AUSTRALIAN Pork

# PREPARING FOR THE SUMMER MONTHS

## SEASONAL INFERTILITY AND BEYOND

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Pork CRC

An Australian Government Initiative

CRC AUSTRALIA

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# SPECIAL MENTION IS GIVEN TO THE FOLLOWING PEOPLE AND INSTITUTIONS FOR THEIR VALUABLE CONTRIBUTIONS.

NSW DPI (formally known as NSW Agriculture) for allowing the use of its Australian Pig Housing Series publications to be included in this manual

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## THE SUMMER CAN BE ONE OF THE MOST CHALLENGING TIMES OF THE YEAR FOR CARE OF PIGS AS THE COMBINATION OF HEAT AND INCREASED DAY-LENGTH CREATE ENVIRONMENTAL CONDITIONS THAT CAN BE DIFFICULT TO COPE WITH AND MANAGE.

Over time, the Australian pig industry has spent considerable resources in addressing the issues that affect pig production during the summer. The aim of this document is to collate the information from many projects commissioned by the former Pig Research and Development Corporation, Australian Pork Limited and the Pork Cooperative Research Centre for High Integrity Australian Pork, that will assist producers to prepare for the summer and minimise the impacts of season on production.

## PIGS CHANGE THEIR BEHAVIOUR WHEN THEY FEEL HOT OR COLD. HOW COMFORTABLE THEY FEEL IS GOVERNED BY COMPLEX INTERACTIONS BETWEEN AIR TEMPERATURE, SKIN WETNESS, AIR MOVEMENT, HUMIDITY, FLOOR TYPE, BREED AND THE AMOUNT AND COMPOSITION OF DIETS.

If pigs are cold, they regulate their body temperature by shivering, altering blood supply to the skin, changing posture or huddling. Alternatively, if they are hot, they reduce contact with other pigs, increase the evaporative heat loss from the lungs and the skin, and reduce food intake. Figure 1 summarises the effects of increasing temperature on the pig.

### THERMAL COMFORT ZONE

The Thermal Comfort Zone is the temperature range in which the pig feels most comfortable. The lower temperature limit of this zone is called the *Lower Critical Temperature (LCT)* and the upper limit is called the *Evaporative Critical Temperature (ECT)*. These temperatures vary according to the environmental interactions mentioned.

If air temperature falls towards the LCT, pigs feel cold and they will huddle and change posture to conserve heat. More of the food eaten is used to generate body heat, leaving less energy available for growth and production. There will be less body fat deposited and pigs will be leaner.

As air temperature rises above the LCT, but within the Thermal Comfort Zone, pigs can maintain their body temperature by a number of methods. If the floor is cooler than the air, they can change their position so that more of their skin is in contact with the floor. They can reduce contact with other pigs. They can wallow, splash, increase water consumption (especially cold water) and increase blood flow to the skin.

In high temperatures, pigs are rarely dry. They deliberately wet themselves to cool the skin through evaporation with drinking water, saliva, dung and urine.

As air temperature rises to the upper limit of the Thermal Comfort Zone, a temperature is reached where the pig starts to pant to increase the evaporative heat loss from its lungs. This occurs at the ECT. A good measure of this point is the pig panting at around 50 to 60 breaths per minute.

Pigs can lose more heat by increasing their respiration rate or panting. The pig is able to raise from the normal 20 to 30 breaths per minute, to over 200. However, heat loss from its respiratory tract is inefficient compared to other animals such as the dog. As air temperature rises above the ECT, the pig pants faster, its body temperature increases and it reduces feed intake resulting in lower growth rates.

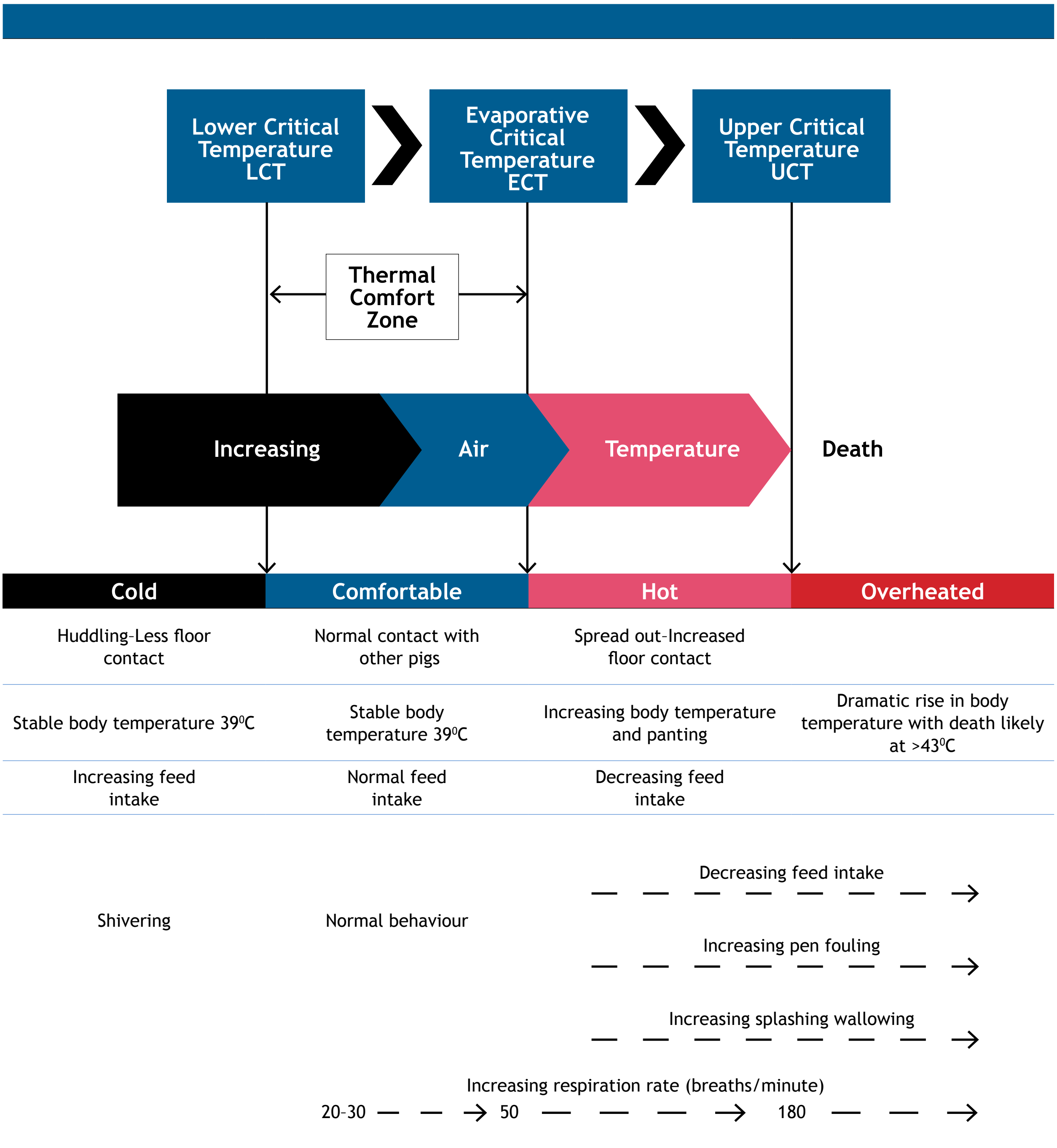
If air temperature rises further, a temperature is reached where the pig's evaporative heat loss from lungs and skin is greatest. It has no further mechanisms left to control its rising body temperature. This point is called the *Upper Critical Temperature (UCT)*.

Air temperatures above the UCT cause a dramatic rise in body temperature, which may be followed by death in extreme cases.

