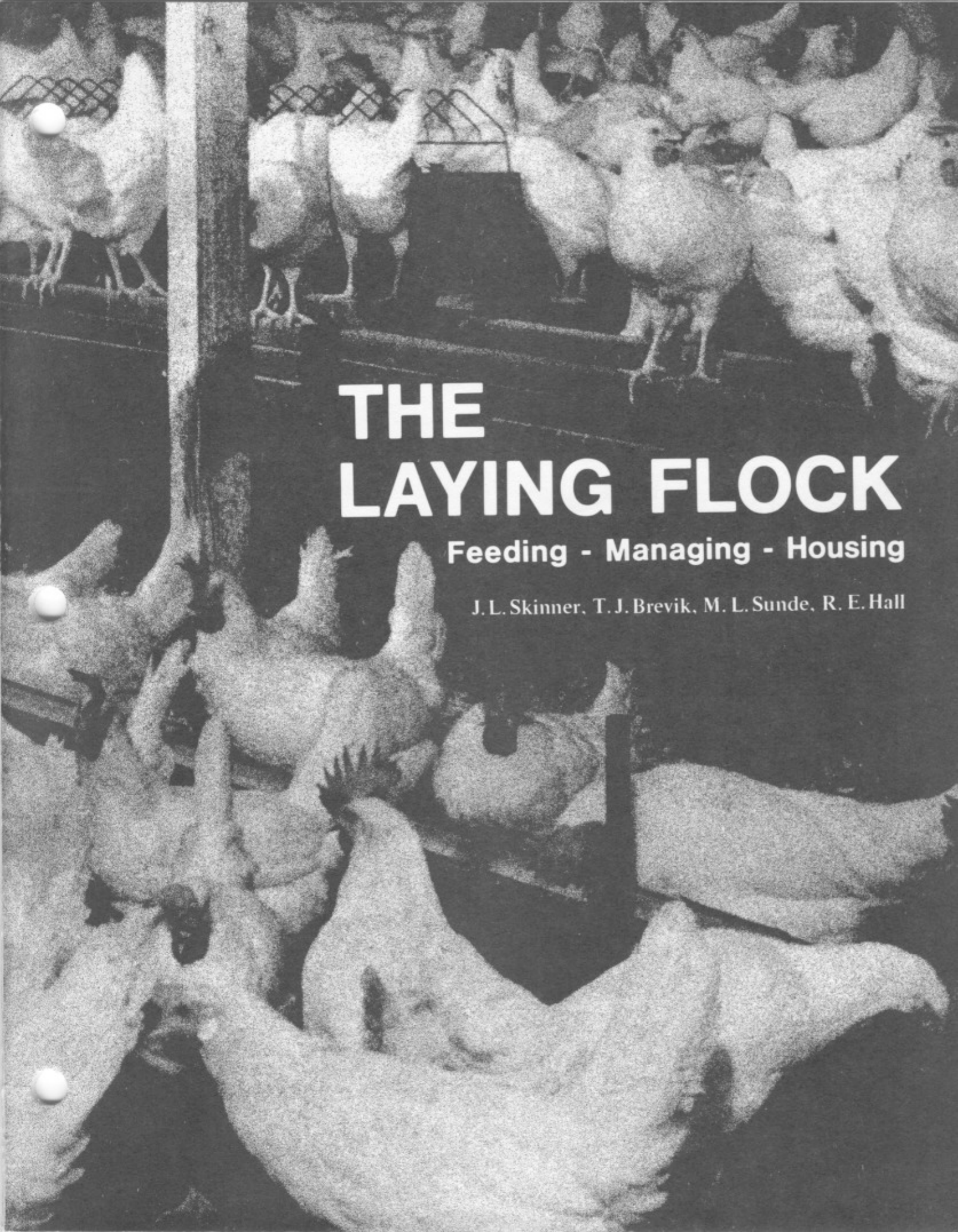


THE LAYING FLOCK

Feeding - Managing - Housing

J. L. Skinner, T. J. Brevik, M. L. Sunde, R. E. Hall

Contents

THE LAYING FLOCK

Successful poultry management requires very close attention to details and poultry "know-how." When someone asks, "Who will produce eggs in the future?," the answer becomes obvious—it will be a trained poultryman. Egg production demands more than pushing buttons. Nor is putting feed into a storage bin and collecting eggs sufficient. Raising chickens calls for as much skill and understanding as any phase of agriculture.

Wisconsin will undoubtedly continue to be an egg producing state. We have an environmental advantage in our cool summers. Feed is readily available. We border large consuming centers. We have a reputation for marketing high quality eggs. A laying flock may add diversification to a general or dairy farm—both poultry and dairy husbandry require operators with similar attributes.

A poultry flock can be adapted to any section of the state. Market outlets are generally available to producers of a quality product. In addition, many producers find it profitable to market their own product through direct retailing or wholesale delivery. Wisconsin has an established industry. We are not starting from scratch.

Buying—What? Where? When?

Egg producing stock developed by a local breeder is a thing of the past. Hatcheries and breeders have become franchised and now reproduce and sell "name lines." These may be either inbred or strain crosses.

Inbred lines are developed and then crossed to produce the commercial chick. Or breeders cross various **strains** until they find a combination that "nicks" well, embodying the greatest number of desired characteristics.

Each line or product of a breeder carries a brand name or number as identifying as those for automobiles or hats. Hired sales representatives cover a rather wide area. But one's choice in ordering stock is limited to that available from hatcheries operating in his area.

A chick buyer should have confidence in the hatcheryman as well as in the chick he purchases. Service following the sale is an important consideration.

Random Sample Tests

Random sample tests at various locations throughout the nation have been the proving ground for most breeders' lines. There is some hazard in acting solely on results from a single year or test. But an average of several tests gives a fair appraisal of the anticipated performance of a single line. Continuous improvement is being made in breeding.

Annual reports of the tests are available through University of Wisconsin, Poultry Science Department or the Wisconsin Department of Agriculture.

Eggs or Meat

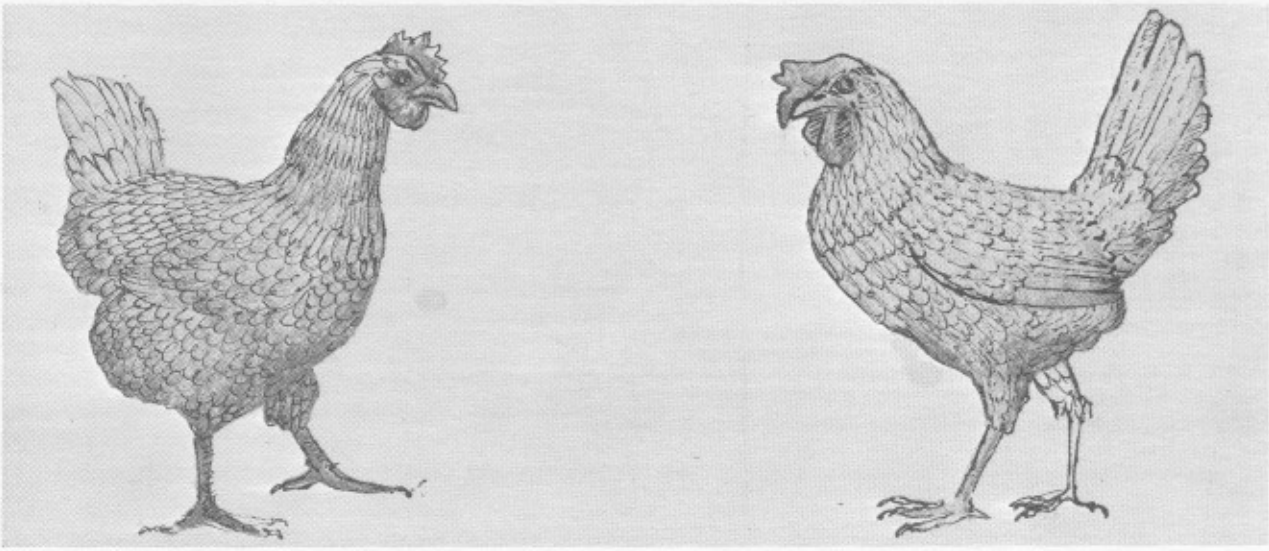
There is no longer significant demand for a dual purpose fowl. Today commercial poultrymen breed either for eggs or meat.

Egg type pullets should begin production at about 21 to 23 weeks. Most flocks will peak at around 90 percent and lay for a prolonged period at 70 to 80 percent production. A flock should produce profitably for 12 to 14 months. Females weigh about 4-1/4 pounds and should produce a dozen eggs on less than 5 pounds of feed.

A meat type bird is expected to lay when 6 months old. Females will then weigh about 7 to 8 pounds. Their production peaks at about 80 percent. They produce hatching eggs profitably for about nine months. Conversion runs about 7 to 8 pounds of feed per dozen eggs.

The price of chicks from heavy or meat strains may vary with the cost of broilers or the availability of chicks. Since most broilers are grown on contractual arrangements the day-old price may not be stated.

Figures 1 and 2. Meat and egg type birds.



Replacing the Laying Flock

There are two sources of replacement stock:

1. Baby chicks (day old)
2. Ready-to-lay pullets (usually at 21-22 weeks of age)

Chickens from egg producing strains usually are sold as sexed pullets. Prices range from 34 to 60 cents per pullet chick with a 98 percent sex guarantee.

In some instances, one may purchase chicks from a preferred line of breeding and arrange with the hatchery to raise the pullets to 21 to 22 weeks of age.

Buying started pullets allows an operator with limited time and manpower to concentrate on layers.

Some operators specialize in pullet production. Either pullets from a designated line of breeding are reared, or one may order a special chick from these operators. Prices vary according to strain of bird and growing system employed as well as number purchased.

Many egg markets require uniform annual production. This makes it necessary to hatch at various times of the year so all flocks will not be coming into or going out of production at the same time. Producers and pullet growers must consider seasonal differences in temperature, length of day, etc. and provide equipment accordingly. Slight differences in performance may be noted when comparing pullets that have come into production at different seasons. Some markets have seasonal requirements and these too must be considered when scheduling replacement flocks if the producer is to receive the maximum return.

Best use of brooding facilities means at least two broods per year—selling one as ready-to-lay pullets or filling two laying houses.

An operator may choose either of two replacement programs or a variation of them. One follows a calendar year. The second is based on a defined laying period. In the calendar year program the hens are disposed of after about 50 weeks of lay, at which time their replacements are nearly ready to be housed. The laying period program usually involves fourteen 28 day periods or 56 weeks of production after which the flock is sold and replaced by ready-to-lay pullets.

A third alternative sometimes considered is to force-molt the flock after 10 to 12 months of production. The flock is then kept for an additional 8 to 10 months of lay.

The best system to use depends on the market being served, the availability of replacement pullets, and projected economic conditions prevailing in the industry.

