Creep Heating General Notes

Summary

1 Effective creep heating control leads to lower piglet mortality as well as lower electricity costs.

2 This document considers some of the general issues concerning creep heating methods and controls, and indicates viability of investments in improved controls.

3 Analysis indicates that is worth spending up to £0.46 ($0.67) per watt of creep heating capacity for energy savings alone, before any consideration is given to improved pig performance.

4 On a typical UK 500 sow site using 250w lamps, this means up to £10,000 (£20 per sow, or £115 per farrowing place). On a typical Midwest US 1250 sow site using 125w lamps, it means up to $17,500 ($14 per sow, or $83 per farrowing place).

5 Effective creep heating control typically improves pre-weaning losses by 2% to 7%.

Notes

1 Creep heating is needed because the temperatures needed by piglets are much higher than those needed for sows. There is no overlap in their temperature requirements.

2 Creep heating is a significant cost - typically ranging from 25p to 100p (38c to $1.50) per pig produced. However, nothing is so expensive as using the wrong amount. Too little and the piglets are cold, lose condition, result in unviable weaners or die through overlying or hypothermia. Too much and piglets are driven away from the creep and overlying losses increase. Therefore, strategies should always be based on maximising the production of the highest number of strong viable weaners, **not** simply on saving energy.

3 Many producers suffer greater overlying losses in summer than winter because of using too much creep heating.. Not only is energy being wasted, it is killing the pigs as well. So there is a great potential for energy saving in creep heating.

4 The most efficient way to use energy is to target it exactly where needed. The most effective way to do this is to enclose the creeps, such that the energy produced by the piglets helps to keep them warm.

5 The suggestion that "open" creeps - permitting as they do an easier and quicker view of the litter - provide a better standard of care is fundamentally flawed. In practice, litters are viewed for at most a few seconds a day, and there can be no decent argument for keeping piglets in sub-optimal conditions for 86,390 seconds a day to provide for convenience and reduced labour input for those few seconds when they are actually being looked at (as opposed to being available for being potentially looked at).

6 Creep lamps target energy use only in the sense that they direct part of their energy (the radiant part) in a particular direction (i.e. downwards onto the piglets). However, the bulk of their energy emission remains as convective energy from the lamp and shade, and they do nothing to increase the air temperature around the pigs. Pigs in open creeps with suspended lamps are always exposed directly to the air temperature at floor level in the farrowing room. They only heat the air around the piglets in so far as they heat the room in general.

7 Heat pads or heated floors are another way of targeting the additional heat energy. Since heat energy is passed almost directly (by conduction) from the heating element to the piglets, they transfer energy much more effectively than radiation. However, it should be recognised that indiscriminate use of heat pad energy is often little better than that with lamps. Whilst heat pads generally have a lower energy rating than the lamps that would have been used, this can often amount to the same model of waste as lamps, but simply at a lower level.

8 Piglets do not have a single level of requirement for supplementary heating. It changes significantly from birth to weaning, but it also depends on a wide range of factors such as milk delivered by the sow, ambient air temperature, air speed, lying conditions, and many others.

9 In situations of this type - consider if you will other types of varying power requirement such as domestic heating, or power output from a motor car's engine - the sensible strategy used is to provide more power or capacity than needed, and then to restrict it to as much as necessary at the time to produce the desired result. For example, you would not want to drive a car that had simply the average power output needed. (That is, you don't have a 35 hp engine, you have a 120 hp engine, and then vary it as necessary.)

10 Any creep heating strategy based upon a single level of heating - one size fits all - is inherently wrong.

11 Piglets will attempt to accommodate whatever conditions you throw at them, in order to survive. Strong healthy new born piglets are liable to survive, whatever you do. But the greater the effort needed, the more that weaker pigs will become marginalised, and the more losses you will get. This is why better or worse conditions reveal as marginal changes in mortality, marginal increases in weaning weight ranges. There is rarely a simple yes (all OK) or no (all dead) situation to analyse.

12 It is not possible to provide exactly the conditions required by every pig all the time. However, it is possible to improve the conditions for most of the pigs, to tighten up the envelope of circumstances, to produce a better match of needs with conditions provided.

13 Creep heating is such an expensive process, and can have such an overwhelming effect on mortality and the economics of weaner production, that it is worthwhile maximising the probability of a good result. For example, going to all the trouble of buying the best breeding stock, feeding the sows all through gestation and then losing an extra pig per litter because of lack of care in creep heating, means all the effort and expense has been wasted. And that's aside from issues such as animal welfare.

14 The biggest single, most overriding, factor in providing creep heating in such a way as to maximise piglet survival and viable is the stockperson running the show. Just as you cannot produce a car that cannot crash, that is immune to driving in such a way as to produce a poor result, that wins the race on its own, you cannot produce a creep heating method, or creep heating controls that - of itself - produces the ideal conditions.

15 But having said that, "you have to give a man the right tools for the job". Grand Prix races are often won by the driver who has neither the fastest nor the quickest car. But there are limits. To assume that the average worker can produce great results with poor quality, inadequate equipment, flies in the face of logic. On the other had, put great equipment in the hands of an inadequate or poorly trained worker, and all the effort has been lost also.

