

SUSTAINABLE POULTRY: PRODUCTION OVERVIEW

LIVESTOCK PRODUCTION GUIDE

Abstract: *Alternative poultry production, especially pasture-based production, offers opportunities for producers interested in boosting incomes, diversifying operations, and providing a specialty product for consumers. This publication provides information on raising poultry on pasture, including descriptions of production systems and facilities, as well as detailed nuts-and-bolts information.*

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Table of Contents

Foreword	1
Part I: Introduction	2
Conventional Poultry and Range Poultry Industries: Snapshots	2
Why Raise Range Poultry?	3
Part II: Alternative Poultry Production Systems ..	5
Confined Production	5
Yarding	6
Field Pen	8
Net-range (Movable)	9
Net-range (Stationary)	12
Free-Range	13
Colony	14
Permaculture Production Systems	15
Choosing a Production System	16
Integrating Poultry onto the Farm	19
Part III: Nuts and Bolts of Production	21
Housing Design	21
Lighting	22
Litter and Composting	22
Net Fencing	23
Other Fencing	24
Land Management	24
Feeder and Waterer Design	26
Brooding and Transition to Pasture	29
Weather	30
Winter Production	30
Predators and Pests	31
Mortality	31
Poultry Behavior	32
Economics	32
Putting It All Together	32
References	33



FOREWORD

Americans eat a lot of poultry products — in 1999, we ate an average of 95 lbs. of poultry meat and 258 table eggs each (1). Per-capita consumption of poultry meat has increased steadily since the 1940s. This trend is largely attributable to consumer interest in low-fat foods, which has driven a major decline in the consumption of red meat. Other health concerns, as well as environmental and animal-welfare issues, have created a strong demand for alternative poultry products raised in a “natural” way, without routine medication such as antibiotics.

The focus of this ATTRA series is *sustainable* poultry production. Whereas most available poultry information is aimed at either large-scale or backyard production, this publication offers hard-to-find current information on small com-

mercial flock production – including many valuable insights from U.S. range poultry farmers, gleaned from computer discussion groups. Since the information presented here is rather detailed, beginning poultry farmers may want to start with SAN’s booklet *Profitable Poultry: Raising Birds on Pasture*, available through ATTRA. General information on *backyard* poultry production – including topics such as incubation, hatching, brooding, culling, layer management, and molting – is readily available from books, magazines, and Extension publications. One particularly valuable book is Gail Damerow’s *A Guide to Raising Chickens* (2).

Related Publications Available from ATTRA

Processing & Marketing Chicken Products: Meat and Eggs

Feeding Chickens

Organic Livestock Feed Suppliers

Range Poultry Housing

Pastured Poultry: A Heifer Project International Case Study Booklet

Legal Issues for Small-Scale Poultry Processors (a Heifer Project International publication)

PART I: INTRODUCTION

CONVENTIONAL POULTRY AND RANGE POULTRY INDUSTRIES: SNAPSHOTS

CONVENTIONAL

All poultry was raised outdoors until the 1950s, when producers turned to indoor confinement for protection from predators, tighter control of operations, labor efficiency, and disease control. The advent of synthetic vitamin D permitted total indoor production – in the past, sunlight had provided a natural source of the vitamin.

Today’s poultry industry is characterized by vertical integration (a single company owning more than one stage of production, such as breeding, hatching, grow-out, and processing). Integration evolved in the ‘50s to reduce risks and improve cost efficiency. Large poultry “integrators” include Tyson Foods Inc., Perdue Farms Inc., Gold Kist Inc., ConAgra Poultry Company, and others. Chicks are hatched in company-owned hatcheries and transported to nearby grow-out farms. Integrators contract with growers to raise the birds. The integrator owns the birds and provides feed, medication, and other supplies; the grower owns the house and pro-

vides litter, labor, and utilities. Integrator-grower relations are an ongoing issue.

Confinement housing is high-density – broilers are raised on litter in houses of 20,000 birds, while layers are raised in cages in houses of 40,000 to 100,000 birds. Growers are generally responsible for disposing of the litter and carcasses, but integrators may take more responsibility for this in the future. Nutrient management plans are becoming more commonplace. “Least-cost” diets are formulated to provide an optimal balance of nutrients and usually contain livestock by-products such as meat and bone meal, feathermeal, etc., as well as routine medication. Broiler genetics are “Cornish cross” (Cornish x White Rock), and layer genetics are Leghorn (white eggs) and Rhode Island Red and New Hampshire (brown eggs). Nutrition and genetic selection have sped up the grow-out period, so that broilers are ready for market at only 6.5 weeks and weigh about 4.5 lbs. live. Birds are processed in large company-owned plants – some plants process a million broilers a week. Cut-up and other further processing yield large profits to companies and convenience to consumers, especially in the form of fast food. The U.S. exports a lot of poultry meat – especially dark

meat. About 8 billion broilers are produced each year in the U.S., bringing in \$14 billion.

RANGE

“Pastured poultry production” is a grassroots movement that focuses on farm-scale production and direct marketing. It has been developed from the ground up by hundreds of family farms, and is driven by consumers seeking an alternative to conventional poultry. This enterprise can provide supplemental income in rural areas. Small farmers raise poultry in “free-range” or pasture-based systems that are part of a diversified farm.

Producers buy day-old chicks, usually through mail-order, from independent hatcheries. They generally use the same broiler genetics developed for the conventional industry, but use a wider range of layer genetics, including many heritage breeds. Most producers raise poultry seasonally, though some larger-scale growers pursue year-round production. Some producers use commercial sources of nonmedicated feed, but most work with a local feed mill to have custom rations made from natural feed ingredients. Broilers are usually grown for eight weeks.

There are very few independent government-inspected processing plants where producers can take their birds for processing, and large-scale integrated companies do not process for independents. “Exempt,” non-government-inspected processing is often practiced on-farm. In many states, exemptions in the federal Poultry Production Inspection Act allow a producer to raise and process 1,000 birds per year for direct sale to customers. Small-scale equipment is used for slaughtering birds by hand. A few egg producers have egg processing equipment, but most wash eggs by hand. The legal environment surrounding non-government-inspected meat processing presents both opportunities and limitations.

Marketing is usually direct to customers and advertising is often word-of-mouth. Farmers sell directly to customers, from the farm or at other locales such as farmers’ markets, and report more demand than they can supply.

It is difficult to estimate the size of the pastured poultry movement; one way is to consider the number of books sold on the topic:

- *Pastured Poultry Profits* – 10,000 sold

- *Free-Range Poultry Production and Marketing* – 3,000 sold

- *The Chicken Tractor* – 35,000 sold

Although there are many producers, the operations are mostly small. A 1999 NCAT survey found that 46% of pastured poultry enterprises produce between 0 and 500 broilers per year; 17% produce between 501 and 1,000 per year; and 18% produce more than 1,000 per year (3). Sixty-nine percent also raise layers, and 31% also raise turkeys. Eighty percent indicated they would like to expand operations.

Although many producers are satisfied with farm-scale production and direct marketing, there is an industry emerging from the grassroots movement that looks beyond direct marketing. Labor intensity limits the number of birds that a producer can realistically produce and market from the farm. To earn more than supplemental income, producers need access to better processing and marketing. Some are building small government-licensed processing plants.

There are a few large-scale companies with national distribution of range and organic poultry products (Shelton’s Poultry Inc. and Petaluma Poultry Processors, to name two); however, they have not evolved with the pastured-poultry movement – they are industrial models. Most pastured-poultry farmers – even those building processing plants – are committed to sustainability and do not seek national markets, but rather regional ones that support local food systems.

WHY RAISE RANGE POULTRY?

Producers are interested in range poultry production for economic and for less tangible reasons. Poultry is one of the first types of livestock that beginning farmers consider. Small-scale poultry production can be profitable with a low initial investment, and it provides good cash flow. But the motivation may be a lifestyle issue. Some families use poultry production to teach a work ethic to children. Home-schoolers in particular use it as an educational tool. Farm-scale poultry production provides a summer job for teenagers and can be appropriate for youth programs and other community development projects. Or people may simply want to raise

chickens to have the meat and eggs available to family and friends.

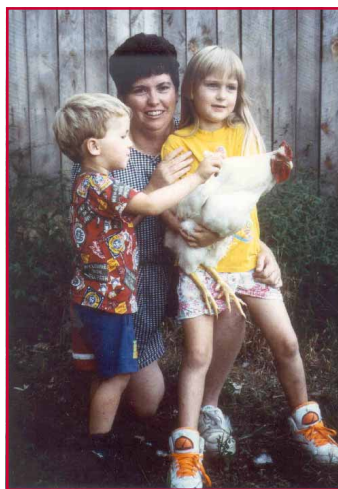
From a production standpoint, the reasons to pasture birds are to obtain nutrients from the pasture, improve land fertility, and improve bird health.

Poultry obtain nutrients from young, vegetative forage plants, but because they cannot digest cellulose as ruminants (cattle, sheep, goats) do, poultry do not make use of the vast energy stored in the plant fiber. Besides plants, poultry on pasture also forage for seeds and live protein such as worms and insects. Pasture is usually planned and managed primarily for ruminants in “extensive” range poultry systems.

Intensive vs. extensive is an important distinction in range poultry production systems.

- *Intensive* range poultry production can be a stand-alone enterprise and requires only a small amount of land. However, careful manure management is needed to prevent excessive soil fertility.
- *Extensive* range poultry production requires a lot more land and is usually part of a diversified operation with ruminants. Mixed husbandry can be very important in range poultry production. Buying land just for the purpose of extensively raising poultry is unlikely to be profitable. In addition, grazing ruminants shorten the grass for the poultry, eliminating the need for mowing. Increased farm diversity can enhance biological diversity and environmental quality.

Soil fertility is a major motivation for range poultry production. Many producers want to take advantage of range poultry manure to improve their pastures for ruminants. Range poultry, according to Oregon producer Robert Plamondon, is “almost essential in reviving a played-out farm on a shoestring budget.” Some vegetable growers insist that in order to build a sustainable system, livestock must be incorporated into the farm for fertility. However, excessive soil fertility can also be an issue, especially in intensive systems.



Much of the fertility in poultry manure is derived from concentrate feed, an important input in poultry production. Layer manure has 1.5% nitrogen (N), 1.3% phosphorus (P), and 0.5% potassium (K) (4). Broiler manure is usually mixed with litter. Birds deposit a lot of their manure in the house at night. These “night droppings” can be removed and spread directly on pastures, or composted first.

Litter is a large-scale problem in the conventional poultry industry. When too much litter is applied to the ground, nutrient pollution occurs (overfertilization with phosphorus) (5, 6). However, in small-scale production, litter is usually an asset rather than a problem, because the volume is much smaller. Excessive fertility on poultry range can be managed by grazing with ruminants, by making hay, or by rotating crops, since these activities remove nutrients.

Many beef producers also keep poultry to scratch apart larva-harboring dung pats to reduce fly and parasite problems on the cattle. Producer Joel Salatin in Virginia has said he would keep layers in his cattle pastures even if there were no eggs – just for the health benefits to the cattle.

Many producers believe that birds are healthier and happier when raised on pasture. Raising small outdoor flocks can reduce the concentration of disease-causing pathogens, and UV light from the sun is a good sanitizer. Still, birds will be exposed to pathogens from wildlife, and pathogens can build up in intensively used areas. Also, exposure to the elements and stress from predation may have negative impacts on bird health.

From a marketing standpoint, birds raised on pasture appeal to some consumers for welfare or aesthetic reasons, or because they believe pasture production is more environmentally sound, or because they believe the meat and eggs are more nutritious or better tasting. Some like the deep orange color of the yolk when layers eat plant material. When direct marketing, a broad range of products is an advantage, in addition to increasing diversity on the farm.

PART II: ALTERNATIVE POULTRY PRODUCTION SYSTEMS

Range poultry production systems, like other production systems, should provide fresh air, clean feed and water, and protection from predators; shelter from cold, rain, wind, and sun; and a source of heat when birds are young (brooding). Birds need to be able to grow, sleep, and lay eggs in comfort. In a good production system, birds are free from stress and disease. Alternative systems also emphasize enabling the birds to behave in a natural way. Pasture-rearing is a cornerstone of this approach. In range systems, land should be well drained and well covered with high-quality vegetation. Pasture rotation will reduce disease-causing pathogens, avoid buildup of excessive manure, and prevent turf damage. However, if done improperly, production on range becomes a problem instead of an advantage.

