Proceedings

ROCKINGHAM POULTRY SERVICEMAN'S ORGANIZATION

POULTRY HEALTH SEMINAR

Roanoke — Salem, Virginia
Sheraton Motor Inn

September 11-12, 1975

Sponsored by

Cooperative Extension Service
Virginia Polytechnic Institute
and State University

in cooperation with the

Rockingham Poultry
Serviceman's Organization

and

Virginia Department
of
Agriculture and Commerce

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PROGRAM

SHERATON MOTOR INN

THURSDAY, September 11, 1975

8:00 - 9:15 Registration

Morning Session - Chairman, Bruce Grover

9:15	Welcome - Bob Ford
9:30	Recent Developments in the Poultry Industry - "Twig" Strickler
10:15	Break
10:30	Conserving Fuel in the Poultry House - Bynum Driggers
11:15	Ventilating the Poultry House - Barry Bingham
12:00	Lunch

Afternoon Session - Chairman, Winston Turner

1:30	Chick Management - Gordon Miller
2:15	Confinement Growing of Turkeys in North Carolina - Charles Brewer
3:00	Break
3:30	Sanitation's Role in Poult and Chick Quality - John Stevens
4:15	Environmental Control of Broilers - James Deaton
5:00	Break

Evening Session - Chairman, Bob Ford

6:30	Program: "Magic Elixir Called Enthusiasm" - Mr. Ross V. Hersey

FRIDAY, September 12, 1975

Morning Session - Chairman, Bob Ford

9:00	The Influence of Gumboro Infection Upon the Pathogenicity of other Diseases - Walter Staples
9:45	Mycoplasma Infections - Harry Yoder
10:30	Break
11:00	Recent Developments in the Marek's Control - Caswell Eidson
11:45	Panel Discussion - Chairman, Dave Ritchie - All Speakers
	A time for discussion of topics that were not completed during the program
12:30	Adjourn

This program has been planned by the Rockingham Poultry Servicemen's Organization.

Bob Ford	President
Bruce Grover	Vice President
Winston Turner	Secretary - Treasurer

PROGRAM COMMITTEE

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Bob Johnson	Bill Weaver
Dave Ritchie	Cliff Douglass
Suresh Singh	Prem Dua
Leroy Thompson	

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Dr. Harry Yoder	Southeast Poultry Research Laboratory U.S.D.A., A.R.S. Athens, Georgia 30601

CONTENTS

CONSERVING FUEL IN THE POULTRY HOUSE

L. Bynum Driggers

The increasing costs of feed grains, fuel, and electric power are a real concern of the poultrymen. The vast supplies are no longer available and thus a major rethinking of energy conserving management practices is in order.

Energy Sources and Losses

In a poultry house, available energy sources are from the birds and supplemental heaters. The cost and availability of fuel for the supplemental heaters are elements of tremendous concern at present. Thus, an all-out effort must be focused upon conserving the heat produced by the birds and reducing the supplemental heating requirements. Heat is used or lost in three major ways.

1. There is a loss through the walls, roof, ceiling, and the floor. These losses can be minimized with the proper type and amount of insulation.

   Insulation - Insulation is a material with a high resistance to the flow of heat. There are many insulation materials on the market but three are used predominately in poultry houses. They are polystyrene foam, polyurethane foam, and mineral wool or fiberglas.

   Figure 1 illustrates the effect of insulation on the heat loss through the walls, ceiling, and roof. The loss is in relationship to the resistance of the insulation of its "R" value. There is a difference of opinion on the "R" value for some materials and thus Figure 2 was prepared on the basis of values given in the 1972 Handbook of Fundamentals published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (1). These curves show the relationship between "R" value and thickness of insulation.

The effect of insulation on fuel savings can best be illustrated using a typical broiler house 40 feet wide, 300 feet long with 7 feet high sidewalls and a roof slope of 5 in 12. The inside temperature is assumed to be 70^{o}F and the outside temperature is 5^{o}F.

Example 1 - No insulation (Figure 3). The heat loss is 1,490,000 Btu/hr. This is equivalent to approximately 20 gallons of propane per hour.

Example 2 - Insulation in the ceiling only. (Figure 4)

$$R = 8 \begin{cases} 1\frac{1}{2}\text{" polystyrene,} \\ 1\frac{1}{4}\text{" polyurethane,} \\ \text{or 2" fiberglas} \end{cases}$$

The heat loss is reduced to 487,700 Btu/hr, which is equivalent to burning approximately 6.6 gals. of propane per hour.

Example 3 - Ceiling insulated as shown in Example 2 plus side-wall insulation with R = 5. (Figure 5)

$$R = 5 \begin{cases} \text{0.8" urethane,} \\ \text{1" polystyrene, or} \\ 1\frac{1}{2}\text{" fiberglas} \end{cases}$$

The heat loss is further reduced to 154,400 Btu/hr, which is equivalent to burning approximately 2.1 gallons of propane per hour.

It is apparent through the examples above of the effect insulation has on conserving fuel.

2. The second major demand for heat is to warm the ventilating air. For each 1,000 cubic feet per minute (cfm), the heat necessary to raise the temperature of the air from $5^{o}F$ to $70^{o}F$ is 78,000 Btu/hr or approximately one gallon of gas. Thus, it becomes clear that in a well insulated house, the heat to warm the ventilating air exceeds the requirements for just keeping the house warm. Therefore, keep the ventilation to the required minimum.

   Gas brooders not vented to the outside whose combustion products are discharged into the broiler house produce about 6 pounds of water for every gallon of gas burned. This moisture must be removed and thus requires additional ventilation air. Consequently the heating cost increases.

3. The third demand for heat is to evaporate moisture from the litter. This requires approximately 1,000 Btu's for each pound or pint of water. Well adjusted waterers and absorbent litter will minimize this requirement and result in a drier floor.

A New Look at Brooding

Studies are being conducted on alternative brooding schemes. Maryland (3) reports a 50 percent reduction in brooding costs using the double brooding method.

Example 4 - Using the house as insulated in Example 2 above and brooding in the middle half (40' x 150") the heat loss becomes 271,450 Btu/hr, equivalent to burning approximately 3.7 gallons of propane per hour. Thus, the fuel requirements are reduced from 6.6 gallons per hour to 3.7 (Figure 6).

Example 5 - By insulating the roof and sidewalls as in Example 3 and brooding in the middle half of the house, the heat loss is 113,080 Btu/hr, requiring approximately 1.5 gallons of fuel per hour.

In the two preceding examples an inside temperature of 80^{o}F was used in the calculations. As the brooder is raised to accomodate twice as many birds, the inside room temperature will likely rise in order to maintain the high brooding temperature surrounding the chicks.

Other studies (4) (5) indicate that temperatures 10^{o}F lower than normally recommended for brooding produce satisfactory results. Low temperature brooding may not be satisfactory in curtain wall houses because the radiation heat losses from the chicks to the cold walls are greater.

Full Scale Studies

Considerable savings in fuel were reported by Baughman and Parkhurst (2) in their comparison of a conventional house to an environmentally modified house. With more pounds of live broilers produced with less feed as a result of better environmental conditions, they concluded that a savings of $44.17 per thousand chicks placed could be expected.

Even though fuel consumption was not itemized, Hester (6) reported that for a 12-month period where 3,153,640 birds were placed in "brown out" houses and 12,546,534 in regular houses a pound of broiler meat could be produced for less cost with the brown out system.

Other Schemes

Older houses with high infiltration losses can be improved by winterizing with a layer of polyethylene film on the inside of the walls.

Whenever possible, ventilating air should enter the house from the attic. Incoming air is preheated to some extent and thus requires less heat to warm up to the house temperature.

Summary

The greatest savings in energy can be realized through the proper installation of adequate insulation in the poultry house. Then, the ventilation rate must be controlled to the minimum.

When a near optimum environment is achieved for the birds, other energy savings result, primarily in feed efficiency. With feed constituting 85% to 90% of the energy costs, improvement in feed efficiency reflects dramatically upon production costs.

