PROCEEDINGS

GAME BIRD WORKSHOP

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NUTRITION AND FEEDING PRACTICES

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This report is based on work done by Dr. M. L. Scott of Cornell University in cooperation with the New York State Game Farm a short distance from Ithaca. Dr. Scott presented this work at the Distiller's Feed Research Council meeting, 1966. He recommends a protein level for pheasants of approximately 30% and for quail 26% at metabolizable energy levels of 1350 kcal/lb. If the amino acid composition were ideal in the feed, the protein level could probably be reduced to about 26%, but since the amino acid needs are not well known, we must stay with this figure of 30% which is about the same as for turkey poults.

The protein requirement decreases as birds grow older and the growth rate slows down, while the energy need remains about constant. The ratio of energy to protein, therefore, increases with age. The specific amino acid requirements, as far as is known at present, are similar to those for turkey poults. Probably, lysine, the sulfur amino acids and tryptophan are the most important ones to consider in formulating adequate rations with the usual feedstuffs available.

The vitamin and mineral requirements of pheasants and quail are of approximately the same order as those for poults. Vitamin A is more critical for quail than for pheasants while vitamin D_3 appears more critical for pheasants. The need for vitamin K is increased severalfold by the use of some drugs such as sulfaquinoxaline.

It cannot be said that there is any one particular ration which will give good results because the value of these rations depends upon the essential nutrients which they supply. As in all poultry rations, it is a matter of supplying the required nutrients in the most economical way. Purified diets have not been successful with pheasants unless some natural feedstuffs such as fish solubles, distiller's solubles, dried whey or liver meal have been present as well.

The cereals commonly used in feeds for game birds include milo, corn, barley, wheat and oats. Because they are used at relatively high levels, they contribute considerable protein to the ration as well as energy. Most cereal protein is rather poor in amino acid balance and must be supplemented by richer protein sources to improve both the quality and quantity of protein in the feed. Soybean meal is an excellent and widely used protein supplement while cottonseed meal, safflower meal and corn gluten meal are also useful. Fish meal and meat and bone meal are common animal protein supplements with blood meal used occasionally as a specific source of lysine.

Extra minerals are usually supplied by bone meal, dicalcium phosphate, ground limestone, salt, manganese sulfate and a zinc salt such as zinc oxide. Alfalfa is an excellent source of vitamin A and some other vitamins. Many are supplied incidentally by other feedstuffs but special consideration still has to be given to them. Commercially available vitamins can be added conveniently and economically.

As the birds grow older, the protein requirement decreases. The protein in the complete ration can then be decreased or the birds can be fed grain containing about 10% protein.

A typical ration for starting pheasants (pounds per ton) would contain:

800 lbs cornmeal
850 lbs soybean meal
60 lbs stabilized fat
100 lbs fish meal
vitamin and mineral supplements

Antioxidants are frequently used to protect the feed ingredients from deterioration before the feed is used and antibiotics are usually added for the slight growth response obtained. The level of antibiotic depends largely on local conditions.

Questions:

Q. Why is it when I use 28% protein I get a lot of slipped tendons but when I drop to 24% I have no problems?

A. Your problem would probably be related to minerals. You should possibly have a little more manganese and zinc. It may be a bit more complicated but those are the things one thinks of first.

Q. My problem is with feather picking. Has this anything to do with the feed?

A. Sometimes deficiencies in the feed will produce this type of problem, but it also can be a vice which may be unrelated to nutritional deficiencies.

Q. What problems do you get into with increased minerals and proteins?

A. Increased minerals can cause a toxicity and also imbalances; that is, they can create deficiencies of other minerals. The only problem with excess protein is that of cost.

Q. What would be the effect of using sulfaquinoxaline year after year?

A. There is an antagonism with vitamin K, which would have to be increased. Vitamin K is necessary for proper blood-clotting and problems with hemorrhaging have been noted. I would like to refer specific recommendations on drug use to Dr. Rosenwald, however.

Q. What is the deterioration rate of these various elements in the feed?

A. It can be quite dangerous to store feed for a long period of time. The fat soluble vitamins are most susceptible to deterioration, particularly vitamins A and E at higher temperatures. It is better not to buy too large quantities of feed at one time.

This chart is designed to aid in formulating rations for game birds. Ordinarily, most of the decisions in formulation can be based upon crude protein, metabolizable energy, calcium, available phosphorus, lysine, sulfer amino acids and tryptophan.

No calculations are indicated for vitamins and trace minerals. Since these nutrients are relatively inexpensive, it is recommended that they be added to the ration in amounts that will supply adequate levels, even if combinations of feedstuffs are rather low in the nutrients used. The values of suggested vitamin and trace mineral additions (Table 1) may be varied if more accurate data on the feedstuffs are available to indicate that a different level should be used.

Target values (Table 2) are also provided as a guide to formulation. Values may be copied from the table to the proper column below for comparing the calculated values with target values for the type of ration being formulated.

TABLE 1 - Suggested levels of additives per ton

Type of Complete Ration	Vit. A M U.S.P. Units	Vit. D_3 M I.U.	Vit. E I.U.	Ribo. gm.	Niacin gm.	Ca Panto gm.	B_{12} mg.	Choline Cl gm.	Vit. K gm.	Mn SO_4 lb.	Zn SO_4 lb.	NaCl lb.	Anti Oxid. lb.	Anti Biot. gm.
Pheasant Starter	20	1.5	5,000	3	40	6	6	112	2	1	0.25	5	0.25	200
Grower	8	1.5	5,000	3	40	5	6		2	0.5	0.25	10	0.25	200
Breeder	8	1.5	20,000	3		10	6		2	0.5	0.25	10	0.25	500
Quail Starter	20	1.5	10,000	3	40	6	6	112	2	1	0.25	5	0.25	200
Grower	8	1.5	5,000	3	40	5	6		2	1	0.25	5	0.25	200
Breeder	18	1.5	20,000	3		15	6		2	0.5	0.25	10	0.25	200

