



Supplemental Light for Dairy Cows

Introduction

Artificially increasing daylength together with increasing light levels have shown significant effects on various mammals. The Farm Energy Centre carried out trials on dairy cattle several years ago in conjunction with Bangor University. The trial showed a 6% increase in milk yield in cows subjected to higher and longer light periods in the winter months.

The technique was not generally taken up commercially as the light levels were high and the type of lighting used was expensive to install and run. However this was one of many trials carried out worldwide that looked at the response to light for increasing milk yield.

Work in America has shown similar results to those that we experienced but with lower lighting levels and more efficient light sources, making the technique look commercially viable. A review of this and other international work has shown that the technique of increased lighting at certain light levels can increase milk yield typically by around 8%, although responses of between 5 and 16% have been found.

American Research

Professor Tucker from Michigan State University published a paper called "Light up Your Cows" which pulled together several pieces of his own work and that of other researchers. A summary of this paper follows and the response/financial implications have been calculated using UK costs.

Conclusions from Professor Tucker's Paper

- Cows should be continuously exposed to 16 to 18 hours of light each day to achieve the benefits of a long day photoperiod. The duration of light is important, as the effects are not triggered until 14 to 16 hours of light have elapsed.

- There is no abrupt increase in milk yield, the response occurs gradually over several weeks.
- Changes in milk fat percentage have not been consistent. Several experiments showed no change whilst others showed a decrease of 0.16% and another an increase of 0.3%.
- Duration of daily light did not have an effect on protein or lactose percentages in milk.
- Long lit days not only produce an increase in milk but also an increase in feed intake. Cows on a lighting regime should be fed at a sufficient level to assure maximum milk production with minimal loss of body condition.
- No alteration of the oestrus cycle was detected and the physical activity of the cows remained the same.
- Long days were shown to prompt cattle to lose their winter coats early over a period of 2/3 months and grow a summer coat. Housed cattle in Michigan showed no detrimental effects because of this.
- Light levels of between 150 to 200 lux are currently recommended by Dr. Dahl of Maryland University to US producers (he has an active programme of work on lighting). The minimum light intensity to stimulate a response has not been determined, however intensities between 100 and 400 lux have been shown to work.
- The optimum lighting layout has not been established however dark corners need not be a concern as cows spend little time there.

Operating/Capital Costs

The most cost-effective light source for this work would be to use high pressure sodium lamps. Fluorescent, metal halide and mercury vapour will all work but capital and running costs would tend to



be greater with these fittings.

Care has to be taken in the selection of the rating and number of fittings, as this will substantially effect the capital cost. To achieve the same average light level, many small fittings can be used or a few larger fittings. Using a lot of small fittings will achieve a very even light distribution but the capital and installation costs would be high. The skill is to achieve what is a reasonable light distribution with the fewest number of fittings therefore keeping the capital cost to a minimum. (Lighting designs are available from the Farm Energy Centre - see details at the end of this document).

The operating costs of an installation are:

- running costs for the lights;
- additional feed intake;
- decrease in milk fat (taking the worst scenario).

Cost/Benefits

In Professor Tucker's paper he gave a typical example of what the operating/capital costs would be. These have been translated to UK costs to give an indication of the expected returns.

Table 1 - Income and Operating Costs Associated with 18 hours of Supplemental Light in Dairy Herds/Cow/Day

Factor	Income (pence)	Expenditure (pence)
8% increase in milk production ¹	30.24	
0.16% decrease in milk fat ² (worst case scenario)		4.98
6% increase in feed intake ³		6.96
Electricity consumption/cow ⁴		3.0
Total	30.24	14.94
Margin/cow/day	15.3	

It is recognised that contracts and cost of feed vary. The above table has been compiled making the following assumptions:

¹ Based on a daily production of 18 litres - 8% - 1.44 litres @ 21p/litre.

² Based on a butterfat price of 1.6p/1%. Therefore for 0.16% x 1.6p = 0.256p x 19.44 litres = 4.98p.

³ Based on a winter ration of £1.16/cow/day.

⁴ Based on an actual scheme for lighting 240 cows to 200 lux using high pressure sodium lights.

Example

Taking a 100 cow herd housed for 180 days then 100 x 15.3p (Table 1) gives £15.30/day. For 180 days this amounts to £2,754. The installation and capital cost of a suitable lighting installation for a 100 cow herd would be around £2,947.

Summary

The trial work has shown that increasing the daylength of lactating cows to 16/18 hours can increase milk yield from 5 to 16%. The affect on milk fat was not consistent in the trials, varying from a decrease of 0.16% to an increase of 0.3%. Feed intake will be increased. From the above example the payback on capital will be about 12 months.

Operating Regime

With regard to the best 18 hours to light, Professor Tucker suggests that the lighting period be centred on the natural daylight cycle, overlapping natural and artificial light as much as possible. This will mean that the cows will receive at least six hours of darkness each day. You should therefore arrange the lighting to take account of the parts of the day when you require access to the cows whilst making maximum use of the Economy 7 night rate.

For instance, starting the lighting at 12.30am would mean it finished at 6.30pm, whilst optimising the Economy 7 period. You must consider if this is sufficiently late enough in the afternoon to have finished milking/feeding, etc.