In high temperatures, pigs are rarely dry. They deliberately wet themselves to cool the skin through evaporation with drinking water, saliva, dung and urine

1 From "Plan It Build It" 1994

FIGURE 1: The effects of increasing temperature on the pig



## AIR TEMPERATURE GUIDELINES

**TABLE 1:** Examples of critical air temperatures[2]

| Pig type | Age (wks) | Weight (kg) | Floor type | Air speed | Energy Intake-MJ/d | Skin wetness[3] (%) | Temperature(0C) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | LCT | ECT | UCT |
| Piglets | 1 | 2 | Mesh | Still | Ad lib | 15 | 26 | 35 | 41 |
| | 4 | 5 | | | | | 24 | 33 | 39 |
| Weaners | 5 | 7 | Mesh | Still | Ad lib | 15 | 26 | 35 | 41 |
| | 6 | 10 | | | | | 24 | 33 | 39 |
| | 8 | 16 | | | | | 22 | 30 | 37 |
| | 5 | 7 | Concrete | Still | Ad lib | 15 | 27 | 36 | 42 |
| | 6 | 10 | | | | | 25 | 34 | 40 |
| | 8 | 16 | | | | | 23 | 31 | 38 |
| Growers | 9 | 20 | Concrete | Still | Ad lib | 15 | 16 | 30 | 38 |
| | 15 | 50 | | | | | 12 | 28 | 36 |
| | 21 | 90 | | | | | 9 | 27 | 36 |
| | 9 | 20 | Concrete | Drafty (D) | Ad lib | 15 | 18 | 32 | 39 |
| | 15 | 50 | | | | | 15 | 30 | 37 |
| | 21 | 90 | | | | | 14 | 29 | 36 |
| | 9 | 20 | Concrete | D + spray | Ad lib | 60 | 20 | 34 | 42 |
| | 15 | 50 | | | | | 17 | 32 | 40 |
| | 21 | 90 | | | | | 16 | 31 | 39 |
| Dry Sows | | 150+ | Concrete (1 sow) | Still | 31 | 15 | 15 | 27 | 36 |
| | | | | D | 31 | 15 | 18 | 29 | 38 |
| | | | | D + spray | 31 | 60 | 20 | 33 | 40 |
| | | | Concrete (5 sows/grp) | Still | 31 | 15 | 12 | 26 | 35 |
| | | | | D | 31 | 15 | 15 | 28 | 38 |
| | | | | D + spray | 31 | 60 | 18 | 32 | 40 |
| Lac Sows | | 150+ | Mesh | Still | Ad lib | 15 | 8 | 22 | 32 |
| | | | | Still + Drip | | 30 | 9 | 26 | 33 |
| | | | Concrete | Still | Ad lib | 15 | 10 | 23 | 33 |
| | | | | Still + Drip | | 30 | 11 | 25 | 34 |

A typical set of air temperature requirements for pigs is shown in Table 1. These figures are only a guide for the conditions outlined in the table. To accurately gauge the critical temperatures for pigs within your piggery, close observation of behaviour and air temperature is required.

Adjust heating, cooling or ventilation systems according to the pig's reactions such as huddling (for LCT), panting (50 breaths for ECT) and loss of appetite (for UCT). Other indicators are clean pens for pigs in their Comfort Zone and dirty pens for pigs above ECT. Textbook temperature ranges may not be valid for your situation.

2 From "Plan It Build It" 1994
3 15%-normal wetness due to drinkers; 30%-typical wetness during drip cooling; 60%-average wetness during spray cooling

## TEMPERATURE AND STOCKING DENSITY

An understanding of the Thermal Comfort Zone for each class of pig provides a basis to maintain good stocking densities.

### PIGLETS

When a piglet is born its body temperature of 39⁰C falls rapidly, but within half an hour it usually begins to rise again. The extent of the drop and the time taken for subsequent recovery depends on environmental conditions. If piglets cannot adjust their body temperature soon after birth, they will develop hypoglycaemia (low blood sugar) and could die if a stockperson does not intervene. So at birth, piglets require a dry draught free creep area, close to the sow's teats. They need to immediately find a warm environment. An additional heat source, such as a heat lamp placed near the rear of the sow during the farrowing period, can improve piglets' survivability immensely.

Young pigs are very susceptible to cold and draught because they have a thin skin, sparse hair coverage and very little fat. Piglets need the creep area heated to between 30 and 35⁰C. By day three a temperature of 28 to 33⁰C is ideal. At four weeks old, piglets like the temperature to be between 24 and 26⁰C. If the creep area is too hot, the piglets will not lie directly under heaters, but they will spread out to control their body temperature. If it is too cold, they will huddle or they will lie near or on top of the sow.

### WEANERS

A pig is most efficient at converting feed to lean tissue during early growth stages. The best productivity is achieved if weaners are kept within their Thermal Comfort Zone (24 to 30⁰C) during this period. Ideally, air temperatures will be set in the higher end of this range at weaning. Weaning presents an environmental challenge when the piglet loses the benefits of the sow and joins a different pen group. This stress may cause nutritional, health and social problems. Other problems that will increase the stress of weaning include pens that are overcrowded, hot and humid or cold and draughty, damp and unhygienic. Under these housing conditions, the weaner may develop diarrhoea, lose weight, fall back in condition and could die.

### GROWERS, FINISHERS, DRY SOWS AND BOARS

Growing pigs, over 20 kg body weight, become less sensitive to cold. At heavier weights they become more susceptible to heat. The Thermal Comfort Zone for growers and finishers is 16 to 26⁰C. The Thermal Comfort Zone for dry sows and boars is also 16 to 26⁰C. Note that pregnant sows are more sensitive to high temperatures in the first weeks and last two to three weeks of pregnancy.

### LACTATING SOWS

The sow has a quite considerable heat production during lactation. Therefore, sows are able to withstand lower temperatures down to 8⁰C. However, they are generally most comfortable at temperatures between 12 and 22⁰C. The difference in needs between the piglets, that require higher temperatures than their mother, can only be met by building farrowing accommodation so that the sow is kept within its Thermal Comfort Zone while supplementary heat is applied to the creep area.

### OBSERVING THERMAL COMFORT

For any class of pig, a high degree of stockmanship is required to provide the correct temperature. For example, a pig may be too cold at 25⁰C in a strong breeze. On the other hand, 25⁰C may be too hot for the same pig in slow moving, humid air. Even at high temperatures pigs can feel comfortable if maximum shed ventilation is combined with spray or drip cooling.

It is difficult to know when the temperature in a pig shed is correct. If pigs huddle together or shiver, they are obviously too cold. If their dunging behaviour changes, causing dirty pens or they are lying scattered across the floor or panting, the pigs are suffering from high temperatures. Regular observations of pig comfort by the stockperson are necessary. However, there may be considerable temperature fluctuations between observations. A maximum/minimum thermometer or a data logger will measure the daily temperature extremes. Where shed temperature problems cannot be readily identified, use data loggers to trace hourly temperatures inside and outside the shed for periods of days or weeks.

A sure indication that the ECT has been reached is when the rectal temperature is 39.5⁰C or higher. This method of monitoring the comfort of pigs is easily applied to sows in farrowing accommodation. Table 2 provides practical temperature ranges for pigs. This may be useful as a guide to initial settings for automatic controllers. It is important to remember that the actual Thermal Comfort Zone for pigs in any particular shed will depend on feed intakes, group size, space allowance, shedding and so on. Always observe the pigs and adjust automatic controller temperature settings to suit.

**TABLE 2:** Practical air temperature ranges between LCT and ECT, for setting automatic controllers[4]

| | |
|---|---|
| Suckers(birth-weaners) | 32-38⁰C |
| Weaners (weaning-8 weeks) | 30-22⁰C |
| Growers/finishers | 20-24⁰C |
| Dry sows/boars | 18-24⁰C |
| Lactating sows | 18-22⁰C |

### TAKE HOME MESSAGES:

- Don't just rely on thermometers to check the temperature is OK -always observe the pigs.
- When they're...
  - Huddling, piling on top of each other and shivering - they're too cold.
  - Lying well away from each other, or they're panting - they're too hot.

## STOCKING DENSITY

Stocking density refers to the number of pigs housed per square metre of pen area. It has a large impact on the thermal comfort of pigs and is the starting point for designing pig housing.

Table 3 provides a guide for stocking densities which are based on requirements during summer.

**TABLE 3:** Stocking densities during summer

| Pig Age (Weeks) | Pig Weight (kg) | Pen Areas | |
|---|---|---|---|
| | | Partial or fully slatted ($m^2$/pig) | Open drained ($m^2$/pig) |
| 3 | 6 | 0.11 | - |
| 6 | 13 | 0.19 | - |
| 9 | 24 | 0.28 | - |
| 12 | 35 | 0.36 | 0.40 |
| 15 | 50 | 0.46 | 0.51 |
| 18 | 65 | 0.55 | 0.61 |
| 21 | 82 | 0.64 | 0.70 |
| 24 | 102 | 0.74 | 0.81 |

Overstocking will aggravate the effects of high temperatures. Understocking will help alleviate poor shed environments that may result from the high temperatures in summer.

## NUTRITION

In hot weather, pigs eat a greater portion of their food when the temperature falls below their ECT during cooler parts of the day, without affecting total feed intake. Feed intake will reduce if pigs spend more than 12 hours per day above their Thermal Comfort Zone, leading to reduced growth rates.

Dietary adjustments are necessary to compensate for reduced feed intakes. For example, the level of lysine in the diet will need to be increased to ensure adequate daily lysine intake, particularly for lactating sows. It may also be necessary to increase the energy density of diets, particularly for lactating sows, by adding oil or fat.

