MONITOR SETTER TEMPERATURE VARIATION

Why monitor setter temperature variation?

• Routine monitoring of temperature variation within and between setters is a powerful tool for checking hatchery maintenance programs.

• Excessive temperature variation within a setter indicates machine malfunction or incorrect machine operation.

• Temperature variation between setters indicates that the machines are not calibrated correctly.

Procedure for measuring setter temperature variation – general principles

• Setter air temperature variation is monitored by measuring the shell temperature of eggs that have little or no embryonic heat production (infertile eggs or eggs incubated between 2-7 days) at different locations within the setter.

• It is important to use the same methodology every time.

• Use the same equipment to measure temperature in all setters and ensure test thermometers are properly calibrated.

• Only test setters that are fully loaded with eggs and in multi-stage machines have balanced sets.

• Wait one day after setting or transfer before measuring temperature.

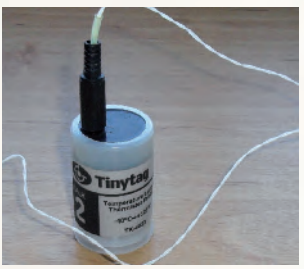
• Frequency of checking depends on how often problems are found. – the more often problems are identified, the more often the setters need to be checked - as a minimum, check setters every three months; if more than 10% of setters have excessive temperature variation increase the frequency of checks.

Aviagen

Hatchery How To 18

MONITOR SETTER TEMPERATURE VARIATION

Procedure for measuring setter temperature variation



In setters that are easy to work safely inside while the machine is operating, eggshell temperature can be checked using a Braun ThermoScan ear thermometer with a preheated tip.

In setters where it is difficult to access eggs at different locations while the machine is operating, eggshell temperature can be checked using data loggers with an external probe (e.g. Tinytags 4023).

Procedure for using Braun Thermoscan

Step 1:
Check that the measuring tip of the thermometer is clean and has a new plastic cover. (Some older thermometer types may need to be kept at incubation temperature for 30 minutes prior to use).

Step 2:
Identify an infertile egg in the centre of the setter tray being monitored using a flashlight.

Step 3:
Measure shell temperature at the equator of the egg, making sure the tip of the thermometer is flat against the eggshell surface.

Step 4:
Record results to machine location.

Procedure for using data loggers

Step 1:
Ensure that all data logger probes are reading the same temperature before use.

Step 2:
Following the manufacturer's instructions, program the data loggers to record the temperature every hour.

Step 3:
Identify an infertile egg in the centre of the setter tray being monitored using a flashlight.

Step 4:
Tape the tip of the data logger probe to the surface of the egg at the equator. Use good quality tape so that the probe tip stays in place.

Step 5:
Attach the logger to the setter tray.

Step 6:
Record temperatures over a period of at least one day.

Step 7:
Download data from logger.

Aviagen

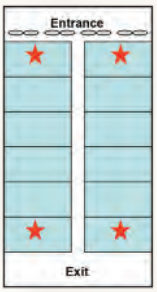
Hatchery How To 19

MONITOR SETTER TEMPERATURE VARIATION

Where to monitor temperature

- Setter type determines the best locations to measure temperature variation.
- The locations chosen should cover the different areas of the setter.
  - In smaller setters, the four different areas of the setter should be monitored.
  - In larger setters with multiple control zones, each zone should be monitored in at least two locations.
- The following diagrams show suggested locations (★) for monitoring temperature.
- In single-stage setters, shell temperatures are checked between 2 and 7 days of incubation.

Multi-stage tunnel

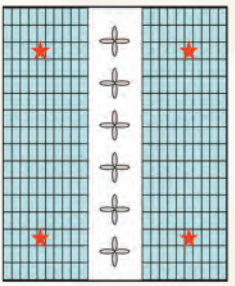


Acceptable eggshell temp range

38.2-38.3˚C (100.7-101˚F)

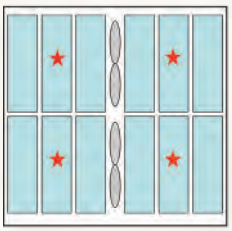
37.1-37.3˚C (98.8-99.2˚F)

Multi-stage fixed rack walk-in



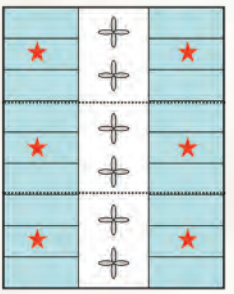
Eggshell temperature should be within ±0.1˚C (0.2˚F) of setter operating temperature.

Multi-stage trolley cabinet



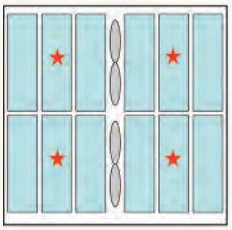
Eggshell temperature should be within ±0.1˚C (0.2˚F) of setter operating temperature.

