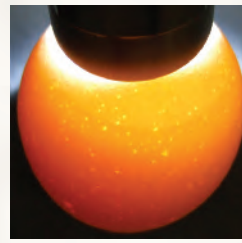
MEASURING FERTILITY & EARLY DEADS LEVELS – PART 1

Why measure fertility and early deads?

- An unfertilised egg cannot produce a chick.
- Flock fertility is governed by management of males and females on the breeder farm and **cannot** be affected by egg handling, egg storage or incubation conditions.
- Early embryo mortality **can** be affected by egg handling, egg storage or incubation conditions.
- The action required to correct poor fertility is not the same as that required to correct excess early dead, therefore it is important to distinguish between infertility and early deads.



An individual egg being candled.

Procedure for assessing flock fertility

- What is an infertile egg?
  - An infertile egg is one that has not been fertilised.
- What is an early dead embryo?
  - An early dead is an egg which has been fertilised but in which the developing embryo dies in the first week of incubation.
  - After an embryo dies it will deteriorate over time, therefore the longer eggs are incubated the more difficult it becomes to distinguish early deads from infertiles.
- During candling eggs with a developed embryo will appear dark.
- Clears are not always infertile.
- A clear egg may be infertile or contain an early dead embryo.

Dark eggs contain a live embryo.

- Therefore, to accurately identify infertility and early deads a breakout of candled clears needs to be completed.
- There are two methods for assessing flock fertility:
  1. In un-incubated eggs.
  2. In clear eggs candled between 10 and 14 days of age.

Advantages	Disadvantages
UNINCUBATED EGGS	
Quick feedback	Destroys potential hatching eggs
Can be done on farm	Small sample size (so the sample result can be very different from the flock average)
Can see mottling and egg quality issues	Takes practice
CLEARS 10-14 DAYS	
Does not destroy potential hatching eggs	No results until approx. 17 days after lay
Bigger sample size (so better precision)	Not necessarily standard practice to candle at 10-14 days
Easy to learn	Internal quality issues difficult to see

MEASURING FERTILITY & EARLY DEADS LEVELS – PART 2

Procedure for assessing flock fertility

Method 1 - Identifying infertility in un-incubated eggs

- Eggs are fertilised high in the reproductive tract and embryonic development continues until the egg is laid.
- This makes it possible to identify infertile eggs before incubation.

Step 1:
Take a sample of 100 fresh normal hatching eggs per house, of known egg age.

Step 2:
Break eggs, one at a time, over a bucket allowing the albumen to drop into the bucket and catching the yolk in your hand. Roll the yolk over until the germinal disc can be seen.

Note: *The task is easier in good natural light. If this is not available, a single-LED (light emitting diode) torch will illuminate the disc without causing reflection off the yolk surface. A magnifying glass can also be helpful.*

Fertile Blastoderm

- White, symmetrical ring 4-5mm (0.2in) diameter, with a clear central area
- Round, with smooth uniform edges
- No bubbles

Infertile Blastodisc

- Dense, white spot, 2-3mm (0.1in) diameter
- Rarely perfectly round, jagged edges
- Bubbles

Example of fertile eggs recordsheet

Record incidence of fertile and infertile eggs and compare to targets.

Company: ACME Farming

Date: 31st January 2010

Farm	W/H 26W	S/V 36W	U/H 46W	R/R 56W	
No. of eggs sampled	100	100	100	100	
Fertile	81	85	81	87	
Infertile	19	5	19	13	
- Mottled yolk	1	2	20	30	
- Watery albumen	-	-	-	-	
- Sticky yolk	-	-	-	-	

Take the chance to observe and record any yolk mottling. If severe, this can increase very early dead embryos.

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MEASURING FERTILITY & EARLY DEAD LEVELS – PART 3

Procedure for assessing flock fertility

Method 2 - Identifying infertile eggs and early dead embryos in clear eggs candled between 10 and 14 days of incubation

- Fertility can also be assessed in eggs candled clear between 10 and 14 days of incubation.
- It is not advisable to try and assess fertility on eggs candled any later than this because post mortem degeneration of the embryo makes it difficult to distinguish infertile eggs from those with very early embryonic development.