TABLE 2 - Nutrient Target Values

Type of Complete Ration	Protein %	Metab. Energy		Calcium %	Available P. %	Lysine		Sulfer AA		Tryptophan	
		1000 KCal per lb.	KCal per % Pro.			%	% of Prot.	%	% of Prot.	%	% of Prot.
Pheasant Starter 0-4	30	1.35	48	1.3	0.45	1.6	5.2	1.05	3.5	0.3	1.0
Grower 4-9	24	1.30	54	0.9	0.45						
Breeder	19	1.30	68	2.3	0.45						
Bobwhite Quail Starter 9-4	26	1.35	52	1.3	0.45	1.35	5.2	0.9	3.5	0.26	1.0
Grower 4-9	24	1.30	54	0.9	0.45						
Breeder	19	1.30	68	2.3	0.45						

GENETICS, SELECTION AND CULLING

Hans Abplanalp

The kind of breeding that has been done with chickens and turkeys during the last forty years is a different kind than you people have been practicing with pheasants. When you call a man a pheasant-breeder, you mean that he is reproducing the pheasants. In the chicken business he would be called a multiplier. He takes the genetic material and multiplies it as effectively as possible. In the chicken industry we have, in addition to the multipliers, foundation-breeders. They are in the business of changing the bird. They are trying to make something different from what we have now. For example, today we produce 70% bronze turkeys and 30% white. It is the breeder's job to change the bird for future needs of the industry and in doing so the foundation breeder has to anticipate what these future needs will be. This is difficult. It also has to be done in your industry. You people will have to take a wild bird and change it to meet specific needs of the future. This will occur as a result of the growth of your own industry and what the customer desires. For example, if you are going to raise 200,000 birds on a single ranch you may get into disease problems and then you may wish to breed disease-resistent strains. In the chicken industry today chickens lay twice as many eggs as they did forty years ago. This has been accomplished by selective breeding. The breeder selects about one-fifth or one-tenth of the best breeding hens, after measuring the ability of each individual hen to lay eggs. This requires individual egg records. Another change in the chicken has been earlier sexual maturity. Today's birds mature at 24 weeks of age, six weeks earlier than did the chickens of forty years ago; and we have experimental strains of chickens here at the University which mature still earlier - at 20 weeks of age. Here then is a possible development that could apply to pheasants of the future. As you people are looking for more efficient production, you will want your pheasants to lay more eggs; you may want to produce birds - young birds - the year-round but more important you will probably want to cut the expense of growing and maintaining adult breeding stock.

Another area of improvement in chickens and turkeys has been in body size and growth rate. In the future you too may have a demand for pheasants of larger or smaller size than those presently available. There are already some large varieties of pheasants, but there are not any real small ones. In the chicken

industry there is currently a great interest in the so-called "midget" chicken. These birds are two-thirds the size of normal laying chickens. They have good laying ability but, more important, they have better feed conversion. Large and rapidly growing birds can easily be selected. In the broiler industry chickens have about doubled their size at ten weeks of age within the last twelve years.

Another thing which might give you something to think about is the use of crosses in the commercial industry. Today, chickens and turkeys that you buy are not pure strains. They are crosses between two, three, or four different strains that have been bred for special purposes. A cross can be made that will produce more efficiently and be more desirable than any single variety alone. In the egg industry, it is now desirable to use two- or three -way crosses. The female is bred for high egg production, viability and eggs that are somewhat below average in size, whereas the male line is bred to bring the egg size up to normal level. This, then, permits the efficient production of eggs and baby chicks from the highly-producing female whereas the male line is somewhat less productive but provides egg size. In the meat type chickens and turkeys the male line is usually selected for rapid growth and large body size, whereas female lines are again selected for egg production. I can see a possible application here in the game bird business. Female lines might be selected for good egg production, possibly to lay eggs the year-round, whereas male lines might be used to bring in the wild characteristics for hunting quality. When you select females for good egg production you may be hurting their wild behavior, which would then be corrected from the male side.

If we look into the future we might ask ourselves if some new kind of bird would be useful. This depends on the market; it depends also on what breeders can come up with. Part of the work here at the University has been to work with some different species to learn more about such possibilities. We might develop ideas which would serve as guidelines. One example of this type of work is species hybrids. You can produce hybrids, for example, between pheasants and chickens, but the rate at which they can be produced is limited. Only 25% of the fertile eggs will show visible development; and only a fraction of these will hatch. However, in the distant future you may imagine that we may come up with the "mule" of game birds; some hybrid that will combine the desirable traits of both parent species. If you artificially inseminate a quail female with chicken sperm, only 10% of the eggs show any development. However, we have

selected quail populations in such a way that hybrid fertility is now higher. After 15 generations our quail populations produce about 35% of developing embryos when inseminated with chicken semen. We are pursuing this to see if hybrids will have a high enough production to be commercially usable, and to find out if hybrids could be used to transfer useful genes from one species to another.

Questions:

Q. If you increase egg production by breeding, what do you lose?

A. You lose egg size, among other things.

Q. Would you consider inbreeding a good way for maintaining the quality once you have reached the type of bird that you are seeking? By taking a hen and breeding her back to her male offspring the following year?

A. Inbreeding is very tricky because very likely you will lose hatchability and egg production; but the offspring are likely to be more uniform. Inbreeding is not a good way to produce the type of bird you want. To get a good final product you should consider crosses, possibly among inbred lines. You can have unpleasant surprises with an inbred line as such.

Q. Under normal circumstances, how small a flock would a breeder have in which inbreeding would occur?

A. You measure inbreeding by the inbreeding coefficient and the rate that inbreeding occurs is about twice the number of mated pairs. If you have fifty pair, inbreeding increases by half a percent per generation.

Q. To avoid inbreeding do you change the cocks then? Get rid of the old ones and buy new ones?

A. It depends upon how large a breeder you are. If you have enough of a population, then you should have two lines and sell a cross between them.