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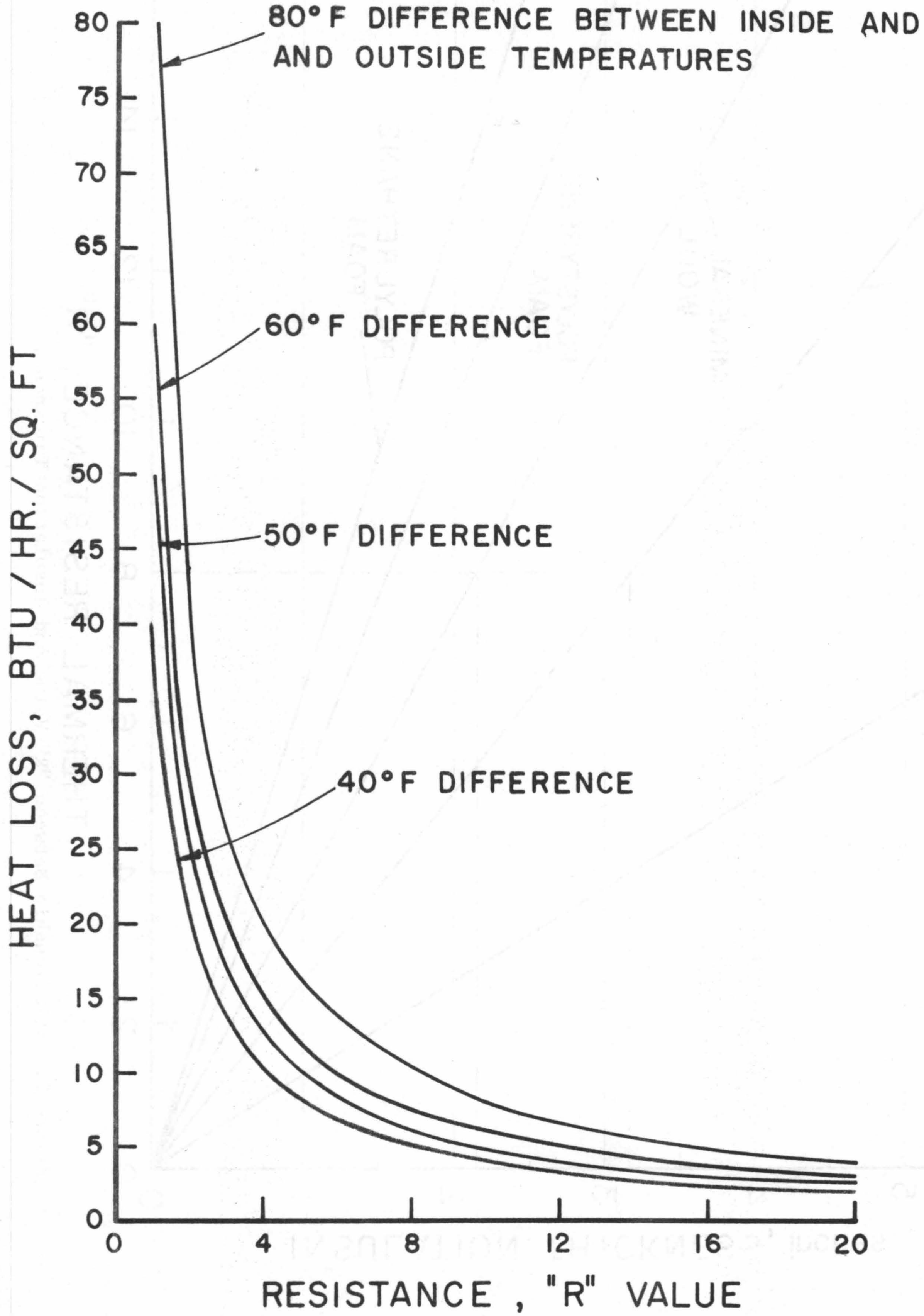

Figure 1. Effect of Insulation Upon the Heat Loss Through the Walls, Ceiling, or Roof.

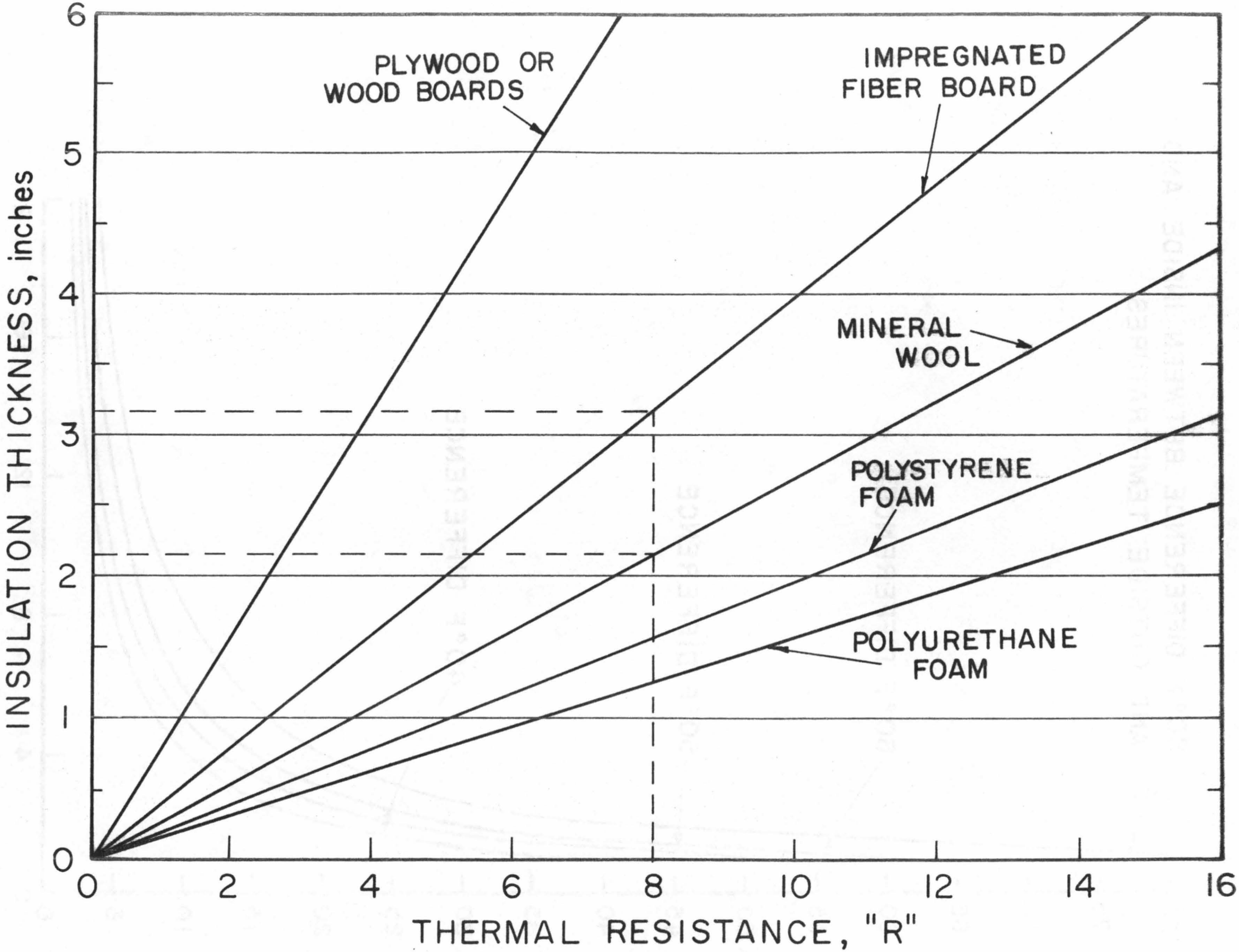

Figure 2. Relationship Between "R" Value and Insulation Thickness.

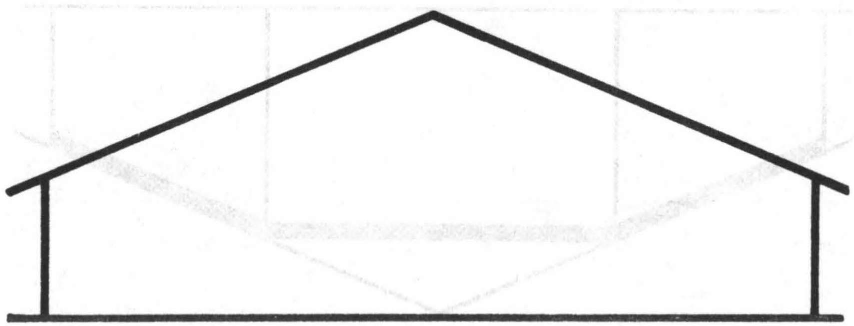

Figure 3. 40' x 300' x 7' sidewall height
No insulation
Metal roof, curtain walls
Heat loss = 1,490,000 Btu/hr

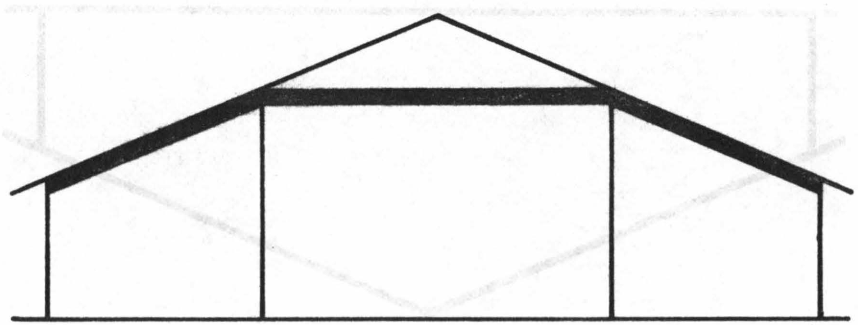

Figure 4. 40' x 300' x 7' sidewall height
Roof insulation, R = 8
Metal roof over insulation
Curtain sidewalls
Heat loss = 487,700 Btu/hr

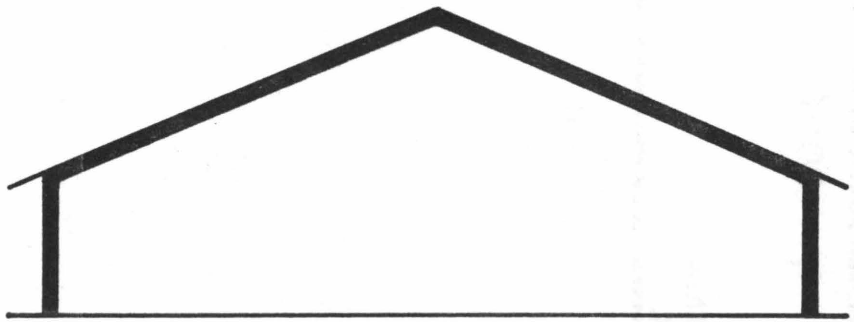

Figure 5. 40' x 300' x 7' sidewall height
Roof insulation, R = 8
Sidewall and End insulation, R = 5
Heat loss = 154,400 Btu/hr

