its effect on animal performance. Dairy farm managers who use these systems say the wet areas under the shades are a major disadvantage. In free stall barns in Missouri, fogging dairy cattle resulted in an increase in milk production.[6]

Dry Cow Cooling

Trials in Florida,[4] Israel,[16] and Saudi Arabia,[15] have demonstrated the need to provide shade and cooling during the dry period. Milk production increased, calf birth weight increased to normal size calf, and reproduction in the subsequent lactation was improved.

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