In general, poultry are raised in three ways:

- 1. Confinement – you keep the birds indoors.** Confinement is the production model used by the conventional industry; however, there are some applications to alternative poultry production. In the conventional industry, broilers are raised on litter-covered floors, and layers are kept in cages.
 - Free-roaming – Layers are not kept in cages but rather on the floor in buildings.
- 2. Outdoor: Contained – you contain (and protect) the foraging of the birds in some way – within a fence, pen, or netting.** Containment allows you to have bird activity where you want it.
 - Yarding – Usually this is a stationary house with a fenced yard. However, the need to avoid buildups of manure, pathogens, and worms, and to provide fresh forage, has spurred grassroots range poultry producers across the U.S. to search for ways to rotate pasture and provide multiple yards.
 - Field pens – Floorless “pastured poultry” field pens or shelters are moved daily; “chicken tractor” pens are used in gardens for fertility and tilling.
 - Net-range or “day-range” (movable) – A small portable poultry house is used with movable net fencing.

- Net-range (stationary) – Stationary houses are used with movable net fencing to rotate pasture.

- 3. Outdoor: Uncontained – you do not contain the foraging of the birds.** Birds range freely during the day – usually in a pasture – and return to a portable house at night. The house is moved regularly to a fresh site.

- Free-range (houses on runners or “skids;” houses on wheels or “eggmobiles”)
- Colony – Several small roosting houses share a common nest house and feeding area.

Choosing a production system involves the following considerations:

- Type – intensive vs. extensive
- Fertility – heavy loads on a small piece of ground vs. light loads on a large piece of ground
- Flexibility – getting started with a low investment and the ability to switch systems
- Labor – labor-intensive manual vs. automated
- Bird welfare – providing fresh forage and fresh air and permitting natural behaviors, while limiting exposure to the elements, predators, and pathogens
- Site- or operation-specific needs – handling rough terrain, keeping eggs clean, etc.

The production systems are discussed in more detail below. Please note that the terms classifying these systems are not legally binding terms, but rather popular-use terms in the U.S., except for the term “free-range.” However, the USDA definition for “free-range” livestock is vague: “free access to the out-of-doors for a significant portion of their lives.” The lack of legal definitions in the U.S. causes marketing problems and consumer confusion.

CONFINED PRODUCTION

Confined production is the system used by the conventional poultry industry. It can be a stand-alone operation on a small amount of land and permits a high level of automation that re-

duces labor. Manure must be managed intensively.

In the industry, broilers are raised on litter-covered floors at a density of 0.7 square feet per bird. Layers are raised in cages (four to a cage) at a density of 64 square inches per bird (7). Cages may be modified to provide more space. “Free-roaming” refers to layers that are kept on the floor of the house, not in cages. Eggs from alternative confinement models are sometimes marketed as “barn eggs” or “nest eggs;” however, “free-roaming” broilers would not be any different from conventional broilers.

In Europe, additional comforts, such as roosts, are offered to layers. Some of these modifications may be of interest to range poultry producers in the northern U.S., where flocks may have to be kept indoors a lot in winter. Percheries and aviaries use perches and platforms to increase vertical space in the house, to allow birds to jump around (8). Slatted floors, used by the conventional industry for broiler breeder housing, are a way to increase stocking density; birds roost on the slats at night and droppings accumulate in a pit.

An interesting floor-raised layer production system was developed by Virginia poultry pioneer Joel Salatin (9) (also known for his “pastured poultry” production system). His “raken house” system keeps chickens with rabbits. The rabbits are kept in hanging wire cages and the chickens are floor-raised. The chickens scratch through the rabbit droppings, aerating the litter. Salatin believes indoor flocks should consist of no more than 300 layers. He also believes that stocking density should be no more than 1 hen per 3 square feet. Otherwise, the manure load exceeds the birds’ ability to incorporate it into the litter by scratching.

In the past, sunporches — elevated runways with wire platforms — were commonly used in poultry production to provide access to sunlight and fresh air. Wire or slatted floors permitted manure to pass through. Nowadays litter is used to dilute manure in confinement production. Sunporches were used to raise birds to maturity, but they also helped poultry to make the transition between confined brooding and outdoor production systems.

OUTDOOR POULTRY PRODUCTION: CONTAINED

Although most grassroots range poultry producers use portable housing, it is important to begin this discussion with systems that use stationary housing.

PRODUCTION SYSTEM: YARDING



Yarding, even on a small scale, can result in dirt yards.

“Yarding” refers to the familiar chicken coop: a stationary house with a fenced yard. Birds are shut up in the house at night. Also called “set stocking,” yarding can be an intensive, stand-alone operation on a small amount of land. It can be used by hobby farmers for low-density, non-commercial production.

Yarding can be an efficient, low-labor system, but “fowl sick” land is a concern.

Although this system can be run with minimal labor (especially if feed and water are somewhat automated), disadvantages include manure and pathogen buildup and turf damage, particularly around the house. The result is “fowl sick” land. In fact, range poultry producer Robert Plamondon in Oregon (10) calls this system inferior to the confinement system because of the disease potential. Mud from bare lots dirties eggs, greatly increasing egg cleaning costs, and yards with heavy clay will become hard and packed from continuous use. According to Plamondon, this system may only work in very dry climates, such as parts of the western U.S., where biological activity is low and pathogens are kept at bay. Older birds, such as layers, are less susceptible than young pullets or broilers to health problems in yards.

A similar system is the “farmstead” production model, which permits poultry to roam a farmstead at will during the day and shuts them in a coop at night. There is no fence, and the birds continuously have access to the same piece of ground. While this may work at a low density and be appropriate for hobby production, it is generally not a commercial production system in the U.S. Disadvantages include loss to predators and droppings in undesired places such as your porch. According to Plamondon, you can get away with anything at low densities (i.e., a 25-50 hen flock) but at higher levels, you need to use a commercial production system.

One way to help reduce the “fowl sick” land problems of yarding is to rest the ground by “double yarding” – dividing the yard in two with a fence and rotating the flock. The British book *Free-Range Poultry* (11) by Katie Thear describes a quadruple yarding system with four rotating yards accessible by four “popholes” (bird doors) from the house. Unfortunately, Thear has yet to see any yarding system that can solve the problems on a large scale.

As mentioned earlier, excessive fertility is prevented when litter is cleaned out of a house and spread on other land, but this is labor-intensive. Resting the ground for part of the year is helpful in reducing manure load and pathogen buildup. Older systems used cultivation of crops as part of yarding to use up the nutrients and keep the soil loose. Although many pathogens and parasites will die after their hosts (poultry) are removed, some are able to survive for a long period of time and re-infect birds when they are returned to the land. Moving a semi-fixed house after a few years to a new site or fallowing the site would solve the buildup problem.

Yards may simply be “scratching areas.” In this case, the focus is on providing not vegetation for foraging but just a place for outdoor access. Amendments such as straw, mulch, sand, or even concrete may be preferable to a dirt lot. They may help reduce mud, and could be removed or cleaned. In the U.K., scratching areas may be open yards, yards partially covered with an overhang, or enclosed verandas.

Straw-yard scratching areas may be a way to address problems in yarding. Plamondon has reported on a system used by a British poultryman in the 1940s. A relatively small yard was completely covered with a thick layer of straw. Additional straw was added weekly. In winter, straw was placed on top of snow! The yard was sheltered to prevent the wind from blowing the straw away. Once a year, the entire layer of straw was removed by bulldozer. Plamondon believes a straw yard has potential as a good hub for pasture-based systems in the U.S.

In Europe, yarding is common, but stocking density recommendations differ in the various certification programs.

- The European Union requirements for “free-range” poultry limit stock density to 1,000 hens per hectare (400 per acre).
- A U.K. organic program called the Soil Association requires fewer birds: no more than 625 hens per hectare (250 per acre).

Both programs require that the land be largely covered with vegetation. In addition the Soil Association demands that pasture be rested for one year in three, unless stocking densities are low enough to “prevent damage to the grassland and avoid disease build-up.” Thear believes

Encouraging Poultry to Forage

Birds may need to be encouraged to forage. Housing design can help; birds may be more inclined to leave a building with many exits. An adequate number of popholes is needed. In Scottish studies examining the foraging habits of chickens when yarding, birds stuck close to the house and used very little of the total area available (11). Encouraging birds to forage will reduce stocking density around the house. Since poultry evolved in a jungle environment, they may not be attracted to open pasture. Bushes, walls, strawbales, constructed shelters, and trees provide a more secure setting. Producers also move feed and water containers to encourage foraging. Some production systems other than yarding are more conducive to foraging. Also, certain types of birds are more inclined to forage than others; the Cornish cross typically used for meat production in the U.S. is not known for foraging. Some producers believe that making forage available during brooding will encourage birds to range in the future.

that 400 birds per acre will cause “fowl sick” land problems. According to Plamondon (10), old scientific literature showed that even 200 birds per acre was too many.

- In France, 30% of poultry is produced on range under the *Label Rouge* certification program. Generally, yarding is used, sometimes unfenced. Under this program, 500 birds per hectare (200 per acre) are permitted, although some participants voluntarily increase the space.



Birds in the French *Label Rouge* certification program are generally raised in “semi-intensive” or large-scale yarding systems.

When yarding is done on a large scale in Europe, it is called “semi-intensive.” The European Union definition for “semi-intensive” is 4,000 birds per hectare (1,600 birds per acre). This type of production is done by some large range poultry companies in the U.S. Even the final rule of the USDA National Organic Program permits this type of industrial production system.

Range poultry farmers across the U.S. have set out to develop ways to rotate pasture, prevent “fowl sick” land, and provide good forage. Movable housing and fencing are keys.

FIELD PEN PRODUCTION SYSTEM — “PASTURED POULTRY”

Field pens are inexpensive shelters that are set in a pasture, garden, or lawn and moved daily to provide multiple yards. This is a favorite production system for beginners, because expenses are minimal and many of the management de-

tails have been worked out, giving producers a good rate of success. However, moving the pens daily is very labor-intensive.

Joel Salatin (9) of Swoope, Virginia, ignited the grassroots range poultry movement in the early 1990s with the development of his “pastured poultry” field pen. Batches of about 75 birds are kept in wooden floorless pens that are moved daily to fresh pasture. Pen dimensions are 10’ x 12’ x 2’. The top of the pen is flat, and three-quarters is covered by roofing. This system was popularized by Salatin’s book and video *Pastured Poultry Profits* (12). The book describes the system in detail and is an excellent guide.

Field pens are moved daily. Low cost and easy use make them a favorite.

The pens, which weigh about 200 lbs., are moved manually by putting a custom dolly on one end and lifting by a handle on the other. Birds learn to walk along with the pen as it is dragged across the field, but occasionally a bird will escape or be crushed. Some producers find they need to move the pen twice a day when the birds get bigger, so that the grass is not “burned” and the birds are not sitting on manure. No litter is used.

Since the field pen is only a shelter, this system is seasonal; birds are usually raised only in warm weather. Pens may need to be propped up in hot weather to allow ventilation. On rainy days, producers use hay to help keep chickens dry under the covered section of the pen. Low spots in the pasture should be avoided, since puddles may form during rain. Roosts can help layers stay out of puddles and manure. The daily



The popular “Salatin” pen.

moves control coccidiosis, a parasitic disease that occurs when birds stay in contact with manure.

The confined space inside the pens makes bird welfare a concern; however, although the birds are not free to roam, they still have the important advantages of fresh forage and fresh air. Pens may not be suitable for turkeys because of their large wing spans.

A field pen generally provides good predator control, but some predators (namely raccoons) can grab chickens through the wire. If there are low spots in the pasture, holes between the bottom of the pen and the ground need to be stopped up with scraps of wood or other materials. Some producers surround the pens with electric net fencing.