16 Whatever type of creep heating you have, you must have decent controls. Many farmers worry too much about the cost of creep control. A lot of this is because lamps are cheap. People are understandably reluctant to spend, say, £50 on controlling something that costs £25, even though it uses £100 worth of electricity a year, and lack of control can cost an extra £100 a year (in pig losses) on top of that.
So, many farmers (and perhaps accountants even more so) are penny pinching, because - as far as they understand it - controls are controls are controls. They don't go from supplier to supplier asking for "something which has these attributes", they ask for "something with this load capacity" and assume they will do the same job. Which they don't. Better controls cost more.

17 For example, a thermostat (with a high enough rating) might seem the same as a precision curve based dimming control with ramping action (like Dicam). At one level it is - it can control the lamps, based on temperature, so it will save running cost. But a thermostat - by stressing the filaments by switching them on and off a lot - reduces lamp life to a fraction of that achieved by ramped dimming. Sure, the thermostat has saved a lot of money at the outset, and it's so easy any electrician can wire it up, and any user can understand a simple number on a dial, but all the saving is used up in the first few weeks of operation. Besides which, piglets don't have a single level of requirement (on and off), it's a varying level. No user can get good results with just a thermostat.

18 Fact is, the cost of the controls doesn't matter as much as people think. If we think purely in electricity cost terms, then a conservative estimate is a 35% reduction in use - though much more is often achieved (see example below).

19 If we assess an investment by normal rules, at normal agricultural interest rates, then the affordable (break even) price - benchmark - is £0.46 (66c) per watt of installed capacity. (Over 5 years @ 7.5% interest, capital and interest repayment.)

20 For a typical small UK farrowing room with 8 lamps @ 250w, this means a justifiable cost up to £920 per room. For a typical US 24 place room of 125w lamps, this amounts to $2,000 per room.

21 In a recent well publicised example in the UK (see Pig Farming Feb 2000), the producer was proud to announce a payback in under 1 year. Their total spend amounted only to £32 per farrowing place ($46) - only 28% of the benchmark figure. This included and electrical installation but also many new heaters. (Controllers as such were the smallest part of the total.) A return on investment of over 100% within a year is large by any standards.

22 In this case history, it's worth mentioning that the producer concerned had spent many years being undecided on fitting new controls (having some other make of control already, which had never worked well, so the heating was effectively manual on-off). Such indecision cost, conservatively, £50,000 ($70,000).

23 The producer now also has (quote) "stronger litters at weaning and fewer small pigs" which was, after all, the object of creep heating in the first place. It's easy to see a better result in this respect as a bonus - after the electricity saving - where it should be primary aim.

24 It's worth mentioning that the staff on the farm has not changed - same manager, same stockmen. What has changed is their ability to control. They now have the right tools.

They had *regulation* previously but had no effective *control* over the situation. It's easy to confuse regulation and control. Regulation means the ability to vary the output. A tap varies water throughput, but it doesn't control the level of water in the bucket. A manual dimmer *regulates* the heating level, but doesn't *control* the temperature.

25 To control a situation requires feedback. That is, you must measure the result - or a representation of the result - compare this with a target, and adjust the output accordingly so as to achieve the target. To give a simple example - if you want to achieve a particular speed in your motor car, you have to measure the speed, compare it with the speed you want, then increase or decrease the throttle (and thereby how much power the engine delivers) accordingly.

You can't control the speed unless you can measure the speed. The throttle must have an effect on the speed, and the vehicle must be able to achieve the speed you're asking for. Seems obvious. But if, say, the engine is already at maximum power, it makes no difference.

26 Open creeps present a particular problem because it's not really possible to directly measure the result. As mentioned previously, creep lamps have little effect on the air at ground around creep zone, so measuring the air temperature in the vicinity of the creep is of no great help. If the sensor is exposed to some of the radiation from the lamp, it can measure to some degree what the pigs experience, but it's not a direct measurement. Generally, open creep lamp controls are compensating for changes in air temperature, rather than controlling the air temperature.

27 Enclosed creeps (if they have effective restriction of air interchange with the surrounding room) means that air temperature around the pigs can be measured reasonably well. Since the level of creep heat controls temperature inside the creep enclosure, and since temperature affects heat loss from the pig, enclosed creeps can produce more predictable and controllable results. Enclosed creeps therefore provide a more predictable way of controlling the thermal balance of the piglets.

28 With heat pads, the mechanism is the amount of heat provided to the piglets by conduction through their skin. As with open creep lamps, there is little point in measuring air temperature around the creep, since this is the same as room air temperature elsewhere at floor temperature.

Since the pig skin temperature is - almost - fixed at around 36ºC (a little below core body temperature), heat pads must be warmer than this if heat is to flow from the pad

to the pig (and not vice versa).
If the pad is any colder than 36ºC, heat will flow the other way (from pig to pad) until the heat pad is warmed up.
So there is no point in setting a pad temperature lower than 36ºC - if you do, and assuming you are measuring pad temperature - the control system will just shut off power to the pad (because it has reached target temperature).
Conversely, pigs will not lie on a pad if it is to hot - at anything above about 42ºC (107ºF), pigs will not lie on the pad for any length of time if at all. If the pig doesn't lie on the pad, it gets no heat from it.
The hotter the pad is, the greater the heat flow from pad to pig. So although you are not regulating the air temperature around the pig, you are varying the amount of heat it has available to cope with the air temperature.
But only between about 36ºC and 42ºC.

