Can long-day lighting work in 3X herds?

■ Implementing long-day lighting can add up to $100 per cow per year, but managing the dark period creates challenges for some producers.

by Gunnar Josefsson

Research and commercial application has shown long-day lighting (LDL) can be profitable, regardless of the scale of production or type of cattle housing. However, many dairy producers on 3-times-a-day (3X) milking schedules have not adopted this practice due to difficulties managing for the recommended 6 or more hours of darkness per day. Recent research on dim lighting and the availability of specialized lighting equipment addresses many of those challenges.

The recommendations for successful LDL are:

■ ***15 or more foot candles*** of light for lactating cows

■ ***16-18 hours*** of light per day

■ ***A daily dark*** period of 6-8 hours

■ ***Managing dry cows*** with natural/short-day ***length.***

Herds milking 3X usually are able to meet all but one of these basic requirements: providing 6 hours of uninterrupted darkness at night.

Red lights, staggered schedules tried

Some dairy producers learned dairy cattle perceive low levels of red light as "dark," using red light as a way to achieve 6 hours of "darkness." However, many dairies abandoned the red lights, feeling they were not suitable for workers' needs when moving cows, feeding or cleaning. A few herds installed higher-intensity red light for better working conditions, but jeopardized the effectiveness of LDL, because cattle perceive higher intensities of red light as "light."

Advisers, myself included, have worked with producers to design LDL programs where the timing for lights in different sections or barns is off-set by 1-2 hours, making better use of naturally dark hours. This is a compromise solution, and does not provide 6 hours of darkness for all groups of cows.

If half or more of the cows experience 5-6 hours of darkness and respond with the expected amount of milk, LDL would still be profitable. However, cows moved between pens or barns with different LDL schedules don't experience a consistent lighting schedule, and their production response has not been studied. Depending on how many cows remain on a consistent LDL schedule, using staggered light schedules might achieve about half the normally expected production increase of 4-5 lbs. of milk per cow per day.

Thus, neither red light nor staggered lighting schedules seems to be viable solutions for 3X herds seeking full LDL benefits.

A new LDL model for 3X herds

Given these challenges, 3X herds need a radically different, but simple approach to LDL.

A new LDL model – specifically for 3X herds – includes:

■ ***A single lighting schedule*** for all lactating cows (all sections of a barn, all barns, holding area, etc.)

■ ***Full light level*** (15 foot candles or more) for 16-18 hours – e.g. 5 a.m.-10 p.m.

■ ***Dim light,*** at 1-1.5 foot candles during the balance of the day (6-8 hours), e.g. 10 p.m.-5 a.m.

This model provides a consistent LDL schedule throughout the lactation period for all cows. Cows can be moved freely between pens and barns as needed – with no change in the LDL schedule for the cow. If and when the herd is expanded, or the parlor schedule changes for other reasons, this can be done with no negative impact on the LDL program, since it is independent of the parlor schedule.

Dim light for cattle and workers

Many producers interested in LDL have raised the question: How dark is "dark" for cows? Until recently, we had very little guidance from scientific studies regarding the level of light cattle can tolerate while still perceiving it as "dark." Studies from the University of Manitoba and University of Alberta, led by

FYI

■ **Gunnar Josefsson is director of research with Orion Agricultural Lighting/Great Lakes Technology. He previously conducted long-day lighting research in the University of Wisconsin-Madison's department of agricultural engineering. Contact him via phone: 920-892-5838, e-mail: gj@gltmfg.com or visit www.barnliter.com.**

■ **For more information on long-day lighting, visit:**

- **http://bse.wisc.edu/hfhp/tipsheets_html/lighting.htm**
- **www.livestocktrail.uiuc.edu/photoperiod**

professor Alma Kennedy, helped fill this information gap. According to these studies, dairy cattle can tolerate at least 1 foot candle of white light and still experience "dark." The research also showed exposure to 5 foot candles at night reduced the normal level of the main nighttime hormone (melatonin) by 50%-70%, a significant interference with the animals' normal night function. Thus, the maximum intensity of night light tolerated by cattle may be in the 2-4 foot candle range. Based on the present findings, we may design night light in dairy barns with an intensity of about 1-1.5 foot candles.

How useful is a level of 1-1.5 foot candles for night time work in a barn? Three things need to be considered:

1 ***the quality of the light.*** Human vision works best with white light. Any colored light (red or orange) reduces the effectiveness of the eye.

2 ***even distribution of the light.*** An average of 1-1.5 foot candles can be obtained using a single, powerful light source, or by using many lower-powered, well-distributed light sources. Large contrasts between bright and dark areas reduce visibility.

3 ***barn work and the human eye.*** Working in the barn typically means moving about relatively quickly. With unevenly distributed lighting, there is not enough time for the worker's eyes to adjust to the constantly changing light levels. If the light levels are uniform, little adaptation is needed and the available light can be effectively used, even when moving about.

For optimum working conditions, it is essential that dim lighting at night be generated from many low-powered white light sources, evenly distributed throughout the barn. Dim light at 1-1.5 foot candles allows surprisingly precise observation. Literature reports that a person with normal eyesight can read newsprint with 1 foot candle of light. More specifically, producers report that ear tags can be read and cows identified at a distance when using this level of dim light. Some producers refer to this as "moon light."

Generating suitable dim lighting

The challenge is to create evenly distributed dim white light, throughout the barn, at levels very close to the target average of 1-1.5 foot candles. Areas with substantially higher or lower light levels should be minimal. In principle, this dim light can be created with separate fixtures, or as a built-in function of dual-level fixtures. New technology – using a dual-level fluorescent fixture – is commercially available.

The initial investment for a LDL system is typically paid back in about 1 year (0.5-1.5 years), based on a net profit of about $100 per cow per year. Using the new model When managed properly, 3X herds can capture the full economic benefits of LDL. ▮