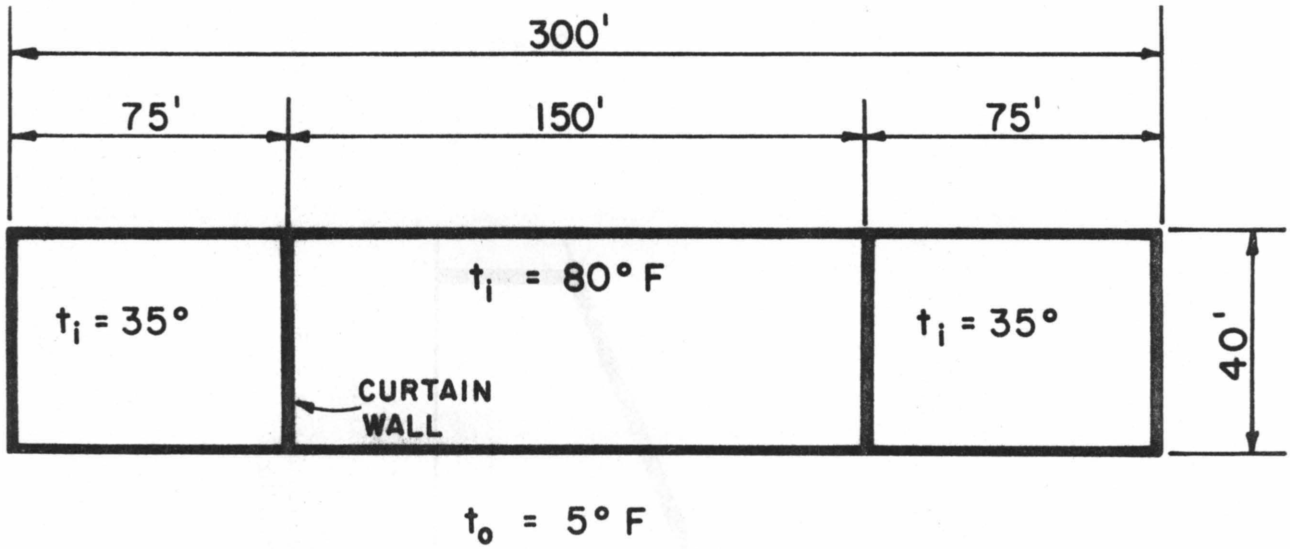

Figure 6. Double Brooding System

VENTILATING A POULTRY HOUSE

Barry Bingham

Why ventilate a poultry house?

Did you know that if you had a tri-deck cage layer operation and you did absolutely no ventilating either natural or powered, that in ten months the water would be seven feet deep. In a broiler house at the end of eight weeks the water would be five inches deep. Of course these examples are ridiculous, because with no ventilation the birds would suffocate, but it does point out the tremendous volume of water that must be removed by the ventilation system.

When I talk about ventilation, I like to talk about, (1) the right amount of air, and (2) the proper distribution of this air.

(1) For winter ventilation, what we are really trying to do is maintain a moisture balance. What this means is that if the chicken produces one pound of water, we want to bring enough air through the house to carry out that one pound. If we bring more air through, then we waste fuel by having to heat the extra air. If we bring less, then we have moisture build-up and wet litter and ammonia generation. We should also try to get a system that controls or minimizes the effects of wind. Infiltration or air that is blown through the house by wind is a very large part of the heating costs of a typical broiler house.

In summer, the idea is to get rid of the heat produced by the birds. The more air going through the house, the closer to outside the temperature can be maintained. The trick is to put enough through to keep the birds reasonably comfortable, and not run the electricity cost unnecessarily high.

Much talk has been generated about odors, oxygen supply, diluting bacteria, etc., and how the ventilation system is needed to control these quantities. I will not disagree that they are important, but I will state that if you control the moisture in winter, and the heat in summer, then you have done the best we now know about how to ventilate a poultry house. In other words, if you control moisture and heat, the other will be taken care of.

(2) The second facet of ventilation is the air distribution within the poultry house. As we said before, the idea is to remove the moisture or heat produced by the poultry. If chickens are over all the house, then air needs to be moving over all the house.

The secret or principle to achieving this movement is to bring air into the house in a small stream which is moving very fast. Once the air enters the house, it starts sucking room air into the stream. The sucking action is called entrainment. The more room air that can be pulled into the stream, the more circulation is achieved. The idea then is to get the air entering the building fast, and entrain enough air to get the air in the whole room circulating.

The term "static pressure" is used to describe the vacuum pulled on the house by the fans. It's one of the laws of physics that if you double the static pressure, you quadruple the entrainment. If the static pressure goes from .03" W.G.* to .06" W.G. you get four times the amount of room air circulating.

* Water Gauge

It is also true that if you increase the static pressure, you decrease the volume of air delivered by the fans. Generally this is not significant until you exceed .10" W.G., but should be kept in mind particularly when ventilating to remove heat in the summer.

To achieve proper distribution, an inlet system should be selected that can keep the air coming into the house at a high speed, and enough of these inlets should be placed in the house to keep the entire air mass in the house moving.

Ventilating a poultry house is not simple, but with the proper equipment, and a little basic understanding of what you are trying to accomplish, the job can be done satisfactorily with a minimum amount of labor.

THE FIRST TWO WEEKS OF A CHICK'S LIFE

Gordon Miller

The first two weeks of a chick's life are by far the most important. This is the time when the grower "makes or breaks" his flock. This is the time when a good serviceman can help the grower the most. It can also be the time when a grow-out operation is a success or a failure.

It makes little difference how good management is after the first two weeks if the baby chicks were not properly cared for early in life.

My subject, "The First Two Weeks," is a slide presentation using pictures I've taken of chick management for the past ten years. It has been my experience that without proper instruction and motivation of the live production staff and growers, baby chick management can and will be the time when poorest management procedures are used.

Why?

1. Proper chick management is not mechanized. There is really no easy or short way to get the baby chicks started off properly. It takes a lot of work and time if proper care is administered. For example:

   A. Caking out house and rebedding if old litter is used; and much work if it's cleaned out all the way.

   B. This is the time that brooders must be cleaned and put in working order.

C. The house must be maintained -- curtains repaired -- fans checked -- and one of the paramount things is being sure that permanent drinkers are in good working order.

D. Jars washed and filled -- paper feeder lids made up; if plastic lids, clean and then fill with feed to proper level. Keeping permanent drinkers working properly, with the water level full and down at a level that day-old chicks can drink, is a most important chore. This will compare in importance to a proper working brooding system. It is a very important labor saving device. Chicks will start using these drinkers at a day old.

E. Keeping the permanent feeder down and full of feed can cut the use of two feeder lids and train chicks to use at an early age.

2. Many growers wait until the last day before chicks come to try to do this vast amount of work. The chick must have a home and consequently the work is not done and you get subpar chick management.

3. Companies can't put a cost per pound value on baby chick management like they can for chick cost, feed cost, grower pay, overhead, condemnation, etc.; therefore, it is not given top priority.

4. Companies do not have a set policy that service staff and grower must follow before chicks are placed.

I think a policy should be written out and followed by everyone involved (Let service staff and grower know what you expect). Don't deviate even though some growers are good and and some are not as good.

A good grower, most of the time, is looking for something that will make him do a better job -- while a poorer grower will try to get around policy because it means more work.

Example: jars and jar management (one 8 ft. drinker within comfort zone of brooder can count as 2 jars).

feeder lid management for the first 2 weeks

type of heat and how long it should stay on

fans and how they should be set at day old

amount of light--Example: 125 watts/1000 chicks for the first 10 days then drop back wattage to 40 watts for remainder of growing period, etc.

The slides today are of both good and not so good management. I think we should keep in mind that good chick management is just good common sense. Make everything convenient for the baby chick and don't worry too much about grower convenience. Get a program going and follow it year round.

I have divided the slides into 3 categories:

1. Before chick arrives
2. After the chick arrives.
3. If it can go wrong, it will.

CONFINEMENT GROWING OF TURKEYS IN NORTH CAROLINA

Charles E. Brewer

History and Early Development

Prior to the 1967-1968 production year, total confinement production of turkeys in North Carolina was limited to a few growers located in the colder, northern Piedmont and western sections of the state. Before this time, the only thing resembling confinement facilities were pole-type sheds used to condition turkeys for winter range.

Confinement production was initiated on a larger scale during 1967-1968 when approximately 2.0 million turkeys were grown in total confinement. A single company started a contract fryer-roaster production program. This fryer-roaster program was initiated with prior planning and logical concepts as related to the turkey's environment and the economics of confinement production. Since 1968, this company has expanded the fryer-roaster program, experimenting with brooding procedures, ventilation and equipment needs, eliminating problem areas, and improving management efficiency, This company followed with a total confinement program for heavy hen and heavy tom production.

Recent Development of Confinement Production

The big move to confinement and semi-confinement production of turkeys which occurred during the early 1970's resulted from many factors. Chief among these was the need for a more uniform supply of turkeys for processing on a year-round basis. The need to operate processing plants more efficiently, maintain a trained labor force, and other factors led plant owners to bring pressure on the producer to grow turkeys on a full-time basis. Many smaller producers became concerned over contract renewals and/or processing time if they refused to produce "off season" or winter turkeys. Hence, the move continued toward more confinement production.