4 From "Plan it Build It" 1994

## SPRAY AND DRIP COOLING SYSTEMS

Spray and drip cooling are the easiest and cheapest methods of combating the adverse effects of high temperature. The pay-back period of one summer often justifies the expenditure on a water cooling system.

### SPRAY COOLING

Spray cooling is only used for growers, finishers and dry sows, where shed temperatures exceed 26⁰C for extended periods. It produces dramatic improvements in herd performance during periods of hot weather. The optimum temperature range for growers, finishers, dry sows and boars is 16 to 26⁰C. Be mindful of the possibility of chilling wet pigs exposed to high wind speeds. It is safer to set the controller temperature between 26 to 28⁰C to avoid the problem, but the potential for chilling needs to be closely monitored by the stockperson. In high temperature climates, spray cooling will maintain appetite, feed intake and growth rates among the grower/finishers while at the same time improving the Feed Conversation Ratio (FCR). Spray cooling will also improve weaning to mating intervals and boar/sow fertility.

Sprays are not suitable for lactating sows because of the danger of wetting piglets and should not be used for weaners as the risk of chilling is too great.

Spraying for calculated intervals and durations will overcome the inability of pigs to sweat. Pigs breathe faster when they suffer high temperatures above ECT. Panting (above 50 breaths per minute) cools pigs by increasing evaporation from their respiratory tracts. Spray cooling will reduce respiration rates to near normal levels of 20 to 30 breaths per minute.

Depending on the relative humidity and the amount of air movement over its body, a wet pig takes up to an hour to dry. The pig's skin temperature can be considerably lowered by a short burst of spray of around five minutes followed by a period of 45 minutes to enable evaporation from the skin to occur.

Individual producers may need to adjust the frequency and length of time the spray nozzles operate. Adjustments will be affected by the type of building, ventilation, stocking density and local climatic conditions. In areas of high humidity, water will take longer to evaporate from the pig's skin. Therefore the interval between spraying may need to be increased slightly.

### DRIP COOLING

Drip cooling can be used in farrowing and weaner sheds. When used in farrowing sheds it is essential that water does not go into the creep area. Sows are drip cooled using one dripper over the shoulder or rump area.

Drip cooling lactating sows in summer has proven its worth through fewer sow deaths, less embryo losses and fewer stillbirths. Case studies where drip cooling has been used for lactating sows have shown increases in appetite, feed intake, milk production, number of pigs weaned, growth rates and piglet weaning weights. At the same time there were marked decreases in respiration rates and sow weight loss during lactation. Also, following weaning, there is a reduction in the weaning to mating intervals and fertility is enhanced.

In extreme conditions where weaners suffer very high temperatures, it may be necessary to install drip cooling in weaner sheds. Use one dripper per five weaners. Be careful not to chill weaners by wetting them during periods of high air speeds.

For both farrowing and weaner applications, install drippers over slatted floor areas. Placement of dripper outlets must avoid wetting solid floor areas. Lactating sows are comfortable between 12 to 22⁰C, while piglets demand a 26 to 32⁰C range. Weaners need 24 to 30⁰C.

## VENTILATION

It is important to stress that water cooling will not be effective unless there is some air movement over the pig. Water cooling must be done in conjunction with adequate ventilation. Poor ventilation in conjunction with water cooling can result in high humidity and may lead to herd health problems.

Over-watering may cause fungal growth on pigs, and high air velocities on a wet pig may cause chilling.

## AUTOMATIC CONTROL

Manually operated spray or drip systems are not as effective as automatically controlled systems. They need constant attention to ensure stock comfort and the stockperson is generally not attuned to frequent changes. Even short periods of high temperature can set herd performance back.

In an automatically controlled system temperature sensors are located at pig height and protected from damage by the pigs. They are shielded from direct sunlight in an area which is representative of the interior air temperature. The temperature sensors relay readings to a control box mounted in a moisture free area. The controller activates or deactivates the spray or drip system using solenoid valves. The stockperson presets the timing cycles and operates temperature ranges. Timer and temperature adjustments made by the stockperson are influenced by shed design, amount of ventilation, relative humidity, and class of pig.

# EVAPORATIVE COOLING

An evaporative cooler reduces the air temperature by passing it through wet absorbent pads. The pads can be located in an air conditioning unit or as part of the building sidewall. This increases relative humidity but reduces air temperature.

The effectiveness of evaporative cooling can be measured by a ‘Wet Bulb’ thermometer. Because water is evaporating from the wet wick, it cools the air causing the thermometer to register a lower temperature than an ordinary ‘Dry Bulb’ thermometer.

The absolute maximum to which an evaporative air conditioner can lower the temperature is equal to the Wet Bulb reading. In cases of high humidity, the Wet Bulb reading is not much below the Dry Bulb thermometer. Evaporative air cooling is therefore less effective in warm coastal regions and the tropics. It is very effective in hot, dry inland areas of every State and is mainly used in lactation and weaner accommodation.

A properly designed evaporative air cooling system can reduce shed temperatures significantly. For example, on a day when the Dry Bulb reading within a shed is $38^0$C and the Wet Bulb is $25^0$C, an evaporative cooler can drop the Dry Bulb temperature down to about $28^0$C at 80 per cent relative humidity.

## MAINTENANCE

Evaporative cooling systems require regular maintenance for proper operation:

- Replace woven fibre pads annually, and cellulose pads about every five years.
- If the pad settles, add more pad material so air does not short-circuit.
- Hose pads off at least once every two months to wash away dust and sediment.
- Control algae build-up with a copper sulphate or other suitable solution in the water.
- As water evaporates, salts and other impurities build-up. Bleed off 5 to 10 per cent of the water continuously to remove salts or flush the entire system every month. This bleed off water can be toxic so take care with disposal.
- Clean out the sludge from the bottom of the collector reservoir at least twice during the summer. Also clean after dust storms.
- At the beginning of winter, cover the whole external air intake with insulated cover pads and drain the water from the unit’s reservoir.

## WATER SUPPLY TO PIGS[5]

# WATER IS THE PIG'S MOST IMPORTANT NUTRIENT, BEING INVOLVED IN EVERY BODILY FUNCTION, AND MAKES UP ABOUT 80% OF TOTAL BODY WEIGHT OF A NEWBORN PIGLET AND ABOUT 50% OF AN ADULT PIG.

Pigs, like many other animals including man, will survive much longer without food than without water. Water is crucial in maintaining body temperature, transporting nutrients, removing toxins, aids in digestion, lubricates and protects organs, and is a critical part in many of the chemical reactions that occur within a pig's body. Water is especially critical during the summer as requirements will increase markedly. It is essential to check the water supply daily for quality and quantity.

### DON'T IGNORE WATER

A poor water supply can lead to:

- Slower growth rate of pigs.
- More urinary infections in sows.
- Lower feed intake in lactating sows, leading to a loss in body condition.

If pigs are deprived of water altogether (e.g. if water supply is inadvertently turned off), they will die within a few days. The first signs of water deprivation (so-called 'salt poisoning') are thirst and constipation, followed by intermittent convulsions. Affected animals may wander aimlessly and appear to be blind and deaf. Most die within a few days.

On the other hand, unnecessary wastage of water will lead to a significant increase in production costs.

## WATER USAGE FOR PIGGERY OVERALL

Research has identified the amount of water required by each class of pig (see Table 4).

**TABLE 4:** Water quantities required for different aged pigs

| | Litres/day* |
|---|---|
| Weaners | 3-5 |
| Growers | 5-7 |
| Porkers | 7-9 |
| Finishers | 9-12 |
| Dry Sows | 12-15 |
| Lactating Sow and Litter | 24-45 |

*Average. Daily consumption for individual pigs can vary 50% from the average.

These figures are useful for calculating the amount of medication to add to water if using water medication.

5 From "Water Supply to Pigs" 1999

## DRINKING WATER QUANTITIES

Water requirements for pigs during summer are provided in Table 4. These figures are indicative of actual water consumed. Non-drinking requirements which include spillage, flushing and cleaning, can be as much as 1.5 times the drinking water requirements. A guide to total piggery water usage (i.e. drinking, spillage, cleaning, spray and drip cooling) for a breeding unit and taking pigs through to bacon weight, is 250 litres per sow per day.

Pigs will only devote a certain amount of time and effort towards obtaining their daily water requirements. Too many pigs per drinker, low drinker flow rates and bad positioning can cause reduced water intake. If access to water is restricted, pigs will reduce their water intake resulting in a lower feed intake and slower growth performance.

Low flow rates in the farrowing house can increase pre-weaning mortality through an increase in overlays due to restless sows having to get up more often as they attempt to consume their 20 to 30 litres of water per day.

