Avian Sciences Research Update

Published as a special supplement to California Agriculture. *Technical coordinator: F. Howard Kratzer, Chairman, Department of Avian Sciences, University of California, Davis. Special Editor: Gary A. Beall, Communications Specialist, Animal Science, University of California, Davis. Photos by Jack Kelly Clark (unless otherwise indicated). All authors are in the Department of Avian Sciences, unless otherwise indicated.*

California is the top-ranking state in the United States in egg production and is second only to Minnesota in the production of turkeys. In addition, many turkey breeders are located in California and supply basic stock to the rest of the country and the world. Meat-bird production is increasing in importance in the state.

Over the years, many of the discoveries in the University of California's Department of Avian Sciences have had immediate application to industry problems. These have covered a range of disciplines, from feeding to breeding to insemination techniques. Many of the principles developed in these discoveries have been important for the production of other animal species as well.

In recent years, we have responded to a need for research related to the consumer in areas such as meat quality, cholesterol in eggs, off-flavors, the effect of gossypol on eggs, residue problems in food, and toxicants (aflatoxins).

The development of methods to protect the environment has also been a concern of the department. Work is underway studying: the dangers of oil pollution on sea birds which may be affected by oil spills; desirable ways of disposing of poultry manure; wild species and problems of reproduction in a number of endangered species of raptors; and the environmental and recreation aspects of game-bird production.

In studying the basic biology of avian species, we are developing information which can have a variety of uses. In some cases, the information can be directly applied to the poultry industry. In other cases, the information may have important biomedical applications: many nutritional discoveries have been made over the years with poultry as experimental animals; studies with mutant strains of chickens—particularly those that develop scoliosis or muscular dystrophy—have had important biomedical applications; and studies of avian species have led to important discoveries in the area of immuno-genetics.

The following pages provide a brief look at some of our major research thrusts. Although not inclusive, they offer a good cross-section of our effort to serve California's poultry industry and the concerns of the general public.

-F. H. Kratzer
Chairman
Department of Avian Sciences

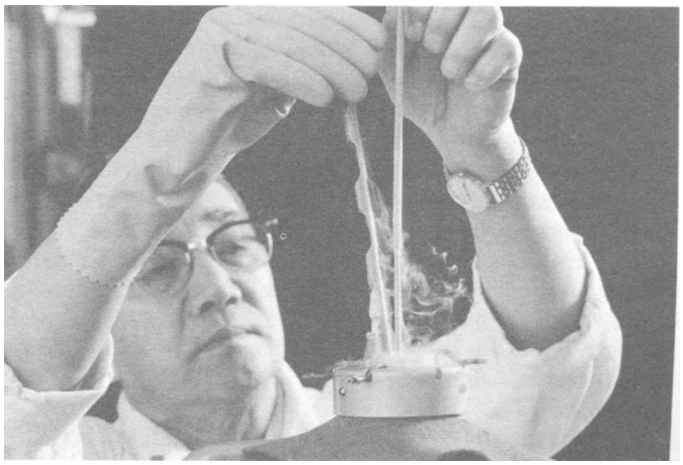
Reproduction

Artificial insemination is an essential technique for the production of commercial turkey hatching eggs because the birds are no longer capable of natural mating.

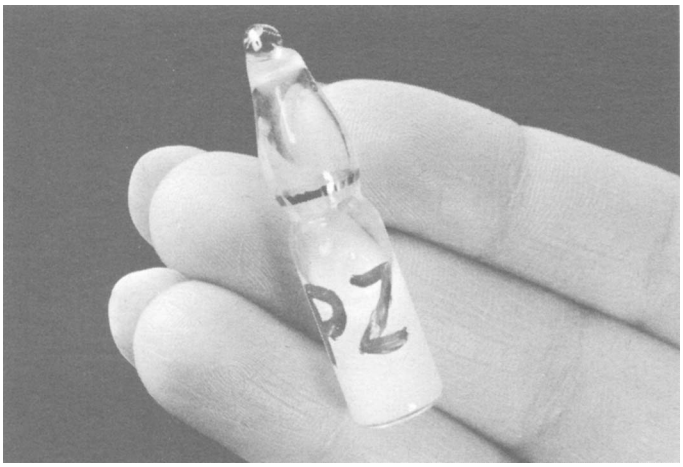
We introduced this technique to the industry in the early 1950s and have since learned much about the reproductive physiology of turkey hens that has led to improved insemination techniques.