Q. If you have two thousand birds, you wouldn't have to worry about inbreeding at all?

A. No, I wouldn't worry about it.

STATE REQUIREMENTS FOR RELEASE OF GAME BIRDS

Harold Harper

The Department of Fish and Game is engaged in bringing in new game birds and establishing them in habitats void of desirable hunting species. For example, we have brought in the Rio Grande turkey and there is good indication they are becoming established. These birds are all wild-trapped rather than game farm reared. Importation of game birds into California began about 100 years ago when prairie chickens were introduced. Since that time the importation of exotic birds has been greatly accelerated. In 1957 controls on the liberation of non-native game birds began in this state. In the past very little attention was paid to the possibility of the introduction of diseases into the wild by release of diseased birds or carriers.

To point out the importance of importation of game birds within this State, lets take a look at some figures. Licensed pheasant clubs were started in 1939; today there are about 200 clubs in California that liberate close to 250,000 pheasants annually. In addition there are over 20,000 chukars and 2,000 bobwhite quail liberated on the licensed pheasant clubs. Clubs are now beginning to introduce turkeys for release as part of their hunting program. Last year, 245 turkeys were released in California for hunting. We have licensed 1,184 game bird breeders. Class 2 breeders, those that raise more than 175 pheasants, number 105. In 1965, 82,000 pheasants were raised for meat.

Dog training is becoming more popular each year. In 1966, 24,000 pheasants were liberated for dog training in addition to 14,000 chukars, bobwhite and coturnix quail. This activity will no doubt expand in the future.

In 1966 the Department of Fish and Game handled 58,000 pheasants and 5,000 exotic game birds, such as, chukars, gray and black francolin.

As with most activities, there are laws and regulations covering the program. At the present time we have four code sections in the Fish and Game Code that deal primarily with resident and exotic game birds. To supplement these laws, the Fish and Game Commission has adopted three regulations. In the Code there are two classes of game birds defined. These are resident game birds and exotic

nonresident game birds. The resident game birds are those that are considered established or found in the wild in this State. It doesn't necessarily mean that they are a native game bird. For instance, wild turkey and red legged partridge are considered game birds, even though they are by strict definition exotic. Exotic game birds are those which are not established in the wild in this State--such as bobwhite quail. The legislature has delegated the authority to release exotic game birds to the Commission and the Commission has adopted regulations that govern the release and possession of exotic birds.

The Commission has adopted regulations for inspection of resident game birds that are imported into the State. Game birds imported into California must be inspected to meet certain criteria such as freedom from disease. Regulations were adopted in 1964 that provide for specifications on importation of resident game birds into California. These provide that anyone desiring to bring live domestically-reared game birds into California, shall have the birds inspected by the Department for disease or health conditions or have a certificate from a licensed veterinarian from the point of origin. The Disease Section of the Department of Fish and Game performs the necessary inspection, not only for birds brought into the State but certifies private game farms in the State. With these laws and regulations we hope to prevent disease in our wild game bird populations.

QUESTIONS:

Q. For awhile the Erckel's francolin came in and was hotter than a pistol. What happened?

A. It is very difficult to get a new bird established. We are going about it in a more refined method. If we get one bird in five that we are working with established in California, we have spent our money very wisely.

Q. Do these Erckel's francolins have a tendency to migrate or what?

A. Yes, some of them move completely out of the area. For example, we liberated Indian chukars near Alturas. Two years later a law-abiding citizen shot a limit in Surprise Valley. This is forty miles airline distance. Some of the wild turkeys move 20 miles in a month.

Q. What kind of a season are they going to have on turkeys?

A. We don't know yet. We are working on that.

Q. How is the game farmer regulated to release his turkeys in the wild?

A. These are classified as domestic turkeys. There is no open season on wild turkeys in the State. If he advertises them as a wild bird, he can't hunt them. If they came off the game farm, they are a domestic turkey.

Q. Do the regulations pertaining to the importation of exotics apply to those that you want to rear in captivity as well as those that are to be released?

A. Yes, it applies to birds brought into the State. The Department of Fish and Game has to have Commission approval before releasing exotics. For instance, in the case of the tinamous we recently imported from Argentina the Department had to apply to the Commission for permission to import these birds.

Q. Where can you get a copy of the regulations?

A. The regulations change quite often. The Code is obtainable through the Printing Plant. You can purchase Title 14 from the Documents Section of the State Printing Plant and they will tell you how much it is a year to keep current. There is a yearly charge for this service.

Q. Did you say that the prairie chicken is not a native bird?

A. That's right. It is from the midwest. It was released in an attempt to get it established. It failed.

Q. Are there any areas where the bobwhite quail has become established?

A. There is one area near Gilroy where bobwhite quail look like they are becoming established; (remark from member of audience).

INCUBATION AND HATCHING PRACTICES

Ursula K. Abbott

The game bird hatchery operator hopes to produce a high yield of vigorous, healthy chicks. High hatchability is the result of the proper combination of a number of important factors. Several of these, including breeding and management of game stocks and the higher nutritional requirements of stock during the reproduction period are discussed by others on today's program. I shall confine myself to comments on the proper management and handling of hatching eggs.

The holding period. Eggs are normally held for a period of time before being placed in an incubator. They may be shipped considerable distances during this interval. The conditions under which hatching eggs are gathered, held and shipped are extremely important. Factors to consider include temperature, humidity, length of holding period, position, cleanliness, shocking or jarring and oxygen tension.

Ideally, hatching eggs should be placed in a cool, clean, humid holding room as soon after collection as possible. The egg room should be separate from other activities involving birds, i.e., separate from the hatchery, chick sorting rooms and, most especially, any adult birds. Temperature in the holding room should be maintained at approximately 55°F with a permissable range between 50° and 60°F. Fluctuating temperatures should be avoided. Hatching eggs of any game species should be collected frequently, especially during extremely hot or cold weather. If the environmental temperature is above 80°F a fertile egg will continue developing. However, cell division and development will not be normal and, if continued for long, will result in an increase of abnormal embryos and in poor quality chicks. If the holding temperature is much below 40°F the incidence of abnormal embryo development will also increase. Prolonged exposure to freezing temperatures will kill the germ or the egg shell may crack. Humidity in the holding room should be reasonably high; excessive dryness results in a rapid evaporation of moisture from the egg, which in turn has a detrimental effect on hatchability and chick quality. The humidity recommended for different locations will vary depending on the local environment. A good rule of thumb is to keep it high, but not so high that the eggs sweat. Proper humidity can be determined by examining the size of the air cell under a candler. Very large air cells are usually an indication that the humidity is too low or that the eggs have been held too long.