### TAKE HOME MESSAGES:

- As far as water availability is concerned poor quantity can be as bad as poor quality.
- So…
  - Check flow rates especially when sprays and sprinklers are working.
  - Make sure there's enough working drinkers per pen.
  - Make sure drinkers aren't positioned too high or too low for the pigs in the pen.
  - Have water quality checked by a reputable laboratory regularly.

## WATER QUALITY

Usually surface waters from rivers, irrigation sources and main supply is of good quality and unlikely to cause problems. An initial analysis of bore water for total dissolved solids is recommended. However a survey of water composition from bores reveals that in the majority of cases, bore water will be suitable for pigs. The figures in Table 5 give a guide to Upper Limits. The figures are conservative and may be exceeded for short periods of time.

**TABLE 5:** Upper limits for levels of specific minerals and potential contaminants in drinking water for pigs

| | Upper limit |
|---|---|
| Coliforms | 10,000/litre |
| Total Dissolved Solids | 3,000ppm |
| Sulphates | 1,000ppm |
| Nitrates | 100ppm |
| Nitrites | 10ppm |
| Iron | 0.5ppm |
| Magnesium | 400ppm |
| Calcium | 1,000ppm |
| Hardness | 180ppm |
| pH | 6.5-8.5 |

### COLIFORM BACTERIA

Coliform bacteria are a measure of microbiological contamination (water pollution). It reflects the overall sanitary quality of water and the degree of contamination with human or animal waste. Coliform bacteria contamination is more a problem with surface water than underground, and with header tanks where sanitary management is poor.

### APPEARANCE

Water is often cloudy due to suspended clay. This is not harmful to stock but, if necessary, such water may be cleared by the addition of filter alum. Iron or algae can also cause water to become coloured or cloudy.

## TOTAL DISSOLVED SOLIDS

If concerned with water quality, the first test to consider is Total Dissolved Solids (TDS). If TDS are elevated, more detailed analysis for sulphate, chloride, sodium, potassium, calcium, magnesium and manganese may be warranted. TDS is a measure of the total inorganic matter dissolved in the water. It is not a precise measure of water quality. Water with a high TDS reading generally has high levels of calcium, magnesium and sodium. The recommended upper level of 3,000 ppm is quite conservative. Levels between 3,000-5,000 ppm are usually satisfactory but might cause temporary diarrhoea or refusal at first by pigs not accustomed to these levels. Levels between 5,000-7,000 ppm are generally safe for grower/finisher pigs, but are less suited to pregnant and lactating sows.

Avoid using water with levels greater than 7,000 ppm.

### SULPHATES

High levels of sulphates have a laxative effect. The recommended upper level of 1,000 ppm is conservative. Higher levels, up to 2,000 ppm, may result in increased diarrhoea without deterioration in performance.

### NITRATES AND NITRITES

Dangerous levels of nitrate and nitrite ions are uncommon. The nitrate ion ($NO_3$) is not particularly toxic, even in excess of the recommended upper limit. Nitrite ions ($NO_2$) are much more toxic, and can result in acute poising. However, nitrate ions can change to nitrite ions, particularly when in contact with iron, zinc or lead. Therefore, avoid storing high nitrate water in galvanised tanks.

### IRON AND MAGNESIUM

Neither iron nor magnesium cause problems for pigs but can precipitate when oxidised and block the fine screens used in drinkers.

### WATER HARDNESS

Usually caused by calcium and magnesium, it rarely causes problems for pigs.

### PH

Water samples generally fall within the acceptable range.

### BACTERIA

Most pathogenic bacteria have an optimum pH for growth of 6-7. Adding acid to water, especially for weaners, maintains a low gut pH and reduces the opportunity for bacteria to proliferate. However, it is important to note that adding acids to drinking water to lower the pH may detach organic matter from pipes and block nipple drinkers.

#### TAKE HOME MESSAGES:

- Manage your header tanks by:
  - Emptying and cleaning periodically with approved disinfectant.
  - Positioning or covering header tanks to ensure there is no possibility of spoiling by bird or rodent droppings, dust or other accidental chemical contamination.
  - Having a close fitting lid and ensure no light enters.
  - Fitting a draining valve - opposite side and lower than outlet - to remove silt.
  - Installing non return valves into the system as a precaution against the backflow of contamination.

## DELIVERY OF WATER

Most piggeries have nipple drinkers rather than bowls or troughs, usually because of the difficulty in keeping bowls or troughs clean. One nipple drinker per 10 pigs is preferable for weaner pigs, whereas one nipple per 20 pigs can be sufficient for grower pigs. But you should never just have one nipple drinker in the pen because this creates issues with dominance and aggression within the group of pigs. Providing each group with more than one drinker has been shown to increase growth rates and decrease aggression. Also allow at least 600 mm between nipples to prevent one pig from dominating two drinkers.

A Canadian survey revealed the average flow rate from nipple drinkers was high, with 20 per cent nipples delivering more than 2 litres per minute. However, the range was considerable with some drinkers supplying only 1 litre per minute. Recommended flow rates for nipple drinkers will vary according to pig age and reproductive stage (Table 6).

**TABLE 6:** Recommended flow rates for nipple drinkers

| | Flow Rate (litres/minute) |
|---|---|
| Lactating sows | 2,000 ml/minute |
| Dry sows and boars | 1000 ml/minute |
| Grower/Finishers | 1000 ml/minute |
| Weaners | 500 ml/minute |

Check that nipple drinkers have the correct pressure backing plates fitted. Low pressure drinkers can be safely used at up to 10 metres of head pressure. Over that value it is best to use a high pressure reducer in the main line. You should match drinker type to water pressure as some nipples are designed for high-pressure 'mains' supply. They are not suitable for low-pressure 'header tank' supply.

The incorrect drinker type will either increase competition or waste water. You should make sure that the nipple drinkers have sufficient flow without being wasteful. Specifically:

- Measure and record flow rates of all nipples at least once per year.
- Check water flow from all nipples between batches of pigs.
- Check water flow, especially during summer (when high water demand) and nipples at the end of the water line.

A sure sign of a water supply problem is if you see pigs sucking on nipples without wasting any water. Another is a sudden increase in the time it takes for a pen to empty a self feeder.

### TAKE HOME MESSAGES:

- Lactating sows typically require a minimum of 17 litres of water per day, and up to 40 litres.
- With a flow rate of 1.0 litre per minute, and allowing for spillage, the sow will require about 25 minutes to consume 17 litres.

**Lactating sows are only prepared to spend a limited amount of time drinking, so a low flow rate will result in them consuming less water than they require.**

FIGURE 2: Measuring water flow rate in dry sow pen

## HOW DO I CHECK FLOW RATES?

You will need:

- Marked water container or 500 ml container.
- Timer (watch).
- Record (for future reference).

Fill 500 ml container from the drinker and record the time taken to fill the container.

$$\text{Flow rate (ml/min)} = \frac{500 \times 60}{\text{Time (sec)}}$$

# FLOW RATES LOW? WHAT TO DO NEXT?

## WATER FLOW - VOLUME VERSUS PRESSURE

The ideal drinker is one that delivers the required volume of water at a low pressure. High-pressure (high velocity) output makes drinking an unpleasant experience.

The volume of water through a nipple depends on:

- The size of the nipple's orifice (outlet).
- The head of water.
- Friction loss through the pipe.

Doubling the nipple's orifice size will have much greater effect on the volume of flow than doubling the height of the header tank.

## POSSIBLE SOLUTIONS TO LOW VOLUME THROUGH NIPPLE DRINKER

- Increase size of orifice or remove blockage (clean, drill or replace).
- Check for build-up or blockages which will restrict or stop water flow through pipe.
- Make sure that supply line is adequate for number of drinker points.
- Check water pressure.

## HEIGHT OF DRINKERS

Ideally the drinkers should be about snout level or just above the pig's backline.

TABLE 7: Recommended height of drinkers for different classes of pigs

| Recommended height of drinkers | |
|---|---|
| Weaners | 25-40cm |
| Grower/finishers | 45-65cm |
| Sows/boars | 60-90cm |

## WATER TEMPERATURE

In summer, water temperature in exposed pipes can become too hot for pigs to drink. Cool drinking water increases the consumption in hot weather and assists the pig to lose heat. Increased water consumption increases feed intake and growth rates. Ideally, keep the water temperature below 20$^{0}$C throughout the year.

- Check that the water supply pipes are not exposed to direct sunlight. Don't use polypipe above the ground and either insulate delivery lines or bury them 600 mm deep.
- Where water is drawn from a dam, place the inlets at least 2 m below the water surface.
- Insulate or paint header tanks white.