Size, design, and construction material can be modified in many ways to make the pen lighter to move, to adapt it to hot climates, or to address other needs. PVC pipe and rebar have been used in place of wood to lighten the structure. However, in areas with strong winds, light pens need to be staked down. Some producers peak the roof to allow more heat to escape, to keep rainwater from pooling, and to keep goats off! Skids or wheels can be used instead of a dolly to move the pen. The field pen can also be adapted for egg production by adding nestboxes (hanging or on skids). See ATTRA's *Range Poultry Housing* for pen designs and construction details.

Pollo Real in Socorro, New Mexico, is the largest field-pen operation in the U.S., producing 50,000 broilers per year.

In Europe, there are some pretty fancy – and expensive – pens. Some have attached housing; these European “ark” houses are available through U.S. distributors, but there are also some

similar U.S.-designed and -built pens. The Henspa (13) is one such American product. Sold for about \$1,000, this unit for 12 layers can be moved on lawns or pasture; it's designed for busy people and features an automatic feeder and waterer. Attractive, elaborate designs like this are described in ATTRA's *Range Poultry Housing*; they are used in the same way as the field pen.

The “Chicken Tractor,” popularized by Andy Lee (14), is another well-known poultry pen, used in a system to provide fertilizer for vegetable production. It is discussed below under the heading *Permaculture Production Systems*.

Net-range or “day-range” manages the foraging birds by using net fencing with portable houses to make paddocks. The motto for this system is “fence the flock, not the field” (14).

NET-RANGE OR “DAY-RANGE” PRODUCTION SYSTEM (MOVABLE)

Net-range uses portable net fencing around a house to make multiple yards. Houses are also moved regularly to fresh sites. This low-cost, flexible system facilitates larger-scale production since moves do not need to be daily. Also commonly called “day-range,” net-range production is usually one component of a diversified farm, done on pastures that are also used for cattle or other ruminants – an extensive system.

Electric fencing technology has allowed the development of net-range. Electric net fencing comes in rolls of 150 to 165 feet. Some



This attractive field pen features an attached house.

Additional sources of information on movable pens include a booklet called *Pastured Poultry* developed by the National Center for Appropriate Technology (NCAT) for Heifer Project International (HPI), available from ATTRA at no cost. It presents case studies from an HPI project, describing the experiences of 19 producers in the South who each raised a batch of pastured poultry in field pens, and includes sections on mortality, weather pen construction, economic analysis, and more. The PasturePoultry listserver is also an important resource (available at <http://www.groups.yahoo.com>).



One of Andy Lee's first "day-range" systems in Virginia.

brands have step-in posts and are easy to move. "Fence the flock – not the field" is a motto of this sophisticated system. It allows you to direct your birds' activity right where you want it. The housing is usually enclosed; it offers improved protection for the birds compared to shelters and a year-round production option.

Net-range has not been fine-tuned; it is still a "work-in-progress," benefiting from continual innovation. The descriptions below are snapshots of the current state of net-range production.

Andy Lee (14) in Virginia, who coined the term and has pioneered the development of "day-range" systems, uses portable housing on skids or runners. His house has popholes at the ends. He loops the electric netting around one end of the house to make a paddock and opens the pophole so the birds can come out. The netting encloses an area roughly 40' x 40' (1,600 square feet of pasture) in which Lee raises 200 broilers or 100 turkeys (he also raises layers with this system). After a week, he moves the netting to the other end of the house. Weekly rotation gives the paddocks a rest. This is similar to the double-yarding practice described earlier, but it is on fresh sites, since the house is moved after each grow-out period. Lee says that 1,000 broilers per acre is fine. The pasture grass under the house may need to be re-seeded. David Schaffer (15) in Kansas uses a floorless house with litter and found it can take two to three years for pasture to recover.

Having used many different "mini-barn"

designs for housing, Lee prefers a hoop house with a litter-covered plywood floor. The house is on pressure-treated skids and is moved by tractor, pickup, or draft animal. Lee recommends at least a square foot of floor space for each broiler in the house.

Lee has experimented with many range production systems and is willing to share his knowledge. He wrote a book called *Day Range Poultry* (16). Contact him directly for more information, preferably by email. He also started the DayRangePoultry listserver discussion group available at <<http://www.groups.yahoo.com>>.

As producers work on fine-tuning "day-range" systems, some recommend that water be placed not only outside but also inside the house. In heat, cold, or rain, some breeds of bird may be reluctant to leave the house. Perimeter fencing around the entire pasture may or may not be used in addition to the netting enclosure. Since many producers graze poultry in ruminant pastures, perimeter fences are often already in place. Some of the factors producers consider in housing are listed below.



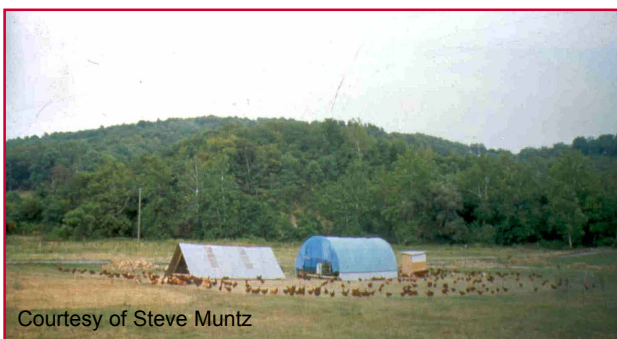
A floorless hoop house with roosts; litter on the ground.

Production Considerations for Portable Poultry Housing

- **"Floor vs. no floor."** This is an important consideration in range poultry housing design. A floor is sometimes a structural necessity to keep hoops in place or keep the house from pulling apart when moved. Also, a floor may be required in cold regions to keep the birds off the ground and can help producers extend their season. Litter is used for insulation on floors, but it is labor-intensive to handle and clean out. A bird-cage-type floor that could be removed would be

an easy-to-clean option. Other options include using a slatted floor or mesh floor with no litter or insulation. Litter is sometimes put directly on the ground in floorless houses, but it can be soaked by heavy rains. The litter can be left behind when the house is moved. An additional option for a floorless house is to use roosts for layers with no litter; however, the manure pack may need to be scraped after moving the house.

- **Number of popholes.** The number of paddock subdivisions can be increased by adding more popholes on the sides of the house that open directly to them. Broad popholes reduce wear and tear on turf at the entryway. Some houses have panels at the bottom that open like a clamshell. Some have continuous openings all the way around at the bottom, encircled by netting, making a central hub.
- **Closing doors vs. not closing.** Opening and closing the doors of a house in the morning and at night is time-consuming. With net-range, you may be able to forego the task, since the birds are protected from predators by electric netting day and night. However, if they bed down outside, they may get rained on or preyed upon by owls. Layers return to the house on their own at night, but may need some initial training. Producers keep them locked in for a few days or shoo them inside in the evening for the first week. Broilers and turkeys are more of a challenge. Depending on the breed, they may not seek shelter as readily. Having broad popholes in the house can help. Lee (14) makes sure a feed trough is in the shelter in the late afternoon to encourage broilers to return to the house. David



Courtesy of Steve Muntz

Joel Salatin's "feathernet" is encircled by netting.

Schaffer (15) had owls enter an open door even after the birds returned to the house. Therefore, he uses a flap door on his house. Birds can come and go, but the flap deters owls.

- **Electric vs. non-electric net fencing.** Since most predators are nocturnal, some producers turn off the electricity for their net fencing at night if the birds are shut in and the house is predator-proof. Producer Tim Shell in Virginia is leading the way in exploring non-electric netting. It should be electrified if you have daytime predators (such as stray dogs) that will not respect the fencing.

Net-range Modifications

The house can be completely encircled by netting, forming one large paddock. Joel Salatin (9) encircles a quarter-acre around the house with netting and puts 1,000 layers in it – he calls this system the "feathernet." He moves the house and netting to a new site frequently (every three days), making a figure-eight with two 450-foot circles of netting (using three rolls each), so he can move the housing into a new circle without letting birds escape. It takes Salatin one hour to move the system, including two skid hoop houses (20' x 20') hooked together, along with a feed sled in a "train." The unit requires five acres of pasture and seven hours of work per week. The houses are floorless and no litter is used for bedding. He uses the system only for his layers and does not shut birds in the house at night; the birds return on their own.

Net fencing is also used with stationary houses to make paddocks.

There are other variations on net-ranging. Some producers use a combination of field pens and net-range, opening up field pens within netting enclosures; the birds range in the entire enclosure during the day. The pens may be moved several times before moving the netting enclosure, but they do not have to be moved daily, since the birds only sleep in them. Aaron Silverman in Oregon groups three pens together in a netting enclosure and moves the enclosure every three to five days.

NET-RANGE OR “DAY-RANGE” PRODUCTION SYSTEM (STATIONARY)

In addition to portable houses, net fencing is also used with stationary houses to make paddocks. Since houses are fixed or semi-fixed, it is possible to incorporate more labor-saving automations of feed and water delivery. Since it is an intensive production system, operations can be stand-alone and done on a small amount of land, but careful manure management is required.

Luke Elliott in Arkansas has used stationary 12' x 21' hoophouses with doors on both ends, making paddocks with electric netting as needed to maintain pasture. He keeps 210 birds in each hoophouse. The turf right around the door of the house gets worn down; Elliott believes that multiple exits are an important modification to reduce turf damage.



A stationary hoophouse in Arkansas; temporary paddocks are made with netting.

Tim Shell (17) in Virginia is a pioneer of stationary and semi-stationary housing. He makes multiple paddocks in a wagon-wheel design with netting. He developed a “stationary netting model” for his broiler breeders; however, he recommends this system for layers and broilers as well.

For layers he recommends a house with eight popholes to access eight separate paddocks. He makes one quarter-acre paddock at a time, radiating out from the house in the shape of a pie slice, using two rolls of electric netting per paddock. Birds are moved to a fresh paddock every seven days. He uses the same ground several times a year but believes that the seven-week rest

period helps prevent disease and parasite problems. He encourages foraging by gradually moving the range feeder to the end of the paddock away from the house. He uses a total of 2 acres for 400 heavy layers and recommends irrigation (in Virginia). For broiler production, birds should be kept for a relatively long time on the first paddock, when they are still small, and for a shorter time on the last paddock when they have grown. Although this is an intensive production system that can be used without ruminants, Shell grazes sheep in the poultry paddocks.

His housing is a 15' x 40' hoophouse providing 1.5 square feet per hen, with no floor but with litter on the ground. Roosts are provided. The hoophouse is stationary but is built to move to a new location if needed. He is also trying out a kit to build a small predator-proof hoophouse (8' x 16'); he will place 100 birds in it. The small house has six popholes accessing six yards.

Another design option Shell recommends is a central straw yard around an open-bottomed house encircled with netting. This can be used instead of multiple popholes in the house, because birds can come and go from any part of the house. An “instant gate” to a paddock can be made by propping up the inner circle of netting.

Shell sells a “Stationary Netting Model Manual”. He is also working on:

- Several permanent pads to which the hoop cover can be dragged and mounted. This would create multiple houses with less expense; the houses could be used in rotation.
- Use of old poultry houses — there are many in the South. Using net fencing with these stationary houses could provide good access to range.
- A conveyor system to reduce labor in handling eggs.

OUTDOOR POULTRY PRODUCTION: UNCONTAINED

In uncontained outdoor production, the foraging of the flock is not contained by a fence, pen, or netting — birds roam at will. “Free-range” usually refers to operations using portable

housing that is regularly moved through a pasture. Birds have total freedom during the day, but the producer has to be faithful about shutting them up at night for protection from predators and the elements. This is usually a mixed-husbandry system; since producers typically graze poultry on ruminant pasture, there is usually a perimeter fence in place for the cattle or other livestock. While these perimeter fences help deter predators such as stray dogs, they are usually not meant to contain poultry. Birds are more subject to predation than in other systems. Since foraging is not managed by net fencing, birds may concentrate in an area for an extended period, damaging pasture.

FREE-RANGE PRODUCTION SYSTEM



Salatin's eggmobile is moved every 3 to 4 days.