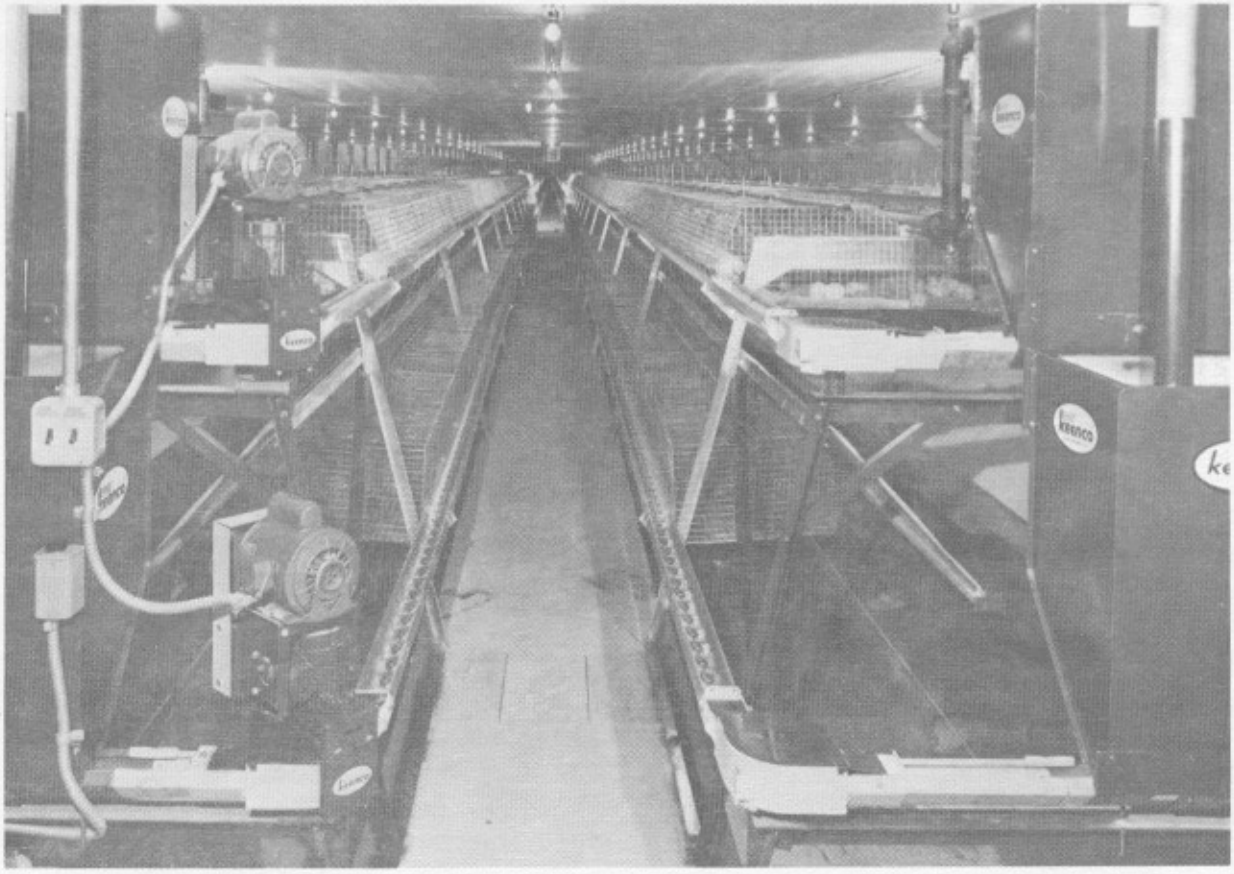


Figure 3. An automated unit for growing replacement pullets from 1 day to 20 weeks of age.

Nutrition

Feed Nutrients

A laying ration must furnish an adequate supply of nutrients. The essential nutrients are (1) adequate energy furnished by starches and fats, (2) proper proteins, (3) necessary minerals, and (4) sufficient vitamins. Hens kept for breeding need more minerals and vitamins than those retained for egg production.

Adequate energy can make a real difference in the egg production rate during the cold winter months. As the laying house temperature drops, energy requirements rise. Avoid feeding high levels of oats or mill feeds (wheat bran or middlings) during cold weather. These materials can be fed in moderate amounts in warm weather without affecting production.

Increasing the percentage of corn, or in special instances, of animal fat not suitable for human use, boosts the energy content. When the energy level goes up, it takes less feed to produce a dozen eggs. On the other hand, as the energy content of the feed rises, the problem of feather eating and cannibalism grows increasingly serious. Generally, we feed a ration high enough in energy to cause some feather eating during the summer months, but not high enough to induce cannibalism. See page 6 for ways to reduce cannibalism.

Two terms describe energy level in the diet—**productive energy** and **metabolizable energy**. Both are usually expressed as the number of kilocalories (large calories) per pound. For the same feedstuff, metabolizable energy usually runs about half again as high as productive energy. For example, a pound of corn contains about 1150 kilocalories of productive energy or about 1580 kilocalories of metabolizable energy. A laying ration should contain at least 900 kilocalories of productive energy or at least 1300 kilocalories of metabolizable energy per pound.

Rancidity can be a factor in nutrition, but if the corn is bright, free from dust, and freshly ground, rancidity is usually no problem. (Finely ground corn is disliked by hens.) Inspect meat scrap and fish meal for rancidity at regular intervals.

Protein is necessary for egg production. Each egg contains about 7 grams of protein. The laying hen must move about this much protein into the ovary or oviduct each day. Combinations of protein feedstuffs must be good or poor production will result. Fortunately, combinations from corn and soybean oil meal are both good and inexpensive. Often small additions of meat scrap or fish meal further improve the corn and soybean combination.

Several minerals are required to get satisfactory egg production. Remember that egg shells contain about 98 percent calcium carbonate and about 1 percent total phosphorus.

Calcium helps produce eggs with normal shells. About 2-3/4 percent of a hen's total intake should be calcium. This can be supplied several ways. The usual plan is to supply most of the calcium in the mash with additional oyster shell free choice in a separate feeder. Some feed manufacturers increase the calcium intake to 3-1/2 percent or more in hot weather, or if the birds are over a year old.

Vitamin D_3 is also necessary to obtain good shells. Its use will be discussed under "Vitamins."

Phosphorus aids egg formation. Most rations supply at least 0.55 percent in our egg laying rations, but reducing the phosphorus to 0.4 percent has not reduced egg production nor produced poor shells. In practical rations a small variation is probably not critical.

Egg shells are poor quality unless about 1/3 to 1/2 pound manganese sulfate per ton of complete feed is added to the ration.

Salt must also be added to poultry rations. For hens on the floor we recommend adding 1/2 percent to complete rations. One-fourth percent to 0.4 percent is usually prescribed for hens in cages to improve the dropping "cone." Ordinarily iodized salt is preferred.

Vitamins are essential for normal egg production. Fortunately common feedstuffs provide sufficient quantities of all but three of the many required vitamins. These three are vitamins A, D, and riboflavin. Some workers have published data recommending certain other vitamin additions.

Vitamin A prevents both nutritional roup and an excessively high incidence of blood spots in eggs. While some reports suggest that very high levels of vitamin A will reduce blood spots, other indicate that when the known requirement is met additional amounts are not beneficial. The diet should contain about 3000 to 4000 International Units (I.U.'s) per pound of feed for laying hens.

Corn in the ration supplies cryptoxanthine which the chicken converts to vitamin A. When a ration containing 60 percent corn is fed, the corn contributes cryptoxanthine equal to about 1800 I.U.'s of vitamin A per pound of mixed ration. This proportion of corn, plus supplement, ensures the availability of sufficient A. However, long storage periods lower the vitamin A content of corn. When nitrites are suspected in the feed or water, additional vitamin A should be provided.

Vitamin D_3 helps prevent soft-shelled eggs. This condition used to be seen frequently in late winter and early spring. Even today we usually see one or more of these cases each year. Substituting vitamin D_2 (irradiated yeast) for D_3 (irradiated animal sterols) results in poor egg shells. Feed chickens only vitamin D_3. Vitamin D_3 can be supplied either by cod liver oils or dry D_3. Because dry D_3 usually costs less, it is more popular.

Riboflavin also aids egg production. Add about 2 grams of pure riboflavin per ton of feed. Riboflavin additives vary considerably in potency, so from 1 pound per ton of one supplement to 10 or more pounds of another may be added. Fortunately, adequate labeling makes the task of determining the proper amount relatively easy. It is seldom necessary to add other vitamins, such as B_{12}, to laying feeds. Most nutritionists recommend a low level of meat scrap or fish meal by-product to provide unknown growth factors and some vitamin B_{12}.

Feeding Programs for Layers

Ration sheets for different programs are available from the Department of Poultry Science. The Department keeps these sheets up-to-date and changes them as new information becomes available.

Select a ration and stick with it. A sudden change of formula may become a stress factor. Merely changing from coarse to fine feed may decrease feed consumption and rate of production.

Three feeding programs are offered:

All mash. Under this program the operator uses a complete feed. A complete diet is almost a must when a mechanical feeder is used. It may be fed as meal, granules, or crumbles of various sizes. An all-mash program also offers the inexperienced or the average feeder the greatest assurance of good production. It comes closest to ensuring uniform yolk color. Use a 14 to 17 percent protein mash. Commercial egg producers use this program exclusively.

Grain and mash. The second plan combines a constant supply of a 20 to 26 percent protein mash with a light grain feeding in the litter each morning and a feeding of corn each evening. Results depend on the feeding skill of the poultryman.

Cafeteria. Maintain separate hoppers of grain—corn and either wheat or oats or both—and of a 26 to 32 percent protein supplement or concentrate. Let the flock do its own balancing. This program can be tricky with older hens. They may become grain feeders, resulting in lowered production. Two-thirds to three-fourths of the feeders should contain grain and one-third to one-fourth should supply the supplement. This system is more likely to work if layers are reared on a cafeteria feeding plan.

A general rule suggests that feeders and waterers, in the floor systems of management, be within 10 or 15 feet of every bird in the house. A similar rule applies to the distribution of nests.

Generally, a 15 to 20 foot trough feeder will take care of 100 birds. Feeding from both sides doubles the space, allowing 30 to 40 linear feet per 100 birds.

To minimize waste, adjust feeders and waterers to shoulder height of the birds. Fill the hoppers only one-third full. In non-mechanized houses, place the hoppers on a 4 inch block or suspend them at an equivalent height so that birds reach out rather than down to feed. Avoid feeders on 18 or 20 inch legs. Their use predisposes the flock to cannibalism because birds must feed standing at eye level of the rest of the flock.

Allow feed hoppers to empty occasionally to avoid mold development. Palatable, fresh mash increases consumption.

A 4 foot water trough accommodates 100 birds (equals 8 feet). A laying flock drinks about 2 pounds of water per pound of feed consumed, and more in warm weather. This amounts to about 50 gallons per day per 1,000 hens.

The water supply must be kept clean. Some researchers suggest that blood spot development in eggs may be due to contaminated drinking water. The flock appreciates clean, fresh water. It is important for high rates of egg production.