Hatching eggs are usually held in open flats or racks with the large (air cell) end up. They should not be held in closed containers (such as egg cartons) or in household refrigerators. The length of time that eggs may be held prior to incubation depends upon the species concerned and also on the temperature and humidity conditions provided. Higher or lower than optimum temperatures or excessively dry conditions will shorten the permissable holding time. Assuming that the holding conditions are optimal, hatchability is usually best in eggs held no longer than one week. Japanese quail eggs tend to drop in hatching power after five or six days; pheasant and turkey eggs after 14 days; some recent evidence indicates that chukar eggs may hatch reasonably well after an even longer period. One effect of holding eggs for periods beyond a week is that the time the embryo needs to complete its development is increased. This leads to problems at hatching time; the hatch is spread over a long period and conditions are not ideal for the retarded group of embryos in the older eggs. If for special reasons eggs must be held for a longer than desirable time and, if consequently eggs of mixed ages are to be set, it is best to set the oldest group first, allowing them extra incubation time, so that hatching may be better syncronized. Eggs held for two to three weeks will require 12-18 hours of additional incubation time.

At the time an egg is laid it is essentially a sterile package; how long it remains so depends on its subsequent treatment, i.e., the cleanliness of the nest, how often it is handled and above all how eggs contaminated with fecal material are treated. The first concern of the operator should be the production of clean eggs, provision of clean nest boxes or cage floors, prevention of breeders walking about in the mud or laying their eggs in the mud are obvious precautions. In spite of such care some dirty eggs will be produced. These can be dry cleaned with a clean abrasive immediately after they are collected. Subsequently they can be fumigated with a formalin-potassium permanganate mixture before their storage. Dry cleaning should always precede fumigation since the fumigant may not penetrate beneath heavily soiled areas. Egg washing is a controversial subject. We do not recommend washing hatching eggs. Washing is an extremely effective way of spreading contamination. A good way of absolutely ensuring infection is to wash all eggs in cold water in an old pail using a dirty rag. Although it is possible to wash eggs under conditions that will not reduce hatchability (controlled temperature above that of the egg, fresh, not reused, water and sanitizing agents) the chances of an inadvertent contamination of clean eggs are too great. If a large number of

heavy dirties are produced these should be handled separately, dry cleaned if possible, if not, then washed separately (as above), fumigated, and then set in a separate machine reserved for this use.

Hatching eggs must be protected against toxic compounds, both during the holding period and during incubation. Treatment of nesting boxes with compounds containing lead or zinc can cause damage. Pesticides (either the compound itself or its carrier) may reduce hatchability as well. Sprays used for insect control should never be permitted to contact hatching egg surfaces.

When hatching eggs are shipped long distances it is important to take every precaution to avoid shaking and jarring. Sudden shocks are most damaging; hatching eggs can tolerate regular movements very well. For this reason the fewest changes in carrier the better. The same considerations with respect to temperature and humidity apply during the shipping as in any other portion of the holding period; extreme temperatures should be avoided as should sudden changes in temperature. Fresh eggs held under optimum conditions will withstand shipment better than older eggs or those held at fluctuating environmental temperatures. Although low oxygen tension and CO_2 build-up are most important during the incubation period, they should be considered during shipping as well. Hatching eggs shipped by air should be placed in pressurized compartments. To date there is no evidence that sonic "booms" damage hatching eggs of any avian species either during holding or during incubation.

Incubation. Time does not permit a detailed discussion of incubation of game bird eggs. Therefore, I will conclude with a few remarks directed at discussions I have read in some of the available books on game bird management. I might suggest that when you read some of these books you should do so realizing that many of the ideas presented on game birds and their management have not been developed through systematically planned experimentation and testing, but rather have evolved in a "cookbook" manner. In other words, someone found something that worked for him and it has been handed on through the literature although it may or may not work or may work only under fairly special circumstances.

The game bird operator (irrespective of species) should acquire a modern, forced draft incubator of the type used for chickens or turkeys. It should be equipped to control temperature and humidity and to turn the eggs automatically every two or three hours. The egg trays of such machines can usually be easily modified

to accommodate the egg size of the game species concerned. The same machine can be used for all species either separately or, if necessary, together. If eggs with different incubation times are involved he can arrange his setting schedule so that all will be ready for transfer to the hatcher on the same day. Hatching conditions are very similar for all game species. The most efficient set up is a series of moderately sized (2000-3000 egg capacity) incubators and 2-3 hatchers. We disagree with the statement in one book, that the game bird operator should start out with a simple type of incubator, possibly the still-air type. The best equipment is the best investment.

The incubator should be located in a room with some form of temperature control. A room temperature of approximately 70°-75°F is best. The incubator room should have adequate air circulation. We do not support the idea expressed by one author that it is best to place the incubator in the cellar. This is not so. Here you could encounter difficulties with air circulation and carbon dioxide buildup.

It is stated in one book that it is necessary to turn incubating pheasant eggs for 21 days. This is not correct. The eggs should be turned for at least 14 days; thereafter, it is a waste of time especially if the machine is one that requires turning by hand and frequent opening. In this instance the procedure could be detrimental. Turning beyond the time required is not of itself harmful however, and is usually done in fully automatic commercial operations, where it would be awkward to cease turning until egg transfer to the hatcher. Turning is most important during the first four or five days until the embryonic membranes, especially the amnion, are formed and functional.

The game bird hatchery operator should take full advantage of the extensive information on proper egg holding and incubation conditions for avian species developed by those working with the highly competitive and efficient chicken and turkey industries.

QUESTIONS:

Q. What do you use to candle dark eggs?

A. We have a powerful commercial candler fitted with a strong light and color filters. We have also found that you can use a 35 mm projector for this purpose.