Eggmobile

If a layer house has wheels, it is often called an "eggmobile" or a "layaway;" these are generally moved often. Joel Salatin (9) has been instrumental in popularizing an eggmobile system in which a layer house is mounted on a trailer hitch and moved through pasture every three to four days, following grazing cattle. He finds that significant acreage (a minimum of 50 acres) is needed in order to move the birds far enough each time that they do not return to the previous spot or identify a favorite spot such as a garden. Wheeled housing can be difficult to park on hilly land. Foraging for insects and plants, the layers will range up to 200 yards from the eggmobile. They usually return but sometimes get lost. Salatin says the eggmobile can be returned to a plot of land after just one month.

Salatin first developed a 12' x 20' house for 100 to 200 layers. He later hitched a second house

to the eggmobile and now houses up to 400 layers. The house must not be made so big that it is unwieldy to move. Since the birds only stay inside the eggmobile at night, Salatin allows only one square foot per bird. For use in the winter or during long periods of inclement weather, more area may be needed since birds will remain indoors. He provides feed inside the house.

In cold weather, bales of hay are added for bedding. According to Salatin, the frequent moves deter predators. When the layers are newly placed in the eggmobile, he encloses them with poultry netting around the bottom of the structure for the first night, so that they learn to go in.

Old mobile-home trailer frames have been used for eggmobiles. Wheeled houses for broilers are not as common. Please see ATTRA's *Range Poultry Housing* for a discussion of eggmobile design.

Skids

Skid housing is used in the "Modern American Free-Range" system for broilers, popularized by Ohio farmer Herman Beck-Chenoweth in his book and video *Free-Range Poultry Production and Marketing* (18). He developed the system for broilers but it also serves for layers. Portable houses on runners (skids) are moved every few weeks to new locations in the pasture. Broilers range freely during the day, foraging about 100 feet away from the skids. Beck-Chenoweth finds that the birds return to the house on their own at night. It is necessary to open and close the house in the morning and evening. He stresses the importance of a strong perimeter fence to reduce

In free-range production, birds roam at will. Portable housing is regularly moved through a pasture. Birds have total freedom but require faithful shutting up at night.

A roost skid for turkeys at Beck-Chenoweth's Ohio farm.



predator pressure from stray dogs; predation at night is generally not a problem if the chicken wire is tightly attached to the skid. He doesn't recommend more than 400 broilers or 100 turkeys per acre.

Beck-Chenoweth's 8' x 18' wooden skid houses are enclosed with chicken wire and have gabled tarp-covered roofs and litter-covered wood floors. He keeps about 300 birds in them. This is a high density, but since he harvests continuously some birds are small. Beck-Chenoweth's system is described on his website <<http://www.free-rangepoultry.com>>.

Skids used for turkey production may be little more than roosts. Heritage turkey breeds are hardy and do not require a lot of shelter when mature.

The British book *Free-range Poultry* (11) shows a number of different skid housing designs on pasture. Some are surrounded by hay since they are not moved frequently. The attractive housing used in the U.K. reflects "planning permission" requirements to keep poultry housing looking decent, even in rural areas, to benefit tourism.

A number of modifications can be made to the free-range system:

- Some producers use a system combining field pens with free-range. They open up their field pens and let birds roam during the day, returning them to the pen at night.
- Bob Tochor in Saskatchewan, Canada, uses a portable hoop house within a very large electric netting enclosure — an entire acre. His 15' x 15' hoop house contains 250 birds. Only one house is placed per acre.
- Jim Hawthorne also fences a large area. To deal with heavy predator pressure, he uses netting and electric wire to make a strong, permanent perimeter fence. He moves two houses around in the enclosure and believes that 600 birds per acre is viable.
- Herding, a free-range method, was used in the past with turkeys. Turkey foraging was managed by a herder.
- "Wire-ranging" is a type of free-range. Electric wire is used, not to confine or manage the birds, but rather to deter predators.

COLONY PRODUCTION SYSTEM

The colony system uses multiple small roosting houses scattered on pasture. It is based on a mixed poultry-livestock system that was popular before 1900 in the California poultry industry centered near Petaluma. The houses have nothing inside but roosts. "Colonies" of roosting houses share a feed area and a nesting house. A nesting house has nothing but nest boxes. The system has been promoted for layers by Robert Plamondon (10) in western Oregon. He moves his houses every few weeks to a new spot 20 to 100 feet away. A perimeter fence reduces predation.

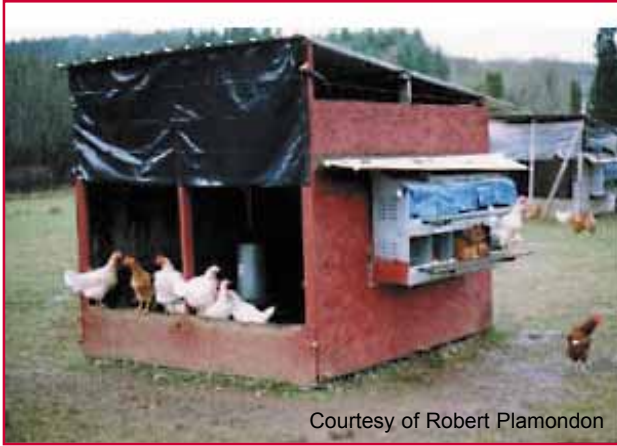
The colony system lends itself to egg production; according to Plamondon, it reduces the labor involved in gathering eggs from houses on range. Eggs are concentrated in special nest houses; the producer collects the eggs onto flats for pick-up by truck or ATV (or, in the past, horse). Plamondon says it is an indication that you need a nest house when you have more eggs than you can carry. Nest houses have litter on the floor to clean hens' feet before laying.

Colony production uses many small houses that share a common nest house and feed area.

Again, the roosting houses contain only roosts inside. Plamondon's houses are floorless and no litter is used. They are on skids. When he moves the house, there is a 2- to 4-inch layer of manure left, which he scrapes with his tractor. The houses should be kept 100 yards away from barns, garages, and other places where you don't want birds to roost.

Plamondon recommends the colony system for mild climates on the Pacific coast and throughout most of the South. Roosting, nesting, and feeding should be under a single roof during the winter in areas with prolonged periods of freezing.

Plamondon's unique open-fronted housing design frees him from having to close his houses up at night. The front wall of the small 8' x 8' house is only 20 inches high. Chickens hop up to the top of the wall and then into the house. Climbing predators are deterred by an electric fence wire strung on insulators along the front



Courtesy of Robert Plamondon

A colony operation in Oregon.

wall. However, some predator losses occur at dawn when birds leave the house too early, or at dusk.

Plamondon encourages foraging by keeping the feeder and waterers outside the house; the feed area is 50 to 150 feet from the house. He also tosses scratch grain on the ground away from the feeders.

He keeps 50 hens in each small house, and his colonies consist of 200 hens each. Plamondon has details on his colony system and house construction, as well as other poultry resources, on his website <<http://www.plamondon.com>>.

PERMACULTURE PRODUCTION SYSTEMS

“Permaculture” integrates natural systems with the production of food, shelter, fiber, and other human needs. Permaculture poultry production systems are usually less commercial than other systems and are specialized to focus on services poultry can provide, such as fertilization, tillage, and insect and weed control. Since the systems are so varied, they are not classified as contained or uncontained in this publication.

CHICKEN TRACTOR

The “chicken tractor” system was popularized by Andy Lee and Patricia Foreman of Buena Vista, Virginia, in their book *The Chicken Tractor* (19). The system integrates poultry and vegetable production, using a small floorless pen enclosed with chicken wire and a covered top. The

Chicken tractors are used in gardens for tillage and for bug and weed control.

pen is moved daily on fallow beds. You may need twice the garden space to use this system, but this allows the land to be “treated” every other year. Garden yields are increased by the added fertility. The chickens also weed and till the beds and help control insects. Garden wastes are useful feed supplements.

In addition to rotating the pen daily to a fresh spot, Lee suggests other ways to use the chicken tractor in a garden, such as keeping the pen in one spot and adding fresh straw bedding daily to create a raised garden bed. (However, according to ATTRA Soil Specialist Barbara Bellows, unless a lot of manure is added or over a year is provided for the straw to decompose, the straw will immobilize nitrogen and other soil nutrients.) Moving the pen after less than one month will put a sheet-mulch on top of the beds to kill grass and weeds and add fertility.

Lee uses a 4’ x 10’ pen that holds 20 broilers or 10 layers. Some producers add a small portable house to the chicken tractor to provide more protection from the weather and to hold nestboxes. Small runs have also been attached.

Lee continues to explore permaculture options other than field pens, using birds in a net-range system to clean up crop residues in market gardens in the fall – turkeys are especially useful for this purpose. “From October through Thanksgiving the turkeys can clean every bit of weeds and spent plants from the garden and leave a rich load of manure behind.”



The inside of Salatin’s overwintering hoop house planted with early vegetables.

In another permaculture example, Joel Salatin (9) uses a hoop house for overwintering layers and integrates it with other farm operations. His son’s pastured rabbits are also moved into the

hoophouse during the winter and kept in wire cages. Below the cages, a wire covering over the rabbit droppings keeps the chickens out of the manure bed, which is used to produce worms. However, the chickens are allowed to roost on the wire and thus add fertilizer. Pigs are also kept inside in small pens. In the spring, after the animals are removed, the hoophouse is used for vegetable production – vegetables are planted in the bedding to get an early start.

There are many other permaculture systems for range chicken production. Art Biggert and Suzy Cook in Washington place a portable house in their market garden and enclose a bed with netting. Their layers forage on winter cover crops and post-harvest crop residues. The house and fencing are moved every two to three weeks. Other permaculture systems include building hoop tunnels in the garden; having permanent wire runs and moving a portable shelter to the runs in succession; and attaching runs to housing. Permaculture systems often focus on self-forage systems; practitioners claim poultry will eat many types of shrubs and plants. See Bill Mollison's book *Permaculture: A Designer's Manual* (20) or Alanna Moore's *Backyard Poultry – Naturally* (21) for more poultry permaculture ideas. ATTRA also has information on greenhouse systems that incorporate poultry and rabbits and make use of their body-heat production.

CHOOSING A PRODUCTION SYSTEM

All systems offer advantages and disadvantages. Tim Shell recommends “thinking for yourself” instead of copying someone else's recipe. Each type of system can be effective, depending on the producer's management ability and level of commitment.

Your motivations will influence the size and type of production system you choose. Do you plan on range poultry being a farm centerpiece or a part-time source of supplemental income? Do you plan on year-round production or seasonal? The following are important considerations:

- **Intensive vs. extensive.** Do you already own pasture and raise ruminants or have access to pasture? If so, you can probably consider an extensive system. If not, it may not be profitable to buy land just for the purpose of

extensively raising poultry. Therefore, you may need to choose an intensive system.

- **Fertility implications.** How do you plan to manage the fertility brought in by poultry? Do you want a light coat of manure spread over a large area or heavier manure on a smaller area? Can you remove excess nutrients by rotating poultry land with crop production, grazing with ruminants, or making hay? Do you want fertility for your pasture? Or composted litter for your market garden or crops? Composted litter can be a valuable by-product for sale, but does it pay you enough to justify the labor involved in manure handling?

Making paddocks with net fencing allows for good fertility management – you have control of the birds' foraging and the ability to concentrate their manure deposition and other activity as desired. A field pen also concentrates fertility where you want it, but a pen filled with large broilers can leave a mat of manure.

- **Flexibility.** Many producers start with the most inexpensive system – a field pen – and try out one batch to see whether they like raising and processing poultry and whether they can build a market. Pens can be built from scrap materials on-farm and can be moved by hand. No tractor, draft horse, or pickup is needed. No fencing is required; a pen can be moved to any convenient place. Pens are a flexible option for those who do not have cattle pastures. While many producers eventually switch to a different production system as they grow, there are some operators who have a fleet of pens.

Production systems using field pens, temporary fencing, or no fencing at all allow you to put your operation in any pasture, even leased, without making expensive improvements. If there is no perimeter fencing, you might want to consider a net-range system.