Another reason for the rapid change over to confinement production was the economic losses experienced from cholera. In the two important production areas of North Carolina, the incidence of cholera and the subsequent economic loss became prohibitive -- this in spite of excellent management, use of bacterins, and predator control programs. Unfortunately for those who might have continued to range turkeys, the C.U. vaccine was not developed until after a substantial portion of our confinement housing was in production.

One North Carolina based company opted for confinement production after years of ranging turkeys. Poor range or pasture lands combined with high density (5,000/acre, 100-200,000 birds/range unit) created disease and performance problems which dictated a change. This company is doing a far superior job in total confinement as compared to previous range performance.

Still another company, unable to secure contract growers, decided on company owned housing. The reasons were availability of labor, company-owned land, and need for expansion of production.

Many other reasons or factors are offered as the basis of a decision to construct confinement housing for turkeys. Most of those expressed are valid, logical decisions. However, quite often, we see growers making precipitous decisions to construct confinement facilities without guidance, counseling, or advice from those with experience in this area. Frequently, I have seen this type of decision made and house construction under way - all in the space of one week. These growers are not planning, thinking practically about the economics involved, or the structure and equipment which will provide the best environmental conditions for the turkey. Fortunately, the rate of decision making and action occasionally is slowed down to some extent by the lending agencies.

Let me cite an example of what I referred to as precipitous decisions. Grower A decides to build a finishing unit for heavy toms or hens. He constructs a 34' wide, 400' long clear-span house with side-wall curtains, insulated roof, no mechanical ventilation. He installs two lines of adult-type turkey feeders and two lines of Mark IV turkey waterers.

Grower B also is building a unit for heavy toms and hens. His facility is a 50' wide, 400' long pole-type structure with side-wall curtains, insulated roof, no mechanical ventilation. The equipment is identical to that of Grower A.

With identical housing density, Grower A has one-third more feeding and watering space per bird than Grower B. Grower A will have more effective natural ventilation than Grower B. Grower A will maintain better litter conditions and likely will show a slight improvement in feed conversion and grade yield when compared to Grower B.

Whether or not you agree with my opinion regarding the Grower A confinement facility, you do recognize that one or the other of these two growers has not given adequate thought to the economics of construction and bird performance. Examples of this nature do exist in North Carolina.

Confinement Housing

Total confinement facilities in North Carolina vary structurally from the extreme of pole-type sheds with no insulation, no side-wall curtains to fan ventilated environmental control buildings.

The majority of confinement housing would fit in the following description: 34'-40' wide, 300'-400' long, clear-span housing, roof insulation, 3/4" styrofoam or 1/2" urethane, 2' solid side-wall and a 5' curtain. Another version of this structure is the 40'-60' wide pole-type shed - the width and pole support being the only structural differences. One major production area, Union and Anson counties in southwestern North Carolina, has constructed many of the wider pole-type confinement sheds.

The industry also is looking into controlled environment housing for finishing turkeys. To date, with three units in operation, the results are inconclusive. The primary problems seem to be inadequate ventilation and poor experimental procedure with the environmental units.

Another approach to partial environmental control presently is under study with one company. Instead of solid, insulated side-walls, black side-wall curtains are used in conjunction with mechanical ventilation to achieve a "brown-out" effect. Again, results are inconclusive.

Still another approach to improving the turkey's environment is the use of thermostatically-controlled side-wall curtains. Operation of the curtains is regulated by thermostats located near the center of the building.

Feeding and Watering Equipment

Feeding equipment in confinement housing varies from farm-built "barrel and tire" feeders to the most current adult turkey feeders available on the commercial market. In many situations, chicken-broiler feeders have been renovated and equipped with feeder tubes. Another example is the use of 700 lb. capacity range feeders in some of the larger confinement units. Disregarding feeder design and house width, the majority of growers will install the equivalent of two lines of feeding equipment. This results in a wide variation in available feeders space per bird.

Types and location of waterers vary considerably. In many of the older (renovated broiler houses) confinement units, 8' waterers are attached at intervals of 15'-25' on the outside wall. This arrangement has an advantage over waterers located inside the building in that litter is kept in better condition. However, the disadvantages (freezing and distance) outweigh the advantages. During the past two to three years, the Israeli hanging waterer has been used almost exclusively in confinement housing. As with feeding equipment, two lines of waterers are used regardless of house width.

Management Program

Litter materials can be soft and hardwood shavings or sawdust. Built-up litter is used almost exclusively. Total litter removal is done once annually or in case of a severe disease problem. The usual sanitation procedures between flocks include removal of caked material from around feeders and waterers and stirring or tilling the old litter. The walls, ceiling, and equipment are washed with a high pressure sprayer and disinfected with similar equipment. After litter is allowed to dry, new shavings are placed in the house.

Turkeys are moved from the brooder house to the finishing unit at five to eight weeks of age. This will vary depending on season, weather, and/or need for the brooder house. Both low-boy and multi-deck semi-trailers are used to move turkeys from the brooder house to the finishing unit.

Bird Density

Total confinement -- Toms 3.0-4.5 sq. ft.

Hens 2.0-2.5 sq. ft.

Semi-confinement -- Toms 2.5 sq. ft. inside, 2.5 sq. ft. outside

Hens 1.5 sq. ft. inside, 1.5 sq. ft. outside

Expected Mortality

With no disease problems, 1.0% per month in the finishing house--3.5-4.0% with toms, 2.0-2.5% with hens.

Market Age, Weight, and Feed Conversion

Toms -- age, 18-22 weeks; weight 22-27 lbs.; F.C. 2.70-3.20

Hens -- age, 15-18 weeks; weight 13.5-15.5 lbs.; F.C. 2.50-2.70

Market age, weight, and feed conversion depend to a large extent on plane of nutrition, feed quality, feeding schedule, and breed of turkey.

Problems with Confinement Production

Inadequate, natural ventilation seems to be one of the most persistent problems with confinement housing. During prolonged dry weather, excessive dust and subsequent air sac problems are created.

During cold, wet weather, litter condition often creates foot pad dermatitis and leg problems.

Floor space, market weight variation, and grade yield are related problems in confinement units. Research at North Carolina State University indicates that as bird density is increased, average weights and conversions are depressed. However, as bird density is decreased, uniformity of individual weight decreases. Our research indicates that grade-yield also is closely related to bird density.

Predators can be a serious problem in and around confinement housing, particularly with older birds. Any predator that gains access to the house can cause severe down-grading from bruises, scratches, and torn skin.

Another problem, as mentioned earlier, is the construction costs of turkey housing. A conventional unit in North Carolina is costing approximately $1.80-$1.90 per sq. ft.

Advantages of Confinement Production of Turkeys

The advantages of total confinement facilities will result in a continuation of this trend. Although we are experiencing a number of problems related to house design and management, the need for a balanced supply of product, reduced disease problems, lower labor requirements, and improved working conditions will tend to increase confinement production of turkeys in North Carolina.

HATCHERY SANITATION SEMINAR

John Stevens

In discussing the job of sanitation, I'll divide my remarks into segments you can define as the What, Who, When, Where and How of hatchery sanitation. The "What" is pretty easy as it just provides a definition of what hatchery sanitation is supposed to do. Our job is to provide the cleanest possible environment for the egg and emerging poult from time of lay until the poult is delivered to the brooder house.

Responsibility for getting the job done ultimately rests, of course, with the breeder supervisor or the hatchery manager. Below the management level, the job has to be done by a lot of people on down to the hired person who works for the farmer with the breeder flock contract or the tray wash operator in the hatchery. As you know, some of these folks are unskilled and relatively low paid. They don't come to work as regularly as you'd like and are apt to have a different idea of a clean egg or tray from your often repeated description. We'll discuss this more a little later, but any program, equipment, or product which you introduce must take these people and their attitudes into consideration. You may be responsible, but you're also dependent on this kind of help for the success of your program.

The "When" of cleanliness or sanitation is, obviously enough, all the time and in all kinds of big and little ways. Ship only clean eggs, clean the farm egg room regularly, keep the doors in the hatchery closed, turn on hatchery foggers at night - the check list goes on and on.

We've gone through the "What, Who and When" in fair time, so I can nag in more detail about the "Where and How." Let's begin our sanitation "Where" back at the breeder house.

Collect and pack only clean nest eggs. If this is not your policy, know it and recognize it as a potential weakness.

Pack eggs on clean flats in clean cases. The newer plastic flats have a lot to recommend them. They can be readily cleaned and disinfected and cause less egg breakage. If compatible flats are used, the need for traying at the hatchery can be eliminated.

The hatchery can cooperate with the individual breeder flock. Return the same flats and cases (especially fiber), to the same breeder farm. Don't penalize the clean breeder flock with somebody else's dirty flats and cases.

Store eggs at the farm in an egg room with good temperature and humidity control. Egg room walls and ceiling should be plywood or other closely fitted hard surfaced wallboard. Paint it with white enamel and have a close fitting door. The floor should be troweled concrete with a working drain. Store eggs on pallets at least eight inches off the floor, so you can clean under them. Wash down the room with a detergent disinfectant at least once a week when eggs are shipped. Use the room only for egg storage.

A poultry hatchery is only an environment capable of maintaining conditions which will permit an embryo to develop, and finally a chick to hatch, from a fertile egg. This can be achieved with varying degrees of efficiency by a hen, a school boy with a heat lamp, or a building with equipment for maintaining hatching temperatures. But efficiency and numbers are required to serve today's poultry industry, and the modern hatchery is the result - complete with precisely determined temperature and humidity, large capacity convenience equipped setters and hatchers, controlled ventilation, managed traffic flow, and separated work and clean-up areas. Today's modern hatchery is scientifically designed for efficient production in quantity and quality. Lack of good sanitation programs and practices can endanger the entire structure.

