

Use and Role of Environmental Controls in
Improved Productivity

The Case of:

Long-Day Lighting (LDL) in Dairy Barns

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LDL – An Emerging Technology

- Potential to improve production efficiency
- Impact on usage of electrical energy
- Reduce energy consumption: Photocell & knowledge of cow's physiology
- Reduce energy consumption: Most energy-efficient technology

Long Day Lighting (LDL) or Photoperiod Management

Scientifically proven and tested in practice:

- Numerous studies with dairy cattle from 1980 until now in North America and Europe
- Increased milk production ~ 5 lbs./cow/day
- UW-Madison trial 2001: over-all increase of 9 lbs./cow/day after 8 weeks of LDL

Simple rules for Successful LDL

- 16-18 hr light = 6-8 hr dark/day
- Light intensity of 15 FC+ in all areas where cows spend time
- Consistent timing
- Dry cows away from barn with LDL

Cost-Effectiveness of LDL

Example 450 cow herd w/ freestall barn, LDL, milk increase 4.0 lbs./cow/day:

- Investment/cow = \$86 - \$115/cow (depending on installation cost)
- Investment paid back in 0.7-1.0 yrs (depending on installation cost)
- Net profit per cow = \$119/cow/year (after investment paid off)

Cost-Effectiveness of LDL

Example 450 cow herd w/ freestall barn, LDL, milk increase 4.0 lbs./cow/day:

- Total net profit accumulated (10 yr useful life) = \$486,000-\$498,000 [*purchased w/ cash*]
- Total net profit accumulated (10 yr useful life) = \$463,000-\$481,000 [*5 yr lease-to-own*]

Compare: Cost of a new freestall barn @ \$1,000 per cow = \$450,000

LDL alone can pay for a new barn in 10 years!!

A Nicer Place to Work

- Dairy farming vies for the position as the top industry when it comes to poor work lighting.
- LDL @ 15 FC provides a vast improvement over the light levels available in the average dairy barn

Competitive Advantage

- A moderate sized dairy farm with 150 cows can add \$15,000/year of net profits. VERY valuable before, during and after herd expansion.
- A herd of 500 cows can earn \$50,000/year of net profits. Larger and expanding dairies look for short payback and minimal drain on cash flow.

Competitive Advantage

The competitive advantage of LDL may make a difference in the local rural economy:

- Smaller dairy farms may stay in business longer, before going out of dairying or out of business
- Moderate and large farms can better and sooner afford to grow their herds

End result: more milk produced, more work opportunities on and off dairy farms

Competitive Advantage

At the state level:

- The number of smaller dairy farms going out business may be reduced
- Moderate and large farms may modernize and expand their herds at faster pace

LDL ECONOMICS

Potential economic contributions from widespread use of LDL in herds >50 cows:

- County level (e.g. Manitowoc, WI): About \$3 million added net profits/yr for farmers and an additional 35 million lbs. milk/yr
- State level (WI): About \$95 million added net profits/yr for farmers and an additional one billion lbs. milk/yr

LDL & Feed Efficiency

LDL can make milk “on the margin”.

Example: 500 cows, 450 lactating, 4 lbs. milk increase. No increase in “overhead costs”.

- Production increase 657,000 lbs./year.
- Increased TMR feed use: 325,872 lbs DM
- w/o LDL: 33 more cows & 856,728 lbs DM

LDL & Feed Efficiency

Example: 500 cows, 450 lactating, 4 lbs. milk increase. No increase in “overhead costs”.

- **Feed efficiency with/LDL:**
0.50 lb. DM/lb. milk
- **Feed efficiency w/o LDL:**
1.30 lb. DM/lb. milk

Save Energy with LDL?

The amount of electrical energy consumed will, on most farms, increase when adopting LDL because **Dairy Barns are Dungeons!!!**

Two ways of saving energy while using LDL:

1. Use a photocell to reduce # of on-hours/day
2. Use the most energy-efficient lighting hardware

Photocell & Skeleton Photoperiod

Use a photocell to reduce # of on-hours/day

- Physiology: cows register day-length by light intensity 12-16 hrs after dawn. Low sensitivity to mid-am to mid-pm.
- Timer set e.g. 5:00am-10:00pm (17 hr)
- Photocell overrides timer from around 8:30am-3:30pm = saves 7 hr run time/day

FLUORESCENT FIXTURES

Freestall barn 450 cows, parlor & holding area.

- About 60 std 400W metal halide fixtures
@465W = 27.9kW
- About 72 Orion LDL4606 fixtures
@221W = 15.9kW
- Energy consumption reduced about 43%

Energy consumption: Fixtures in freestall/parlor systems

- “Dungeon”: 6 FC (12 hr) MH - 40%
- 15 FC, no LDL (12 hr?) MH - 100%
- 15 FC LDL – 17 hr MH - 142%
- 15 FC LDL & ph.cell MH - 83%
- 15 FC LDL & ph.cell FL - 47%

SPREADING OF A NEW TECHNOLOGY

LDL can spread wide and fast:

- Profitable at small and large scale
- Short payback, modest investment
- Suitable in conventional & freestall barns
- Simple to manage, low maintenance
- New research: possible for every farm to practice LDL regardless of herd management and frequency of milking

Recommendations

- Promote energy-efficient technology and smart management such as photocell & skeleton photoperiod!
- Remind farmers to follow the basic rules in order to achieve the expected productivity gains.
- Providing the required dark period saves energy and makes sure the milk and profits keep coming.