Dairy Lighting Requirements

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Proper lighting is an environmental factor that is often overlooked or is given little attention during planning, construction, or maintenance of dairy facilities. Worker efficiency, safety, and comfort can be improved with proper lighting in a dairy unit. Also, research has also shown that supplementing lactating cows with 16 to 18 hours of light per day increases milk production by 5 to 16% as compared to cows exposed to 13.5 hours or less of light per day (Peters, 1994).

Currently, a demonstration project is underway in three separate dairy barns in the Minnesota counties of Otter Tail and Morrison. New lighting systems were designed and installed this past winter and energy use and milk production data are being collected this spring and summer. A series of barn meetings were held to review the installation and another series will be held late fall or winter to report on results.

Table 1 lists the illumination levels recommended for various areas in a dairy unit. The unit of illumination is the foot-candle, which is defined as one lumen falling on each square foot of work area. A lumen is a measure of the rate of flow of light from a source such as a lamp or the sun. These illumination levels can be satisfied with various types of lamps, including incandescent, halogen, fluorescent, mercury vapor, metal halide, and high-pressure sodium. In selecting the lamp type, the most important characteristics are light quality and energy efficiency. The quality of the lighting installation is influenced by the color of the light, light uniformity, glare, and reflectance of the surfaces in the room.

Table 1. Recommended illumination levels for the milking center and feeding areas.

Work Area	Ilumination Level (foot-candle)
Parlor Room	
General Lighting	20
Operator's Pit	50
Milk Room	
General Lighting	20
Washing Area	100
Bulk Tank Interior	100
Loading Platform	20
Utility or Equipment Room	20
Holding Area	10
Treatment and Maternity Areas	
General Lighting	10
Treatment or Surgery	100

Office	50
Feeding area--Tie-stall barns	10
Feeding area--Free-stall barn	20

Factors affecting efficiency include amount of light per watt and lamp life. Fluorescent, metal halide, and high-pressure sodium lighting systems are significantly more expensive than incandescent. However, the energy cost savings combined with longer lamp life offset the higher initial costs for energy efficient lighting systems. The energy efficient alternative will typically pay for itself in two years or less in dairy applications (Chastain, 1992).

Other characteristics to consider when selecting a lamp type are starting temperature and warm-up. Incandescent and high-pressure sodium lamps perform well at cold temperatures (-20F or colder). The minimum starting temperature for most fluorescent lamps is 50F. Ballasts are available that allow fluorescent lamps to start at -20F, but costs are significantly higher than for standard ballasts.

Incandescent and halogen lamps do not have a warm-up period. Standard fluorescent lamps have a slight starting delay, but by using a quick-starting ballast, the time can be reduced. All high intensity discharge lamps have a warm-up period which can range from 1 to 15 minutes. Quick starting high-pressure sodium lamps can be purchased, but at about twice the cost of ordinary lamps.

Fluorescent lamps are most often used in milking centers, except in the holding area where low-bay, high-pressure sodium fixtures are used. In tie-stall barns, fluorescent lamps are generally used over feeding areas. For free-stall barns with high ceilings, high-intensity discharge lamps (such as a high-pressure sodium fixture) have been the most economical.

A new Agricultural Engineering Update will be available from the University of Minnesota Biosystems and Agricultural Engineering Department at the end of July, 1996 which will include design tables for selecting lamp type, lamp size, mounting height, and fixture spacing. To receive a copy, contact Dick Nicolai by e-mail (nicol009@gold.tc.umn.edu) or Robert Schug by phone (612) 625-9733.

References:

Chastain, J.P. 1992. Lighting Requirements for the Milking Center. In: *Milking Center Design*, NRAES-66, Proceedings from the National Milking Center Design Conference, Harrisburg, PA. Nov. 17-19, pp 214-229, Northeast Regional Agricultural Engineering Service, Ithaca, NY 14853-5701.

Peters, R.R. 1994. Photoperiod and Management of Dairy Cows: A Practical Review, In: *Dairy Systems for the 21st Century*, Proceedings of Third International Dairy Housing Conference, pp 662-666.