Sanitation is a progressive term indicating a high degree of cleanliness which can theoretically be increased to reflect between 99 and 100 percent absence of mold and bacterial organisms. Sanitary conditions in a hatchery can be promoted by use of a complete sanitation program within the hatchery and by maintaining the lowest possible entry of microorganisms into these clean premises.

Rate of penetration of pathogenic microorganisms into a clean hatchery can be decreased by isolation of the hatchery and its parts from as many contaminants as possible. Location of the hatchery building in a generally clean area away from other buildings - especially feed mills, poultry houses and processing or rendering plants - is a prime requisite for new hatcheries. Every hatchery should, so far as possible, isolate itself from dirt or soil. Clean vehicles should deliver sanitized eggs to a receiving room which is closed off from the rest of the hatchery. Working personnel should use foot pans containing regularly changed disinfectant solutions and should change into clean work clothes after entrance and before going into hatchery work areas. Only clean air, conducted directly to individual hatchery modules, should be used for ventilation.

Hatchery design also contributes to cleanliness. Building and equipment materials are chosen for easy sanitation and nonretention of dust or dirt. Interior areas are laid out so that eggs or chicks move from one room directly to the next requisite location without passing through other hatchery work areas. Ventilation equipment should be constructed to include washable and replaceable filters on all intake fans. Water pans on all evaporative coolers should be readily accessible for periodic cleaning and refilling with a use solution of an approved disinfectant.

Finally, hatchery design should provide for immediate and complete disposal of all hatchery wastes and effluent . . . broken or unhatched eggs and dead chicks should be moved out of the hatchery as soon as possible and temporarily stored in closed shaded containers until final disposal away from the hatchery. Floors should be sloped to large capacity drains which can be conveniently reached for sanitizing or deodorizing.

Very careful attention should be paid to the hatchery water supply. Purity of water is, of course, the first consideration. Entrance of bacteria via the water supply is never tolerable, and we'll assume this point is well covered. However, water hardness and iron content are overlooked more often than good management practice should permit. Hard water can cause rough and difficult to remove calcium and magnesium sediments and precipitates to form and adhere to surfaces which have been disinfected. The disinfectant is then blamed for causing this hard rough scale, but the real villain is the water supply. This same calcium and magnesium scale can build up in water lines and clog valves and spray or fog nozzles. Excessive iron content can promote the growth of "iron bacteria," clog valves and nozzles, and color white surfaces an attractive mottled shade of red.

Water hardness above 160 ppm calls for installation of water conditioning or softening equipment. Iron standards are more difficult to establish. The U. S. Public Health Service calls for limits of 0.3 mg. of iron per liter, and the top hatchery limit should probably be no greater than 1 ppm. Water conditioning systems are also available for iron removal.

Good design and water supply undoubtedly promote effective sanitation. However, any hatchery will benefit from routine use of an efficient sanitation program. Such a program has as its first and well recognized objective the reduction of existing microorganism loads to safe levels in the affected area. A surface is usually said to be satisfactorily clean when a two inch square sample yields a bacteria count of less than ten, and mold of less than five. Counts above thirty are unsatisfactory.

There are a number of sanitation programs available, including fire, which will effectively destroy microbes. Further criteria materialize, however, when consideration is given to personnel applying the sanitizer and the surfaces being sanitized. The disinfectant should be safe to use under conditions of ordinary precautions. For maximum long range efficacy it should even be relatively pleasant to use and should hopefully provide some visual evidence of cleaning ability to the person using it.

Disinfectant solutions are sprayed on a variety of surfaces. Wood, concrete, metal, plastic, rubber are common materials which must be sanitized but not corroded, rotted, or otherwise adversely affected. Surfaces should dry in normal time without slippery or sticky residues. Disinfecting equipment should be readily purged of remaining solutions, and use solutions should not clog nozzles or lines of foggers.

It is important to have some ideas of the attributes and limitations of the various types of disinfectants available. One purpose of this talk is to acquaint you with the strong and weak points of those chemical disinfecting and sanitizing agents available, and to provide you with some basis for selecting the product which will best suit your individual needs.

Let's spend the next few minutes looking at some common types of disinfectants available to the poultry industry. This table gives a brief description of five generic types of disinfectants available under a whole hoard of trade names. In the first column listing properties, the first three terms-gram-positive, gram-negative, and bacterial spores-may be unfamiliar to some of you. Gram has nothing to do with weight, but was the name of a Danish biologist who discovered that certain bacteria were always permanently colored by a specific stain - now referred to as Gram's stain - while all others could be decolorized and would not permanently retain the stain. These two groups have other features in common, and the gram-positive and gram-negative groups are probably the two broadest bacterial classifications in general use. For our purposes we'll remember that Streptococcus and Staphylococcus organisms are gram-positive while Salmonella, E. coli, and Pseudomonas bacteria belong to the much more numerous gram-negative group.

Staph, Pseudomonas, and Salmonella Cholerasesuis

Are usually the three organisms tested, since they are three of the more difficult bacteria to kill. Other organisms such as E. coli or most other Salmonella species are more easily killed at much lower disinfectant concentrations.

Some bacteria have the ability to enter a resting or spore forming phase. In this phase they are highly resistant to adverse conditions including standard disinfectants. Bacteria with this quality are not ordinarily a hatchery problem.

The next five columns compare various standard types of disinfectants against the properties in the first column.

Iodophors:

Iodophors are combinations of elemental iodine and an organic solubilizing agent, usually a nonionic surface active agent (surfactant). These complexes retain most of the microbicidal activity of iodine, but are readily water soluble and are less toxic than aqueous solutions or tinctures of free iodine.

Iodophors possess a wide spectrum of antimicrobial activity, including most gram-positive and gram-negative bacteria, fungi, and many viruses. They are unaffected by hard water salts and have a unique built-in use-discard indicator - when the solution loses its yellow color, it is no longer effective and should be replaced with a fresh solution.

Since iodine is more active in the acid range, most iodophors contain phosphoric or hydroxyacetic acid, and possess pH levels of two to four in use solution. The iodophors are ideal disinfectants for use on precleaned surfaces, but are inhibited in their action by the presence of high levels of organic debris.

Most idophors are recommended as disinfectants at concentrations between 50 and 100 ppm Titratable iodine and sanitizers between 12.50 and 25 ppm.

Quaternary Ammonium Compounds

Quaternary ammonium compounds or "Quats," as they are popularly referred to, are cationic surface active agents. The most popular types are extremely water soluble and have a very rapid speed of kill. They are also effective deodorizing agents.

Quaternaries, like iodophors, are reduced in effectiveness by heavy organic loads. Being cationic in nature, the quaternaries are also incompatible with anionic surfactants and should not be used in combination with such materials.

Cleaning of surfaces prior to the use of quaternary ammonium disinfectants should be carried out with nonionic surfactants, or if it becomes necessary to employ an anionic surfactant, the surface should be thoroughly rinsed before applying the quaternary.

It is known that hard water salts affect the bactericidal activity of quaternary ammonium disinfectants. This effect, however, is merely one of reduced speed of kill and not of true inactivation. Quaternary ammonium compounds, having very high hard water tolerances, are available for use in hard water areas.

Most Quaternary ammonium compounds are recommended disinfectants at a level of 400 ppm active ingredient for nonporous surfaces and at a level of 800 ppm active ingredient for porous surfaces. They are usually recommended as sanitizers at a level of 200 ppm active ingredient.

Synthetic Phenols:

The synthetic phenols most widely employed as disinfectants are the arylphenols, the simple akylphenols, the halogenated phenols, and the nitrophenols. Because of their lack of solubility in the neutral and acid pH ranges, these compounds are normally formulated in the alkaline range. Most phenolics are incompatible with nonionic surfactants and should not be used in conjunction with such materials. Although somewhat less resistant to the inactivating effects of organic debris than the coal tar disinfectants, most phenolics are superior in this respect to quaternaries, chlorine, and iodine based disinfectants.

The phenolics, like the coal tar disinfectants, vary widely in efficacy from one compound to another. Because of this, one finds many different concentration levels recommended. Most phenolic formulations are recommended for use as disinfectants at levels ranging from 250 to 2,000 ppm active phenol.

Chlorine releasing agents:

Chlorine gas and chlorine releasing agents have been employed as disinfectants or sanitizers in poultry plants for many years. The most common forms of chlorine releasing agents are sodium and calcium hypchorite, the organic chloramines, the chloroisocyanurates and chlorine dioxide. The most popular type appears to be the hypochlorites.

Chlorine has an extremely rapid speed of kill and is effective against a wide spectrum of organisms. Its principal disadvantages are its poor resistance to inactivation by organic debris and its corrosive nature.

The hypochlorites are supplied as either liquid or solid and usually contain from 2 to 10% available chlorine in liquid, and up to 70% available chlorine in the powdered form. The majority of these products have limited shelf life. The organic chloramines and the isocyanurates are considerably more stable than the hypochlorites but are slower in speed of kill. All forms of chlorine are more effective in an acid environment than in an alkaline one.

Chlorine compounds are extremely effective disinfectants on thoroughly cleaned surfaces but are rapidly inactivated by organic debris. Most chlorine releasing agents are recommended as disinfectants at levels of 200 to 300 ppm available chlorine and as sanitizing agents at levels of 50 to 100 ppm available chlorine.