Multi-stage trolley walk-in



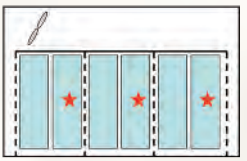
Eggshell temperature should be within ±0.1˚C (0.2˚F) of setter operating temperature.

Single-stage trolley with vertical central fans



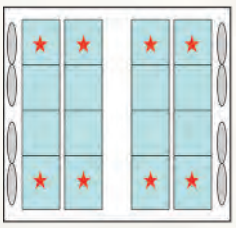
Eggshell temperature should be within ±0.1˚C (0.2˚F) of setter operating temperature and recorded from eggs between 2 and 7 days of incubation.

Single-stage laminar flow cabinet



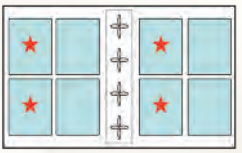
Eggshell temperature should be within ±0.1˚C (0.2˚F) of setter operating temperature and recorded from eggs between 2 and 7 days of incubation.

Single-stage trolley walk-in



Eggshell temperature should be within ±0.1˚C (0.2˚F) of setter operating temperature and recorded from eggs between 2 and 7 days of incubation.

Single-stage trolley with horizontal ventilation fans



Eggshell temperature should be within ±0.1˚C (0.2˚F) of setter operating temperature and recorded from eggs between 2 and 7 days of incubation.

Aviagen

Hatchery How To 20

MONITOR SETTER TEMPERATURE VARIATION

Interpreting results

- Compare shell temperature data between locations within a setter and between setters.

- If the temperature from a location within a setter is outside the acceptable range, then complete a thorough maintenance check on the setter.

- If there are differences between setters, then check setter calibration.

Setter	Location 1	Location 2	Location 3	Action taken
Set temperature = 37.5°C (99.5°F), Acceptable range = 37.4-37.6°C (99.3-99.7°F)				
1	37.5°C (99.5°F)	37.5°C (99.5°F)	37.4°C (99.4°F)	
2	37.5°C (99.5°F)	37.4°C (99.4°F)	37.6°C (99.6°F)	
3	37.3°C (99.2°F)	37.4°C (99.3°F)	37.3°C (99.2°F)	Recalibrated
4	37.4°C (99.3°F)	37.5°C (99.5°F)	37.5°C (99.5°F)	
5	37.6°C (99.6°F)	37.5°C (99.5°F)	37.4°C (99.4°F)	
6	37.2°C (99.1°F)	37.5°C (99.5°F)	37.4°C (99.4°F)	Water leak repaired
7	37.5°C (99.5°F)	37.5°C (99.5°F)	37.4°C (99.4°F)	
8	37.6°C (99.6°F)	37.5°C (99.5°F)	37.5°C (99.5°F)	

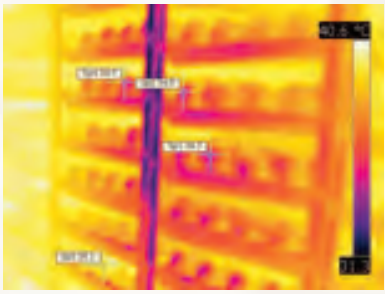
The example above shows two setters that were found to be outside the acceptable range and the corrective actions that were taken.

- After completing maintenance and calibration checks, re-check shell temperatures to ensure that all locations are within normal range.

- Keep records of results and maintenance carried out.

Maintenance issues that can cause temperature variation

- Humidity sprays wetting eggs or floors.
- Blocked humidity nozzles.
- Temperature sensors out of calibration.
- Humidity sensors out of calibration.
- Incorrect ventilation fan speeds.
- Water cooling or heating solenoids stuck open.
- Heater bars not working.
- Too much cold air entering the setter.
- Ventilation dampers not working correctly.



Thermal camera image of eggs chilled by faulty humidity nozzles

IMPROVE HATCHABILITY OF STORED EGGS

Short periods of incubation

● Eggs stored for more than a few days will not hatch as well as eggs set when they are 3-4 days old (Fig. 1).

● Stored eggs have more early embryo mortality, and the embryos that survive tend to be slower to develop and slower to hatch.

● When hatches are delayed, some chicks may not emerge in time to be counted, and chick quality may suffer because the chicks are too immature when they are placed.