We discovered two major sperm storage sites in the hen's oviduct. The most important site lies at the junction of the vagina and the shell gland, designated as the uterovaginal region. The other is at the top of the oviduct at the junction of the infundibulum and the magnum. It is now known that after an egg is laid, the sperm are released from the lower storage site and travel up the oviduct to the upper storage site into the funnel region where they fertilize the ovum as it is ovulated.

We also found that the storage tubules, or sperm-host glands, in the uterovaginal region consist of a single layer of columnar cells arranged in the form of a blind-ended tube. A more extensive study of this sperm-host region revealed that



Freezing turkey semen in liquid nitrogen.



Ampule of frozen turkey semen.

it consists of three circular folds of muscular tissues, covered with a heavily ciliated mucosal epithelium, which effectively separates the vaginal and shell gland regions of the oviduct. By removing the cilia, we discovered that the sperm-host gland apertures were confined to one fold adjacent to the shell gland. This explains why fertility is curtailed when there is a hard-shelled egg in the shell gland at the time of insemination. Apparently, the pressure of the hardshelled egg compresses the tissue and seals many of the apertures so that sperm entry is effectively blocked. It also points out the need for deep and multiple inseminations to maintain optimum fertility in the turkey hen.

We also are developing techniques for the long-term storage of turkey semen. This would: (1) enable the turkey industry to utilize in subsequent years male lines that had been disposed of because of maintenance costs; (2) permit early sale of male stock used for routine multiplying inseminations rather than keeping them for an entire season; and (3) permit the retention and preservation of unique germplasm such as mutants and endangered breeds.

We have studied the best cryoprotective agent for freezing; the optimal cooling rate; the optimal thawing rate for frozen semen; and the procedure for the removal of the cryoprotective agent before insemination. But precise information is still lacking, and freezing turkey semen remains economically unsuccessful. However, progress has been made. Progeny have been obtained when the thawed, frozen sperm are introduced into the magnum, which lies between the two sperm storage sites, by a surgical procedure.

-F. X. Ogasawara

Turkey cage management

In several years of testing, the reproductive performance of Broad Breasted White breeder males was studied under different systems of management including cages, cubicles, and floor pens. Our results indicated that males kept in cages from 30 to 52 weeks of age produced more and better semen than comparable males kept in cubicles or on the floor. The ratio of average feed consumption to average body weight was approximately the same for males in all managements.

Further studies showed that males showing a marked decline in semen volumes at 52 weeks of age could be recycled to a second period of semen production by being subjected to an 8-week period of non-stimulatory light (8L:16D) followed by a 20-week period of stimulatory light. Males rejuvenated in this manner produced considerably more semen per bird than comparable males kept continuously on stimulatory light.

Other tests indicated that turkey hens kept in cages produced slightly more eggs than comparable hens kept on the floor, but fertility and hatchability were about 5 percent below that for hens kept on the floor. It was also noted that the incidence of soft-shelled and cracked eggs was approximately 5 percent greater from hens in cages than from floor birds. After three years of intense selection for better shell quality, we were only able to reduce the incidence of soft-shelled and cracked eggs by about 2 percent.

-Allen Woodard

Controlled feeding of leghorn layers

Feed represents up to 70 percent of the cost of producing eggs. Therefore, one of the best opportunities to reduce costs is to increase feed conversion efficiency. This might be accomplished by limiting body weight gains through restricted feed intake. Heavy broiler-breeder strains are routinely maintained on controlled feeding programs to prevent excess fat deposition, but Leghorn layers are normally full-fed with access to feed 24 hours a day.

Controlled feeding experiments which we conducted at four field locations indicate that some flocks of Leghorn layers do over-consume energy when full-fed. In these cases, reducing feed intake by 8 to 12 percent slightly lowered rate of lay and egg size, but the trend was toward a higher egg income over feed cost of one to two cents per dozen compared with full-fed controls. Strain of layer significantly affected the response to feed restriction.

Although additional research is needed to refine the method, controlled feeding is being tried on a limited basis by some commercial egg producers. Equipment manufacturers are designing feed delivery systems to simplify adaptation of the technique.

Milo Swanson
Extension Poultry Specialist

Max Clover photo.

Leghorns on restricted feed test.