## BLOCKAGES

A major source of water line blockage is due to a high level of suspended solids in the water. High levels of dissolved solids and minerals can form deposits which will also reduce the water flow. Installing a water filter will reduce most blockages as it's not recommended to remove pressure regulators from drinkers in an attempt to reduce blockages and improve the water supply. This may lead to pressures that are too high for some classes of pigs.

FIGURE 3: Different drinkers that can be used in piggeries

## SEASONAL INFERTILITY[6]

# ONE OF THE GREATEST EFFECTS ON THE PRODUCTIVITY OF A HERD DURING THE WARMER TIMES OF THE YEAR IS THE PHENOMENON KNOWN AS SEASONAL INFERTILITY.

During this time, attention to detail regarding all aspects of breeder care including nutrition, health and environmental requirements become more critical. The sows and boars will be under pressure because of the heat and day length and they will be relying on our care to get them through.

## WHAT IS SEASONAL INFERTILITY?

Sows and gilts commonly experience a depression in fertility, which may also be accompanied by a reduction in litter size, during summer and early autumn. This can equate to a 3-7 per cent reduction in herd fertility compared to the annual average (Auvigne and others, 2010). This fertility drop is usually referred to as "seasonal infertility" and can take the form of a reduction in the proportion of gilts reaching puberty as well as a delay in the time that gilts reach puberty, poor oestrus expression, extended weaning-to-oestrus intervals in sows, and high anoestrus rates amongst gilts and sows. Importantly, incidences of pregnancy failure and late pregnancy loss are also considerably higher during summer/early autumn, with a higher proportion of sows exhibiting a regular or irregular return to oestrus post-insemination (Table 8). The increased incidence of abortion may be particularly evident in the autumn.

**TABLE 8:** Typical pattern of pregnancy losses or failures during seasonal infertility period (O'Leary, Final Report to Pork CRC, 2010)

| | Season | |
|---|---|---|
| | Spring | Summer/ Autumn |
| Number of sows | 135 | 175 |
| Regular (21 day) returns | 3.7% | 8.0% |
| Negative pregnancy tests | 3.7% | 12.6% |
| Abortions | 0.7% | 2.3% |
| Adjusted farrowing rate | 91.9% | 77.1% |

## WHAT CAUSES SEASONAL INFERTILITY?

It is established that the seasonal breeding pattern of animals is controlled primarily by melatonin, which is secreted by the animal in response to changes in the daylight length during the different seasons. These changes in melatonin production modify hormone secretory patterns, affecting ovary function and embryo development. However, the severity of seasonal infertility varies from year to year, suggesting that additional environmental factors, in particular temperature, also affect reproductive function. Recently, an additive effect of high ambient temperatures on summer suppression of fertility has been demonstrated in France (Auvigne and others, 2010). The negative impacts of high ambient temperatures on reproductive function, in particular reduced expression of oestrus behaviour, impaired pregnancy function and increased foetal losses, are consistent with the common symptoms of seasonal infertility. As a result seasonal infertility is often a complex mixture of different causes as well as different reproductive responses to environment and management that may also vary in its severity, and or occurrence, between farms in the same region or country. The considerable variation among farms clearly indicates that farm management practices also play a role in the expression of seasonal infertility.

6 From "Seasonal Infertility in Pigs" 2010

## WHICH SOWS ARE AFFECTED BY SEASONAL INFERTILITY?

Interestingly, analysis of commercial figures and research data indicate that there may be an interaction between parity and both incidence and type of seasonal infertility observed. Incidences of delayed oestrus post-weaning (Figure 4A) and reduced farrowing rates (Figure 4B) during summer appear to be greater in first litter and younger sows compared to higher parity sows. On the other hand, while the data set presented in Figure 5 demonstrates a reduction in the litter size of sows mated during summer, it is apparent that seasonal reductions in litter size may not occur in gilts.

Sows may ovulate earlier in the heat period during the summer/early autumn. Hormonal support of the pregnancy may be reduced in weeks 3-4 after breeding. These studies indicate that animals which are more susceptible to reproductive problems during winter and spring (namely, early parity sows) are more likely to experience a drop in fertility during summer, and can be identified as 'at-risk' sows. It is also recommended that individual production units examine their breeding and reproduction records to determine whether they also have particular groups of animals which are prone to seasonal infertility.

**FIGURE 4A:** Effect of parity on:
A) the difference in the proportion of sows expressing oestrus within 7 days of weaning in summer versus spring (adapted from Belstra and others, 2004)

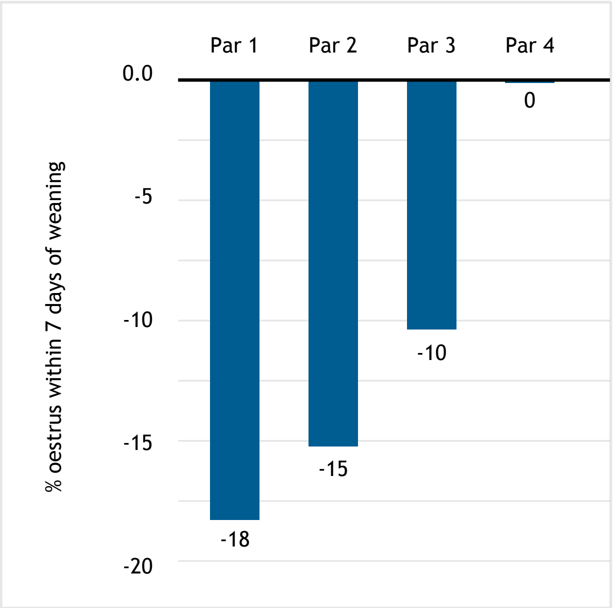
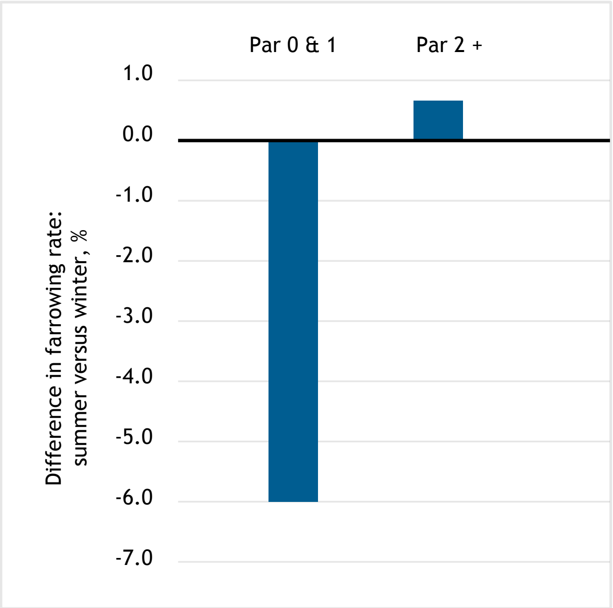



**FIGURE 4B:** Effect of parity on:
B) the difference in farrowing rates between animals mated during summer versus winter (Hughes and others, unpublished; n = 704 and 726 animals in summer and winter, respectively)



## WHICH GILTS ARE AFFECTED BY SEASONAL INFERTILITY?

Analysis of management records of 3,901 gilts obtained from three farms in Australia (Grupen and others, Final Report to Pork CRC Project 2D-108, 2009) shows there is a higher probability of late pregnancy loss (after day 30 of gestation) in gilts that are 240 days of age or older at their first service (Figure 6). Gilts cycling before 240 days of age probably didn't contribute to this decrease in reproductive performance, as usually these gilts that are mated at their second heat, have improved pregnancy outcomes. The increased late pregnancy loss in gilts shown in this study can probably be attributed to gilts that attain puberty later (240 days or older) and are then mated at their first heat. Studies using strict heat checking to detect first oestrus are needed to confirm the "late puberty" gilts theory. Also, it appears that when these "late puberty" gilts were kept in the breeding herd, a higher probability of late pregnancy loss was also observed in later parity sows (Figure 7, Farm C). Records of 10,123 sows were examined in this analysis (Grupen and others, Final Report to Pork CRC Project 2D-108, 2009). Again, further studies are needed to confirm this idea.