Yolk Color

When hens are on grass, the yolk color darkens. Consumers prefer eggs with a medium-yellow yolk color. Producers should also be interested in yolk color because eggs from hens fed very high levels of new yellow corn frequently are graded down to "B" because of the darker yolk shadow seen when the eggs are candled. Eggs usually grade slightly higher if no more than 65 percent corn and only 2 to 3 percent alfalfa were used in the ration—adding 5 percent alfalfa darkens the yolk and decreases feed efficiency.

Feed Conversion (Efficiency)

Feed conversion refers to the pounds of feed required to produce a dozen eggs. A general yardstock, it makes no particular reference to size of eggs produced, i.e., medium, large, or jumbo.

Rate of production is a very important factor in determining efficiency. Record both egg production and feed consumption for any given period—a year, a month, or a week. Reduce the eggs to dozens. Divide the pounds of feed by the dozens of eggs to obtain the feed conversion or pounds of feed required to produce a dozen eggs. This number should be about 4.2 for profitable production with laying strains. Try to reduce it to about 3.8. In some experimental groups this figure was reduced to 3.2 for a 10 month period. When feed conversion approaches 5, check on feed wastage, rate of production, size of the layer, and make-up of diet.

In any feeding program one should not put emphasis on efficiency that will greatly increase cost (per pound of the) diet. Sometimes yearly profits can be maximized by use of less expensive diets that may slightly lower efficiency.

Flock Health

All chickens are susceptible to disease. Infections may occur in single individuals or be widespread depending upon the infectious agent involved, the resistance of the flock, and the environment provided.

Infections may spread through part of a flock, the entire flock, or to other flocks even though the latter may be some distance away (as on another farm).

Disease prevention depends on four major considerations:

1. cleanliness
2. proper nutrition
3. proper environmental conditions
4. presence of some immunity (vaccination programs)

Cleanliness

There is no substitute for cleanliness. This includes everything the birds or eggs come in contact with either directly or indirectly.

Clean, disinfect, and air-out a poultry house before putting birds of any age in it. Disinfecting is not a substitute for cleaning. Disinfectants are only effective on clean surfaces. When preparing a previously occupied poultry house, follow these steps:

1. Remove dust, dirt, crusted manure, litter, feed, etc.
2. Thoroughly clean the building and all equipment, including air intakes, overhead ledges and fans. High-pressure water (600 to 1000 per square inch) is best. Chemicals added to the water aid cleaning and disinfecting, but high-pressure water alone is excellent.

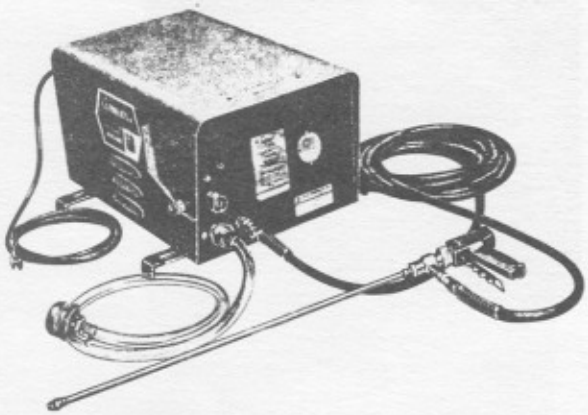


Figure 4. A small high pressure washer.

3. Follow the manufacturer's instructions if disinfectants are used. All disinfected surfaces must be dry and the building aired-out before birds are put in.

Clean **automatic waterers daily**. Slime and decomposing feed can harbor disease organisms and molds.

Nutrition

Nutrition plays a major role in the health of the flock and in its ability to resist disease. The nutritional needs of a healthy flock are normally satisfied by an adequate supply of clean fresh feed, easily accessible, and containing the necessary amounts of required ingredients.

Tonics, appetizers, and stimulants are not necessary. Use them only under the direction of a qualified poultry specialist.

Environment

Environmental conditions contribute directly to flock health. Poor environment makes birds more susceptible to disease as well as contributes to the spread of many diseases.

Adequately lighted, well ventilated, relatively dry quarters are desirable. A good environment provides:

1. Shelter, protection and comfort.
2. Convenient and adequate supplies of proper feed, clean water and fresh air.
3. Equipment and facilities that are conveniently arranged for both birds and caretaker.

Waterers should be easily reached by the birds, of adequate capacity and should **not overflow**. Feeders which waste feed or become fouled aid the spread of disease.

If litter is used, it should be absorbent, relatively dust-free, and resistant to matting. Litter under waterers and feed troughs should be replaced when it becomes damp or matted. Moisture in litter fosters parasite development and growth of molds and bacteria.

With cage systems, the birds are unable to move to a more acceptable or healthy location. The manager must control the environment uniformly to get satisfactory performance.

Vaccination Programs

Immunization by vaccination is recommended for some diseases.

Planning is important because immunity is not effective immediately. When planning vaccination programs consider the disease history of the farm, the community, and the state or region—and vaccinate only healthy birds.

The following protection program applies to Wisconsin: (1) Vaccination is generally recommended for bronchitis and Newcastle. (2) Vaccination is conditionally recommended (depending on history of premises and community) for fowl pox, laryngotracheitis, epidemic tremors and cholera. (3) Inhibitory drugs in feed are generally recommended for coccidiosis if brooding is done using the floor system. If the cage system is used for brooding, inhibitory drugs may not be needed. (4) Most egg-type chicks sold to commercial producers will be vaccinated for Mareks disease before they leave the hatchery. (5) The franchised poultry breeding organizations have instituted programs designed to keep their primary breeding flocks free of certain Mycoplasma infections.

When administering vaccines or drugs, follow the manufacturers' directions precisely.

Key Points in Disease Prevention

1. Keep visitors away from poultry buildings.
2. Do not mix birds of different ages.
3. Remove sick, injured and dead birds as soon as noticed, and burn or bury dead birds immediately.
4. Screen or cover all poultry house openings so wild birds and rodents cannot enter.
5. Clean trough-type waterers daily. Check operation of individual cups and direct action valves or nipples. At the same time, check operation of feeders, fans and lights.
6. Remove wet litter spots as they occur.
7. Never permit contaminated equipment (crates, tools, trucks, etc.) from other poultry farms in your buildings.
8. Obtain reliable diagnosis before administering drugs or biologics. (In Wisconsin, free diagnosis is available at the Central Animal Health Laboratory in Madison and at the Regional Animal Health Laboratory in Barron. Both are operated by the Wisconsin Department of Agriculture.)

Remember—stress intensifies any disease outbreak or increases its chance of occurring. **Good management** reduces stress.

Intestinal Parasites

Piperazine is the recommended treatment for round worms, i.e., the large intestinal round worms.

Hygromycin offers the most satisfactory control of capillaria worms.

A specific control for tape worms is not known. Some companies have preparations that may help, but do not always give the expected results. Composition of the various wormers differs, so **follow** the manufacturer's directions.

Worms are not usually a problem for flocks grown and maintained on wire or slat floors. However, all flocks should be periodically checked for the presence of worms.

External Parasites

Several kinds of lice and mites attack chickens. Heavy infestations cause irritation, discomfort and general unthriftyness. Lice found on birds, called biting lice, feed only on skin scales and feathers. They do not pierce the skin to suck blood. However, their irritation may lead birds to scratch causing skin abrasions and open wounds.

Mites, microscopic relatives of the spider, pierce the skin and feed on blood. The **Northern Fowl** and **Red Mite** are two of Wisconsin's most common kinds. Red mites generally attack birds at rest and live in cracks in the roost, floor walls or other sheltered area. Northern Fowl mites spend their entire life on the bird, congregating around the vent, at the base of new feathers and anywhere the skin is rough. A heavy population can reduce the male's willingness to mate. Mites or blood spots may appear on the eggs.

Lice and mite control is simple if you use the right insecticide properly. Community-penned birds can treat themselves with an approved insecticide mixed with dusting material. If this is not practical, spray or dust each bird individually. For Red Mites, you only have to treat roosts, walls, litter, nest boxes and other equipment. Treat all mite hiding places thoroughly. Insecticides usually do not kill mite and lice eggs. Apply a second treatment ten days after the first to kill newly hatched mites and those which escaped the first treatment.

State and Federal agencies approve insecticides before they can be sold. However, regulations change each year. Check with your local Extension office before buying and using an insecticide. See publication A2227 for poultry pest control recommendations.

Keep pigeons, sparrows, starlings and other wild birds away from your flock to prevent them from carrying or spreading parasites to your flock.

Dubbing

Dubbing is the removing of the comb and, in some instances, the wattles from chickens. It may be done to either males or females. Frequently, dubbing is done when chicks are day old using a curved manicure scissors. At this age very little bleeding or discomfort is noted.

The reasons for dubbing are:

1. It reduces the possibility of injury to the large tender comb surface.
2. It allows birds with large combs to eat and drink more easily from some types of feeders and waterers.
3. It prevents some birds with large combs from becoming frightened due to sight restriction from one side.

The comb evolved as a secondary sex characteristic functioning in temperature reduction (heat exchange) during periods of egg production.

Dubbing does create some stress, and therefore should be done only if it serves a definite need or purpose.

Debeaking

Debeaking is the removing of a portion of the upper (and often a lesser portion of the lower) beak of the fowl. It is the most effective way to control cannibalism.

Figure 5. Removing a portion of the beak is an accepted control for cannibalism.

Cannibalism in poultry is a costly, vicious habit. It includes feather picking, flesh eating, and vent picking. Idleness is one of many factors or conditions which may cause or contribute to this vice. Because it is a habit, eliminating the cause will not stop or cure cannibalism.

Many things can cause cannibalism to start—overcrowding, lack of ventilation, too much light, absence of feed or water or lack of feeder or waterer space, insufficient nests, and unbalanced diets, to name but a few. Cannibalism usually results from a combination of several of these. You may not know exactly what triggered it. But the potential is always there, and stress, however slight, can start birds picking.

Debeaking can be done at anytime from day old on. It is done with an electrically heated blade which both cuts and cauterizes the beak to prevent bleeding. The amount of beak removed and the heat of the blade determine the speed of regrowth. Chicks debeaked moderately (about one-fourth of the beak) at 6 to 10 days of age will usually not need further attention for about one year. Observe the flock closely and re-debeak any or all when regrowth makes it advisable. Remember that debeaked birds can no longer pick the last particles of feed from the trough or floor. Therefore, maintain at least 3/8 inch of feed and water at all times for debeaked birds—more if the birds were severely debeaked.

See Special Circular 112, Control Cannibalism in Poultry, for more information.

Management Systems

There are two major ways of housing laying hens—in cages and in floor pens. Each of these systems can be varied as to size, construction material and extent of mechanization. There is no one best system or arrangement. Any good lay-out must take into account:

—Bird comfort
—Operator efficiency
—Operational costs
—Egg handling
—Durability
—Initial cost
—Service availability

Figure 6. A typical "flat deck" cage installation.

Photo courtesy Brookside Distributors, Inc.

Bird comfort must head this. The hen must be reasonably comfortable if she is to produce large numbers of eggs with small amounts of feed and stay healthy in the process. The house must be arranged efficiently for the operator if he is to do a good job rapidly. The operating costs of all fans, feeders, manure removal systems, and other machines must be held down or their use may not be justified. Provisions must be made for handling eggs rapidly with minimum breakage. Total cost must be within the competitive levels established by producers in other areas.

