

- g. Excess body weight, especially in broiler breeder males (>4,800 g, 10.6 lb).
- h. Nutritional deficiencies or excesses; severe feed restriction.
- i. Feet and leg problems, especially in males of heavy breeds.
- j. Certain drugs, pesticides, chemicals, toxins, or mycotoxins.
- k. Parasites, such as mites.
- l. Inadequate floor space.
- m. Decreased mating frequency, or no mating, is commonly seen in many of the conditions listed above; this may often be the direct cause of infertility.
- n. Inadequate lighting (intensity or daylength).
- o. Improper artificial insemination procedures (if artificial insemination is used).

2. Sign: Eggs candle clear; broken out eggs show enlarged germinal disc; no blood. Fertile. Some are termed "blastoderm without embryo."

Causes:

- a. Eggs stored too long. They should be stored <7 days.
- b. Eggs held under poor conditions, temperature too high or too low. Fluctuating temperatures. Temperature should be 60° to 65°F (15.6° to 18.3°C).
- c. Fumigation improper — too severe or done between 12 and 96 h of incubation. Incorrectly spraying or foaming eggs with disinfectant.
- d. Eggs damaged during handling and transport by jarring, temperature shock (temperature increased or decreased too rapidly), etc.
- e. Eggshell sealed — respiration inhibited.
- f. High temperature in early incubation.
- g. Very young or very old breeders.
- h. Heredity, inbreeding, chromosome abnormalities, or parthenogenesis.
- i. Breeder flock diseases.
- j. Failure of a basic organ system to develop normally.
- k. Egg wash temperature too high.
- l. Egg-borne infections (e.g., *salmonella*).
- m. Drugs, toxins, pesticides, etc.
- n. Infrequent or incomplete egg collection.

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3. Sign: Eggs candle clear; broken out eggs show blood ring or small embryo that died before 3 days of incubation; no dark eye visible.

Causes:

- a. Eggs stored too long or under improper temperature.
- b. Fumigation improper — too severe or done between 12 and 96 h of incubation.
- c. High temperature in early incubation.
- d. Low temperature in early incubation.
- e. Eggs damaged during transport by jarring, etc.
- f. Breeder flock diseases.
- g. Old breeders.
- h. Embryological development accidents.
- i. Inbreeding, chromosome abnormalities.
- j. Severe nutritional deficiencies, e.g., biotin, vitamin A, copper, vitamin E, boron, or pantothenic acid.
- k. Frequently associated with a high incidence of infertility.
- l. Drugs, toxins, or pesticides.
- m. Contamination.
- n. Embryos less developed at oviposition, i.e., pre-endoderm or very early endoderm formation.

4. Sign: Dead embryos; 3 to 6 days of incubation; yolk sac circulatory system present, embryo on left side, no egg tooth.

Causes:

- a. See causes 3.a-n.
- b. Lack of ventilation, or sealed shells, carbon dioxide >1%.
- c. Improper turning — <1/h or >6/h; improper turning angle.
- d. Vitamin deficiencies — vitamin E, riboflavin, biotin, pantothenic acid, or linoleic acid.

5. Sign: Dead embryos; 7 to 17 days of incubation; each embryo has egg tooth, toenails, feather follicles (8 days), feathers (11 days).

Causes:

- a. Improper incubator temperature, humidity, turning, ventilation. Low humidity increases abnormalities of aortic arches (13 days).