Step 1:
Candle three setter trays per flock, between 10 and 14 days incubation.

Step 2:
Remove and hold the clears, keeping them separate to flock and setter tray.

Step 3:
Open the eggs with forceps at the air cell, taking care when removing the membrane that no egg contents are discarded.

Step 4:
Identify fertility or stage of development at death, using the photos below.

Degeneration after death will change the appearance of the early dead embryos and this is also shown in the photos.

	Normal appearance of live embryo.	Appearance after 8-10 days incubation	Appearance after 14-15 days incubation
Infertile			
Death after 24 hours development			
Death after 48 hours development			
Death at blood ring stage* (2.5-4 days)			
Death at black eye stage (5-12 days)**			

** With blood ring stage deaths, once the blood vessels degenerate, often the only sign of embryo development is a change in colour to a creamy yellow. This does not indicate contamination.*

*** Embryo death at the black eye stage is often associated with bacterial rots – in addition to discolouration, the egg contents smell bad and have often disintegrated.*

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MEASURING FERTILITY & EARLY DEAD LEVELS – PART 4

Example of candling analysis recording sheet.

Record incidence of fertile and infertile eggs and compare to targets.

Transfer Candling Analysis

Company: ACME Farming

Farm: Underhill Farm Age: 46 Weeks

Setter tray size.: 150

Set: 31/01/2010 Candled: 11/02/2010

Broken Out: 11/02/2010

Setter No: 4

Interpreting results

The table below gives top quartile targets for hatchability losses when performing detailed diagnostic/ research type egg breakouts (% of total eggs set).

Flock age	Stage of development of embryo					
	Infertile	24 hours	48 hours	Blood ring	Black Eye	Feathers
Young (25-30 wks)	6	1	2	2.5	1	1
Peak (31-45 wks)	2.5	0.5	1	2.0	0.5	1
Post Peak (46-50 wks)	5	0.5	1	2.5	1	0.5
Ageing (51-60 wks)	8	0.5	1	3.0	1	0.5

Tray number	1	2	3	4	5	6	7	8	9	10	Total	% of eggs set
No. of eggs removed	36	34	30								100	22.2
Infertile	23	22	21								70	15.6
24h early dead	1	2	2								5	1.1
48h early dead	2	2	2								6	1.3
'Blood Ring' (2.5-4 days)	5	6	7								17	3.8
'Black Eye' (5-12 days)	1	2	1								4	0.9

If the target for a category is exceeded the cause of this should be investigated

	Hatchery	Farm
Causes of high infertility		• Young/old males • Males heavy or losing condition • Females under/over weight or losing condition • Nutrition • Drugs/toxins in feed • Disease • Legs/feet in poor condition
Causes of early embryo mortality (1-4 days)	• Long egg storage (> 7 days) • Egg store temperature too hot, too cold or fluctuating • Formalin exposure 12-96 hours of incubation • Slow to reach incubation temperature	• Yolk mottling due to stress (over mating, stocking density) or nicarbazine • Egg collection not often enough (should be >3 times/day) • Nutrition
Causes of embryo mortality 5-7 days	• Long egg storage (> 7 days) • Egg store temperature too hot, too cold or fluctuating • Formalin exposure 12-96 hours of incubation • Slow to reach incubation temperature • Eggs contaminated during storage • Condensation on the egg surface • Turning angle too shallow, frequency too much or too little	• Yolk mottling due to stress (over mating, stocking density) or nicarbazine • Egg collection not often enough (should be >3 times/day) • Nutrition • Floor or soiled eggs

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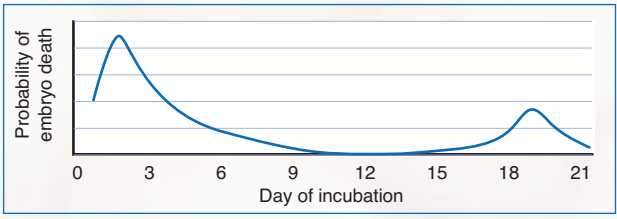
BREAK OUT AND ANALYSING HATCH DEBRIS

Why break out and analyse hatch debris?

