



The University of Georgia

Cooperative Extension Service

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HATCHERY/BREEDER TIP...

FERTILIZATION OF THE AVIAN EMBRYO

Fertilization in commercial chickens is usually the result of natural mating. However, in some cases, artificial insemination is practiced. The turkey industry especially depends on artificial insemination since natural mating is virtually impossible as a result of intense genetic selection for confirmation and body weight.

Natural Mating and Fertilization:

Mating in chickens is the culmination of a sequence of behaviors. For example, the rooster will initiate mating by exhibiting "courtship" behavior: dropping one wing and dancing in a circle (the lowered wing will be on the inside of the circle dance). The hen will "crouch" to indicate receptiveness. The rooster will then "mount" the hen and grab her comb, neck feathers, or the skin on the back of her head or neck to help stabilize him on the hen's back. The next behavior is the "tread" (the rooster walks quickly in place on the hen's back) and finally the "completed mating" is the culmination of the behavioral sequence. The completed mating occurs when the rooster dips his tail to the side of the hen's tail and spreads his tail feathers so that their cloacae come in contact. At this point the rooster's ejaculate is released directly into the hen's vagina via cloaca. In the typical breeder house with thousands of birds, the entire sequence of behaviors does not always occur, and the courtship dance is frequently left out of the sequence. Chickens are polygamous, but certain males and females selectively mate regularly. Some females in the flock will show avoidance to specific males, and therefore are rarely mated by those males.

The rooster usually ejaculates between 100 million and 5 billion sperm at a time with greater concentrations produced at the beginning than at the end of the day, when depletion occurs due to multiple matings. A rooster may mate from 10 to 30 or more times per day, depending on the availability of hens and competition from other roosters. First ejaculates average about 1 milliliter, but after several ejaculations the average ejaculate will be reduced to 0.5 milliliter or less (these data were obtained from semen collection by stimulating and massaging the male). The numbers of sperm per ejaculate and the volumes of semen should be lower in natural matings as compared to semen collection by stimulation and massage. The frequency of mating follows a diurnal pattern with mating frequency reaching peaks early and late in the day.

Despite frequent mating, the number of sperm per ejaculate seldom is less than 100 million which is the minimum requirement for high fertility. With natural mating, better fertility will result when mating occurs after the hen has laid a hard shell egg. However, if the hens are mated frequently (daily), there is unlikely to be a noticeable difference in fertility regardless of when the matings occur.

PUTTING KNOWLEDGE TO WORK

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The copulatory organ.

The rooster has a small phallus that becomes engorged with lymph to form a copulatory organ. The copulatory organ is rudimentary and at the time of mating there is practically no penetration. The hen everts her vagina during copulation which helps to transfer the semen into the oviduct. Ducks, geese, and some other birds have more well-defined copulatory organs.

Movement of sperm cells.

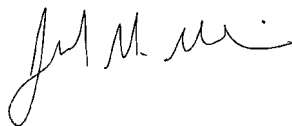
The sperm propel themselves into the uterovaginal spermatozoa storage tubules. Motility is an important quality for semen, as sperm that are not motile will not reach the storage tubules. Sperm are released from the storage tubules at regular intervals to fertilize the sequentially ovulated ova. After release, the sperm are carried to the ovum primarily by contractions of the hen's oviduct, and sperm motility is no longer critical. If there is no egg in the oviduct, the movement of sperm from the uterus to the infundibulum occurs in less than 30 minutes. Within 5 to 10 minutes after an ovulation, a few sperm move to the germinal disc (location of the pronucleus) on the surface of the ovum (egg yolk). More than 50 sperm may penetrate the outer layer of the ovum, but only one unites with the female pronucleus to form the zygote. Even though only one sperm is needed to fertilize the ovum, research has shown that when sperm penetration average is less than 30 in a breeder flock, poor fertility will be associated with that flock. Flocks with good fertility average well above 50 sperm penetrations per ovum. On the first day following a single mating, a fertile shelled egg may be produced, however, only 10-20% of the eggs will initiate cell division. Normally, maximum fertility from a flock of hens will not occur until at least the second day post mating.

Viability of newly produced sperm.

Fresh sperm have a fertilization advantage. Because of their greater viability and the fact that the sperm from the most recent insemination are stored on top of older sperm in the storage ducts they have a greater chance of reaching the ova. If roosters are removed from the flock and replaced with new males on the same day, after three days practically all offspring will be sired by the new males.

Fertility after removal of males from flock.

Fertile eggs continue to be produced after males are removed from the flock because of sperm storage and survival within the hen's oviduct (sperm storage tubules). Fertile eggs can be produced for up to 4 weeks after removal of males, but the number of sperm is reduced resulting in lower fertility and hatchability. In the last 10 years, advancements have been made in the cryopreservation of semen such that in certain strains 70% fertility has been achieved from inseminations with semen that has been stored frozen. With continued advancements in this area, storage of semen for later use, as in the case with mammals, could become practical in the future.



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****Consult with your poultry company representative before making management changes.****

“Your local County Extension Agent is a source of more information on this subject.”