Q. Which way are the eggs supposed to be set? Point down?

A. In most of the modern machines, the eggs are set small end down; air cell end up. They are incubated, however, in a vertical tilted position and turned every 2-3 hours. Sometimes the entire tray rotates and sometimes only the individual rack.

Q. What should the humidity be during incubation?

A. This depends upon the species, (egg size, shell thickness), type of incubator used and the location. Usually around 83°-85°F wet bulb when the dry bulb reading is the standard 99.5°F. Higher altitudes require higher humidity as do small eggs. During hatching the humidity is raised (88°F wet bulb) and the temperature lowered about 1°F.

Q. Do you recommend sterile gloves for handling eggs?

A. On a practical basis it is best to handle hatching eggs as little as possible. Avoid touching clean eggs just after handling those with heavily contaminated shells. Keep a jar of disinfectant handy.

Q. How can you recognize infertile eggs?

A. They appear as "clears" under the candler. Or if you wish to determine the fertility in unincubated eggs, break each out into a dish, being careful not to break the yolk. The germ spot appears as a small dense white area on the yolk surface. If the egg is fertile the germ spot has a ring or "donut" shape with a dense outer ring and a clear inner part. An infertile germ spot is smaller in diameter and is flocculent or fluffy in appearance, without the ring structure. One can use dirty or cracked eggs for these examinations.

MANAGEMENT IN CONTROL OF DISEASE

Merton N. Rosen

This is just a brief outline of some conditions found most commonly on game farms throughout the State. The most common disease is coccidiosis. It usually occurs in young pheasants. The signs of the disease are a general weakness, diarrhea, and a weakened condition that can simulate the paralysis of botulism. Actually, many diseases can imitate one another, so that it is essential to submit the birds to a veterinarian for a proper diagnosis. The organism invades the intestine, oocysts are passed out with the droppings undergo development and become infective. They are picked up in contaminated feed, water or litter. The birds will eat each other's feces and they will become infected.

Another disease encountered is blackhead. Blackhead occurs more frequently in chukars than in pheasants, but pheasants can get blackhead. One important factor is not to mix species. Blackhead infects birds when they are transferred from batteries to the ground because then young pheasants have the opportunity to pick up the parasite from contaminated soil. When they are infected the birds become weak, have a loss of appetite and may show a diarrhea. The parasite invades the intestinal tract and passes into the liver. In addition to causing areas of injury within the liver, the parasite causes a white plug to form in the cecum. For either blackhead or coccidiosis it is important to keep the ground dry. If the birds are raised on wire you will not experience these particular diseases. As far as coccidiosis is concerned you can use a coccidiostat. There are many of these prophylactic drugs available on the market. Some are more effective than others. If you have clean, dry pens with very little cover, sunlight assists in preventing coccidiosis or blackhead. Drugs are not generally used to prevent blackhead until the disease is in a flock. Usually the drugs are started at a therapeutic level.

A third disease is botulism. This occurs in older birds. It appears in the late summer and early fall. Heavy cover encourages the appearance of botulism. Usually the maggot is the source of the disease. Birds may die in heavy cover, maggots develop on the carcass and these larvae are extremely toxic, so that if only three or four are eaten the mature bird will die. The maggots also have the ability to burrow into the ground; as a matter of fact, this is the natural process whereby they develop further into the pupa stage when they are encased for development into

the adult fly. Pheasants will dig into the ground to get at the developing pupa; therefore when dead birds are collected it is necessary to remove the first few inches of soil as well so that no maggots remain. All carcasses should be picked up immediately including dead mice, gophers, rats, snakes, or anything else in which maggots may develop. The cover should be kept to a minimum and planted in row strips. There are no drugs that will do any good other than antitoxin. It is difficult to get commercial antitoxin. The real prevention lies in proper management to exclude botulism.

Gapeworm occurs in older birds, usually in the breeding flock in the spring when the ground is wet. The symptoms are coughing and gasping, the pheasants shaking their heads as they try to expel the worm. The earthworm carries the gapeworm eggs and, of course, when the ground is wet the earthworm comes to the surface and is eaten. There are some fairly new drugs which are effective in killing gapeworm.

One of the questions asked most frequently is where did I get this disease? The usual sources are the free-flying birds such as sparrows, rodents, people and other game farmer's birds.

A common practice that should be discouraged is the exchange of birds among breeders. This practice results in the importation of other breeders' troubles. If a contract needs supplementation the birds should be delivered to the release point. If this is impossible a section on the farm should be isolated from the resident flock.

If the incubator area is to be disinfected first remove all of the movable equipment so that there is all possible coverage on the walls that might be obscured by such equipment. The incubator should be fumigated with formaldehyde gas. The ratio is one ounce of formalin to one-half ounce of potassium permanganate per hundred cubic feet of incubator space. This may be used while the eggs are in the incubator. It should not be used just prior to hatching or between the second and fourth day of incubation.

It is bad practice to keep hospital pens. The best thing to do with sick birds is to submit them for diagnostic purposes to the poultry laboratories.

LIVESTOCK AND POULTRY DIAGNOSTIC LABORATORIES IN CALIFORNIA

W. W. Worcester

The poultry and livestock diagnostic laboratories operated by the California Department of Agriculture, Division of Animal Industry, are called Agricultural Veterinary Laboratory Services. Six laboratories are strategically located throughout the state to furnish diagnostic services to the livestock and poultry industries, the various bureaus of the division, certain poultry disease projects, and general biological services to other bureaus of the Department.

General pathology laboratories are maintained at Sacramento, Fresno, Petaluma and San Gabriel for both animal and poultry disease diagnostic work. The laboratories which handle the diagnoses of poultry diseases only are maintained at Turlock and Lancaster.

The Petaluma laboratory covers the coastal region north of San Francisco Bay, and the north central area of California is covered by the Sacramento laboratory. The laboratory in San Gabriel serves the Los Angeles-San Bernardino-Riverside area, while the Fresno laboratory takes care of livestock and poultry in the Fresno area and as far south as Kern County. The Mojave Desert area has the services of the Lancaster laboratory. The other poultry laboratory is situated in Turlock where there is a heavy concentration of poultry. County laboratories are located in Los Angeles and San Diego. The laboratory in Los Angeles does only large animal work, and the San Diego laboratory does both livestock and poultry work. These and all of our state laboratories are completely equipped.