There are also currently available a number of combination sanitation products. These sanitizers usually combine quaternary ammonium compounds and synthetic phenols with formaldehyde and obtain sanitizing capability from all three ingredients. None of these products pass the EPA standard tests as disinfectants, but in field use they appear to act as satisfactory sanitizers.

Both in this country and internationally, quats have been the most widely used active ingredient in hatchery disinfectants. They should, however, be formulated with other materials to improve their cleaning ability and their activity against gram-negative organisms, notably pseudomonas species. When used in fogging equipment, quats should be buffered with appropriate anti-corrosive ingredients to prevent rusting of metal equipment or prolonged exposure.

As I indicated earlier, great care and expertise must be used in selection of a cleaner or detergent for use with a quat disinfectant. Never use any detergent with a quat except on advice or recommendation of the quat manufacturer. Pseudomonas is a particularly undesirable organism in a hatchery. Addition of from 10 to 50 ppm of EDIA at use dilution will provide complete disinfectant activity against this organism.

With these additions or qualifications in mind, quats are an excellent choice for hatchery disinfectants. They are fast acting - broad spectrum disinfectants. When correctly formulated, quats are non-corrosive to hatchery materials. Used as directed, they are safe for personnel to use. They are also pleasant and convenient to work with. Although practically odorless, quats are excellent chemical and bactericidal deodorants. Formulated with appropriate detergents, they are among the most effective cleaners available to the industry. Either in price per gallon of concentrate or in use solution, they are among the least expensive disinfectants available.

Every hatchery manager should follow a routine procedure for testing or demonstrating the efficiency of his sanitation program. In several states, effective swab or air sampling programs are offered through state universities or poultry associations, hatchery or company personnel.

The sterile swab and plate method is easily learned by a reliable, careful employee. Recommended prepared and packaged trypticase soy agar plates and individual sterile swabs are available from any micro-biological house. Exposed or swabbed plates are then transferred to an incubator cabinet, held for four or five days, and then read.

Bacterial colonies appear as dots or rods. Molds are larger clumps or discs with a characteristic "hairy" or "moldy" appearance. Less than ten bacteria per plate indicate a satisfactorily clean area. Over thirty is unsatisfactory. If unsatisfactory or borderline plates persist, consult your state laboratory for assistance in determining the specific nature of this problem.

A major advantage to examination by hatchery personnel is that an inspection routine can be timed to take place as specific rooms or equipment are available for testing. Effectiveness of a sanitation program is best determined following completion of the procedure and not in the presence of pipped eggs or half way through the work day in the wash room. Also, corrective work may be more immediately instituted following observation of an unsatisfactory plate.

We've discussed cleaning and fogging disinfectants. There's one operation in which no disinfectant is recommended. Use a good detergent in your tray and box washer, and keep your water hot. There's no point in trying to disinfect the dirty water that's being recycled through the tray washer. Make sure the spray disinfectant rinse is applied to each tray or box when it is removed from the washer.

ENVIRONMENTAL CONTROL FOR BROILERS

J. W. Deaton

Environmental control for broilers touches many areas in broiler production. Some of the main areas are biological isolation, pollution control, automation, energy conservation, and utilization of fuel and feed.

What I would like to do today is spend my time almost exclusively in the area of energy conservation and utilization of fuel and feed in the production of broilers.

For temperature during the brooding period, we stay with the general recommendations for temperatures of 90° F. the first week, 85° the second week and 80° the third week. Energy requirements for broilers during this time are met primarily with energy sources from fossil fuels. With fossil fuel supplies in jeopardy, much work is being conducted to find ways to limit the use of fossil fuels during the brooding period. In fact, results with work with limited area brooding at our laboratory show that fossil fuel use can be cut as much as 70% (Reece, F. N., and F. W. Harwood, Broiler Industry, September 1975 edition).

Because we are in the business of producing a nutritious, excellent-tasting animal protein food, we find that in an economic evaluation of production costs, feed accounts for some 60% to 75% of the total cost of producing this broiler, after depreciation is excluded. Most of the energy in the form of feed is required during the growing period.

The data in Table 1 demonstrate the effect of low and moderate temperature on broiler body weight feed consumption and feed conversion from 22 to 56 days of age.

Table 1. Effect of low and moderate temperature on broiler body weight, feed consumption and feed conversion (mixed sexes - 8 weeks)

Temperature (^{o}F.)	Per 1000 Broilers: Meat (lb. live wt.)	Feed (lb.)	Feed conversion
45	3,558	8,895	2.50
55	3,532	8,441	2.39
65	3,618	8,177	2.26
75	3,461	7,614	2.20

When the data in Table 1 are evaluated economically, assuming a $140 per ton feed cost with a 40-cent Ready-to-Cook (RTC) broiler market, the data then appear as in Table 2.

Table 2. Effect of low and moderate temperature on feed costs and meat produced. Cost of feed - $140 per ton; Broiler Market - 40 cents RTC

Temperature (^{o}F.)	Per 1000 Broilers: Value of meat	Cost of feed	Return (meat-feed)	Decrease in return from maximum
45	$1082	$623	$459	$69
55	1074	591	483	45
65	1100	572	528(Max. return)	--
75	1052	533	519	9

The calculation is based on a dressing yield of 76%. Therefore, as demonstrated in Tables 1 and 2, rearing temperature does significantly influence the production cost of broilers.

The way to counteract the effect of low or winter temperature on broiler production is to improve broiler housing. The factors of major importance in improved housing are proper insulation and ventilation control. In the production of broilers, a considerable amount of energy is required for metabolism. This energy is essentially waste heat unless it is properly utilized or recycled. About 50% of the winter heat production or energy metabolism is in the form of sensible heat that is a form that can be used to heat the broiler house. The other 50% is in the form of latent heat or moisture that should be removed from the broiler house. The amount of energy produced from metabolism in the form of sensible heat in a 24-hour period in the winter for a house of 13,500 broilers averaging 2.9 pounds is equivalent to the energy in 78 gallons of liquified petroleum gas produced. With the house insulated properly and with the proper ventilation system, the sensible heat can be utilized and the latent heat removed from the house.

The data in Table 3 demonstrate the effect of moderate and high temperature on broiler body weight, feed consumption, and feed utilization from 28 to 56 days of age.

Table 3. Effect of moderate and high temperature on broiler body weight, feed consumption and feed conversion (mixed sexes - 8 weeks)

	Per 1000 Broilers		
Temperature (^{o}F.)	Meat lb. live wt.	Feed (lb.)	Feed conversion
65	3,843	8,109	2.11
75	3,732	7,651	2.05
85	3,430	7,134	2.08
75-95*	3,424	7,122	2.08

* A 24-hour linear temperature cycle ranging from 75 to 95 to 75^{o} F.

The data in Table 3 show that environmental temperature controls feed intake, which controls growth.

Because we produce meat on a weight basis, instead of selling chicken at a specific age, we sell at a specific weight. Therefore, under summer conditions, we generally keep the chickens on feed longer than under winter conditions and market at an older age. For each additional day that a broiler is kept on feed to reach a specific weight under one system such as high temperature versus moderate temperature, the cost is about 2 points per day on the feed-conversion scale. For calculation or equations, each 0.1-pound depression in body weight represents one additional day that the broilers must be kept on feed.

With the depressed growth as given in Table 3, the data were then recalculated and are presented in Table 4.

Table 4. Effect of moderate and high temperature on predicted market age, broiler body weight, feed consumption and feed conversion (mixed sexes - 8 weeks)

Assumption - 2 points more feed required for body maintenance for each 0.1-pound difference in 8-week body weight for data presented in Table 3.

Temperature (°F.)	Meat (lb. live wt.)	Age (weeks)	Feed (lb.)	Feed conversion
	Per 1000 Broilers			
65	3,843	8-0	8,109	2.11
75	3.843	8-1	7,955	2.07
85	3,843	8-4	8,301	2.16
75-95*	3,843	8-4	8,301	2.16

* A 24-hour linear temperature cycle ranging from 75 to 95 to 75° F.

When we equate body weight, high temperature is also obviously detrimental to feed conversion (Table 4).

An economic evaluation of the data in Table 4 is given in Table 5.

Table 5. Effect of moderate and high temperature on feed costs and meat produced. Cost of feed - $140 per ton; Broiler Market - 40 cents RTC

	Per 1000 Broilers			
Temperature (^{o}F.)	Value of meat	Cost of feed	Return (meat-feed)	Decrease in return from maximum
65	$1168	$568	$600	$11
75	1168	557	611(Max. return)	--
85	1168	581	587	24
75-95*	1168	581	587	24

* A 24-hour linear temperature cycle ranging from 75 to 95 to 75^{o} F.

Obviously, from the data in Tables 2 and 5, temperature plays a significant role in the production of broiler meat.

Another factor that is receiving considerable attention, and rightly so, because of the potential economic gain is that of light control in broiler production. Results of recent work at our laboratory (Table 6) indicate the effect of light duration and intensity on broiler body weight, feed consumption and feed conversion. The data in Table 6 were collected under a temperature regime of 90^{o} F. the first week, 85^{o} the second week, 80^{o} the third week, 75^{o} the fourth week and 70^{o} from 5 through 8 weeks of age.

Table 6. Effect of light intensity on broiler body weight, feed consumption and feed conversion, moderate temperature (mixed sexes - 8 weeks)

	Per 1000 Broilers		
Treatment*	Meat (lb. live wt.)	Feed (lb.)	Feed conversion
1	4,087	8,624	2.11
2	4,136	9,265	2.24

* Treatment 1 is continuous light at an intensity of 1.2 footcandles

Treatment 2 is continuous light with 12 hours of continuous light at 19 footcandles and 12 hours of continuous light at 1.2 footcandles.