**FIGURE 5:** Effect of parity on the difference in total litter size between sows mated during summer and winter (Hughes et al., unpublished; n = 704 and 726 sows in summer and winter, respectively)

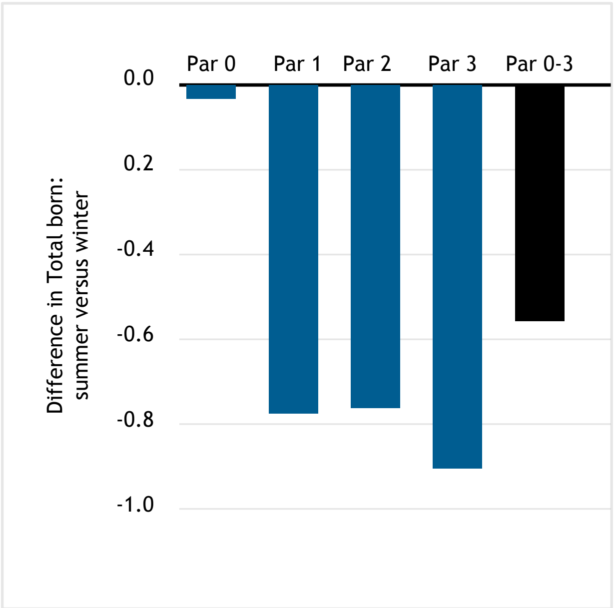



**FIGURE 6:** The effect of age at first service on the probability of late pregnancy loss (after Day 30 of gestation) (modified from Grupen et al, Final Report to Pork CRC Project 2D-108, 2009)

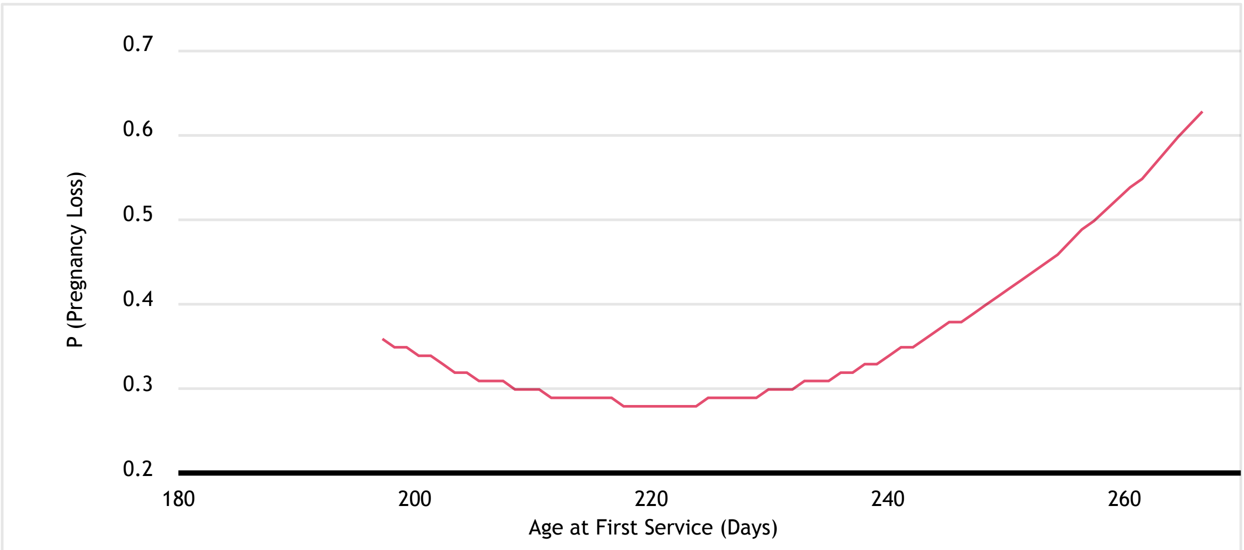
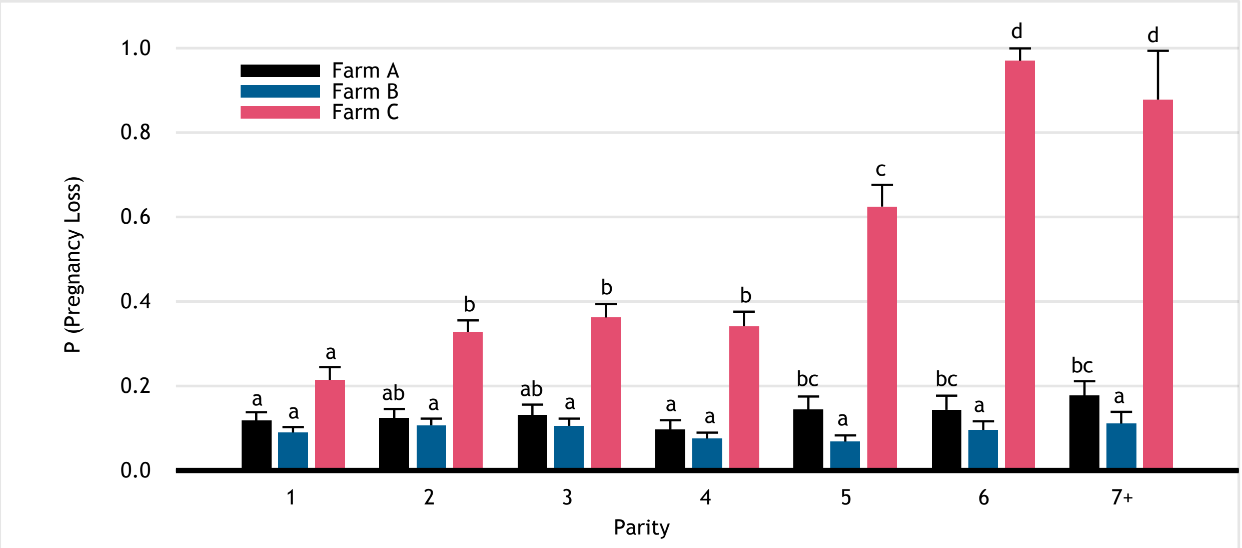


FIGURE 7: The effect of parity on the probability of late pregnancy loss (after Day 30 of gestation) on Farms A, B and C during the seasonal infertility period. a-dFarm groups with common letters are not significantly different (Grupen et al 2009)




In other Pork CRC-funded research at the University of Sydney by Dr. Bertoldo and others, evidence has emerged that eggs shed in the seasonal infertility period are poorer quality than those ovulated over the rest of the year. This could result in poorer fertilisation, failure of fertilised eggs to develop through the embryonic growth stages and/or poorer corpus luteum formation, causing reduced/ inadequate release of progesterone (the key hormone required for pregnancy support).

## SO WHAT ARE THE MAJOR RISK FACTORS FOR SOWS AND GILTS?

The take-home messages from studies conducted by the Pork CRC indicate that sows are at greatest risk of displaying seasonal infertility if they:

1. Are at parity six or more.
2. Take longer than five days to return to heat after weaning.
3. Are early weaned.
4. Wean less than eight piglets.

These factors also contribute to reduced sow fertility and productiveness for the rest of the year, suggesting that seasonal infertility is most likely to be shown by sows that are of questionable fertility, or have been subjected to sub-optimal management, regardless of season.

This is almost certainly true in gilts as well. Those gilts most resistant to puberty stimulation are also the most prone to delayed puberty in the summer and early autumn. What's more, increasing a gilt's stimulation by providing regular boar contact from around 25 weeks of age will reduce, but not eliminate, seasonal delay in puberty attainment.

It seems clear that individual gilts and sows appearing to be at greatest risk of showing a seasonal infertility problem are those that are low ranking and group housed where competition for feed is high.

## STEPS TO ALLEVIATE THE EFFECTS OF SEASONAL INFERTILITY

### 1 OESTRUS DETECTION PROCEDURES

During the long days of summer, the hormone signals responsible for inducing puberty, and indeed resumption of oestrus regularity post-weaning, are suppressed. Consequently, optimising gilt response to boar contact and decreasing incidences of delayed oestrus expression post-weaning, particularly in early parity sows, will most likely require an increased level of boar stimulation. It is therefore suggested that during the seasonal infertility period the following changes in the application of boar contact are made:

- For gilts and early parity sows, ensure full physical contact (preferably in a detection mating area NOT in the gilt/sow pen) with a mature (> 12 months old) boar.
- Increase the frequency of boar contact to twice daily for a period of at least 10 minutes per contact period.
- Conduct boar contact at a ratio of one boar per 8–10 gilts/sows.
- Only use boars with a high sexual motivation, and optimise pheromone production and sexual motivation by ensuring boars receive a mating at least every fortnight, but preferably weekly.
- Match the size of the boar used to the size of the female (to avoid structural damage).
- Prior to bringing gilts/sows to the boar pen, allow the boar five minutes to become used to his surroundings.
- Where possible, avoid the hottest parts of the day and conduct heat detection and AI in the cooler parts of the day.
- The duration of oestrus may be reduced in summer and can be detected by recording when sows start to stand and for how long they stand. If these recordings indicate that sows stand for shorter periods and or later after weaning, this may be a reason to AI at first standing rather than postponing AI until PM or next morning, if there is a seasonal fertility problem.

