Lighting Design for Livestock Buildings

John P. Chastain, Larry D. Jacobson, and Jerry Martins

SUMMARY

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Modern livestock facilities need to provide a high quality working environment to optimize worker efficiency, safety, and comfort. Proper lighting is an environmental factor that is often overlooked, or given little attention during the planning, construction, and maintenance of livestock facilities. However, it is just as important to the efficient operation of a livestock operation as ventilation, heating, or cooling.

Provision of the correct amount and quality of light has been documented to improve worker productivity in office and manufacturing businesses (Beck, 1995). Increases in worker productivity of 8 to 13.2% have been observed for mail sorting and drafting tasks after a new lighting system was installed. In the manufacturing industry, improved lighting has accounted for significant reductions in product defects. A manufacturer of airplanes reported a 20% improvement in the defect rate after retrofitting the lighting in production areas. Many of the tasks in livestock production are visually similar to mail sorting and manufacturing. As a result, provision of the right amount of light for the task would be expected to improve the productivity of livestock workers as well.

The objectives of this paper are to: (1) provide a summary of the lighting needs of livestock facilities; (2) present an empirically based indoor lighting design method; (3) describe the application of the lighting design method for the retrofit of four dairy facilities; and (4) compare the lighting system performance with design expectations.

Conclusions

A simple indoor lighting design method was presented and was evaluated by field measurements on retrofit fluorescent lighting systems in four dairy facilities. The following conclusions were developed based on the data analysis and observations made by the authors.

(1) Theoretically, the measured illumination values should be 19% greater than the design predictions. On the average, the measured illumination values were 17.5% higher than predicted by the design method. The data indicate that the lighting design method performed well over a wide range of illumination values (108 to 538 lux).

(2) The lighting systems for the milking areas were designed to provide a *CV* of 25% or less by limiting the value of *s/Hp* to less than 1. The measured values of *CV* in the three milking areas were 6%, 23%, and 26%. Therefore, the uniformity criterion was met in two out of three milking areas.

(3) The measure of uniformity used was the coefficient of variation (*CV*) about the mean illumination level. The coefficient of variation was found to correlate well with respect to the ratio of the average fixture spacing and mounting height above the work plane (*s/Hp*).

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Publications

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