Feed normally represents 50 percent or more of the cost of producing eggs. Other costs include about 25 percent for pullet depreciation, and the final 25 percent for building, taxes, utilities, labor, medication, etc.

Egg production requires good records and a careful analysis of those records. The successful operator recognizes the importance of paying attention to every detail that has a bearing on expenses or return from his flock.

Management Rules

- Visit the flock regularly. Time spent watching them may be the best investment ever made. You can often spot impending problems.
- Keep to regular schedules of feeding, lighting and chores –chickens are creatures of habit.
- Approach the hen house just like any other lady's home –knock before entering.
- Don't do the unexpected. A flock becomes accustomed to certain movements, noise and colors.
- Don't put new birds in a house after the social order has been established. This will usually occur during the first four weeks of age.
- Keep house temperature between 45°F. and 70°F.
- Decide on a lighting program and stick with it.
- Don't change feeds–it may lead to trouble.
- Supply plenty of water. Lack of water raises more havoc than lack of feed but both are bad.
- Don't sacrifice hen habits and comfort for labor-saving "gimmicks."
- Clean and service thermostats, fans, shutters, light bulbs, fuse panels and all control devices monthly.
- Check the mechanical adjustments of belts, conveyers, cages (levels), feeders, waterers and all service devices monthly.
- Adjust equipment to size of hen and size of eggs being produced at any given time.
- Keep an adequate supply of repairs on hand at all times (belts, motors, fuses, shear pins).

Culling

Discard the weak, crippled, or obviously unhealthy pullets at the time of housing. It is often profitable to house some of the "underprivileged" together until they start producing. The low position on the totem pole may account for their slower development.

Present-day breeding in our laying strains, pullet costs, and egg production potential requires less culling than was formerly recommended. In fact, don't cull during the first seven or eight months of production. Remove only those that appear in poor health. A 1 percent monthly mortality is about average.

Some culling may be done later in the laying year paying particular attention to health as well as the other factors of conventional selection. Different strains may show variation in rates of pigment loss. When selecting the better producing birds pay particular attention to late and rapid molting and freedom from excessive fat deposits in the abdomen in addition to the fading of the shanks and feet.

Figure 7. Housing chickens on multiple levels sharply reduces cost.

Photo courtesy Brookside Distributors, Inc.

Broodiness

Broodiness has largely been removed from laying strains by selective breeding. In recent years strain crossing has caused some of it to return. It is rarely seen in hens in cages. Some broodiness may be observed in floor managed flocks. Remove the broodies as soon as observed on the nest, and place them in a slat or wire floored broody coop. Feed them a complete ration and they should be ready to return to the laying pen in five to seven days.

Lighting

Laying hens and, in fact, all birds are sensitive to light. They usually seek or build nests, mate, and lay eggs as day length increases (spring). They cease egg production, molt, and regrow feathers as day length decreases (fall). Man has taken advantage of this and with electric lights, given the laying hen a condition of perpetual spring. The result is year-round egg production.

Windowless houses make exact control of day length a simple matter. Operators with windowed houses can get the same effect if they consider the present day length and what it will be at the various times in the birds life making adjustments accordingly.

Many pullets are grown with 6 to 9 hours of light per day. This is increased to about 12 hours at housing time (21 weeks of age). From this point, increases of 15 minutes per week give the effect of increasing day length for much of the hen's productive life. After peak production is reached (at this time the birds will be receiving about 14 hours of light) the increase in day length should be made more slowly. It is doubtful if any stimulating effect can be obtained from more than 17 hours light per day.

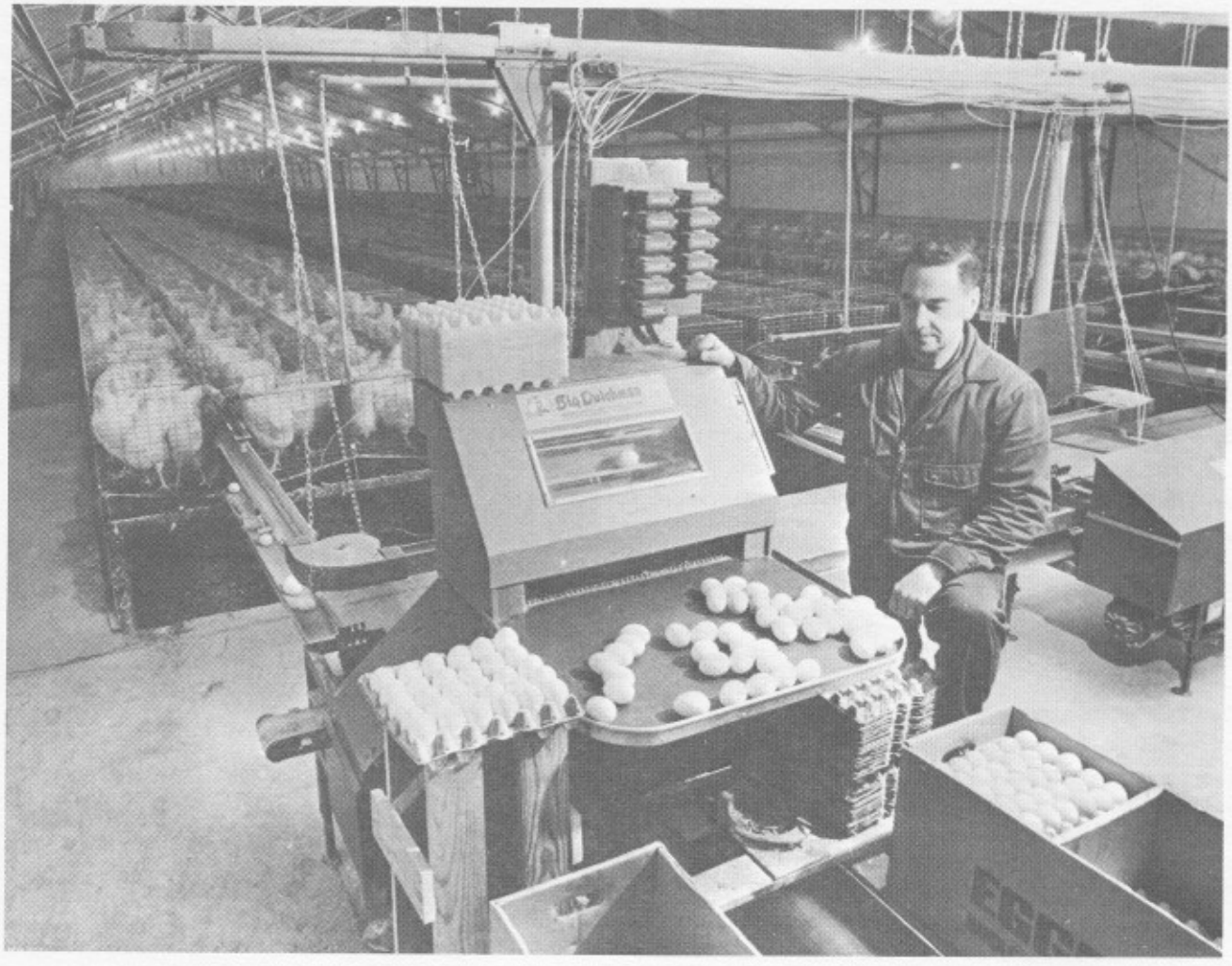
Nesting

Lower nests in the laying house to floor level or place extra nests at floor level until pullets use them.

Place nest pads in wire floor nests for the first three months or until the flock has reached peak production. Arrange nests in the pen convenient to the birds and to their established social orders.

When housed pullets come into production, encourage nesting by making trips through the house at short intervals. On each trip, pick up the floor eggs and place them in the nest. "Level off" the floor nests birds have made in the litter. Constant removal of nesting spots on the floor encourages laying in the nests.

Figure 8. Modern egg production equipment.



Care of Eggs–Egg Quality

For quality eggs, consider the "Egg Commandments."

1. Buy production bred chicks.
2. Adopt good feeding practices.
3. Confine the laying flock–keep no males.
4. Adopt good management practices.
5. Collect eggs three times daily.
6. Cool eggs as soon as possible.
7. Hold at 60°F. and 75 percent relative humidity.
8. Store cases and fillers in cool room.
9. Use a sanitizer detergent at 120°F. for 2 minutes when washing eggs.
10. Pack eggs small end down.

Most commercial egg assemblers wash all eggs they buy. When this is done the producer should separate the very dirty and checked eggs. These should be cased separately and so labeled.

Careful washing will not hurt egg quality. Use the proper detergent, the correct time and temperature, and replace the washing solution frequently. Wash all eggs for uniform appearance.

Only egg coolers hold the correct temperature and humidity constant. Basements are suitable for year around cooling only once in a million times. A basement usually has a temperature of 70°F. And it is generally too dry unless the floor is "wet down." Molds and undesirable odors are frequently present. Eggs pick up odors and musty smells when these are present in the storage area.

Oiling Eggs

Spray eggs lightly with a white mineral oil to retain quality. This should be done as soon after collecting as possible. Rinse washed eggs to remove scum which interferes with penetration. Spray when the eggs are in flats with the large end up. Use 4 to 5 grams of oil (less than a teaspoon) per three dozen eggs.

There are a number of spray materials on the market. Some device, such as an aerosol bomb, must be used to spread the oil as a fine mist. Treated eggs do not appear oily.

Some plants treat eggs after they have been processed and packaged.

Housing

Maintaining a Dry, Warm, well-ventilated poultry laying house during the winter presents a critical problem in Wisconsin. It takes careful planning, a properly-built house, and good management.

If your house is to remain dry, you will need:

1. Adequate insulation plus a good vapor barrier.
2. Proper ventilation.
3. Sufficient heat.
4. Practical management such as removing wet litter, stirring caked litter, and removing excessive droppings wherever they occur.

A 4 pound bird gives off about the same heat as a 40 watt light bulb. Much of this can be used for warming the incoming cold, outside air. Water vapor ties up some of the heat and prevents its use for warming the house. Birds produce close to 5 gallons of water per each 100 hens daily. Much of this must be removed by ventilation, or the moisture build-up will cause a wet house. In extended periods of cold winter weather, even a well-insulated house can develop wet spots. Without sufficient heat a poorly-insulated house is impossible to keep dry. Condensation and subsequently frost forms when the moisture laden air strikes the cold wall surface.

Why Insulate and Ventilate?

- Maintains a dry, fresh house.
- Cuts down on space and feed requirements–hens in a comfortable house eat less.
- Helps keep litter dry.
- Saves labor–cleaner eggs, less changing of litter, longer equipment life.
- Improves working conditions.
- Increases hen house life and reduces maintenance costs.
- Lowers summer temperatures.
- Reduces drafts.
- Creates a uniform atmosphere in all parts of the house.
- Removes odors and gases.