- It is normal for there to be some embryo mortality during incubation.
- Embryo losses tend to follow a consistent pattern (although it will vary slightly with flock age).
- Some embryo malpositions and abnormalities have known causes and can be the result of specific problems.
- Analysing embryo mortality patterns and abnormalities can help to identify which aspects of the incubation process need closer investigation in order to improve hatchability and chick quality.

Normal pattern of embryo loss during incubation showing peaks in mortality during early and late incubation



Procedure for breaking out hatch debris

Step 1:
Sample selection and preparation.

- Hatch debris breakouts should be integrated with other QA procedures such as measuring egg water loss and chick yield.
- Monitor three setter trays per flock per week, and label sample trays clearly at the time of set.
- The eggs used for the sample trays should be clean nest eggs of known flock source, flock age and egg age.

Note: *Clear or non-viable eggs should not be removed from trays. However, it will not be possible to distinguish infertile from early embryo mortality on clear eggs left in the setter for 18 days. A separate sample of eggs should be used for fertility identification.*

Step 2:
Take off and count dead in shell.

- On the day of hatch, count chicks and culls out of the sample setter trays. Record their numbers per tray.
- Collect, count and separate out the unhatched (dead in shell) eggs. Record their numbers per tray.

Note: *The totals for chicks plus culls and dead-in-shell should equal the number of eggs set, less any removed at candling.*

Step 3:
Breaking out dead in shells.

- Identify and count any eggs where the beak has pierced the shell (pips). Record numbers, and note if any chicks are still alive.
- Open all the eggs, at the air cell. Take care not to remove any egg contents when lifting the air cell membrane.
- Identify the stage of development of the embryo and sort eggs into groups of infertile, early dead (0-7 days) mid dead (8-15 days) and late dead (15-21 days).
- Check very late (20-21 days) dead embryos for malpositions.
- Check for malformations in the mid and late dead embryos.
- Also record any with cracked or poor quality shells and any eggs that are contaminated.

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BREAK OUT AND ANALYSING HATCH DEBRIS

Breakout findings

	At the start of the recording period, the embryo will look like this:	By the end, the embryo will have grown to look like this:	After death appearance changes and the embryos may look like this:
Infertile No obvious signs of development.			
Early dead 1-7 days The end of this stage is marked by the appearance of the egg tooth on the beak.			
Mid dead 8-14 days Embryos have an egg tooth but no obvious feather development.			
Late dead 15-19 days Well feathered embryo, fills the shell. Yolk may be external or retracted.			
External pip 20 days The beak has broken through the egg shell.			
Contaminated Deep discolouration of the egg contents, which smell off.			

Common malpositions

Malposition 1 Head in small end

Malposition 2 Head turned to left

Malposition 3 Feet over head

Malposition 4 Beak above right wing

Malpositions normally occur in 1.5% of all eggs set.

Head in small end of shell (Malposition 1) is the most variable malposition as it is caused by setting eggs upside down. The occurrence of this malposition should not exceed 0.1% of eggs set.

The incidence of Malposition 2 (head turned to left) and Malposition 3 (feet over head) is normally 0.25% of eggs set (each).

The incidence of Malposition 4 (beak above right wing) is normally about 0.4% of eggs set.

Common malformations

Occasional abnormalities are not a cause for concern. Further investigation is appropriate only if a single malformation occurs at levels over 0.5% of the eggs set.

Exposed brain | **Ectopic viscera** | **Duplication of body parts**

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THE PROCEDURE FOR ANALYSING HATCH DEBRIS

- Record the number of eggs falling into each category for each tray.
- Add these numbers together to determine the total number of eggs falling within each category.
- Calculate the total as a percentage of the number of eggs set.