- **Labor and management.** While producers discover many labor-saving solutions in any production system, there are important inherent differences among the systems. For example, with field pens, there is no need to

open and close doors. With an uncontained outdoor system such as free-range, you need to be faithful about opening and closing doors (or devise an automatic closer). According to Robert Plamondon (10), there used to be full-time workers in California's Petaluma poultry industry employed to open and close doors in the morning and evening. Net-range systems may or may not involve door-closing.

Moving houses takes time. The daily moves for field pens are particularly labor-intensive, but cleaning litter out of a house also takes time. Back injury from dragging heavy field pens by hand is a concern for some. Daily moves require a lot of discipline.

Opportunities for automation of feed and water delivery are greater with stationary or semi-stationary housing — important in reducing labor. Users of field pens are noted for hauling five-gallon buckets of water and feed to each pen. Pens have to be served as individual units, sometimes twice a day; pens may take twice as long to service as other systems. Replacing the use of five-gallon water buckets with piped water reduces labor with pens. Ease of access is also an issue. It can be hard to reach birds in parts of the field pen, depending on design; larger houses allow you to stand up.

Management is a key consideration, especially when adopting a new system. It takes a lot of time to work out the production details, such as how often to move a house or how often to move net fencing. An advantage of the field pen system is that many bugs have already been worked out.

Although reducing labor is important, it is also important to take time for a close-up look at your flock every day, to monitor their health and catch any problems.

- **Bird welfare.** Some consider the field pen inhumane because it exposes birds to the elements. Pens do not provide the substantial protection offered by enclosed housing; birds are affected by cold, heat, wind, and rain. The confining quarters can lead to pecking problems, because the birds lower in the pecking order cannot run away. Some egg-eating

occurs because the birds do not have a lot to do. Birds may end up spending time in manure when they are larger, and breast blisters can develop. On the other hand, the Cornish cross birds typically used for meat production are not active anyway. They were bred for confinement systems that encourage inactivity, since activity burns calories that could be used for growth. If more-active breeds are used, less-confined systems may be preferred for welfare reasons.

Site-specific and Operational Needs

- **Terrain.** Rough terrain can make towing houses more difficult and pulling pens by hand impossible. In arid climates, hard ground may be a problem for inserting posts for net fencing. A free-range system like the eggmobile requires extensive pastures to keep birds from returning to the same place.
- **Predators.** Heavy predator pressure increases the risk of losses. The field pen usually protects against both overhead and ground, daytime and nocturnal predators. Some producers attempt another system but switch back to pens in the face of hawk problems. In a free-range system like the eggmobile, layers may wander off and get lost.
- **Weather.** Preparing for weather extremes is important. Enclosed housing ensures shelter from the elements, and your workload stays the same when bad weather occurs since you are already prepared. In windy areas, it is easier to weigh down one house instead of several individual pens to prevent them from blowing away. Field pens, shelters, and other non-enclosed housing must usually be shut down for winter, especially in areas with cold winters.
- **Operation-specific.** There are many specific considerations and tradeoffs that depend on your operation. For example, if you are producing eggs on range, it is important to use a production system that keeps the eggs from getting dirty. Cattle may interfere with poultry housing if there is no netting or fence to keep them away. For processing, it may be easier to catch poultry from a house than from a pen; David Schaffer (15) funnels chickens

right from his house into a stock trailer. The choice of a production system is related to the type of chore cycle you want – light work every day or heavy work on a few days. The choice of a production system is even related to feeding issues. Salatin promotes an extensive grazing system for reducing feeding costs: Since layers are able to forage for high-protein insects in warm months, less concentrate feed is needed. The confined quarters of the field pen system keep feed in front of the birds at all times, an advantage if you want to encourage your birds to eat and grow quickly.

Note: The choice of a production system may be influenced by genetics. Cornish cross

broilers are not known for foraging. They were developed for confinement systems and are relatively inactive, especially as they grow. The field pen system forces them to graze. Plamondon prefers two different systems depending on the type of bird: his family uses a free-range type system (colony) for layers but field pens for broilers. He says the broilers prefer to be in the shade and close to their feed anyway, so a pen is appropriate. Producer Kip Glass (22) did a study comparing pens to “day-range,” and he prefers pens for broilers. On the other hand, layers are lighter birds and much more inclined to forage than the heavy Cornish Cross broilers. In the future, producers may have more options for broiler genetics adapted to foraging.

SUMMARY OF FEATURES OF RANGE POULTRY PRODUCTION SYSTEMS						
	Yard	Pens	Net-range Moveable	Net-range Stationary	Free-range	Colony
Type	Intensive	Extensive but can be intensive	Extensive	Fairly Intensive	Extensive	Extensive
Fertility	Heavy	Can be heavy	Light	Can be heavy	Light	Light
Flexibility	Rigid	Very flexible	Flexible	Less Flexible	Flexible	Flexible
Labor	Can be automated; No moves; Litter clean-out needed	Very labor intensive; Daily moves needed; No litter clean-out	Labor intensive; Frequent moves; May need litter clean out	Automated; No moves or infrequent	Labor intensive; Frequent moves	Labor intensive; either frequent or infrequent moves
Welfare	Poor to good	Poor to fair	Good	Good	Good	
Seasonality	Year-round	Seasonal	Can be year-round	Year-round	Can be year-round	Good
Comment on use	Not viewed favorably by U.S. grassroots producers; more popular with industrial range production	The all-time favorite	Growing widely in popularity	Holds a lot of promise for the future	Steady growth	Can be year-round Not currently widely used

Note: Permaculture systems are not categorized, because of their wide variability.

INTEGRATING POULTRY ONTO THE FARM

Animals and cropland have been separated in modern agriculture, in which livestock and feed-crop production are distinct industries. Range poultry production reverses this trend by reintegrating poultry with the land base as part of a whole farm system.

A permaculture concept called “stacking” combines several enterprises on the same piece of ground. Various species of domestic animals can be raised together to complement each other, creating mutually beneficial relationships (17). For example, Salatin keeps turkeys in his vineyard to control the grass and bugs; the vineyard shelters the birds.

As noted earlier, poultry production can be complementary to vegetable production. Chickens may be confined in “chicken tractor” field pens or allowed free access to the garden at certain times (23). Dr. Jim McNitt (24) at Southern University studies the fertility contribution of pastured-poultry field pens integrated with vegetable production. Chickens also help to control crop pests. They will eat insects in some crops, for example potatoes, without damaging the plants. Researchers at Michigan State University (25) have studied the use of chickens and geese in apple orchards; chickens were found to control insect pests while geese aided in weed control. Chickens are sometimes used for tillage – clearing surface weeds and bulbs out of a plot of land, scratching, and preparing the ground for vegetable planting. “Fold” houses in the U.K. have allowed flocks of chickens to help glean fields after crops were harvested (11).

Poultry may share permanent pasture with cattle, sheep, and goats, improving the pasture

soil with their manure. As mentioned earlier, poultry contribute to cattle health by picking apart dung pats that harbor fly and parasite larvae. Multi-species grazing is commonly employed by pastured-poultry farmers. Several species of animals may be grazed together simultaneously, or the grazing may be staggered to allow only one species at a time in the paddock. Multi-species grazing can aid in protecting poultry from predators that respect large animals. However, cattle and goats may disturb poultry housing and feed. Producers with field pens have complained of goats jumping on top of the pens and damaging them. Cattle may also disturb field pens, but they do not usually interfere with netting. Cattle have been known to kick turkeys, causing injury. It is necessary to exclude ruminants from poultry feeding areas to prevent foundering. This can be done with netting or wires.

Other Benefits Offered by Poultry

- Some people keep chickens for tick control.
- Turkeys were used in the past for insect control in crops, such as in tobacco during colonial times. Turkeys are more aggressive foragers than chickens.
- Weeder geese were used on a large scale in California in the '50s to weed cotton fields before the widespread use of herbicides. Geese have been used successfully to weed crops such as strawberries, potatoes, and onions. Geese have a strong preference for young grasses.
- Ducks, more commonly eaten in Europe and Asia than in the U.S., have been used to control aquatic plants in ponds, especially duckweed and pondweed. Muscovy ducks have been used for fly control on dairy farms.

Application of outdoor poultry production to international development work

The production systems described in this publication are useful not only for U.S. range poultry production but also for developing countries. A range production system can allow birds to gather much live protein in the form of insects and worms. Production systems in developing countries rely heavily on integration with other farm activities. For example, layers in Ethiopia are commonly pastured with cattle to aid in cattle parasite control. While the confinement system used by the conventional poultry industry can be efficient in feeding large numbers of people, it may not be as practical in places where adequate sources of grains and protein feedstuffs are lacking.

Ducks and geese provide insect, snail, and slug control.

- Guinea fowl, considered luxury food in Europe, are good foragers, controlling insects in pastures and gardens. Because of the noisy calls they sound when alarmed, guinea fowl and geese can also act as “watch-dogs.”

ATTRA can provide more information on turkeys, geese, weeder geese, ducks, guinea fowl, gamebirds, peafowl, capons, quail, pigeon, and ratites (ostrich, emu, and rhea).



A good community project.

PART III: NUTS AND BOLTS OF PRODUCTION

This discussion of the “nuts and bolts” of outdoor poultry production applies to any of the production systems discussed above, and many comparisons will be made to confinement production in the conventional poultry industry. It is important for range poultry producers to know the facts of confinement production. For one thing, that knowledge will help in their marketing of alternative poultry products. Also, much of the conventional information is “cross-over,” applying to range systems as well.

HOUSING DESIGN

Poultry housing should provide protection from cold, rain, wind, and hot sun, and provide heat during brooding. Housing should also provide protection from predators, as well as good ventilation to remove ammonia, humidity, and carbon monoxide. Many innovative housing designs are used in range poultry production.

There are many types of field pens. Roofing is flat, peaked, domed, or hooped. Building materials include wood, PVC, rebar, electrical conduit, and bamboo. Portable and stationary housing designs and materials also vary tremendously. The “best” type of construction and material may depend on your skills (e.g., whether you can weld). There are both floored and floorless designs. Some have multiple popholes; others have entire sides that open up. Housing usually provides at least 1 square foot per bird, with the birds spending much of the day outside in good weather. Building materials need careful consideration for certified organic production; no treated wood can come in contact with the animals. Most portable housing needs to be staked or weighted down in strong winds. Insulation may be needed in roof and side walls in cold areas. Roosts will help keep layers clean and dry.

Multi-use housing is preferred by producers with diversified farms. A poultry hoop house can also make a good shade hut for sheep or winter storage for hay. Andy Lee uses greenhouse bows and a 22-mil woven poly cover with chicken wire on the ends. Some hoop houses are designed to use solar energy in winter. For example, Joel Salatin uses double layers — a shade cloth and a clear tarp. The shade cloth can be removed to

make a solar greenhouse during winter. Salatin uses a hoop house made with steel bows from the Brower Company (26). Tim Shell, on the other hand, saves money by using a single white 20-mil woven polytarp from Northern Greenhouse (27). It provides sufficient shade in summer but lets in light in winter. Shell (17) can provide hoop house construction plans. Shell has started using an 8' x 16' Winkler hoop house kit (28). He believes it's the most economical option (under \$1,000), and says it can be assembled in two hours.

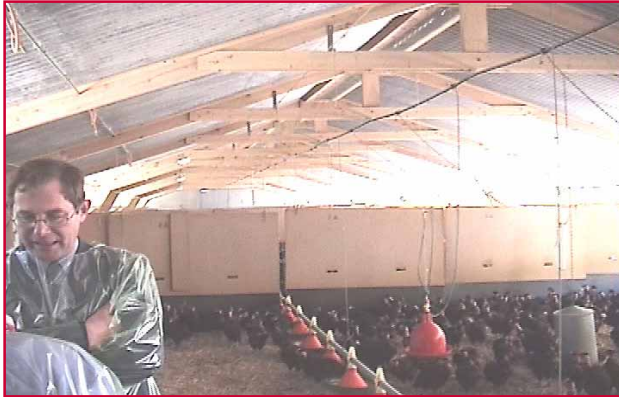


Salatin Hoophouse.