Keeping a House Dry

Wet houses become a problem in winter when they are tightly closed. Poultrymen try to keep houses warm by closing doors and windows. Then not enough air moves through the house to carry away the moisture produced by the birds. Eventually the air gets so saturated that walls, windows, and litter become wet. Damp litter results in stress factors, dirty eggs, and extra labor and expense to replace with dry litter.

To keep a house dry, excess moisture must be removed continuously. This is done by bringing in cold outside air, warming it to house temperature, and removing it to the outside after it has picked up excess moisture.

Heat is needed to warm the incoming outside air. The birds in a completely filled laying house provide enough heat to do this.

Insulation reduces heat loss through the walls and ceiling. The retained heat will warm the air so it can hold more moisture as it moves out of the poultry house. Insulation also raises the inside surface temperatures of walls and ceilings, making condensation less likely.

A vapor barrier on the inside wall protects the insulation. If the moisture-laden house air gets into the insulation, it could condense, making the insulation wet. Wet insulation won't insulate and will eventually rot a building frame. Locate the vapor barrier between the insulation and the inside of the house.

Ventilation moves air in and out. The system should be designed to ventilate all parts of the house uniformly and adequately.

Removing droppings helps reduce the load on a ventilation system. Twice weekly removal leaves only about 70 percent as much moisture to be exhausted by ventilation compared to houses where droppings are left in place. Keeping the house dry is still less of a problem when droppings are removed daily. Basement dropping pits are a recent attempt to store the manure somewhat away from the birds.

How Much Insulation?

Any material used in construction possesses some insulation value. But materials made expressly as insulators are much more effective than denser structural materials. The ability to insulate is stated in units of resistance (R) or sometimes by how fast heat will pass through (U) a poultry house. About 15 units of resistance, R, is desirable in the sidewalls, and about 20 units in the ceiling. In terms of U values, an R value of 15 equals a U value of .07 and an R value of 20 equals a U value of about .05. About 4 inch blanket insulation in sidewalls and about 6 inches in the ceiling are required in most construction. Rigid foam and other plastic insulation materials are gaining increased acceptance. Many of these materials are very effective in holding down heat transfer. Care should be taken to see that these rather fragile substances are properly protected to avoid damage. Also, they should be fireproofed and protected against invasion by rodents. In considering the various kinds of insulation materials available it is well to consider that those of mineral origin (fiberglass, rock wool, etc.) are fire resistant and do not absorb moisture while those composed of cellulose fibers must be treated to resist fire and do have a tendency to attract moisture. The siding, sheathing, and interior lining may add to the insulation.

Ventilation

To ventilate any poultry house successfully, a producer needs a combination of factors. The main ones are:

–Volume of air moved.
–Distribution (flow patterns) within the house.
–Location and size of air intakes so as to prevent drafts.
–Controls to maintain desired conditions.
–Ways to cope with power failures.

If any of these are lacking, then chances are the house will not be dry or well ventilated.

There must be a source of heat. Heat maintains temperature and evaporates moisture. In a laying house the birds should supply enough of this heat.

Figures 9-13 show various systems for ventilating a poultry house. Of the various possible ventilation systems, a mechanical system is best. There are two basic types of mechanical ventilation – *exhaust fans* and *pressure* or *intake fans.*

In an **exhaust** system (Figures 9-10) fans force air out of the building. This creates a slight vacuum in the building. Air then comes in through intake openings to equalize pressure. Where fresh air inlets appear uniformly around the building, fresh air distribution should occur uniformly.

In a **pressure fan** system (Figures 11-12) fans draw fresh air from the outside and build up enough pressure to push stale, moisture-laden air out through exhaust ports and any other openings.

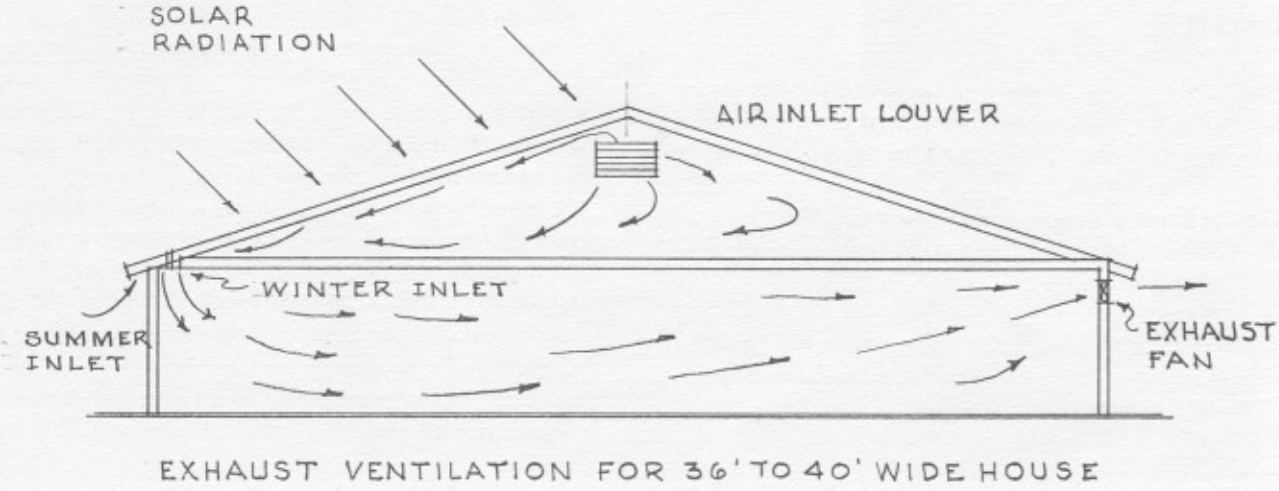
Either the exhaust or pressure system can do a good job if properly designed. It is important to plan for incoming air as well as the outgoing air.

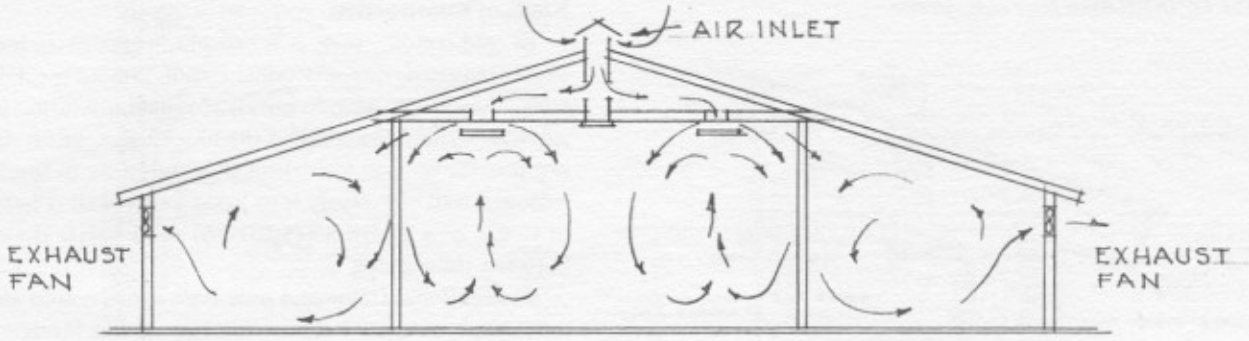
Fan capacity is an important factor. The correct capacity depends primarily on the total weight of poultry in the house. Approximately 1 CFM (cubic foot per minute) handles 1 pound of bird. This rule of thumb may be stated as 3 CFM per bird for light breeds, 4 CFM per bird for medium breeds, and 5 CFM per bird for heavier breeds. Others say 3 to 5 CFM per bird. Many commercial systems have a 7 CFM per bird rating for added safety.

If a producer had 1000 four pound birds, he would need a fan capacity of 4000 CFM. A fan or fans should then be selected to deliver this quantity of air at 1/8-inch static pressure.

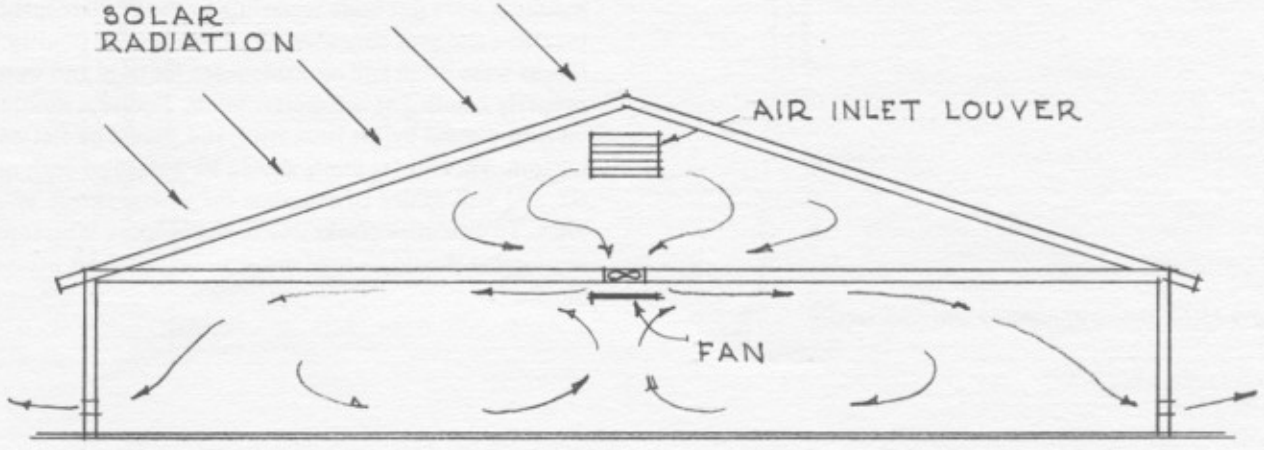
Small houses (24 feet wide or less) where birds are housed on the floor may be satisfactorily ventilated with the gravity system. This is based on the principle that warm air rises. A gravity system needs draft free inlets and controlled outlets.

Figures 9-13. Air flow patterns in several types of ventilation systems.