**TAKE HOME MESSAGES:**

- During the period of seasonal infertility usual practices used for oestrus detection and stimulation may not be sufficient.
- During this time it's suggested that:
  - Gilts and sows are mated at the first sign of standing heat instead of delaying AI or mating.
  - Gilts and young sows have full physical contact with a mature, highly motivated boar, that is similar to them in size.
  - Increase the frequency of boar contact to twice daily for at least 10 minutes per time.
  - Matings and AI only occurs in the cooler parts of the day.

### 2 INSEMINATION PRACTICES

There is now some evidence that sows appear to ovulate earlier during oestrus in the summer/autumn period (van Wettere, Pork CRC project, 2D-125). Thus it is recommended that sows are inseminated when they are first detected on heat, regardless of when they return after weaning. Once the first insemination has occurred, further inseminations can be provided at twenty-four hour intervals as normal. Note that during summer, appropriate semen storage becomes even more critical as poor semen quality will only add to other factors that are compromised during this season, aggravating the risk of poor reproductive performance.

### SEMEN STORAGE

Semen should be stored around 17°C in a dark place (semen is sensitive to UV light). Temperatures between 15 to 20°C can be tolerated by semen. However, temperatures above and below this range are detrimental to semen and will not only reduce the number of viable sperm cells but also the shelf-life of the semen. Temperature fluctuations also reduce quality of the semen, even within the recommended storage range.

Therefore, at drop-off, semen should preferably be stored in a temperature-regulated storage box if not stored immediately in a semen fridge. If a temperature controlled storage box is not available, a very well insulated esky or Styrofoam box can be used but does not guarantee storage conditions.

Semen fridges and drop-off storage boxes should be checked for proper operation at least once a week. This includes maintaining a daily record of the temperature indicated by the digital or analogue reading of the fridge, but also a weekly check to see whether the reading is showing the actual temperature, by means of a second, preferably MIN/MAX thermometer in the fridge. It is also recommended to have a liquid thermometer in the fridge as this will give a temperature that is closest to that of the semen.

Semen should be laid flat (not upright) and turned at least, preferably twice per day, to maximise contact between sperm cells and nutrients in the extender. To minimise temperature fluctuations, the semen fridge should be opened as little as possible, and therefore turning of semen and other activities that involve opening of the fridge should be combined as much as possible. Adding fresh warm semen (in case of DIY collection) will also cause temperature fluctuation and should be avoided by pre-cooling elsewhere.

For the same reason (temperature fluctuation) excess semen should not be returned to the main semen fridge after an AI session. It is better to take a calculated number of doses and get more when running short. In summer semen will undoubtedly warm up during an AI session (temperature fluctuation), possibly above the optimum temperature range, even when using an esky. It is therefore recommended to use a temperature controlled esky in the mating shed.

Use of ice-packs during summer in mating shed esky's is questionable, as the effect of the ice-packs on the temperature is not controllable and will depend on the temperature of the icepack and its size relative to the amount of semen in the esky. Use of ice-packs has been demonstrated to drop the temperature in the storage container below optimum range, not only causing fluctuation of the temperature but also cold damage. As a cooling aid, it is better to use a large body of a coolant (cool pack) that has a temperature of 15 °C, placed on top of the semen tubes (cool air travels down).

**TAKE HOME MESSAGES:**

- Semen should be stored around 17°C in a dark place (semen is sensitive to UV light). Temperatures between 15 to 20°C are OK for semen.
- During the warmer weather make sure that:
  - Semen fridges and drop-off storage boxes are checked for proper operation at least once a week.
  - Semen should be laid flat (not upright) and turned at least twice per day.
  - Semen fridge should be opened as little as possible to minimise temperature fluctuations.
  - If you don't have a semen fridge or temperature controlled esky in the mating shed, semen doses should be taken to the mating shed in an esky with a large cool-pack (not ice-pack), which is placed on top of the semen doses.
  - Only take as many semen doses as you need, better to go back and get some more, than have extra doses sitting in a hot shed, which will then have to be thrown away.

## 3 INCREASED EMPHASIS ON CHECKING FOR RETURNS

It is important to rapidly and accurately identify sows which fail to conceive or maintain their pregnancy. By comparing the progesterone profiles of those sows which failed to farrow with on farm observations of timing of pregnancy loss, it is clear that the majority of not-in-pig sows (i.e. those losing their pregnancy after pregnancy check) were actually conception failures (regular returns to oestrus) or early pregnancy failures (irregular returns to oestrus) (Table 9).

**TABLE 9:** What really happens to summer pregnancies – an analysis of 25 Summer pregnancy failures

| | On-farm observations | What the hormones tell us |
|---|---|---|
| Three week returns | 6 | 12 |
| Early pregnancy failure | 9 | 12 |
| NIPs | 10 | 1 |
| Total pregnancy failures | 25 | 25 |

(van Wettere and others Final Report to Pork CRC, 2008)

This misdiagnosis of early pregnancy failures emphasises the importance of conducting oestrus detection around day's 18-23 post-insemination and improving the accuracy of ultrasound detection of pregnancy, possibly by avoiding doing it too early in gestation (i.e. before day 28-30), and by adding a second check on day 40-50 post-insemination.

Thus, conduct more frequent and accurate oestrus detection and pregnancy diagnosis during the seasonal infertility period for gilts and sows.

- Between day's 18 and 23 post-insemination, boars are used daily to detect returns to oestrus.
- Pregnancy detection using ultrasound should occur twice, between day's 28 and 30 of gestation and again between day's 40 and 50.

### TAKE HOME MESSAGES:

- If you've had seasonal infertility problems on farm you need to detect empty sows ASAP.
- This can be accomplished by three pregnancy checks:
  - Using a boar to check for returns at around 18-23 days post-insemination.
  - Pregnancy checks with an ultrasound between days 28 and 30 of gestation.
  - Pregnancy checks with an ultrasound between days 40 and 50 of gestation.

## 4 MAXIMISE NUTRIENT INTAKE BY LACTATING SOWS

Although lactating sows are usually fed ad lib, most commercial sows are unlikely to consume sufficient feed during lactation to fully meet their nutritional requirements, particularly in the summer months. The nutrient requirements of lactating sows can be estimated from their maintenance requirements for nutrients as well as the requirements for the level of milk production. The calculations are based upon knowing the number of piglets weaned, weaning weight, weaning age, sow feed intake and sow live weight. The nutrient requirements of lactating sows at various levels of lactation performance may be calculated by using the Pork CRC spreadsheet (See attached excel spreadsheet Appendix 1).

Voluntary feed intake during lactation is often affected by the higher temperatures during summer months which not only reduces feed intake but also has a direct effect on milk production. Poor feed intake during lactation can cause excessive body weight loss, especially in younger sows, causing a poor onset of hormone activity after weaning. Thus, all attempts should be made to improve voluntary feed intake during lactation, particularly during summer months.

Management methods to ensure high feed intake during lactation in the summer period include:

### *Feed frequently*

Feed frequently, particularly at "high intake" times which seem to be in the morning and the late afternoon. Sows will not compensate by eating more at other times, even when food is freely available. Also the design of the feeder is an important determinant of voluntary feed intake during lactation as feeders that provide small amounts of fresh feed frequently are preferred to feeders that have large amounts of feed (often stale and/or spoiled) available at all times.

### *Increase energy density*

Sows will consume at least the same amount or even higher amounts of a higher energy diet compared to a lower energy diet. Recommendations for the minimum level of energy in lactating sow diets is now at least 14.0 MJ DE/kg and good performance may be achieved with even higher levels of 14.5 MJ DE/kg. Furthermore, the sow's heat production can be decreased by decreasing the fibre and/or increasing the fat content of lactation diets.

### *Increase protein density, particularly for young sows*

Previous research has shown that very low protein diets (approaching 12-14 per cent CP) reduce voluntary feed intake in lactating sows. Most lactating sow diets will contain at least 18 per cent CP and often over 1.0 per cent lysine to ensure that adequate protein and amino acid levels are achieved during lactation. While it is extremely difficult to provide the sow with excess dietary protein, it should be noted that voluntary feed intake may be compromised by high protein levels if lactating sow diets contain in excess of 22–24 per cent CP.

### *Control pregnancy intake*

It is well established that the more the sow eats in pregnancy, the less she will consume in the subsequent lactation. The results of a number of studies showed that sows consumed about 1 kg/day less during lactation for every 10 MJ DE/day increase in feeding level during gestation.

### *B-vitamin and methyl donor supplementation for sows during gestation*

In pregnant gilts and sows, metabolic demand for folate and vitamin B12 increases dramatically during the first 30-60 days of gestation. However, current recommendations for B-vitamin intakes are based on the minimum levels required to prevent signs of deficiency in genotypes of 20-50 years ago, and it is suggested that the optimal B-vitamin intake required to maximise reproductive performance may be higher, particularly in modern, prolific sows. A series of studies were conducted by Dr Will van Wettere in two Pork CRC projects to investigate the effects of adding betaine and extra folate/vitamin B12 to gestation diets on reproductive performance.