California has one of the largest diagnostic systems in the United States. We handled approximately 17,000 poultry cases and 10,000 livestock cases in 1966. The number of poultry autopsied is between 50,000 and 60,000 annually. Each poultryman usually submits half a dozen birds for examination rather than just one. Between five and six hundred different diseases and conditions affecting livestock and poultry are diagnosed in our laboratories.

There is no research done in the diagnostic laboratories. If there is a new disease in the field that must be studied, it is turned over to research people at the University, especially if it happens to be an economic problem. We do not work on pets, such as dogs and cats, but we do work on zoo animals, game birds and fur-producing animals.

The staff in our laboratory services consists of 19 veterinarians, 12 bacteriologists or technicians, 12 laboratory assistants, one parasitologist, seasonal people to do the serology, and the usual clerical help. Our personnel and laboratories are qualified and equipped to do all types of bacteriology, pathology, virology, and parasitology to arrive at a diagnosis.

One million serological tests are performed annually for pullorum disease and one million for Salmonella typhimurium. We do about 200,000 mycoplasma (PPLO) tests, 200,000 brucellosis tests and many other individual type tests that may be required. All of these major testing programs are based on a goal of eradication of the particular disease.

The game bird people will have to look at the fact that the poultry industry is investing large sums of money on the eradication of diseases by test and slaughter. The result is that they are cleaning up to the point where they have disease free flocks. The industry is looking at the game bird people's products that are being released throughout the state, and they are wondering just how clean those birds are.

Following are the addresses and telephone numbers of the state and county livestock and poultry diagnostic laboratories in California:

Fresno Veterinary Laboratory Services
2789 South Orange Avenue
Fresno, California 93725
Telephone: Area Code 209-266-9418

Petaluma Veterinary Laboratory Services
1500 Petaluma Boulevard South
Petaluma, California 94952
Telephone: Area Code 707-762-7386

Sacramento Veterinary Laboratory Services
P.O. Box 9702 (Mail)
3290 Meadowview Road
Sacramento, California 95823
Telephone: Area Code 916-428-3172

San Gabriel Veterinary Laboratory Services
P.O. Box 255 (Mail)
714 South Santa Anita Street
San Gabriel, California 91778
Telephone: Area Code 213-282-6127

Turlock Veterinary Laboratory Services
P.O. Box P (Mail)
Fulkerth Avenue and Soderquist Road
Turlock, California 95380
Telephone: Area Code 209-634-5837

Lancaster Veterinary Laboratory Services
P.O. Box 1226 (Mail)
45556 North Division Street
Lancaster, California 93534
Telephone: Area Code 805-942-7918

Los Angeles County Livestock Department
9744 Atlantic Avenue
South Gate, California 90281
Telephone: Area Code 213-567-2171

San Diego County Laboratory
Building 4, County Operations Center
5555 Overland Avenue
San Diego, California 92123
Telephone: Area Code 714-278-9200 Ext. 295

EGG-BORNE DISEASE PREVENTION

A. S. Rosenwald

The emphasis of this talk will be on egg-borne diseases. In addition, I want to touch on the dangers accompanying the introduction of exotic birds. This practice may result in the introduction of costly exotic diseases, not only to your own enterprise but to poultry ranches and farms--the industry as a whole. The poultry industry of California yields over 350 million dollars of income per year and you should realize what effect your operation may have on disease and income from turkeys and chickens as well as on your own current and potential income. Careless or poorly planned introductions of new species or stock could result in such diseases as pullorum or infectious sinusitis (CRD) in clean flocks of chickens or turkeys when birds, such as pheasants, which you raised under "exposed" conditions are released. Obviously, should you introduce any such disease--not excluding fowl plague even--onto your own premises through faulty planning the roof could fall in.

There is also the problem of transmission or introduction of infection through contamination from such external sources as free-flying birds, turkeys or chickens, dogs, cats, cattle or sheep, ducks, snakes, rats, mice, or other rodents, insects, and really most important, man himself--is as careless as they come!

Now let's talk about egg-borne infections. There are basically two kinds of these. Transovarian infections are those in which the ova are infected and the disease-causing organisms are transmitted from the infected or carrier adult female through the egg to the chick or poult which hatches. Such infected chicks can be a source of infection in the hatcher (fluff) or serve as foci of infection to their broodermates spreading the disease horizontally. Examples are pullorum disease and Mycoplasma gallisepticum infection (CRD and infectious sinusitis).

Other egg-borne diseases are due to contaminants which penetrate the shell after the egg is laid and settle down in residence to cause trouble. While paracolon and paratyphoids can be truly transovarian, most of the disease problems they cause are due to shell penetration. These shell-penetrating egg-borne infections are usually due to bacteria which are motile and are increased by the use of dirty eggs, poor or infrequent egg gathering, egg washing, generally poor hatchery and farm sanitation, and the presence of rodents, snakes, etc., which also harbor these parasites in the gut.

Control of true transovarial infections requires elimination as breeders of flocks or groups of breeding birds known to be infected with the disease (such as pullorum disease), good hatchery and flock sanitation, separate hatching, brooding, and rearing for clean chicks, prevention of cross infection of the chicks by segregation of groups, and planned management to prevent contamination or infection. Carrier birds can be detected by various means suitable for specific infections, e.g., agglutination test for pullorum.

Shell penetrating infections can best be controlled by planned sanitation, pre-incubation egg fumigation, use of healthy breeder flocks, protection from infection shedders, and similar means of breaking the infection chain.

In either case, chicks hatched as infected can act as foci of infection for their penmates and even other groups (horizontal transmission). And, clean groups can become infected after hatching if reasonable care is not taken.

So far as further surveillance is concerned, it should include pre-release testing of birds for pullorum disease so as not to disseminate infection to wildfowl or by contact to domestic poultry.