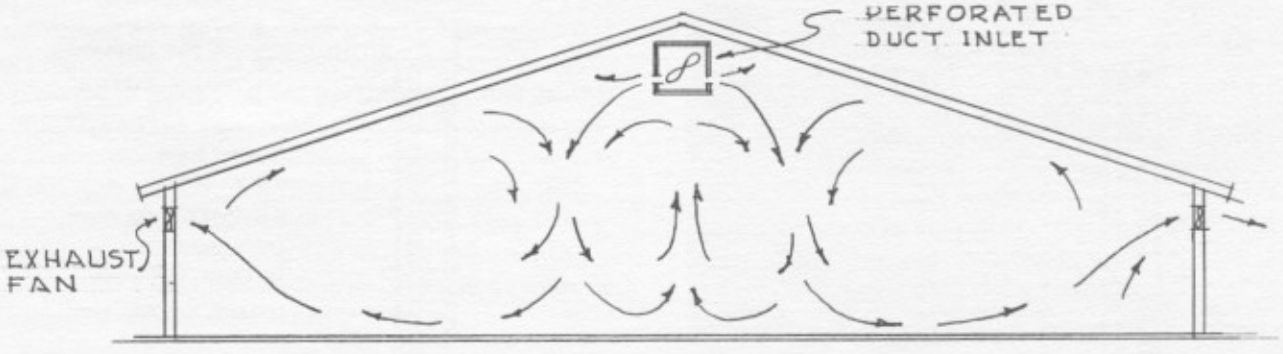




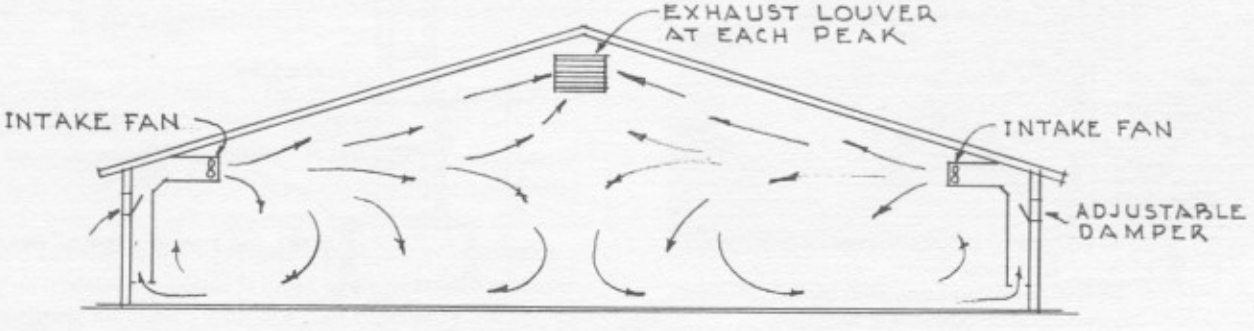
EXHAUST VENTILATION FOR 72' WIDE HOUSE
(REVERSE FANS IN SUMMER)



PRESSURE VENTILATION FOR 36' TO 40' WIDE HOUSE
(FOR WINTER USE)

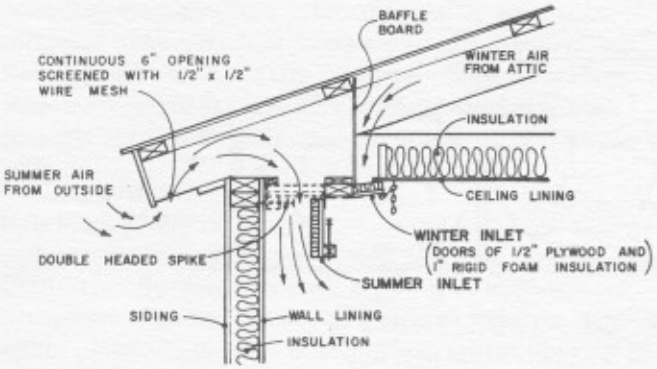


PRESSURE PLUS EXHAUST IN A 50' WIDE HOUSE
(REVERSE FANS FOR SUMMER VENTILATION)



RECIRCULATING SYSTEM THAT MIXES ROOM
AIR WITH FRESH AIR FROM OUTSIDE

Figure 14. Detail of air-inlet construction.



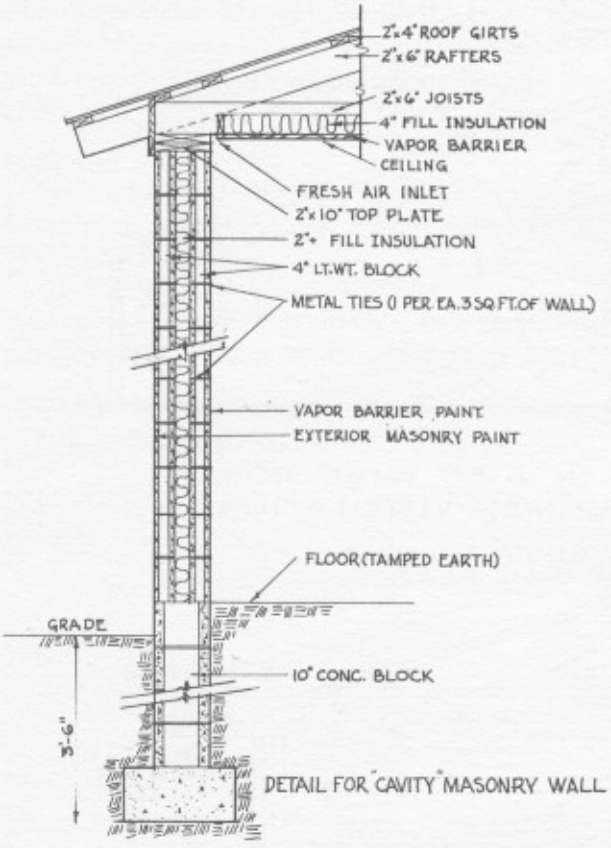
Kinds of Construction

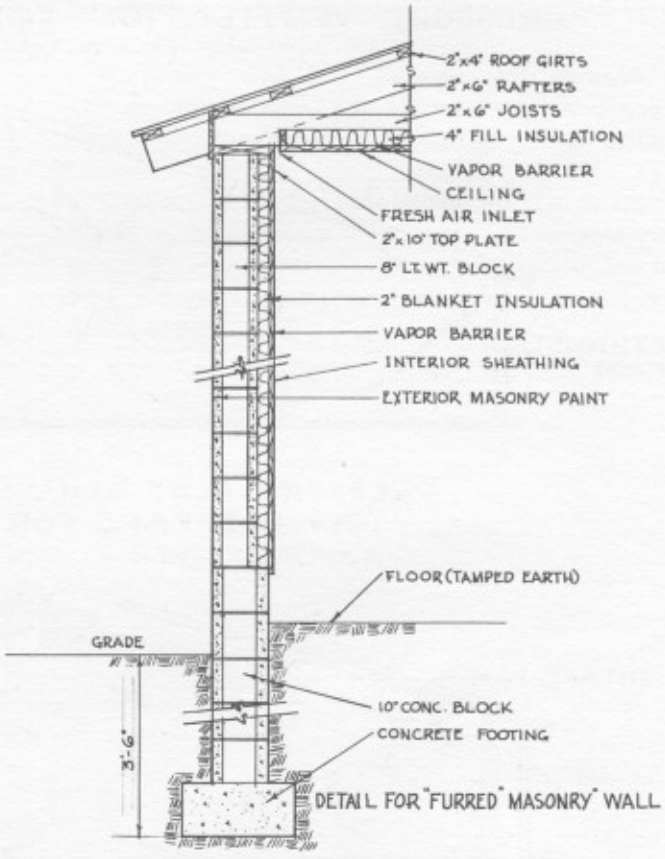
In cold regions, such as Wisconsin, where extra insulation is required, masonry construction creates special problems when attempting to install adequate insulation in the sidewall. Filling the cores of the block helps, but it does not provide enough insulation. The only way to insulate a masonry wall effectively is to build a core wall (Figure 15) or to use 2" x 2" strips (Figure 16) and insulate the wall between these strips.

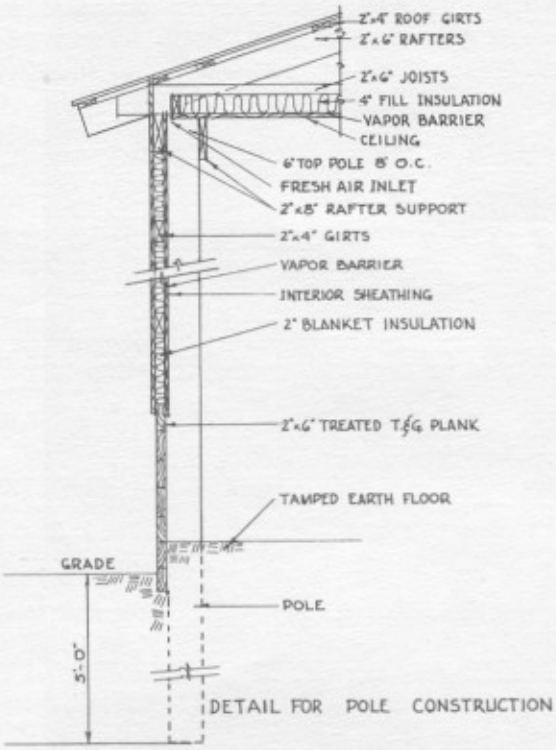
Conventional frame and pole type construction are more popular today because they are easy to insulate, and owners feel more confident tackling some of the construction work themselves (Figures 17 and 18).

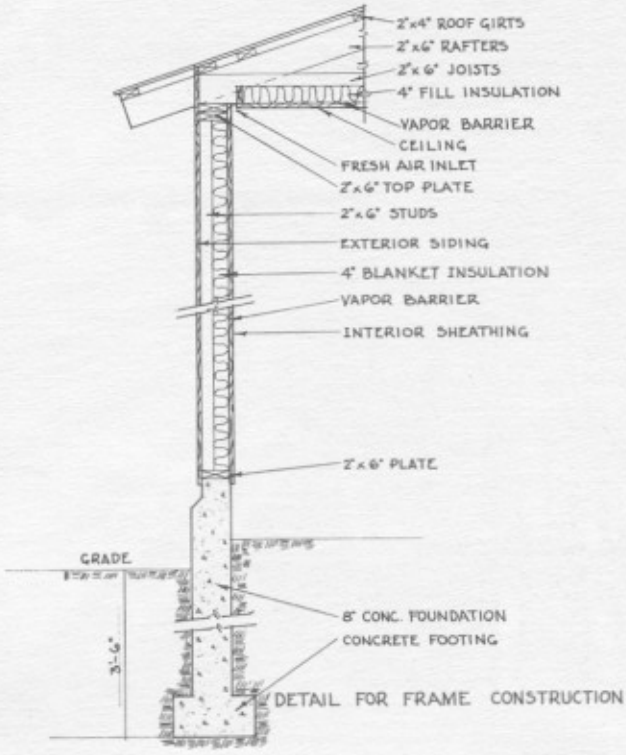
In addition to lack of insulation, many existing masonry buildings were not built according to the best-accepted practices and probably should not be used for poultry. The blocks were often laid on inadequate footings and were not properly handled at the mortar joints. Footings should rest on firm ground below frost level, and should be flat on the bottom. The mortar joints should be well filled with mortar, and well tooled to compress the mortar firmly into the joint. To minimize cracks due to shrinkage, a mortar-joint reinforcing should be used every second or third course of blocks.

Figures 15-16. Details of masonry wall construction.









Figures 17-18. Details of pole and frame construction.

Home-grown lumber often figures into a decision to select this type of construction. The main advantage of a pole building over conventional frame is that it eliminates a concrete foundation. And if properly built, it is more adequately anchored to the ground and less subject to wind damage.

Rigid frame buildings are becoming more common and are usually identified with a package offered by a commercial firm selling a poultry laying facility. Generally, these are equipped with insulation and ventilation. They offer a complete poultry production unit which minimizes the planning that a producer needs to do. The cost of construction usually exceeds other types.

Most poultry houses are now built as a complete package or unit by a qualified firm. Construction may be a rigid frame, a pole type building, a tilt-up concrete wall panel with insulation bonded to the concrete prior to tilting, or panelized units of wood and man-made building materials.