Supplementing gilt diets with 2 g betaine/kg during summer increased ovulation rate by 1.1 ova, with this effect most evident during periods of prolonged ambient temperatures in excess of 35ºC, and also tended to reduce the interval from start of boar contact to puberty attainment. Supplementing gestation diets with betaine to provide between 7.5 and 9.0 g supplemental betaine to the sow each day increased total litter size of higher parity sows mated during summer by 1.6 piglets and also increased total litter size of higher parity sows mated during autumn/winter, albeit the increase was smaller.

The common supplementation rates for gestation diets are 2.0 mg/kg folic acid and 20 µg/kg vitamin B12. Adding an extra 20 mg/kg folic acid and 150 µg/kg vitamin B12 to sow gestation diets increased total litter size of parity 2 and 3 sows by 0.6 piglets and decreased incidence of early pregnancy loss across all parities.

**TAKE HOME MESSAGES:**

- Feed frequently particularly at "high intake" times i.e. the morning and the late afternoon and ensure feed is fresh-clean out all stale feed.
- Increase energy and protein density in sow diets during the summer.
- Control pregnancy intake as the more the sow eats in pregnancy, the less she will consume in the following lactation.
- Betaine supplementation of pre-mating gilt diets during summer improves growth rate and may improve reproductive performance. The estimated cost is 4.2c/day/gilt (based on intake of 3 kg/day and on a retail cost of $7/kg for betaine).
- Supplementary betaine during gestation improves litter size of older parity sows, particularly during summer. The estimated cost is $6.00 - $7.20/sow/gestation (or 5.3 to 6.3 c/day based on a retail cost of $7/kg for betaine).
- Supplementary folate and vitamin B12 improves litter size of early parity sows and may reduce the incidence of early pregnancy loss across all parities. Any expected response is likely to be independent of season. The estimated cost of this extra supplementation is $0.80/gestation (or 0.7 c/day based on $3/tonne).

## 5 HOUSING AND FEEDING IN EARLY PREGNANCY

Mixing sows in early pregnancy is risky, and should be timed carefully, i.e. mixing of different sows into groups should occur either prior to mating (eg. at weaning) or just after mating when the sows are no longer exhibiting any signs of standing heat, but before implantation has commenced (e.g. from five days after service, where service refers to the last mating). Ideally, inseminated gilts and sows should be maintained in stable groups from this time. It is also critical that nutrient intake of individual sows in groups is not compromised during the first four to five weeks of pregnancy. If possible, individually feed mated sows and gilts, at least for the first month of pregnancy. Further information regarding feeding pregnant sows can be found in the APL/Pork CRC publication "Feeding Pregnant Sows in Group Housing Systems - An Update".

## 6 ENSURE ADEQUATE WATER INTAKE OF SOWS DURING SUMMER

Lactating sows typically require an average of about 17 litres of water per day, but individual sows can consume up to 40 litres, and possibly more in summer. With a liberal flow rate of 1 litre per minute, and allowing for spillage, the sow will require about an hour per day to consume 40 litres. Lactating sows are only prepared to spend a limited amount of time drinking, so a low flow rate will result in them consuming less water than they require. Any restriction of water intake through reduced water flow in drinkers may reduce voluntary feed intake during lactation. Flow rates in drinkers for lactating sows should be in excess of 1 litre per minute. Drinkers in farrowing sheds should be capable of delivering flow rates of up to 2 litres per minute and must be a minimum of 1 litre per minute.

In addition, the temperature of the water delivered to sows may become important during summer. Thus it is recommended that water supply pipes are not exposed to direct sunlight and the temperature of the water delivered through drinkers to the lactating sow is kept cool. The results of an APL project conducted by Willis and Collman (2007) showed that sows provided with cooled water at 20°C compared to water equivalent to an ambient temperature of between 18°C and 35°C, significantly increased their daily water intake and daily lactation feed intake, which had flow on effects on piglet weaning weight.

### TAKE HOME MESSAGES:

- Make sure that the sows' water supply has:
  - A good flow rate (at least 1 litre/minute, but preferably 2 litres/minute).
  - Been checked regularly for purity and dissolved solids.
  - Kept as cool as possible - who wants to drink hot water in the summer?!

## 7 PROVIDE COOLING FOR SOWS AND BOARS

High temperatures (and humidity) in summer may reduce expression of oestrus as well as libido in gilts and sows. High temperatures will also affect boar libido which will reduce his ability to detect oestrus. Boars in a DMA (detection mating area) and sows housed in the mating shed can be cooled using drippers or sprinklers/sprayers. It is also important to ensure adequate air flow using natural ventilation or fans to allow the drying effect to cool sows and boars. Taylor, Kruger and Ferrier (1994) recommend short bursts of spray of around five minutes followed by a period of 45 minutes to allow evaporation from the skin. Controlled environments using refrigerated air conditioning or evaporative cooling are very effective but are often expensive to operate.

### TAKE HOME MESSAGES:

- Don't run drippers continuously.
- Short bursts of sprays or dripping followed by a period of no water is effective for cooling and doesn't use as much water.

## 8 MATE MORE SOWS DURING THE SEASONAL INFERTILITY PERIOD

A decline in farrowing rates during summer/early autumn represents a significant economic loss, primarily due to the inability to maintain consistent production volumes. It is therefore important to improve planning to help anticipate the seasonal infertility period and have enough additional gilts on hand to cover for the anticipated drop in farrowing rate. This must be achieved without crowding the gilts or pregnant sows as overcrowding will have significant impacts of animal welfare.

### TAKE HOME MESSAGES:

- Plan to mate more sows to cover the shortfall in expected farrowings, but make sure you have enough space for the extra gilts in the gilt pool and extra sows in gestation - DON'T CROWD.

## 9 STAFF ORGANISATION

As the period of seasonal infertility tends to coincide with the peak in staff holiday absences, it is worth carefully organising staffing schedules through this period to ensure some of the staff more experienced in oestrus detection and insemination are available during the seasonal infertility period. Additional training for all staff during this time will also reap benefits.

## 10 ENSURE GILTS CAN ATTAIN PUBERTY BY ABOUT 220 DAYS OF AGE

Don't cut corners when it comes to preparing your gilts for their first mating! The evidence indicates that the rate of late pregnancy loss (after day 30 of gestation) is higher in gilts that attain puberty late (≥ 240 days of age). Furthermore, these "late puberty" gilts also appear to experience a higher incidence of late pregnancy loss in later parities. Therefore, it is recommended that a good plane of nutrition be provided to ensure your gilts can attain puberty at around 220 days of age. Cooling and water should be provided as recommended previously for sows and boars, as heat stress can impact the ability of gilts to consume sufficient feed. Also use boar exposure procedures as outlined above for sows to help stimulate the onset of puberty in your gilts. Finally, it is recommended that you cull gilts that don't attain puberty before 240 days of age from your breeding herd, as these animals may go on to experience a lifetime of reduced reproductive performance.

**TAKE HOME MESSAGES:**

- Don't cut corners in gilt preparation.
- Feed gilts well to make sure they reach puberty by about 220 days.
- Cull gilts that have not reached puberty by 240 days.
- Provide cooling and sufficient good quality water.
- Follow summer oestrus detection protocols i.e:
  - Mate gilts at the first sign of standing heat instead of delaying AI or mating.
  - Make sure gilts and young sows have full physical contact with a mature, highly motivated boar, that is similar to them in size.
  - Increase the frequency of boar contact to twice daily for at least 10 minutes per time.

## 11 INCREASE LACTATION LENGTH

This suggestion is out of left field and probably is unrealistic commercially for many producers but it is still a consideration for those who may be able to adjust weaning age e.g. post de-stocking or upgrading sheds. During the summer months, extending the length of lactation to 28 days (minimum 23 days if this achievable) may reduce the likelihood of late pregnancy loss. As hormone levels are suppressed during the period of seasonal infertility, follicle development may be impaired and result in fewer ovulations in the oestrus after weaning. This would mean that hormonal support, because of a reduction in the number of corpora lutea, would be reduced, resulting in a greater chance of late pregnancy loss. Also, it has also been shown that longer lactation periods result in increased embryonic survival, perhaps by allowing the sow's reproductive tract to recover more, and resume normal hormonal function (Takai and Koketsu 2007).

**TAKE HOME MESSAGES:**

- If you wean early i.e. around 21 days, extending weaning age (if possible) may reduce irregular returns.

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