In chickens and turkeys, there have been less than ten outbreaks of pullorum in the last fifteen years. If game birds to be released are carriers and go into turkey or chicken pens to feed and thus cause a break in the cycle, a real disaster may result. The pressure would then be on you to do a better job of disease control and better planning and management.

A disease that is of great importance is known as PPLO (Mycoplasma gallisepticum). It causes infectious sinusitis in turkeys and CRD or chronic respiratory disease in chickens. It is commonly known as PPLO, which stands for pleuropneumonia-like organisms. This disease can be transmitted as a true transovarian infection just as pullorum disease can. If there is one infected chick in a flock of 1,000 you might have 100 infected in 5 or 6 weeks and you could end up by breeding time with practically 100% of the flock infected. This disease can be transmitted from adult apparently healthy pheasants, chukar or quail to turkeys if they are in close proximity.

Another similar disease is paratyphoid infection caused by the salmonellae, and there are about a thousand different varieties of these, of which five or six hundred have been isolated from poultry. Each of these are potential human pathogens. They can cause food poisoning in man. They are frequently transmitted by the egg-borne route but ordinarily not by ovarian infection. Usually it is transmitted by contamination of the shell with fecal material when it is laid or by other contaminating sources such as the presence of rats or mice which are carriers of this group.

Pre-incubation fumigation--care of the hatching egg is of extreme importance in reducing this type of infection. The earlier suggested levels of potassium permanganate-formalin fumigation would be doubled, or tripled, in the pre-incubation stage. I suggest that there be at least 50 to 79% relative humidity in the fumigation chamber used.

Blood testing is one means of detecting certain of these infections, but what you do afterwards depends on planning the "man" in management.

QUESTIONS AND ANSWERS:

Q. If your birds are blood-tested, can it show up in your breeding stock after the blood test?

Worcester A. We do not suggest a serological test for the general group of paratyphoids, because there are 1,000 different serotypes or more. Besides, negative tests are not conclusive. It is possible for the bird to carry the infection in the intestinal tract without a serological response, the contamination may occur later from the environment. The pullorum test is best used on birds that are to be mated for the production of chicks or to be released. The whole blood test should not be used because pheasants do not show good reaction with it, rather you should use the serum plate or tube test for accuracy.

Q. Is this a requirement by law?

Worcester A. No, it is a voluntary program. It is not mandatory.

Q. Are there any diseases that are dangerous so far as meat birds are concerned?

Worcester A. There are some diseases that Public Health becomes extremely concerned about. There are some diseases that are transmissible to human beings.

Q. How about this paratyphoid?

Rosen A. Well, if there was a food outbreak, public health would enter into the picture.

Rosenwald A. In some of the food poisoning situations one is not justified in blaming the producer because food poisoning salmonellae may be introduced as a contaminant later on (preparation of food). Anyone concerned with livestock of any sort must concern themselves with salmonellae because they are present in all livestock and, of course, in man as well; he could be the original contaminator. Blood test is not too effective. Other means of detection of paratyphoid are bacteriological (examination of culls and pips). If there are losses in a brood of chicks or poults, then a laboratory diagnosis should be obtained.

Q. Is there any test that can be made, such as blood test, for the paratyphoids? How about preventive measures--drugs?

Worcester A. This is a big problem. The turkey people spend days and days and days discussing this problem because it is such a big one. At one time in the state we had almost 200 turkey breeder flocks infected with S. typhimurium, but by running the tube tests and intensive follow-up with typhimurium we have controlled it. But this test was designed for just this one salmonellae and so this last year we only had two infected with typhimurium. We tested almost a million turkeys just to pick up these two infected flocks. Another method that is being used is to take hatchery refuse such as pips, dead germs, etc., and culture them. If you have an outbreak on your ranch, it usually stays the same particular type of salmonellae. There are various ways of handling it, such as egg fumigation. The turkey people have their men picking up eggs every two hours and then they fumigate those eggs just the minute they are picked up. If you had an endemic infection on your premises, you would have to go into this type of work to get rid of the organism. If you want a copy of the fumigation bulletin, there is one available at all the diagnostic laboratories, and they will just give it to you or you can write in to the Department of Agriculture or to the University of California Agricultural Extension Service for one.

Q. Due to the unseasonable weather this year the eggs were real bad. Is there something that we can put into the water since we did have to wash in order to get rid of the excess dirt?

Rosen A. There are a number of commercial sanitizers that you can wash eggs with.

Q. We use bluestone. Is that all right?

Rosen A. There are a number of other ones that are better than that. When you do use the sanitizer, make sure that you change it frequently so that it is effective. Proper washing and proper temperatures are important, but this practice is making the best of a bad situation.

STATE-OPERATED PHEASANT REARING PRACTICES

Ken Doty

State game farms have a year-round program. The ground is exposed to sunlight as much as possible during the summer when the breeder pens are empty to help control disease problems. In the fall the pens are plowed with a rotograder; in October, it is worked up for a seed bed and the cover crop (dwarf essex garden rape) is planted for the following spring. By the first of March, the cover crop is approximately 12 inches in height, and the pens are ready for the breeding stock.

One rooster and eight hens are put in each 24 sq. foot pen. The hens start laying about the middle of March and the first eggs are collected about March 20th. During cool weather the eggs are collected once each day, but as the weather warms they are collected two and three times per day.

Each Monday eggs are set in Jamesway incubators on a 3 stage basis. In the past, all of the eggs were set in one incubator, but toward the end of the hatch they tended to overheat. Presently, four trays of eggs are set in several incubators on the first Monday, a second group of four trays the following Monday, and on the third Monday the incubators are fully loaded, thus, there are three different stages of development simultaneously in the incubators. On the 21st day of incubation, the eggs are transferred to still-air hatching machines. The eggs pip on the 24th day and on the 25th day the chicks are removed from the hatcher and transferred to the brooder houses.

After the chicks have been removed from the hatchers, the equipment is steam cleaned including the humidity water pans and the trays that held the eggs. The equipment is then fumigated with formaldehyde gas and left over night. The following day, the machines are aired out.