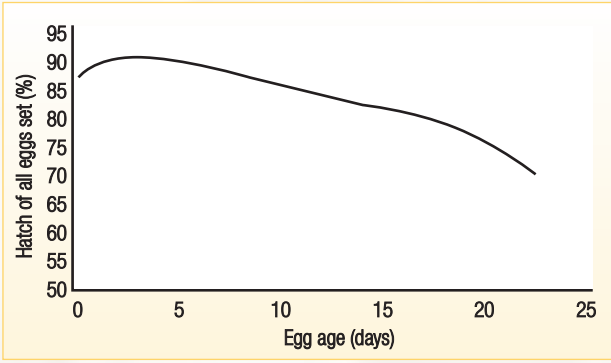


Fig. 1. Hatchability falls as egg age increases.

Natural incubation and SPIDES

● A farmyard hen will lay one egg in her nest every day until her clutch is complete. Each time she returns to the nest to lay an egg, the older eggs already in the nest will be warmed, effectively providing them with a short period of incubation.

● Trials have shown that mimicking the natural process in the nest by introducing Short Periods of Incubation During Egg Storage (SPIDES) can help maintain good hatchability in stored eggs.

● Well-implemented SPIDES treatment can restore 60% or more of the hatch decrease that would be observed in untreated stored eggs. If currently 10% hatchability is lost due to storage, implementing SPIDES can improve hatch by 6-7%. The absolute improvement increases as the storage time increases.

● Because it mimics a natural process, SPIDES has been found to be robust, with considerable flexibility. For example, the heating speed, terminal temperature and target days to implement SPIDES all have a wide range within which the treatment works well.

● Normal storage recommendations (holding eggs below physiological zero 24°C/ 75°F) still apply when the eggs are not being treated.

● Other beneficial effects of SPIDES treatment include:
• Reduction in the number of early deads.
• Shortened incubation times. In machines filled with a mixture of egg ages this makes it easier to manage take-off times and to avoid dehydration and overheating of chicks.

● Research continues into how SPIDES works. There is evidence that SPIDES helps rescue cells that would die during egg storage. It is also possible that the heat treatment advances embryo development to a stage that is more resistant to storage.

SPIDES AND EFFECTIVE EGG STORAGE

• In trials with broiler and parent hatching eggs, improvements in hatchability have been seen with egg storage periods as short as seven days (see Figs. 1 and 2).

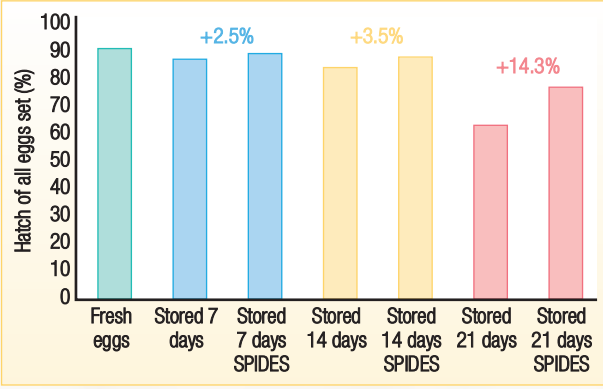


Fig. 1. The effect of SPIDES on hatchability of eggs stored for seven, 14 or 21 days.

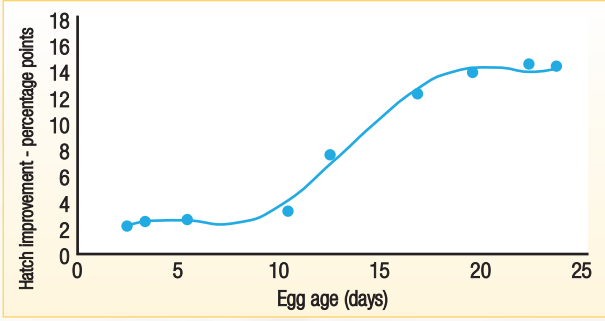


Fig. 2. Improvement in hatch seen in 34 field trials in six hatcheries.

What temperature should the eggs reach?

• Eggshell temperatures need to reach a temperature of between 32°C (90°F) and 38.3°C (101°F) for SPIDES to be effective.

How long do the eggs take to warm up?

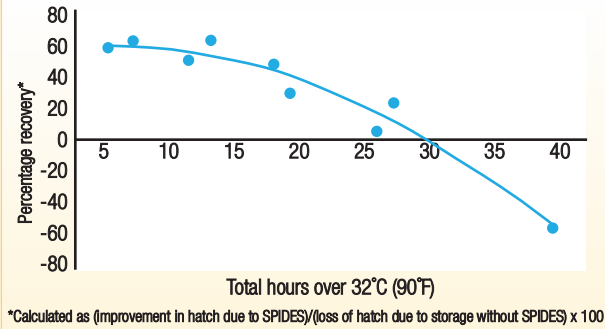
• The time taken to reach 32°C (90°F) can range from two hours to eight hours, depending on the type of machine used and how full it is.
• The time taken to warm the eggs above 32°C (90°F) does not have any effect on the outcome of SPIDES – fast or slow heating times can both be effective.