29 Outside this range, you are not supplying heat to the pig. Either because the pig itself is supplying the heat (to the pad), or it won't lie on it (so derives no benefit). The margin is really quite narrow. Heat loss (by the pad) is partly through the floor, but mostly to either free air (if no pigs are present) or conduction to the pigs. Rate of heat loss differs markedly depending on whether pigs are lying on it, so the same heating level would produce very different heat pad temperatures depending whether pigs are lying on it or not.

30 Since pads are typically specified with a particular heat capacity, not for a particular area or surface temperature which can mean a large range of temperatures. For example, a small pad with a high heat capacity may produce very high surface temperatures, and this will vary depending on whether pigs are present or not. Pigs may get off the pad, which gets hotter, and they are reluctant to return. It is therefore essential to control the temperature of heat pads accurately, and on the basis of pad temperature, not air temperature.

31 Piglet supplementary heat requirement varies markedly over the few short weeks from birth to weaning. Many farms (with non-Dicam controls) rely on the "skill and judgement of the operator" to decide on the temperature and minimum settings. This almost always produces inconsistent results and higher heating bills. Far more consistent results are achieved by using a plan (which can be adapted and adjusted as necessary) rather than this erratic process. This means that creep heat controls should have a "curve" (impossible, clearly, with basic controls such as manual regulators or thermostats.

32 Manual regulators - dimmers, transformers or 50% switches - can reduce power consumption for part of the time, which saves money, but cannot respond to changes over a 24 hour period. Since farms in which workers watch around the clock are somewhat rare, they are unlikely to produce effective results. Like a stopped clock, they can be right twice a day, but that is all.

33 Circumstances vary markedly, even within apparently similar installations. For example, with two seemingly identical systems, an installer may have put the sensors in a different place, or the farm uses a different make of lamps (though of equivalent rating). Although control systems can respond such as they are able, they have only part of the information. For example, an air temperature sensor can only read air temperature. If the sensor has been put just above the pig lying area, it will measure the air rising off the pig (or general air temperature when a pig is lying underneath it). It cannot know which is which.

34 It is therefore most important to examine the operation of the system - and the response of the pigs to it - most carefully. Although it is useful to gain experience from other users and other sites, it is wrong to assume that just copying what they do (or what they say they do, or what you think they do) will give the best results. Not least because they may have got it wrong themselves.

35 Having a look at the response of the pigs is vital - whether they are lying comfortably, or are huddled up by the heater - but is limited on its own, and a means of effective feedback of system operation is very important. This is very easy with Dicam - not only does it show temperatures, max and minimum temperatures with digital accuracy, it provides an easy way to check operation, and therefore a way of relating settings and operation to the response of the pigs themselves.
Even more so when used with Barn Report. Barn Report makes it possible to assess

performance and conditions to a much greater degree. By looking at results with a wide and objective view (as opposed to subjective impressions gained from looking at the pigs for a few minutes now and then), it helps with improving performance of the pigs and looking for ways to improve the outcome in both stock management and electrical cost terms.

36 Energy savings by new or improved heating controls are well established, and proven time after time - although only where farms take the effort to use them well. As to the other side of the equation - reduce piglet losses and more even litters - specific information is, sadly, remarkably thin on the ground. This is partly because piglet viability is more difficult to measure directly - it's easy to check the electricity bills, read a meter on the wall, or even to read it off Barn Report summaries, more difficult to convert "piglet health" into an objective measurement. Partly, because piglet health is, naturally, a combination of factors, indicators and causes; only some of which are related to creep conditions. Measuring improvements in the animals would mean careful record keeping and assessment, which few are willing to undertake on a consistent basis. And more to the point, the electricity bill is a simple hard fact to hang your hat on, that you have to pay for, while a "pig viability" measurement would be subject to question, and you don't get a bill if its lacking.

37 Far easier, then to put the emphasis on electricity bills, and leave the pigs themselves with a "doing Ok" or "lying better" without putting a specific value on it. The (few) assessments that have been done suggest pre-weaning mortality reductions of 2% to 7%, but do not distinguish between types of controls or strategies.

Despite the perils and pitfalls, creep controls can and do save considerable sums of money for many producers, and produce better and stronger weaned pigs in the right hands.
In a US case history (recently published), the overall annual saving was about 1/3rd as compared to a "similar" farm. The similar farm was in fact fitted with exactly the same equipment, but used in a different way, with less or no effort made to achieve savings, or perhaps to optimise the environment.
This latter point - the effort made - is a crucial factor. To repeat an earlier point - without the controls, without the right tools - farms cannot achieve the savings or improvements, but the equipment is just a tool which needs the right skill and judgement.

Nick Bird
2001-06-04