Floor or Floors?

The single story house is the most popular today. With certain types of construction, it offers the most floor area for the least money. In general, it can easily be mechanized and is flexible as to equipment arrangement or alternative uses. It does, however, take more space than a multi-story house, but this seldom presents a problem in Wisconsin.

The multi-story house is more common when remodeling existing buildings, such as a stall type dairy barn. Consider it also when there is not enough space for a one-story house. Investigate and compare carefully the costs of remodeling and of building new.

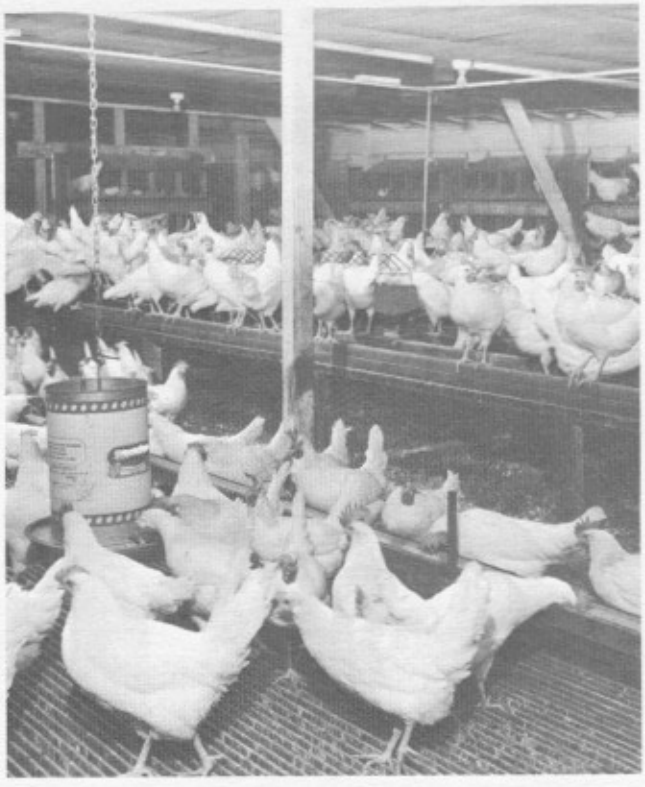


Figure 19. Slatted floor system requires no litter. Removal of droppings is necessary only once a year.

Figure 20. Cage system consolidates feeding, watering and egg gathering operations.

Window Area

Houses are sometimes classed according to type or amount of window area. Windows present a maintenance problem and are an area of great heat loss.

Poultrymen still use the regular barn type sash, but find it difficult to maintain and make weathertight. Barn sashes should be provided with storm windows and weatherstripped on the north side of the building. Normally, about 1 square foot of glass for each 25 to 35 square feet of floor is recommended. For additional protection, install three-fourths of this on the south side and one-fourth on the north wall of a house which runs east and west.

Windowless houses are rapidly becoming standard for the industry. Omitting windows reduces the initial building costs, cuts down on heat loss, and eliminates considerable maintenance. Without windows, all the light and ventilation depend on electricity and a mechanical ventilation system.

Windowless houses are usually preferred because they allow complete control of light and seasonal effects are lessened.

Width of House

How wide should a house be? A house 36 to 40 feet wide works well for laying. Insulation, ventilation, and management requirements are known, and well-designed plans available from several sources.

Interest in wider houses for larger flocks is evident. Houses from 50 to 80 feet wide are being built. But limited information is available on the insulation, ventilation, and management of these buildings. Some of the first wide houses were hard to ventilate. But a better ventilation system has solved some of the problems.

Housing Systems

Several systems and combinations of systems are now in use. Each has advantages and disadvantages. The operator holds the key to success. One with desire and know-how would probably make any system work, provided it met the basic requirements.

Houses are presently arranged in the following ways:

1. **Cage systems** are the *most popular method* of producing table eggs. This involves many small wire compartments, each equipped with its own feeder and waterer and arranged so the eggs roll out of the cage. Droppings fall through the cage floor into pits or onto dropping-boards from where they are scraped into pits. Dropping pits range from 6 inches to 8 or more feet deep. With shallow pits, the droppings are scraped or washed into a holding chamber or directly into manure spreaders every few days. In the deeper pits they can accumulate for prolonged periods of time (a year or more).

Feed may be supplied to cages by hand, eggs picked up by hand, and ventilation adjusted by the operator. Or these "chores" may be totally mechanized so that the feed, air, water, eggs and manure are all moved mechanically.

Cages vary in size and bird capacity. Usually three to five birds are housed in the smaller cages.

Cage systems equipment costs more per bird than with floor systems. This is offset by housing more birds in a given size building making the overall cost of house and equipment quite similar. Cages offer the following advantages compared to floor systems:

1. Eliminate the need for caretakers to enter the pens with the birds (this often appeals to women workers).
2. Eliminate part of the social pressure on the hens by breaking the flock up into many small societies.
3. Eliminate the floor-egg problem.
4. Produce an egg that is more acceptable to egg receivers and processors.
5. Can be easily programmed for the inexperienced operator.
6. Reduce some diseases.

Some of the disadvantages of cage systems compared to floor units include:

1. Hens tend to have a very rough and ragged appearance.
2. The entire house must have a very uniform and acceptable total environment since the hen cannot move to a more comfortable location.
3. Egg production (total eggs laid) may be somewhat lower.
4. There may be more odor because the droppings are not mixed with litter and because the hens are housed closer together.

Reversed cage design (where long axis of cage fronts on feeder and/or waterers) offers increased feeding space per hen. It does, however, require a different overall house size and equipment spacing to make the best use of the building.

The cage system appeals to many because it can use many sophisticated mechanical devices to take the place of human labor. However a large number of hens are needed to justify the use of such mechanics.

2. A built-up **litter covers the entire floor** of one type. Feeders and waterers are located on the litter, and nests line one or two sides of the house. This arrangement takes a low investment, since it needs a minimum of equipment. But it requires a well-insulated house with a properly-designed and well-managed ventilation system.

3. A built-up **litter over about 60 percent** of the floor area with a raised wire or slat floor over the remaining 40 percent—usually down the middle of the house—is very popular. This raised floor provides a place for feed, water, and roosts. About 70 percent of the droppings collect below the raised floor and are removed by a mechanical cleaner about twice a week. Removal of droppings also gets rid of considerable moisture, thus reducing the ventilation problem. The floor litter is easier to manage since it contains fewer droppings and less moisture.

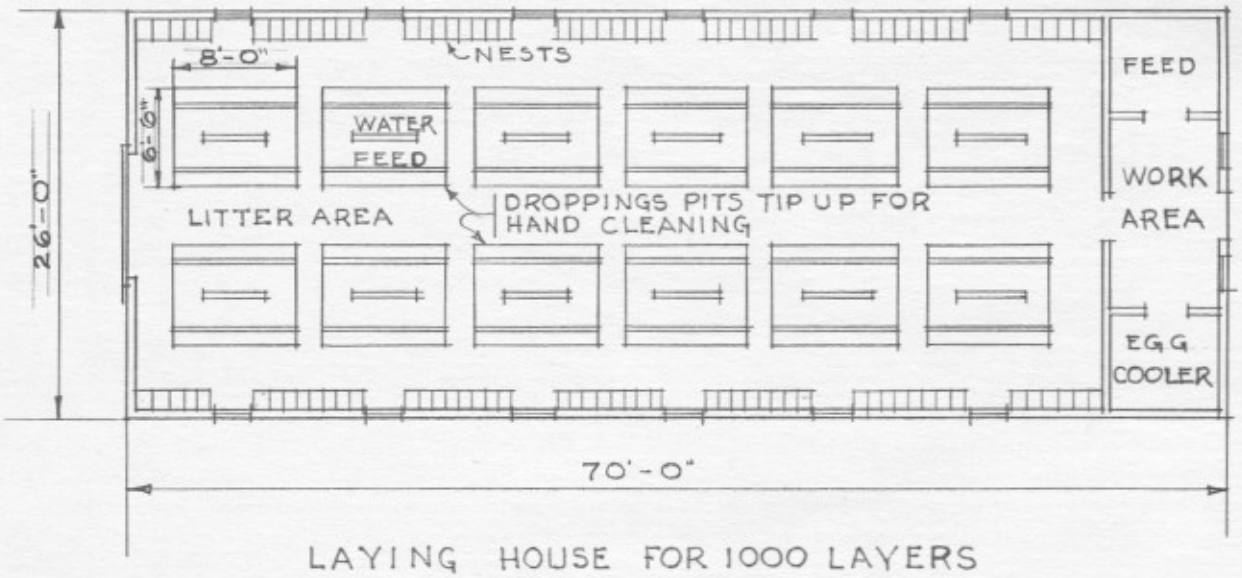
4. **Wire or slat surfaces** over the entire floor also are used. Wire floors are subject to rust and mechanical damage. They sometimes produce foot problems in the chickens. Slat floors are made by arranging strips of wood parallel to each other about 1/2 inch apart so that the droppings are pushed between the slats by the birds' feet.

Droppings then accumulate in a pit below, the same as with wire floors. The depth of the pit may vary from 2 or 3 feet to 8 or 10 feet. The floor must be removed at least once a year to clean the shallow pits. With the deep pits, droppings may accumulate for several years if no water is permitted to enter the dropping area.

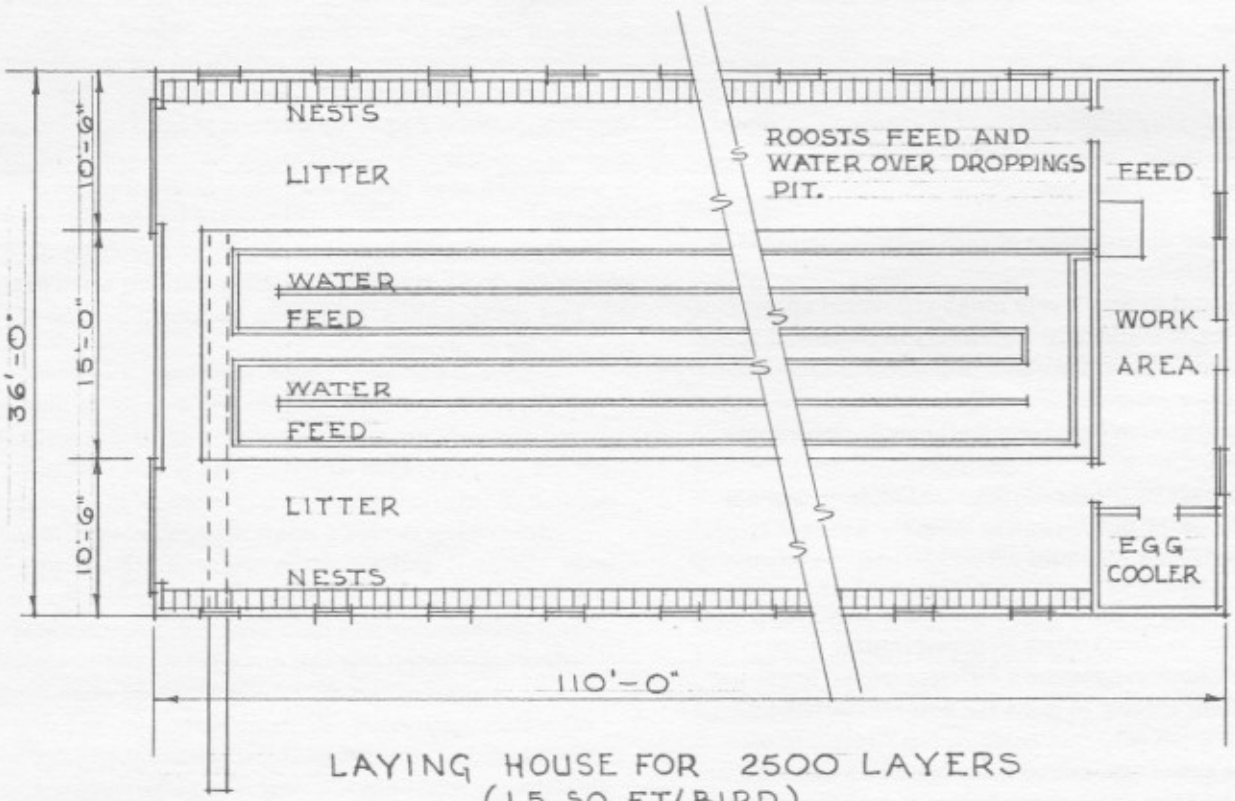
Breeder flocks are frequently housed on slat floors.

