The Effects of Lighting Manipulation on Dairy Cattle Management

COOPERATIVE EXTENSION SERVICE

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Photoperiod is the duration of daily light exposure. Manipulating photoperiod length can increase milk production in dairy cattle. When manipulating the photoperiod, two common time divisions are used. The first one is a long-day photoperiod, 16 hours of light and 8 hours of dark. The second is short-day photoperiod, 8 hours of light and 16 hours of dark. Many studies have shown having different photoperiods for the different stages of a cow's life cycle improve milk production, reproduction, feed efficiency, and heifer growth.

Lactating Cows

Cows given long day photoperiod increase milk production up to 10% compared to cows that have natural lighting. Results of a study show that within the first 10 days of the lactation, cows that receive 16 hours of lighting a day produce 3.7 pounds more milk a day than cows under a natural lighting scheme. After 20 days in milk, the difference in milk production between the two groups increases to 6.8 pounds per day. This difference in milk production remains constant until 100 days in milk when the groups switched lighting schemes. After the switching of lighting, 16 hour lighting post switch slowed the decrease in milk production of those cows that originally started with natural lighting.

Lighting can also affect dry matter intake of dairy cattle. Cattle exposed to long day photoperiod have higher dry matter intake, anywhere up to 6% higher than those cows exposed to natural photoperiod of 9 to12 hours of light. Even though dry matter intake increased with long day photoperiod, average daily gain was not different from those exposed to a natural photoperiod. The lack of differences in daily gain suggests that long day photoperiod cows are more feed efficient and are capable of converting increased dry matter intake into milk.

Photoperiod can also affect reproductive performance. Dairy herds that provided 24 hours of light to cattle saw negative results. Providing 24 hours of light resulted in longer days between breedings, more days open, and more breedings per cow.

Prepubertal heifers

A goal of the industry has been to get heifers into the milking herd as soon as possible. To achieve this goal, heifers are fed high energy diets so they reach breeding size faster. Previous research has indicated that long day photoperiod can lead to leaner growth, greater mammary development, and lower the age to puberty by an average of one month. One study determined how photoperiod would affect various aspects of dairy heifer growth. Breeding and calving of the heifers in the long day photoperiod occurred earlier than heifers in a short day photoperiod. Even though long day photoperiod heifers had a lower body weight, they did not experience limited skeletal growth. Instead, they had lower body condition scores because they were using the energy that they consumed for skeletal growth. Feed intakes did not differ between the short day photoperiod and long day photoperiod groups and long day photoperiod heifers spent less time at the feed bunk, which would suggest they were more feed efficient.

The long day photoperiod heifers also had higher milk production throughout the first 5 DHI tests.

In one of the first studies looking at differences in the growth between heifers with supplemented lighting (16 hours) and natural lighting, heifers in the supplemented lighting group had a larger heart girth size of about 1.6 inches after the 16-week trial. These heifers also averaged 1.9 pounds of daily gain compared to the 1.7 pounds for the heifers in a natural lighting scheme.

Dry Cows

Dry cows have the opposite effect with a long day photoperiod compared to lactating cows and heifers. Providing dry cows with a short day photoperiod leads to higher milk production the next lactation. One study has shown milk production increased 6.8 pounds per day in the next lactation. Milk fat and protein yields were also higher in the short-day photoperiod cows. A short-day photoperiod also lead to 2.9 lbs more daily dry matter intake during the dry period.

Additional Management

Additional studies investigated other management practices combined with manipulating photoperiod. One of them is using bST while managing photoperiod. Within four weeks of the treatment, production levels increased. Cows that were on long day photoperiod and received bST treatments had higher dry matter intake and met increased energy demands. Cows that receiving bST and were on a short day photoperiod used their body reserves to meet their energy demands.

The number of dairy farm going to three times a day milking has increased. This often leads to exposure to light at all hours of the day. Twenty-four hour photoperiods do not show the positive results seen with a 16-hour photoperiod. In order to manage this, melatonin treatments have been suggested as a supplement for a natural melatonin response that a cow would experience in the dark. However, melatonin treatments did not show a difference in milk production. This leads to the conclusion that only a natural melatonin response would produce the benefits discussed earlier.

Implementing Lighting

Lighting is measured in footcandles. In order to reap the benefits of a long day photoperiod,15 footcandles of light in the housing area is recommended. This measurement should be taken three feet above the stall surface. A light meter should be used to ensure cows are receiving the right amount of light. Darkness is also an important role in lighting manipulation. Cows cannot perceive light under 5 footcandles. Anything above this may disrupt a cow's photoperiod. Darkness does not affect a cow's day to day life, they are still able to find feed and water, but for operations milking 3X, darkness can affect employees. Low intensity red lighting has been known to prove useful for employees to find their way around the barn without disrupting the photoperiod of the cows. Placing low intensity red lights 20 to 30 feet apart and 10 feet off the ground helps employees in the barns and still allows one to benefit from managing the photoperiod of the lactating cows.

Conclusion

Lighting affects many different aspects of a cow's productive life and its effects start at an early age. Farmers have many different protocols to increase milk production including

manipulating the amount of light available throughout the day. One practice that would yield significant results would be to start managing lighting at a young age. Producers should provide long day photoperiod to their heifers to help increase dry matter intake and make them more feed efficient. Providing a long day photoperiod would also allow them to breed heifers at an earlier age. Dry cows benefit the most from a short day photoperiod, 8 hours of light and 16 hours of dark. Dry matter intake increases when dry cows have shorter lighting periods. After calving, switching cows to a long day photoperiod, 16 hours of light and 8 hours of dark, can increase milk production and dry matter intake.