Example recording sheet for hatch debris break out information

Transfer Candling Analysis

Company: ACME Farming

Farm: B20 Age: 31 Weeks

Setter tray size: 150

Set: 3/3/2010 Candled: 14/3/2010

Broken Out: 24/3/2010

Setter No: 12 Hatcher No: 3

Tray number	1	2	3	4	5	6	7	8	9	10	Total	% of eggs set
No. of eggs removed	17	18	15								52	11.6
Infertile	6	4	4								14	3.1
Early dead (0-7 days)	5	5	5								15	3.3
Mid dead (8-14 days)	2	1	1								4	0.8
Late dead (15-21 days)	5	5	4								14	3.1
External pip	1	3	1								5	1.1
Dead and cull chicks	1	0	2								3	0.7
Contaminated	1	3	1								5	1.1
Poor shell quality	0	0	1								1	0.2
Cracked shell	0	0	1								1	0.2
Malpositions												
-Head in small end	1	-	-								1	0.2
-Head to left	-	-	-								-	-
-Feet over head	-	2	1								3	0.7
-Beak above right wing	-	-	-								-	-
Malformations												
-Exposed brain/eye	-	-	-								-	-
-Extra limbs	-	-	-								-	-
-Ectopic viscera	-	-	-								-	-
Notes												

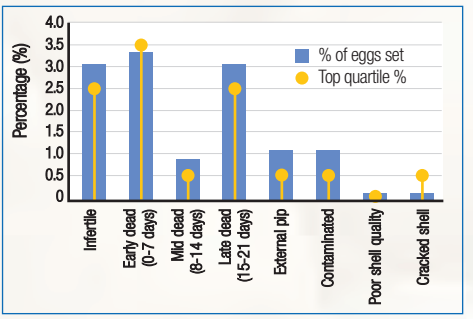
Interpreting results

- Compare the results with the targets for the age of the flock concerned.

Flock age	Stage of development of embryo						
	Infertile	Early dead	mid dead	late dead	ex pip	cracked	contaminated
Young (25-30 wks)	6	5.5	1	3.5	1	1	0.5
Peak (31-45 wks)	2.5	3.5	0.5	2.5	0.5	0.5	0.5
Post peak (46-50 wks)	5	4	1	2.5	0.5	0.5	0.5
Ageing (51-60 wks)	8	4.5	1	3	0.5	1	1

- Plot results against target. If any figure is above target an investigation into the reason for this should be set up.

Simple hatch debris analysis



Notes: Any assessment of infertility made at the end of incubation during a breakout is likely to be inaccurate as it is not possible to distinguish true infertile from early deads. If the early dead plus infertility numbers exceeds the target then follow procedures to identify infertile eggs and early deads before taking further action.

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POSSIBLE CAUSES OF EMBRYO MORTALITY

	Hatchery	Farm
Early dead (0-7 days)	• Formalin exposure 12-96 hours. • Slow to reach incubation temperatures • Condensation on egg surface • Turning angle/frequency incorrect • Long egg storage • Fluctuating egg storage temperature	• Inadequate egg collection • Nutrition • Egg contamination • Floor/soiled eggs
Mid dead (8-14 days)	• Embryo temperature too high	• Nutritional deficiencies • Contamination
Late dead (15-19 days)	• Setter/hatcher temperatures/ humidities incorrect – check egg shell temperature and water loss • Transfer damage • Eggs set upside down • Insufficient water loss	• Nutritional deficiencies • Contamination
At pipping	• Inadequate turning/eggs set upside down • Transfer damage • Excessive fumigation in hatcher • Long egg storage	• Nutritional deficiencies
Contam-ination	• Egg shell disinfection inappropriate • Condensation on egg surface during storage or transport • Thin or cracked shells • High level of contamination in the hatchery (if late deads only)	• High levels of floor eggs • Poor nest hygiene
Malpositions	• Head in small end – egg incubated upside down, high incubation temperature or shallow turning angle • Beak above right wing - heat stress • Other malpositions - causes unknown	• Beak above right wing - Nutritional deficiencies (linoleic acid)
Mal-formations	• Exposed brain - high early incubation temperatures • Ectopic viscera - high incubation temperatures mid-term • Extra limbs - rough handling or jarring of the eggs during collection/transport	