The conventional poultry industry has done many housing studies. Although these were done with confinement production in mind, the information is useful for range poultry housing. Environmental control may become a useful feature in range housing. Conventional textbooks such as *Commercial Chicken Production Manual* (29) and Extension materials describe the use of insulation in roofing material, ventilation in houses, and convection cooling from air flow. Good ventilation provides fresh air while avoiding unwanted drafts. Natural ventilation is used in range poultry housing; open-sided housing and ridge vents allow heat to escape from the roof. Forced-air ventilation is common in the conventional industry, using fans, air intakes, and exhausts, often combined with evaporative cooling pads. Air is exchanged every minute in a house with forced-air ventilation.

See ATTRA's *Range Poultry Housing* for more details on design, construction plans, building materials, and alternative wood treatment reci-

pes. Most designs are movable. Small-scale poultry production books such as *A Guide to Raising Chickens* (2) have details on small stationary house construction (the familiar chicken coop).



In France, dividers separate the birds into small flocks. Access to outdoors is provided.

LIGHTING

Natural lighting is typically used for broilers in range poultry production. In contrast, the conventional industry uses constant artificial light (24 hours a day) or intermittent lighting to encourage feed consumption. Light intensity is kept fairly low—0.35 to 0.50 footcandles—for broilers, to reduce activity, piling, and cannibalism. The light level is just enough for a person to read by.

Turkeys originated in North America (Mexico) and therefore are sensitive to daylength (photoperiod). They are stimulated by increasing day length to reproduce in the spring. Decreasing daylength stimulates them to replace their feathers (molt) in the fall in order to have a new set for the winter.

Chickens originated near the equator where the photoperiod varies little year-round. They are not as photosensitive as turkeys but they are still somewhat so. Both conventional and many range chicken egg producers use artificial lighting to stimulate production during days of declining natural light, resulting in a more constant supply of eggs. Electrical, solar, and battery-powered lights are used. Extension publications and small-scale poultry production books are good sources of information on proper lighting for pullet and layer development.

The wavelength of the light is related to bird activity. Long wavelengths (red, orange, and

yellow light) stimulate sexual activity, which can lead to aggression. Fluorescent lighting is short wavelength lighting and does not stimulate sexual activity; incandescent lighting is long wavelength lighting.

LITTER AND COMPOSTING

Litter dilutes manure and absorbs moisture, provides cushioning and insulation for the birds, and captures nutrients for spreading where you want them. Litter also protects wooden flooring from getting wet and rotting, and is sometimes used directly on the ground of floorless buildings. However, handling manure and litter by hand is very labor-intensive.

The conventional poultry industry uses rice hulls and pine shavings for litter. Other materials include recycled newspaper treated with boric acid, dried wood fiber, peanut hulls, and chopped pine straw. Small-scale poultry producers use other materials as well and have identified some problems: hay and straw become slimy; sawdust gets eaten by chicks; wood chips are costly, and hardwood shavings can put splinters in chickens' feet.

In the conventional industry, litter is spread 2 to 4 inches deep and maintained at 20 to 30% moisture. There is a 10-day rest period between flocks. Houses are cleaned out or at least de-caked once per year. After removal from the house, litter is usually spread on pasture.

Some range poultry producers are interested in the "good" microbes that may be present in litter and help induce immunity in birds, particularly during brooding. They do not clean out litter, and may depend on "bioprocessing" inside the house to digest and keep it at a manageable level.

To stimulate bioprocessing, producers encourage birds to scratch up and aerate bedding, often throwing in whole grains to encourage more scratching. According to Salatin, at a density of five square feet per bird, the bedding is fluffed and tilled up as fast as the birds manure—it does not cap or cake. Broilers are not as active in scratching up litter as older birds, and so rototilling may be needed. Also, moisture from water leaks can cap bedding. Using portable roosts inside can help even out the deposition of manure. Heat from bioprocessing is an advantage in winter housing. Biodynamic additives or EM

(Effective Micro-organisms) have been added to poultry litter to enhance bioprocessing and reduce ammonia. Call ATTRA for more information on EM or see <<http://www.emtrading.com>>.

Shell considers deep litter an opportunity for good manure stewardship, especially during the winter months when there is no growth of pasture, and nutrients from manure would be lost by being washed away or volatilized. Shell is interested in capturing the nutrients in poultry manure in a “carbon bank” and “investing” or spreading them on the farm where needed. Carbon helps absorb excess nitrogen. Litter from the houses has valuable nutrients and is spread on pastures or collected for gardens. Shell recommends a diverse mix of bedding materials: wood chips, leaves, sawdust, planer shavings, corn fodder, ground corn cobs, soybean stubble, hay chaff, spoiled hay, straw, peanut hulls. He removes litter infrequently, only once every couple of years.

Litter can also be composted after removal from the house. Composting will reduce odors and pathogens and improve the carbon-to-nitrogen ratio. According to ATTRA Technical Specialist Steve Diver, it also makes stable humates that may be less vulnerable to leaching. Composting litter is sometimes combined with offal from processing or mortalities; however, scavenging wildlife may interfere. ATTRA has information on farm-scale composting available upon request.

NET FENCING

While portable electric net fencing can be convenient and versatile, learning how to use it requires a significant time investment. It is important to mow the ground underneath the electric fence, or keep sheep or other ruminants there to graze beneath it, so that the growing forage doesn't short out the fence. Having the bottom of the netting close to the ground will help keep small birds in, but it

also makes the fence more likely to short out. Shell recommends a very hot fence and repeated testing. Train young birds with a small-mesh netting before switching to the lighter, larger-holed netting. Poultry need training because their feathers help insulate them from shock.

Stray dogs are not always deterred by netting, because they may jump over before they realize what it is. Wildlife are more cautious. Electric netting can actually “train” the predators to avoid it.

Two companies that make electric netting include Premier (30) and Kencove (31). Some producers prefer to buy the charger from Premier – Shell recommends the Intellishock 42b portable solar charger – and the netting from Kencove. Compass Fencing and Grazing Systems (32) offers a range of poultry netting. Electric netting usually comes in 150 to 165-foot rolls and costs about \$1 per foot. Netting may last two to five years.

Check the following features when choosing netting:

- The mesh spacing should be close enough to keep young birds in. A large-holed mesh can be used for larger birds.
- Posts with pins for treading-in are easy to place in the ground.
- Dry soils require a positive/negative charge.
- Good service by the supplier is important.

Shell is also pioneering the use of *non*-electric netting. He uses a plastic netting that is cheaper than electric and easier to use; there's

no need to learn electric fencing technology and no need to mow under the netting to prevent shorting out. The grass growing up just improves the seal. Tenax Corp. (33) is a supplier.

Layers and turkeys may escape over fencing. Turkeys, especially heritage breeds, may fly over five-foot-high fences. Therefore producers usually clip their wings by cutting several primary flight feathers.



OTHER FENCING

Perimeter fencing in extensive systems is usually for the sake of the ruminants and is built to keep them in and predators out. *Intensive* poultry systems also use perimeter fencing; it may be netting or another type of fence. Producer Jim Hawthorne (34) in Missouri uses net fencing in combination with three strands of electric wire.

Robert Plamondon's fencing is unusual: he uses only electric wires. "The best kind of fence," he says, "is going to depend on your goals, your land, and even your personal idiosyncrasies." He designs his fences to keep predators out, not chickens in. "A fence that 'leaks' chicken is not a big deal to me." He uses one electric wire at 5" off the ground to enclose chickens. He says that some chickens will still hop over the wire or duck under unless you go to a lot of trouble to eliminate high and low spots on pasture, but they do not fly over the electric wire. A second wire 10 inches off the ground will keep most raccoons out. "The predators content themselves with trying to pick off hens that have strayed past the perimeter, and stop chasing them if they recross the wire." He prefers low, step-over fences for ease of access. Fencing chickens *out* of a garden area involves different strategies. To exclude ruminants from poultry feeding areas, he puts the lowest wire 12 inches off the ground to keep sheep and goats out. Hens can come and go since they duck under wire if it is higher than their back.

Plamondon uses aluminum wire instead of polywire or steel. Aluminum is very visible to predators and to him. Polywire may be better if you need to rewind it back onto reels when moving fence. Plamondon just drags his wire when moving.

LAND MANAGEMENT

Chickens obtain limited nutrients from forage, while ducks, geese, and turkeys obtain more. Poultry can also obtain nutrients from seeds and live protein such as worms and insects — even mice and small snakes. However, when formulating rations, it may be best to assume zero contribution from pasture — it is difficult to know what nutrients will be supplied and in what amount. Winter production means less live protein on pasture.

Poultry do not "graze" in a particularly orderly fashion. It is important for forage to be young instead of long and rank. According to one producer, "chickens ignore vegetation over four inches high — all they will do is trample and poop on it." Salatin stresses the importance of ruminant grazing to keep the pasture short (about 3 inches high), instead of mowing, which can leave sharp points that hurt chickens' feet.

Producers who combine range poultry with ruminant production usually choose their forages and manage their pasture to meet the nutritional needs of the cattle, sheep, or goats. Many variables come into play in determining the "best forage" for your operation: soil type, pH, amount of rainfall, field fertility, crop history, type of tillage for seeding (broadcast over existing pasture for improvement, or complete tillage), size of pasture, and other planned uses of pasture, such as grazing other livestock or making hay. Contact your local Extension service to discuss options.

For certified organic production, there should be no synthetic chemicals applied to the land for three years.

A perennial polyculture pasture with multi-species legumes and grasses may be ideal. Pasture swards of diverse species are the most reliable for a wide range of conditions, from high moisture in spring and fall to the hottest and driest days in summer. A common recommendation with ruminants is "graze what you have" instead of re-seeding. This can also apply to systems that include poultry. Polyculture pastures are not created overnight — they require a few years of fairly intensive management — and they require ruminant grazing. The composition of the pasture gradually changes and improves.

Related ATTRA Publications:
[Sustainable Pasture Management](#)
[Rotational Grazing](#)
[Multispecies Grazing](#)
[Nutrient Cycling in Pastures](#)
[Assessing the Pasture Soil Resource](#)

SPECIALTY PASTURES FOR POULTRY

There is some interest in specialty pastures for poultry. In the U.K., for instance, there are special pasture seed mixes available for sheep/poultry pastures.

Much of the research done in the early- to mid-1900s on feeding forages to poultry is still applicable today. Plamondon summarizes his readings: "As for re-seeding, everything I've read points to oats as the ideal cool-season green feed, while ladino clover, alfalfa, and to a lesser extent other clovers are better summer feeds. My own experience with oats has been very favorable. Oats seem to do very well when broadcast by hand" (35). "In Ohio Experiment Stations in the '40s and '50s, ladino clover and alfalfa remained palatable throughout the summer if mowed occasionally. In fact, the Experiment Station published special rations for pullets on first-class pasture, with a protein level of only 10%. Pasture supplied the rest. (Note that this was growing pullets, not modern broilers. Results with laying hens were also pretty good, though)" (36).

According to Aaron Silverman in Oregon, poultry prefer broadleaf plants over grasses. He integrates poultry with vegetable production and runs poultry on the cover crops. He has found New Zealand white clover ideal, although expensive. It fixes nitrogen in the soil, is low growing, and does not require mowing. It develops deep roots that allow it to stay green during long dry summers in the West, but it does not form a dense mat that resists removal for planting crops or limits diversity in a pasture. And, he says, the chickens love it (37).

Grasses such as perennial and annual ryegrass and sudan grass can stay green in the long dry summers in the West, but poultry may not like them as much. Producers are also interested in millet and sorghum for their drought tolerance.

Dry pasture is an issue for western producers. Plamondon in western Oregon recommends mowing dry pasture to turn dead grass into mulch and reduce fire danger. He also finds that if the grass gets too tall, his hens do not range much. They "only move through a few tunnels through the grass to get to the feeders and waterers" (38). He has found that throughout the

summer, his eggs retain the deep orange yolks characteristic of birds on fresh pasture. He believes the layers find dandelions and other deep-rooted plants that stay green all summer. He is reluctant to place field pens on dry pasture because he's concerned that birds with only dry forage to eat could lead to crop impaction. Some producers in the West raise birds on irrigated pasture.