When the effects of light intensity were measured under a high or summer temperature condition, the results are as given in Table 8.

Table 8. Effect of light intensity on broiler body weight, feed consumption and feed conversion, high temperature (mixed sexes - 8 weeks)

	Per 1000 Broilers		
Treatment*	Meat (lb. live wt.)	Feed (lb.)	Feed conversion
1	3,739	7,328	1.96
2	3,629	7,185	1.98

* Treatment 1 is continuous light at an intensity of 1.2 footcandles.

Treatment 2 is continuous light with 12 hours of continuous light at 19 footcandles and 12 hours of continuous light at 1.2 footcandles.

The economic evaluation of the data in Table 8 when adjusted for the body weight difference is given in Table 9.

Table 9. Effect of light intensity on feed costs and meat produced, high or summer temperature. Cost of feed - $140 per ton; Broiler Market - 40 cents RTC

	Per 1000 Broilers			
Treatment*	Value of meat	Cost of feed	Return (meat-feed)	Decrease in return from maximum
1	$1137	$513	$624(Max. return)	--
2	1137	523	614	$10

* Treatment 1 is continuous light at an intensity of 1.2 footcandles.

Treatment 2 is continuous light with 12 hours of continuous light at 19 footcandles and 12 hours of continuous light at 1.2 footcandles.

It is interesting to note from the data presented in Tables 6 and 8 and reflected in Tables 7 and 9 that light intensity has a greater effect on feed conversion and the economic evaluation for broilers reared in a moderate temperature than for those reared in high or summer temperatures. The apparent reason for this difference is the fact that high temperature affects the activity of the broiler. The broiler is less active under a high temperature regime; therefore, less feed is wasted and less energy is used.

The amount of light needed for maximum growth and best feed conversion is just enough for the broilers to find the feed and water and for the caretaker to see the level of feed in the feeders and the level of water in the waterers. Quantitatively, for broilers after the first 5 days, this amount is approximately 140 watts per 1000 square feet of floor area of incandescent bulbs 8-feet high, with some margin for dirty and burned-out bulbs. With no margin of safety after the first 5 days, approximately 84 watts of incandescent bulbs per 1000 square feet of floor area would be required. For the first 5 days of the brooding period, approximately 1.4 watts per square foot of light should be provided in the brooding area to assist the chicks in finding feed and water. The data in Table 10 show the light intensity at broiler level with different size bulbs in a windowless house at our laboratory

Table 10. Light intensity in a 36- by 80-foot house, with 2 strings of bulbs equidistant from the side and on 10-feet centers = 16 bulbs, 8 feet from the floor

With new bulbs

25 watt bulbs = .5 to 1.5 footcandles

15 watt bulbs = .25 to .75 footcandles

7 1/2 watt bulbs = .10 to .25 footcandles (too dim)

Essentially, the light data in this paper show that we need a light-controlled house for broilers reared under a moderate temperature regime (3 or 4 batches of broilers per year) but an open-sided house for broilers reared in the summer months (1 or 2 batches per year). The $10-gain noted in Table 9 for light control will be practically eliminated in the cost of electricity for fans for the broilers reared in the summer. We recently calculated that at least 75% of the total electricity required for fans for broiler production in a windowless house would be required in the summer.

SUMMARY

Continual pressure must be maintained to increase the efficiency of converting plant and waste animal protein to a nutritious food product. Parameters discussed in this paper are effect of temperature, ventilation, and light on broiler production efficiency.

THE INFLUENCE OF GUMBORO INFECTION ON THE PATHOGENICITY OF OTHER DISEASES*

Walter S. Staples

Our discovery of the influence of Gumboro infection on the pathogenicity of other diseases came about as a result of an investigation to determine the cause or causes of "CATASTROPHE" flocks.

1. Catastrophe Flocks

Some of these flocks were diagnosed as Inclusion Body Hepatitis Syndrome, some as Gangrenous Dermatitis. Some were diagnosed as Air Sac due to Mycoplasma Synoviae infection. Most included birds with anemia, hemorrhagic syndrome, peritonitis, and/or septicemia. In fact, the lack of similarity of lesions or disease occurrence; the lack of benefit from medication; and, while related to specific breeder flocks, the lack of predictability of degree of the disease led to solving the problem.

These suggested that susceptibility to rather than by a specific disease indicated lack of maternal antibody protection for a disease to which some but not all broiler flocks were being exposed. The diversity of disease lesions, and the inability of researchers to reproduce lesions and losses as seen in the field, further suggested interference with the immune mechanism of the chicken.

2. Breeders Positive, Broilers Negative

When we did serological tests on CATASTROPHE broiler flocks and their breeder flock sources, we found the broilers positive and the

*Script Accompanying Slide Presentation

breeders negative for Gumboro. This held true in several geographic areas.

3. Geographic Areas

Maine and Mississippi, Maryland and California, Georgia and Arkansas, whether the flock problem diagnosis was Inclusion Body Hepatitis, Mycoplasma Synoviae, or Coli Baccilosis.

4. Room 7 Door

We developed an on-going exposure system in Room 7 of our positive pressure isolation building in which we exposed progeny of field flocks.

5. Positive Pressure Building

Progeny of field flocks that tested positive for Gumboro and progeny of field flocks that tested negative for Gumboro.

6. Field Test Results

The results confirmed the field test serology for CATASTROPHE broiler flocks when progeny of the Gumboro negative breeders died and progeny of the Gumboro positive breeders lived. These birds that died had lesions typical of field cases of Inclusion Body Hepatitis--Gangrenous Dermatitis Syndrome - 7, 8, 9, 10, 11, 12, 13 Room 7 lesions. We then vaccinated 12 week old pullets with commercial Gumboro vaccine, mated them, and grew their progeny in Room 7.

14. Vaccinates in Room 7

They survived; and progeny of non-vaccinated breeders died. The true test of a practical immunization program must be at commercial field level. We then vaccinated breeder flocks and placed their progeny on farms in Arkansas and Georgia with progeny of Gumboro susceptible non-vaccinated breeder flocks.

15. Field test Chart

In pens where 200 toe cut for identification chicks from susceptible and vaccinated breeders were intermingled and in pens where flock sources were kept separate, there was consistently lower mortality in the progeny of Gumboro vaccinated breeders.

16. Summary of Three Tests

While it was impossible to post every bird in these field tests, Inclusion Body Hepatitis was laboratory diagnosed in each flock. We have not found Gumboro as a mortal disease itself in meat line birds. When no other disease except Gumboro occurred, there was no mortality that could be attributed to Gumboro. Gumboro did cause severe lesions in the bursa of 6½ week old chickens.

17. Infected Bursa

Fabricius 72 hours after exposure of susceptible chickens; and that organ was in most cases destroyed. But like surgical bursectomy loss of this organ did not cause death. Why then does Gumboro have an influence on pathogenicity of other diseases?

Much is to be learned about immuno-suppression and the various responses of avian hosts to infection. We do know that there are two general classifications of cells that respond at specific time and/or to specific diseases. These are the Thymus dependent and the Bursal dependent cells. The Thymus, or T cells, relate to cellular immune response and do not appear to be affected by Gumboro. The Bursal, or B cells, however, relate to humoral antibody response; and if the Bursa of Fabricius is damaged during the critical peirod when its cells are seeding other organs, organs which will continue to produce B cells when activated by infectious agents, the result may be permanent immuno-suppression.

18. Permanent-Temporary Immuno-Suppression

This critical period is during the early days of the chick's life, up to about two weeks of age. Damage after about two weeks may be only temporary; but if Gumboro exposure occurs in conjunction with vaccination or other disease exposure, the immune response may be delayed causing increased severity of reaction and longer period of disease manifestation. In practical application, the control program to prevent damage to the immune system of broilers (or breeders) is to immunize the breeders. Gumboro immunizing of breeders may protect their progeny for up to six weeks of age.

19. Maternal Antibody Protection

Protection for six weeks would be adequate to prevent damage to the immune system of broilers; and there would be no interference to producing immunity from vaccinations to other diseases prior to six weeks of age.

The level of maternal antibody protection in broilers will vary considerably due to age at which the breeder flock was exposed to Gumboro, the quantitative level of breeder exposure, and possibly to other reasons. As breeders get older, they become more resistant to Gumboro exposure; and it takes increasing amounts of vaccine to produce immunity. Because the immune mechanism of the breeder may be damaged if exposed to Gumboro at early age, it is undoubtedly better to delay vaccination or natural exposure of the breeder flock until the age of immune-competence. This is rather an elusive age because it may vary with diseases, breed of bird, and for other reasons. We do know that immuno-competence increases with age. We must also keep in mind that most breeder flocks must be vaccinated for Infectious Bronchitis, Newcastle Disease, Pox, and perhaps Laryngotracheitis as well as for Mareks Disease. Gumboro infection at the same time will cause more or less suppression of immune response to these diseases for which we hope and expect to gain protection by vaccination for both the breeder and its progeny.

Because of these very practical problems, it would appear that the least breeder damage and the most broiler progeny protection would result from Gumboro vaccination after eight weeks of age.

A second problem in practical application of Gumboro immunization is the lack of quantitative measurement of the Agar Gel Precipitin test. This test readily identifies individuals in a flock that has been exposed to Gumboro: but it does not tell us what level of maternal antibodies will be passed on to the broiler progeny.