Mechanical cleaning with a cable type cleaner beneath slats or wire floors frequently presents problems because of the large area and volume of manure. The operator of slat or wire floor houses should maintain a constant program of rat and mouse control.

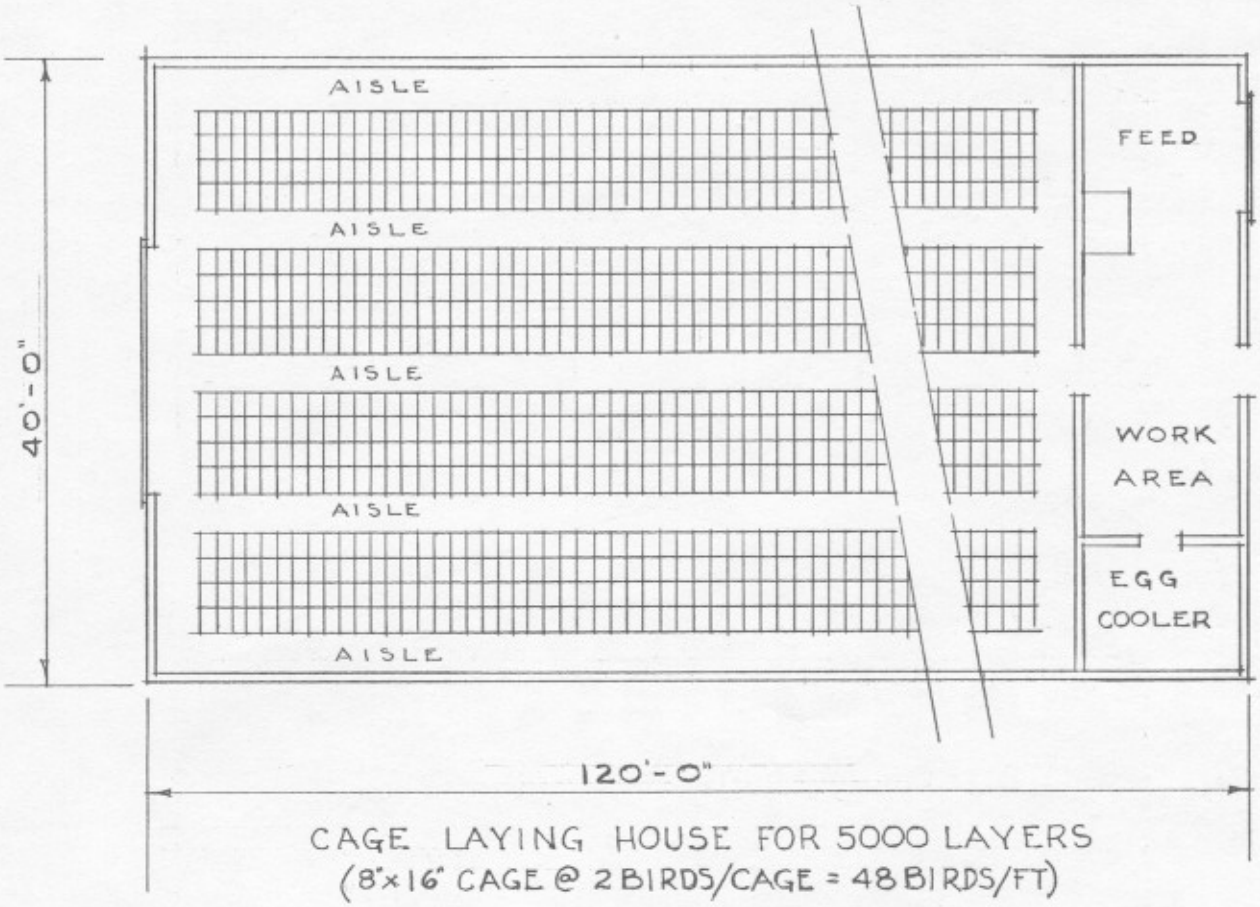
Feather picking and cannbalism may be a problem on wire or slat floors. Hysteria may affect chickens when pen size, bird concentration, equipment placement or noise levels become intolerable.



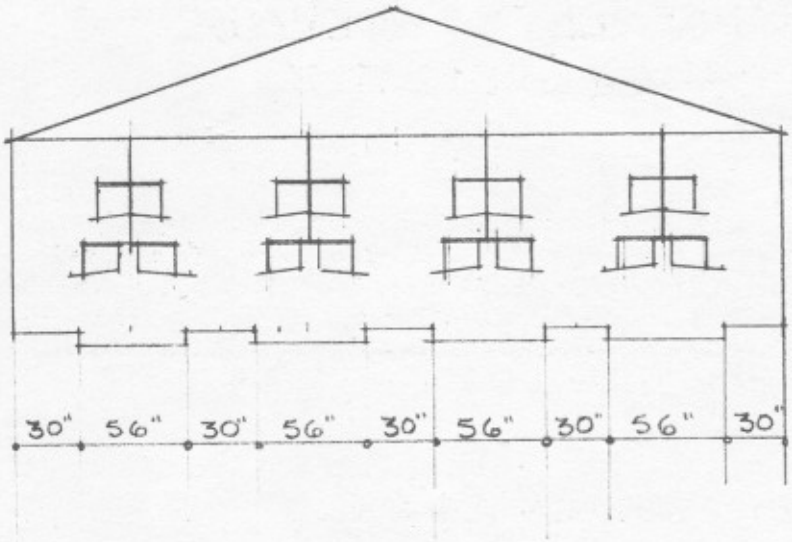
LAYING HOUSE FOR 1000 LAYERS
(1.6 SQ.FT./BIRD)



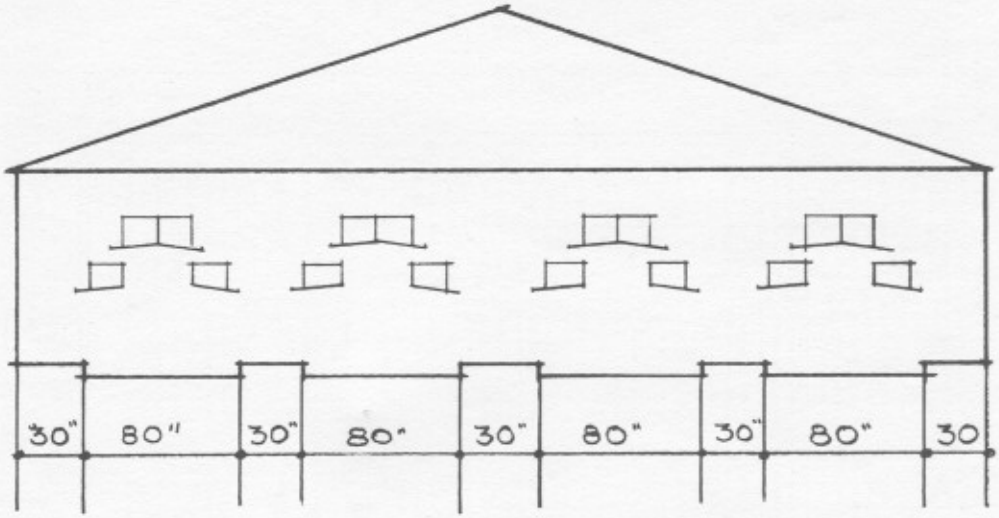
LAYING HOUSE FOR 2500 LAYERS
(1.5 SQ. FT/BIRD)

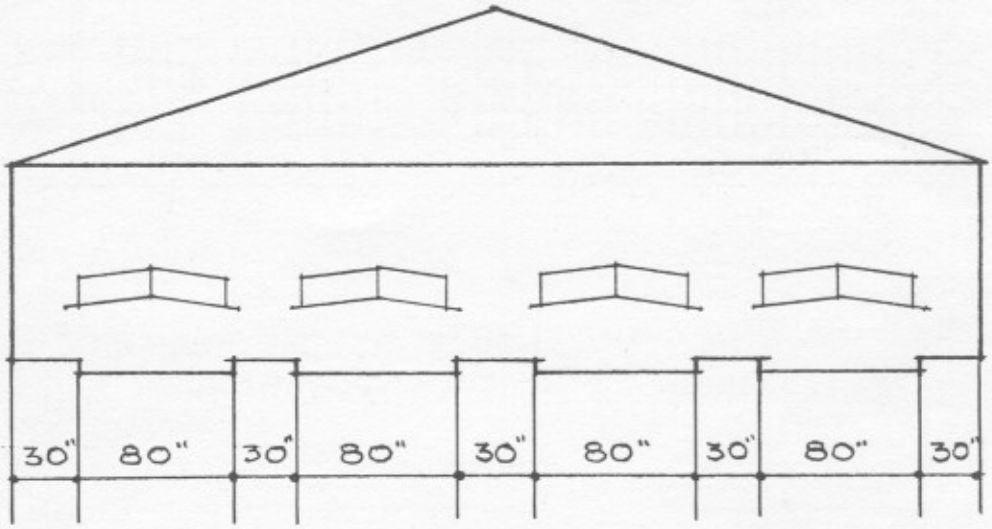


CAGE LAYING HOUSE FOR 5000 LAYERS
(8"x16" CAGE @ 2 BIRDS/CAGE = 48 BIRDS/FT)



CAGE ARRANGEMENT IN 32' WIDE HOUSE
(PARTIAL DROPPING BOARDS REQUIRED)





CAGE ARRANGEMENT 40' WIDE HOUSE
(48 BIRDS PER LINEAR FOOT)

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A1774 **THE LAYING FLOCK—Feeding, Managing, Housing**