SHADE

Shade is an important consideration when pasturing birds. Some certification programs in Europe *require* shade, such as tree and bush plantings, for bird welfare and to integrate the poultry building into the landscape. Tall crops such as corn or sunflowers could also be planted to provide shade and additional feed. "Agroforestry" combines agriculture with forestry production. For example, woody ornamentals (dogwood, curly willow) could be planted for multiple uses, including shade. An orchard could be an ideal setting.

One U.S. producer provides shade with a portable shade/water wagon. A hay wagon is covered with a tarp, and waterers, supplied by a 200-gallon stock tank, are hung from the corners. Birds lounge under the wagon during hot weather and eat from movable feeders placed close by. The wagon is moved every couple of days to keep manure from collecting (39). The producer finds that the birds like the shade so much that it's hard to get them back into the house at night in the summer.

Fire ants on pasture can be a concern in the South, especially for field pens. However, one producer actually used layers to control the problem: "We put a cage of our Rhode Island Reds on our mounds and they dig them out and eat them with great gusto. The next day we move our cages and there's a hole where the ants used to be and they've never returned" (40). ATTRA has a publication on sustainable fire ant control.



Special shade units are built on range in France.

FEEDER AND WATERER DESIGN

Feed and water delivery are important parts of a range poultry production system, and depending on design, they can be automated to save labor. It can be difficult to automate feed and water delivery in portable housing or pens, but hauling five-gallon buckets of water and feed gets old. Some other considerations for delivery systems include adequate access of birds to feed and water, automation, regulating water temperature, sanitation, and avoiding spillage.

WATERERS

To improve their birds' access to waterers, French producers in the *Label Rouge* program keep water and feed both in the house and at locations on pasture. That way the birds do not have to run back to the house between mouthfuls of feed to get a drink. Water intake can be a limiting factor in bird growth. If birds cannot drink, they will not eat.

Water availability and delivery should be planned for weather extremes. Birds will not last long in hot weather without plenty of water. Water needs increase dramatically in hot weather and may increase the producer's workload. Two rules of thumb are: water consumption increases about 3.5% for each degree of temperature over 70°F, and water consumption over a 24-hour period is about equal to the age in days multiplied by 0.18 ounces. Because of the inactivity of Cornish cross, it is especially important not to place water too far from them in hot weather. Birds need less water in cold weather, but freezing can make winter watering a problem. Ideal water temperature is 70°F. Very hot water (above 86°F) or very cold (below 40°F) will decrease intake and slow growth.

Water quality should be tested regularly. Water from wells may have high nitrate levels and high bacterial counts because of runoff from fertilized fields. If the water is hard, minerals may cause blockages in valves and pipes.

Types of waterers include:

- Founts
- Hanging waterers (bell-shaped domes or "plasson" waterers)
- Trough waterers
- Cup and nipple waterers

Pan-and-jar waterers are a type of fount used for baby chicks in the brooder. Larger founts are used with older birds. Aaron Silverman uses a type of bell waterer ("low profile") that even very young chicks can drink from (41).

Bell waterers are often used in field pens. A five-gallon bucket is set on top of the pen with a gravity line leading to the bell waterer inside, which should be hung so that the rim is at the bird's shoulder height. As birds grow bigger, they may bump the bell waterers and slosh water out. Shell recommends keeping the water level in the bell low and filling the ballast completely to reduce sloshing. One bell waterer may be enough to supply all the birds in the pen during most of the year, except in the heat of summer. However, since the lines can get clogged, having more than one waterer is an important safeguard. During the hottest summer weather, field pen producers must usually refill the five-gallon buckets several times a day. One producer places feedbags over the tops of the buckets to block the sun and lower the water temperature.

Trough waterers use a suspension valve or float valve to turn the water off and on.

Brower Company (26) supplies many founts, hanging waterers, and trough waterers.

To increase automation of water delivery on pasture, water can be delivered via plastic water lines from a stock tank. Piped water saves labor and helps ensure a constant water supply. Delivery can be by gravity or by pressure from pumps. Bell waterers have plastic valves and cannot handle household pressure, but some trough waterers have float valves and can handle higher pressure (42). Above-ground systems like this can be dragged when pens are moved; however, they are subject to freezing in winter. Robert Plamondon and Karen Black in Oregon describe the system they use thus:

Our broiler watering system is fed by a 500-gallon stock tank at the top...of our property. Half-inch black poly tubing is the main line, fed via a bulkhead connector. We have t's at intervals, with a valve and a garden hose adapter. We run garden hose from the mainline to the clusters of houses, and there is usually an irrigation distribution adaptor to feed 2 or 4¼" drip tubing to the houses. The bell waterer tubing is just large enough to slip over the ¼" tubing; the

Little Giant waterers get a barbed-to-pipe thread adapter to connect them to tubing. (43)

Cup waterers and nipple waterers have the potential to automate water delivery in a house and can work off low-pressure gravity. Cup waterers are small drinking cups that are filled by a suspension valve or a trigger operated by the bird. Nipple waterers are also operated by the bird. Cup and nipple waterers reduce water use by preventing spillage, which also keeps the litter drier. Cup waterers and nipple waterers are placed at regular intervals on a water line and put water in easy reach; birds have only to move one or two body-lengths to reach it. Nipples should be placed at the bird's eye level. The height of nipple waterers needs to be adjusted as the bird grows; cup waterers are more forgiving and do not need to be adjusted as often (42).

Tim Shell has been a leader in using cup and nipple waterers for range poultry production. Since his house is stationary, it is especially important to avoid sloshing and the wet spots that would contribute to capping of his litter. Shell puts a 55-gallon drum in the house in the shade. He plumbs it with a float valve and gravity-feeds without a regulator. He uses a subsoiler to bury the black plastic pipe to keep the water cool in summer, and the reserve of water cools at night to lower the water temperature during the day.

I would recommend the nipples in two ten-foot joints hung down the inside of the house about two feet in from the walls.

They come pre-installed on 3/4 inch pvc pipe spaced 8" or 12" or 15" apart. I would go with the 8" and get the roaster nipple, it lets more water through. (17)

This would service 200 to 300 birds. He also uses courtesy waterers in the field. Shell has bought nipple waterers from Val Products (44) and G&M Sales (45); he has bought cup waterers from Georgia Quail Farm (46).

Robert Plamondon stresses the importance of the reserve tank when using nipple waterers especially if using *above-ground* black tubing. The water heats up in the tubing and will burn birds' mouths unless it is first mixed with a reservoir of cool water. Plamondon is also interested in cooling water tanks with aluminized bubble wrap for insulation.

Commercial Chicken Production Manual recommends one bell waterer per 63 broilers (45 roasters), one eight-foot trough for 250 broilers (167 roasters), and one cup or nipple per 10 broilers (seven roasters) (29).

Sanitizers are used in the conventional industry to keep water lines clean. According to the *Ross Broiler Management Guide*, the conventional poultry industry chlorinates at 1 to 3 ppm. Range poultry producers have tried apple cider vinegar, chlorine, hydrogen peroxide, and Shaklee's Basic H to help limit algae growth in water buckets and tanks. Lids on buckets help keep out bird droppings, and screens filter out bugs and debris. Plamondon suggests making the buckets dark to prevent algal growth or wrapping them with aluminum foil and clear packing tape.

FEEDERS

Types of feeders include:

Hand feeding

- Shallow pans for brooding
- Trough feeders
- Hanging feeders

Automated feeding

- Conveyor-and-pan
- Trough-and-chain.

Hand feeding is labor-intensive. Shallow pans are needed for tiny chicks in the brooder; the lid of a cardboard box works fine.

Trough feeders are long feeders that come in many sizes and styles. Some have flip-tops, others have a bar on top to unseat birds that try to roost on them (droppings would dirty the feed).



A bulk feeder for turkeys at Beck-Chenoweth's farm in Ohio.

In field pens, 5-foot feed troughs are commonly used for 90 birds. Some producers fill the feeders twice per day toward the end of grow-out when birds are big (47). Those using field pens usually have to remove the feeder first to move the pen, adding additional labor, unless they are able to attach the feeders to the pens as “sidewall feeders.”

According to Robert Plamondon, one problem with trough feeders is that you need several sizes for birds as they grow. It can be difficult to find large trough feeders. Brower (26) has vinyl feeders 4.5’ long x 4” tall x 6” wide that hold 35 lbs., partially full. The old galvanized type can be found used (48). Kuhl Company (49) has both 50-pound and 300-pound-capacity shielded range feeders.

There are many possibilities for homemade trough feeders, such as recycled rain gutters with capped ends. Andy Lee cuts a 20-foot PVC well casing in half lengthwise; each side holds three 5-gallon buckets of feed and can serve 150 large broilers. Shell (17) offers the following recommendations for using PVC feeders: cut only one-third off the top of a 4-inch pipe, use anti-tip sticks, cap the ends, and drill half-inch weep holes at both ends to let rainwater out.

Using large bulk outdoor feeders can reduce labor. They are easier to fill because you can back a pickup to them and dump in feed. Some large feeders even have skids so they can be dragged. Plamondon’s feeders hold two to four weeks’ worth of feed – 550 lbs., delivered by truck to the field. Joel Salatin’s feed sled holds 1 ton of feed.



A portable feed bin.

Wet feed is a concern when feeding outdoors. If feed gets wet, it can harden and be difficult to remove. Some producers allow wet feed to freeze in winter and feed on top of it. Some bulk feeders come with rain shields. Plamondon uses old turkey range feeders with waterproof lids on top and rain shields above the pan. Similar feeders are made by Shenandoah (50). Rain shields can be made from light-gauge sheet metal. Shell doesn’t worry about rain on the feed. He recommends regulating feeding so that there is only a 1% residue left daily. Since birds will be cleaning it up every day, it won’t have time to spoil. And he finds birds actually like wet feed (51).

Hanging feeders are traditionally tubes with a round base. Some tube feeders also have rain shields. Since hanging feeders are off the ground, they cannot be tipped over by the birds. An advantage of hanging feeders is that they can be lifted higher as the birds grow. Feeders should be at the top of the backs of the chickens to keep them from wasting feed by slinging it to the ground.

Feed wasted by spillage is common in feeders filled by hand; wind also blows fines out of the feeder. Feeders should be filled only half-full. If feed is spilled, encourage birds to clean up the residue by moving the feeder daily before the birds have a chance to dirty the feed on the ground with their manure (17).

Adequate feeder space is important so that birds can get to the feed. According to *Commercial Chicken Production Manual*, birds need 2 inches of trough space each through the first 5 weeks, 3 inches to 7 weeks, and 4 inches beyond 7 weeks. For troughs that are accessible from both sides, divide the length requirement by two. When tube feeders are used, 20% less feeder space is needed than the above recommendations (29). Broiler breeders on a restricted diet require 6 inches per bird (52).

Make sure the feeder is large enough to hold the amount you need to feed daily. The conventional industry’s rule of thumb for broiler feed consumption is 2 times the body weight: A 5-pound broiler eats 10 pounds of feed during its life. Broilers are generally full-fed – there is no restriction on the amount of feed they get. If you regularly allow the feeder to become empty, there may be a frenzy at feeding time. Hungry birds will climb over each other to get at feed, result-

ing in scratches that can get infected and need to be trimmed or discarded at processing (17). Since not all the birds will be able to eat at once, only the most aggressive will get enough feed, and growth will not be uniform. If feeders do not run empty, there is no frenzy and no need for all birds to have access at one time (53).

Some producers *intentionally* restrict feed because they are limiting growth (i.e., for broiler breeders). They have sufficient feeder space for all birds to eat at once. Shell makes a raft of PVC pipe feeders. If you are exclusion-feeding to keep ruminants out, make sure your whole flock can fit in the feed area. In his usual spirit of innovation, he has considered feeding pellets and whole grain in the grass.

Few U.S. range producers are using automated feed systems such as conveyor-and-pan and trough-and-chain. However, these feeders can provide a uniform distribution of feed throughout a house. They can be adjusted to the proper level as birds grow. In French free-range production, automated feeding is commonplace in stationary houses, and bulk feeders are also placed on pasture.