How many heat treatments are needed?

• The number of heat treatments needed will depend on how long the eggs are stored.
• The first treatment needs to be given before hatchability begins to decrease – about five days into storage.
• The best results will be obtained if the eggs are given repeat treatments at five or six day intervals.
• Treating eggs when they are fresher than 5-6 days will not harm them.

HOW LONG DO EGGS NEED TO STAY ABOVE 32°C?

- Remember that the time the egg is above 32ºC (90ºF) will include some of the cooling period as well.
- SPIDES seems to work best when the length of time that eggshell temperature is above 32ºC (90ºF) is short.
- Prolonged time above 32ºC (90ºF), especially if treatments are repeated several times, will not give as good a result as when the eggs are cooled immediately after the target egg temperature has been reached.
- If giving multiple heat treatments, then the best results will be achieved when cumulative time above 32ºC (90ºF) (the average time above 32ºC (90ºF) per treatment multiplied by the number of treatments) is 12 hours or less.
- Once the time above 32ºC (90ºF) exceeds 28-29 hours, there will be no net improvement in hatch due to SPIDES (Fig. 1).



*Calculated as (improvement in hatch due to SPIDES)/(loss of hatch due to storage without SPIDES) x 100

Fig. 1. How much hatch loss after storage can be recovered by SPIDES?

Procedure

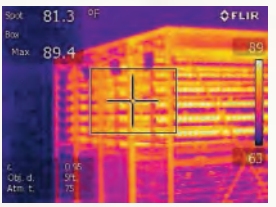
- Treat the eggs in setter trays held in well-spaced racks on farm trolleys or on setter trolleys.
- Plastic or fibre egg trays which are closely stacked together are not suitable.
- Eggs can be heated using the existing setters in the hatchery. Single or multi-stage machines are suitable although care must be taken with multi-stage machines not to overload their heating capacity with too many cold eggs.
- The eggs must be given enough time in the incubator for the eggshell temperature to reach a minimum of 32°C (90°F). Use tiny tag loggers to check locations within the machine to identify hot and cold spots, and make sure that all the eggs reach target temperature.
- Give the first treatment at 4-5 days egg age, and repeat at 5-6 day intervals as necessary.

SUGGESTED TREATMENT FREQUENCY FOR DIFFERENT STORAGE DURATIONS

Once the eggs have reached 32°C (90°F), they should be cooled back to the egg store temperature as quickly and evenly as possible.

• In single stage hatcheries, the setter pre-heat program can be used to cool the eggs down to 24°C (75°F). They can then be moved to the cooled egg store.

• In multi-stage hatcheries, with no opportunity to cool eggs in the incubator, it will be best to move the eggs to the egg store immediately, placing them well away from other eggs in the store. Be aware that if warm eggs are placed back into the egg store immediately they may cause a temporary rise in air temperature in the store.



• Once SPIDES is used on a routine basis, then the existing egg store can be partitioned so that there is a space dedicated to cooling eggs after SPIDES treatment.

Eggs should be heated until they reach at least 32°C (90°F).

Egg age at set	Number of treatments	Egg age (days) at treatment
7	1	4-5
14	2	5-6 and 10-12
21	3	5-6, 10-12, 15-18

Troubleshooting

• The table below gives possible causes to consider when SPIDES either does not improve hatch at all, or does not restore 60-70% of the loss.

Observation	Possible causes	Action
Treated eggs hatch no better than untreated eggs	Eggs did not reach 32ºC (90ºF) because heating time was too short for the number of eggs loaded in the machine	Use Tiny Tag loggers to check that heating time is long enough to reach target temperature under prevailing loading conditions
	Total time above 32ºC (90ºF) was longer than 28 hours	Use shorter and fewer heat treatments so that time above 32ºC (90ºF) totals 12 hours or less. Make sure that the eggs are cooling evenly
	Eggs packed onto close-stacked trays while still warm on farm	Allow eggs to cool on separated racks until below 24ºC (75ºF)
Treated eggs hatch better than untreated, but <60% of the hatch drop has been restored	Eggs did not reach 32ºC (90ºF) because heating time was too short for the number of eggs loaded in the machine	Use Tiny Tag loggers to check that heating time is long enough to reach target temperature under prevailing conditions
	Eggs packed onto close-stacked trays while still warm on farm	Allow eggs to cool on separated racks until below 24ºC (75ºF)
	Total time above 32ºC (90ºF) was longer than 12 hours (but less than 28 hours)	Use shorter heat treatment time or drop one treatment; make sure that the eggs are cooling evenly
	Only one SPIDES treatment given to eggs stored for 13 days or longer	Use additional treatments
	No improvement in early embryo mortality, but hatch time is quicker than untreated eggs	First SPIDES treatment given too late – give the first treatment before six days storage