20. A.G.P. Test

Experience has shown us that if less than 100% of a 1% sample is positive, there will be some fully susceptible chicks. If we kill day old chicks and bleed them, we may find that the maternal antibody level is so low that some are negative even though the breeder flock sample was 100% positive. These chicks, with low level of protection against Gumboro exposure, if exposed to Gumboro mechanism or temporary immuno-suppression when broiler vaccinations for respiratory diseases were being applied. We might be misled by AGP test results because of the lack of quantitative measurement of the test, particularly in very high Gumboro exposure conditions. We are testing several methods with hope of developing a dependable Gumboro immunizing program.

21. Gumboro questions

There appears to be considerable confusion concerning Gumboro Disease. The only commercial vaccine available nationwide is USDA approved for 10 day application only: our research would conclude this would result only in damage, not benefit. Gumboro is reported to always "live over" on a farm: but in our experience, reasonable sanitation and disinfecting has broken the cycle. We have been told of rather high mortality in 16 week old Leghorn pullets diagnosed as Gumboro: but we have exposed mature birds with as much as 60 times vaccine dose with no apparent ill effects. In our experience, a secondary disease presence is necessary to produce mortality. We have been led to believe that Gumboro is highly contagious, easily and quickly spread among chickens within a flock and from pen to pen and house to house on a farm: but we have observed a Gumboro negative breeder flock in a multi-age, multi-house unit that never did become positive although all other houses in the complex were positive. We also have vaccinated individual 17 week old birds and noted it did not spread to contact birds. There appears to be a strong age resistance to Gumboro infection with rapid spread only in young susceptible chickens.

We can, at least, suggest the desirability for considerable reliable research to correct some of these misconceptions regarding Gumboro.

I would like to re-emphasize the complexities of Gumboro Disease and particularly the difference, the BIG difference, between Gumboro and other common poultry diseases.

22. Viral Arthritis Bird

With a disease like Viral Arthritis, when the legs are twisted out of shape, we can see the effects of the disease. Gumboro produces NO twisted legs, NO respiratory signs, NO outward appearances of disease. The effects are far more deleterious.

23. Turtle

Like tearing the shell from a turtle

24. Porcupine

or pulling the quills from a porcupine

25. Eagle

or breaking the wings of an eagle,

the immuno-suppressive effect of Bursa of Fabricius damage from Gumboro infection reduces or eliminates the host protection from stress and disease.

26. Gumboro Like AE

We will some day eradicate Gumboro; but in the meantime, breeder immunity to Gumboro, like breeder immunity to Epidemic Tremor, is the best protection for broilers.

27. Conclusions

We have concluded from our research that progeny of Gumboro susceptible breeders, when exposed at young age to Gumboro, may experience high mortality from other diseases including usual vaccines; that Gumboro susceptible breeders may be water vaccinated at 12 weeks of age and their progeny will be highly resistant to losses with lesions of Inclusion Body Hepatitis-Gangrenous Dermatitis syndrome; and that the reason for varying pathology and non-specific mortality is due to Gumboro caused immuno-suppression.

28. Recommendations

We recommend that all breeder flocks be tested for Gumbor at six to eight weeks of age, to vaccinate Gumboro negative flocks at twelve weeks of age, and DO NOT VACCINATE BROILER CHICKS FOR GUMBORO.

MYCOPLASMA INFECTIONS

Harry W. Yoder, Jr.

The diagnosis and control of *Mycoplasma gallisepticum* (MG) infection in poultry became almost a simple routine during the late 1960's. Then more confusion became apparent as *M. synoviae* (MS) infection slowly increased as a respiratory disease. During the same recent years, more uncertain reactions were recorded within the usual mycoplasma control programs which were based primarily on repeated serological testing of breeder flocks. It was no longer possible to simply classify flocks as completely "negative" or "positive," especially concerning MG testing. An unofficial category of "suspicious" flocks was offered during prolonged studies involving repeated serological and cultural work.

Increased efforts to conduct cultural studies to aid in the final confirmation of testing results have definitely provided some very important information, but several weeks or months have often been necessary. Each case seems to become a diagnostic research project. The profits from such delayed reports may provide for more rapid interpretation of serological test results in the future since some grouping of problem types is now possible.

A. Typical obvious reactor flocks.

   Numerous agglutination reactions readily confirmed by the hemagglutination-inhibition (HI) test. Flock need not have clinical signs.

B. Atypical reactor flocks.

Generally fewer reactors which usually are weak to moderate and HI confirmation is not certain. Agglutination reaction tends to be mainly MG or MS rather than both. Clinical signs are rarely evident.

C. Atypical, transient, reactor flocks.

Weak reactors which may become negative within several weeks to several months. Reactor rates may vary from low to high. Frequent tendency for MG and MS reactions within the same flock. Confirmation by HI testing is not clear. Clinical signs are rarely evident.

Experience has given us confidence that MG or MS separately can usually be isolated and identified during repeated studies if the MG or MS HI reactions linger or elevate. No proof of mycoplasma infection has been obtained from the transient reactor flocks even though the moderate reactions may have lingered for 3 or 4 months before regressing.

All of the frantic concern about the positive or negative MG and MS status of poultry flocks is based on the knowledge that these avian mycoplasma infections can be egg transmitted. This fact is played down by some poultrymen because they claim these newer moderate MG infections have not caused condemnations in broiler progeny. However, laboratory studies show that many of the recent MG isolates are fully capable of producing airsacculitis in the presence of infectious bronchitis vaccines or field infections in broilers.

A more realistic viewpoint is that these newer isolates of MG are less invasive or less pathogenic, do spread more slowly, and often do not stimulate a high percentage of titer of serological reactions.

This variation does not justify the term "Variant Mycoplasma."

If research proves that one or more special selected MG antigens can truly yield significant titers in otherwise questionable serological reactor flocks, we might then be able to avoid the costly slow culture studies we now feel are so important.

The entire MS picture is not pure and simple either, but most all problems have been answered within a couple of weeks when both serological and cultural studies have been applied to problem flocks. The most troublesome aspect is that so many parent flocks do become MS positive by the time they are 30 some weeks of age. This apparent reflection of ease of transmission is not too alarming since clinical respiratory disease with processing plant condemnations for airsacculitis has not been generally prevalent. It still requires a peculiar set of infectious agents and environmental stress conditions mostly associated with winter to produce severe MS airsacculitis.

MG has almost become a thing of the past in turkeys except for a few scattered outbreaks during recent years. However, MS seems to have increased. It causes a small percentage of sinusitis and a variable extent of airsacculitis under certain conditions only. The ever present <u>Mycoplasma meleagridis</u> (MM) infection of turkeys causes airsacculitis in almost every flock of poults, but it rarely produces dramatic problems and little real progress in its control has been documented. It probably causes greater losses due to airsacculitis condemnations in market turkeys.

There is an increasing number of reports that MM is somehow associated with leg weakness and with crooked neck deformity in turkeys. The evidence to date is not complete, but suggests the role of MM as a partial contributor in a complex syndrome involving bone development and metabolism. This adds weight to the apparent need for continued work aimed at the eradication of mycoplasma in poultry, including MM in turkeys.

RECENT DEVELOPMENTS IN MAREK'S CONTROL

Caswell S. Eidson

Recently in laboratory and field trials, birds were vaccinated with cell-free HVT vaccine by aerosol spray. In laboratory trials, birds vaccinated by aerosol spray were as well protected against challenge with the virulent Marek's disease virus as those vaccinated by subcutaneous inoculation. Birds were vaccinated with a sprayer (Spraying Systems Company, Wheaton, Illinois) that emits particles of which 90% are less than 3 microns in size.

In field trials approximately 300,000 birds have been vaccinated by aerosol spray with between 1,000 to 5,000 PFU of cell-free HVT vaccine. The chicks were sprayed while they were in the trays of the hatcher. The hatchers measured 4' x 9' x 6' and hold approximately 8,000 chicks. Prior to spraying the chickens, the incoming and outgoing air ducts were sealed. The chicks were sprayed for 12 - 15 minutes with 250 - 300 ml of diluent and after completion of spraying the chicks remained in contact with the aerosol for an additional 5 minutes.

For comparison, an equal number of chickens were vaccinated subcutaneously with approximately 1,000 PFU of cell-free HVT vaccine. In this study there were 2 poultry companies involved. Farms selected for this study had at least two poultry houses, so that one house contained chickens vaccinated by aerosol spray while chickens in the second house were vaccinated by subcutaneous inoculation.

All of the birds vaccinated by aerosol spray with 5,000 PFU were protected against challenge to the virulent Marek's disease virus. However, two groups of chickens vaccinated by subcutaneous inoculation had 8.50% and 5.41% condemnations attributed to Marek's disease.

In contrast one group of birds sprayed with 4,000 PFU had 3.93 condemnations due to Marek's disease while the adjacent house, vaccinated by subcutaneous inoculation, had only 0.48% condemnations.

In this trial in which birds were vaccinated with 3,000 PFU there was one group of birds that had 23.4% condemnations for Marek's disease. Also there was one group of birds injected subcutaneously with the HVT vaccine that had 2.67% condemnations due to Marek's disease.

The condemnations due to Marek's disease in birds vaccinated with 2,000 PFU by aerosol spray were essentially the same as those vaccinated by subcutaneous inoculation.

At company number 2 the overall incidence of MD in birds vaccinated with 5,000 PFU by aerosol spray was essentially the same as in those vaccinated by subcutaneous inoculation. Possible reasons for the erratic results in the aerosol vaccinated birds were the large amount of dust, down, and egg shells in the hatcher. Also the large number of chicks in the hatchers may influence the results.

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