Feed should be used within four weeks of milling to prevent nutrients from deteriorating (2). Store feed off the floor and away from moisture. Many small-scale producers use clean plastic trash containers; larger producers may use bulk bins on wagons in the field. Stationary houses may use a feed bin on a pad.

BROODING AND TRANSITION TO PASTURE

Chicks need to be brooded after hatching to prevent chilling until they are fully feathered. They also need protection from predators. The temperature at the start of brooding is 95°F and is reduced by 5°F every week for 2 to 4 weeks. Books and Extension publications are excellent sources of general brooding information. After brooding, birds are moved out to pasture.

BROODING SET-UPS

Brooding can be “cool-room” or “warm-room.” Cool-room heats a localized area with heat lamps or a large pancake brooder. Warm-room heats an entire room with space heaters. The conventional industry often does “cool-room” brooding in a large house using pancake

or infrared brooders; birds are confined with brooder guards or cardboard curbs. Pancake or infrared brooders are sometimes called “hovers.” They are usually umbrella-shaped and use electric or gas heat. Most range poultry producers use the cool-room method.

Small-scale poultry producers brood in a variety of set-ups. Heat lamps are generally used above a box that confines the chicks close to the heat source and reduces drafts. Litter covers the floor. Sand can be used but is not useful for composting later as shavings are. The box is usually placed in an outbuilding. For more birds, more or larger lamps are used and the chicks are confined in a larger area such as a small brooding house. Some producers brood in a greenhouse.

Plamondon has an interesting description on his website <<http://www.plamondon.com/brooder.shtml>> for an electric-lamp brooder in a wooden hover. It was developed in the 1940s by the Ohio Experiment Station and was popular for small commercial flocks.

Small-scale producers sometimes use brooder boxes. These are individual boxes that contain their own heating element, feeder, and waterer. Some are floor brooders that are placed on litter. Battery brooders are brooding boxes stacked on top of each other to save space. They have wire floors. Hatcheries such as Murray McMurray (54) sell brooder boxes and battery brooders. It may be possible to find older used battery brooders.

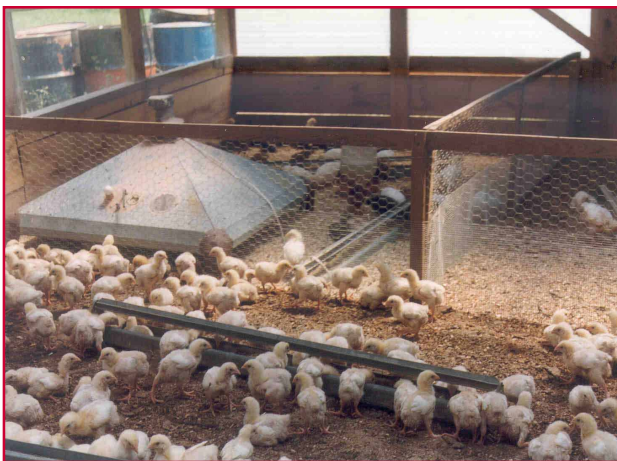
After brooding, transition to the field is a concern. In the spring and fall, producers may brood birds up to three or four weeks before moving them to grass. In the summer, birds only spend a couple of weeks in the brooder and may not be fully feathered when they go to pasture. With field pens in particular, young birds can be chilled, especially by contact with wet ground.



Chicks being moved to pasture in a field pen.

Adaptations can be made to houses to ease the transition. Aaron Silverman in Oregon has built a run onto the side of his brooder house. A sheltered roosting compartment in a field pen or straw for extra warmth can be useful before releasing birds to pasture. Wire-floored sunporches were used in the past. Some were even positioned above the grass to allow the birds to eat some forage.

Total field brooding holds potential. Robert Plamondon believes that the potential exists to brood from day one in a *portable* brooder house in the field, if appropriate heat sources are used, such as small propane hovers. “The U.S. models are all enormous 500+ chick brooders, but the British Maywick brooders seem to be available in sizes that can be throttled back to a reasonable level of heat for a small flock. They have a U.S. distributor. (My experience with using hundreds and hundreds of feet of extension cords to run heat-lamp brooders has not been encouraging)” (55). David Schaffer (15) in Kansas has used a propane brooder in a hoop house on pasture, but the propane lasts for only three days. After that, he uses body warmth of the flock for heat (500 chicks). The hoop house has flaps that enclose chicks but some wriggle through to the pasture at three days old. Advantages included not having to move chicks after brooding and putting chicks on pasture sooner. However, with field brooding it is more difficult to closely monitor the chicks.



Salatin brooder.

WEATHER

Weather is the big variable for outdoor poultry operations. Year-round production systems

can be planned for hot summers, cold winters, and prolonged periods of wet ground. However, seasonal production systems provide less shelter and are more vulnerable to drastic, unexpected temperature swings, storms, and winds. Strong winds can chill birds and overturn pens and houses that aren't staked down.

WINTER PRODUCTION

Range layers are often overwintered. Layers can handle cold weather fairly well as long as they are dry, but wet conditions are a problem. Some housing for range layers is heated in the winter, but unheated housing is also common, even in the North. Many producers rely on the heat that layers generate together at night. Field pens are generally not used for winter, but some producers have tried to winterize them for layers by wrapping plastic around the pens. Pens are hard to move in the snow and would require litter. Bales of hay can be added to enclosed housing to help insulate the birds. Temporary winter quarters can actually be built from straw bales.

Measures need to be taken to prevent water from freezing, and warming the water will help production. Birds may not drink water if it is very cold. Some producers are content with dumping a frozen bucket of ice out every morning and refilling it with fresh water. A heated metal platform can be used to warm the water; one producer recommends using a metal waterer rather than a plastic one because metal heats better. Heat cables or heater tape can also be used to keep water from freezing. Some producers do not provide water if there is clean snow.

Although the goal of seasonal producers may only be *survival* of the birds during winter, the goal of year-round producers is continued *production*. They want the birds to keep laying well. U.S. range producers usually do not raise broilers in winter, but there is interest in range production systems and housing that will allow year-round production.

Enclosed housing, such as hoop houses, is important to continue broiler production in winter. In the past, houses were designed with open ends in order to draw them together in a row in winter to make servicing multiple units easier during a time when birds do not venture outdoors as much. For areas with long winters, more floor space is required, since birds stay indoors. Some houses are designed to capture solar en-

ergy in winter. Bioprocessing litter can also add warmth.

Winter Production Issues

- Birds do not have green forage and insects to eat in the winter but there are still advantages to outdoor access in winter, including exercise and fresh air. Birds may venture out in snow if it has a layer of straw or is beaten down by other animals.
- Hauling thawed water through snowdrifts can be a problem for producers.
- Frozen ground makes using net fencing difficult in winter; it gets hard to push the posts into the ground.
- In unheated housing, eggs can freeze. Some producers collect every two hours to prevent freezing; some heat the nestboxes.

Wintering Case Study

Joel Salatin uses a stationary hoophouse for layers in the wintertime in Virginia. Although the 20' x 120' hoophouse is unheated, bioprocessing in the litter provides significant warmth. The temperature of the house reaches about 70°F even on cloudy winter days.

PREDATORS AND PESTS

Predator control is an important consideration in range poultry production. Most predators are nocturnal (raccoon, opossum, weasel, owl, etc). Daytime predators are mainly stray dogs and hawks. It is important to identify the predator affecting your flock so you can control it. Nocturnal predators can be controlled by shutting the birds in houses at night, as long as the houses are predator-proof. During the day, stray dogs can be controlled by fencing. Other predator controls include moving the house frequently to keep predators off guard, grazing on short-grass pasture which predators do not like to cross in the daytime, keeping housing away from wooded areas, keeping the housing close to your residence, grazing birds with cattle or other large animals, and using guardian animals. Flashing red lights mounted on posts have been developed by pheasant producers in Minnesota to discourage night-time predators. Robert Plamondon comments that, in his losses to predators, he has

not noticed plumage color to be a factor (56).

However, there is no proven control for aerial predators such as hawks and other raptors during the day. Some producers have a lot of predator pressure and lose several birds per day to hawks; others lose only a few per year. Bald eagles wiped out a range turkey operation in Wisconsin; spectators came to view the eagles.

Young Cornish-cross broilers are not known for seeking shelter from raptors. Older roosters may be able to sound an alarm and teach young broilers to seek shelter. If the broilers seek shelter but cannot get there in time, wider doors or wider eaves on housing might help them. Tall crops like corn and sunflowers can also help. Breeds other than Cornish cross may seek shelter more readily. Young birds are sometimes kept in the safety of a field pen until they are larger and less likely to be preyed upon by raptors.

Other aerial predator controls include the use of overhead netting, like the type used for fruit trees; however, it is impractical in many range production systems. Producer Jim Hawthorne believes portable radios and realistic scarecrows are helpful. One Alabama producer uses low eaves on his house to deter hawks – panels at the bottom of the sides open like clamshells. Producers have even strung CDs to flash reflected light at raptors. Hawk control in the past included a trap on a post or an electric shock on top of a post. Today, it is likely to be illegal to trap hawks; check your state and local regulations first. You may be able to trap them in a leg trap without crushing the leg. (One producer recommends padding the jaws and welding a piece of iron to them so the trap does not close all the way.) Then you can haul the raptor to another location; however, hawks may return. Call the local USDA-APHIS office and ask for the local federal trapper. The trapper may have suggestions and can also remove the animals.

Rodents such as rats may be a problem, especially in stationary houses. The space between the ground and a raised floor provides a darkened airspace and nesting sites. Make sure the floorspace is one foot or more above the ground so rodents do not feel protected (57).

MORTALITY

Mortality can be high for beginning range poultry producers – as high as 30% – because

of brooding problems, weather, crushing of birds when pens are moved, and predation. After a producer has several seasons of experience, mortality is much lower.

POULTRY BEHAVIOR

In addition to their needs for physical shelter and feed and water, poultry have behavioral needs that should be considered in production. These include eating, drinking, and foraging behaviors; social behaviors such as flocking, aggression, dominance, feather picking, and cannibalism; reproductive behavior; egg laying behavior, including timing of laying and nest-site selection; as well as dust bathing, pecking and scratching, and roosting (8).

ECONOMICS

Range poultry can provide supplemental income on a small scale. Many producers raise about 1,000 birds per year and report that they are easy to direct-market. You can get in with a low initial investment – under \$1,000 if you find some of the processing equipment used or make it yourself. Most producers sell meat directly for about \$2 per pound and are able to net about \$2 to \$3 per bird. When farmers start out with their first batch of birds, hourly earnings may be very low. However, as they gain experience and their efficiency increases, hourly earnings also increase. University of Wisconsin studies show an experienced farmer can earn nearly \$10 an hour (58). Eggs provide a particularly good cash flow – you have something to sell every day.

For production budgets detailing income and expenses for both small and larger-scale production, see *Growing Your Range Poultry Business: An Entrepreneur's Toolbox*. In addition, the *Toolbox* can help you study the feasibility of a start-up or expanded enterprise or to plan a business such as a small processing plant. It takes you through a marketing plan, production plan, and using an income statement to determine whether your enterprise will be profitable, as well as a cash-flow plan to determine whether you can afford to do it.

PUTTING IT ALL TOGETHER

The title of this ATTRA series is *Sustainable Poultry*. Sustainable agriculture refers to agriculture that is environmentally sound, economically viable, and socially just. Broad knowledge is needed for successfully raising small commercial flocks. The main considerations include:

- **Environmental.** The re-integration of livestock with the land base is a key concept of sustainable agriculture. When feed is produced on the farm and manure recycled back to crop fields, nutrient cycles are closed.
- **Economic.** You should be profitable unless you have planned for it to be a hobby or intentionally subsidize it from other farm operations; otherwise you will not remain in business and will not be able to make a positive impact on your community and environment.
- **Social.** Agriculture is increasingly more consumer-oriented as more consumers make conscious choices about their food and how it is raised.

Help us better help farmers. If you have suggestions for improvements in this publication or for sources of information on sustainable poultry production, please call Anne Fanatico at 1-800-346-9140, or email her at <annef@ncat.org>.

An important resource for networking and information is the American Pastured Poultry Producers Association (59).

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