Jamesway battery brooders used in this operation are warmed prior to receiving the pheasant chicks. The birds are kept for two weeks in the batteries and are then transferred to brooding floor pens with heat lamps. Rice hulls (30 cents per yard in bulk) are used for litter. When the birds are four weeks old, they

are placed in the holding pens. Sometimes on the 25th day (just prior to being moved) a few of the birds start picking. These are debeaked lightly by holding the bill against the electric heat unit of a Lyons debiller. Both the upper and lower bills are removed evenly just to the quick. Usually there is very little picking problem for the next two or three weeks. All the birds are debeaked at seven or eight weeks of age when their pin feathers are beginning to develop.

Initially, one hundred young birds are put in a pen 24 x 48; then, as they get older they are moved to a 48 x 96 foot pen. If picking is a problem, they are divided by half and given twice the area.

In disease control, strict sanitation is maintained at all times. It is better to prevent disease than to try to cure it after it has once started. In summing up, good management is the key to successful game farming.

BROODING, RAISING AND GENERAL MANAGEMENT

A. E. Woodard and W. O. Wilson

Part I - A.E. Woodard

Prior to my employment here, I held the position of Assistant Superintendent at the Jerome Game Farm, at Jerome, Idaho. Our objectives were to brood and rear pheasants and chukars for release in the Southern half of Idaho. I would like to mention a few management practices employed at this facility that may be of interest to you.

1. Spacing of houses: A minimum of 200 feet was maintained between the incubator facility and the brooder houses, as well as between rearing and breeding pens.

2. A wire mesh netting was implanted 1 1/2 feet into the ground to discourage rodents, dogs, etc., from gaining entrance into the rearing and breeding pens.

3. Flight prevention included the use of completely enclosed pens, or brailing the breed stock.

4. Wire guard rings were placed around the hovers for the first week of age. This guard served two purposes; it kept the chicks close to the source of heat and reduced air movement across the floor. Chicks were allowed free access to outside runways after 2 weeks of age.

Our management of game birds here at the University of California, Davis differs appreciably from that previously mentioned. All brooding is done in 5-deck battery brooders. Certain modifications are necessary for brooding quail in commercial chicken batteries. A smaller wire mesh paneling is required to keep quail chicks from escaping. The floor of the chick battery is covered with crinkled surface paper (drop-cloth) to prevent spraddling and to provide a surface on which to sprinkle feed. It is important that chicks learn to eat as soon as possible after they arrive. The cloth is removed when the chicks are one week of age.

We have been experimenting with keeping several species of adult game birds in individual wire floor cages. Chukars lay reasonably well in individual cages and maintain adequate body weight. Fertility of eggs from chukars has been about 90%.

Experiments involving the effect of holding period on hatchability indicate that holding eggs beyond 3 weeks results in an increase in early embryo death.

Both pheasants and guinea fowl have been maintained in individual 12" cages at Davis. Although egg production is not high, it may be possible to select for higher rates of lay under cage management.

There is no new known control for cannibalism. Good management practices, reduced light intensity during the brooding period, and debeaking are the best procedures. Cannibalism can be induced by, over-crowding, inadequate waterers, overlighting, inadequate diet, and many other types of management faults.

In conclusion, birds in the wild are admirably suited to taking care of themselves. They search for food when in hunger, seek shade when hot, seek shelter when frightened and depend on no one for their livelihood. We take these wild creatures and confine them to a small area, and make them completely dependent upon the caretaker. Our management practices should be aimed at taking proper care of these birds. The birds should have access to fresh, clean water, an adequate diet, good cover and good sanitation.

Q. In your experiments you were keeping the chukars on wire. Are you going to do any checking on the wildness of these birds after they have been on wire?

A. One has no way of knowing what the future wildness of these birds will be. Another strain of males may be crossed with the females to restore wildness in their offspring.

Q. How do you control rodents under feeders?

A. This is a difficult problem in game bird management. Both poison baits and certain mechanical devices have been used. At least two poison baits have been mentioned. These are Prolin (Hub States Chemical Co., Wisconsin) and Pidal. Both contain anticoagulants. A live trap for control of mice called Catchall (Crest Mfg. Co., Albe, Iowa) has been reported to be very effective in reducing mice populations around feeders.

Part II - W. O. Wilson

My favorite research involves a study of photoperiodism in various birds. The moult pattern is tied up with light and not with temperature. As long as 30 years ago it was reported that pheasants, like chickens, respond to light. It is possible to bring pheasants into production on Christmas Day or anytime of the year, depending

upon the lighting program. There is a period when pheasants are refractory or will not respond to light. This prevents birds from laying when they are too young. Birds that are hatched at certain times of the year will not respond to light until they have experienced decreasing daylight. By exposing birds to eight hours of light and sixteen hours of darkness, we have been able to cause them to mature at an early age. We have recently been studying changes in the brain of the bird during this period.

A considerable amount of research is being conducted in the area of temperature regulation in the birds and how this relates to behavioral patterns; panting, shivering, and other reflexes. In regard to wildness, those pheasants we have kept in cages are extremely nervous and they never seem to calm down, regardless of how long they are held. By putting on specs (colored contact lens) we can work around the pheasants without any evidence of fright on the birds' part. With Japanese quail we have removed both eyes, surgically removed the pineal gland and still the birds respond to light in their reproductive pattern. Perhaps by mechanical means we can keep the bird wild. This deserves investigation.

At the University we have experimental chambers in which we can simulate any time of the year, with regard to both temperature and humidity. In our studies at Davis we can work with several varieties of game birds. The pheasant, as I mentioned before, is used in studies of cannibalism. Certain species are more valuable for certain studies than others. Because of their rapid maturity and highly efficient rate of lay we find the Japanese quail suitable for many studies. By accident we raised some birds under conditions of high temperature. We had a high mortality, but when the temperature was reduced, to our surprise, these were the most docile birds that we have had. This occurred during the first week of brooding. It may be that they were too pooped to move out of the way and as a result they had an entrainment that caused all the fear to be removed. If we can do this, perhaps we can induce the opposite result and make the birds more flighty.