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An Introduction to Natural Farming Poultry Production in Hawai'i, the Wave of the Future

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Introduction

In the wake of domestic and world events over the past decade, the perspective of agriculture in the geographically isolated state of Hawai'i has finally begun to focus on attaining self-sufficiency and assuring food security while preserving Hawai'i's unique and limited natural resources. Conventional livestock production as currently practiced, however, precludes achievement of these objectives without addressing effective pollution-prevention plans, cost of importing commercial feeds, and the ability to provide consistent quantities of product for the local market. Without imminent solutions, local supplies of fresh meat, milk, and eggs will continue to decline, necessitating further reliance on imported food. One sustainable alternative to conventional production is "Natural Farming," which incorporates the use of indigenous micro-organisms (IMOs). This fact sheet provides information on the sustainability characteristics of a Natural Farming poultry production system for egg and meat production with affordable housing, a compliant waste-management program, and practical management schemes that producers can use to help get the birds off to good start.

Self-Sustainability

Over the past 40 years, Hawai'i has shifted its economic base from sugarcane and pineapple to tourism; consequently, the value of agriculture has dangerously eroded. Food production is given lower priority in the allocation of finite land and water resources than housing and production of non-food crops. Agricultural inputs (feed, fertilizer, stock animals) were cheaper to import than produce locally until oil prices hit historic highs. Many livestock-support industries, such as slaughterhouses, feedlots, feed mills, processing plants, tropical feed production, are no longer in business. Reliance on food imported at costs lower than it can be locally grown has driven many local farmers out of business. However, Natural Farming practices can aid the Islands in attaining self-sufficiency and assuring food security.

Pollution-Prevention, Waste-Management, and Nutrition

Under "intensive" livestock production, animal waste is viewed as a liability that can impact surface water and groundwater, air, and soil, resulting in ecosystem disruption and negative health and aesthetic outcomes. Improper waste management can also generate flies, rodents, odors, and other nuisance and health concerns. The Clean Water Act and Coastal Zone Management Initiatives require BMPs that will protect Hawai'i's unique island ecosystems and conserve its limited natural resources.

Another issue is the need for locally produced animal feed that is nutritious, economical, and available in sufficient, consistent quantities. Livestock producers are still in search of alternatives to imported animal feeds, which account for up 80% of operations.

One alternative to conventional production that addresses both these issues is Natural Farming, which has been practiced in Japan for generations and has since been adopted in many Asian countries, such as South Korea, Mongolia, China, Thailand, Vietnam, and Philippines. This system pairs well with raising pigs and poultry.

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Natural Farming incorporates use of indigenous micro-organisms (IMOs) into livestock production. For more information about these, please refer to the CTAHR publication "How to Cultivate Indigenous Microorganisms," BIO-9 (Park and DuPonte 2008), available free of charge at http://www.ctahr.hawaii.edu/oc/freepubs/pdf/BIO-9.pdf. IMOs are incorporated into a green-waste litter at the base of poultry housing, forming a dry, leach-free waste-management system. This process promotes fermentation and composting of organic matter, including animal waste, green waste, and agricultural by-products, which is in compliance with nutrient-management regulations that protect the environment. The IMO-composted litter can then be converted to compost, which can be used to produce plant material to be used for livestock feed.

Housing

Natural Farming facilities require inexpensive construction materials such as galvanized or plastic roofing, chicken wire, bare dirt or concrete flooring, and green waste or straw bedding inoculated with lactic acid-producing bacteria and IMOs to initiate the composting process of the manure. Energy requirements are very low because ventilation, drying, and cooling are provided by strategic positioning of the facility to optimize solar and wind energy. These facilities are essentially odorless and fly-free and do not discharge wastewater or runoff. IMO populations, solar drying, and adequate ventilation of the litter deter fly and odor production. After 1 year, up to one-half of the composted bedding can be removed and used to sustain integration of plant (vegetables, fruits, animal feed) and animal production.

The Hubbell Bubble Natural Farming Chicken Coop

Materials List

Amount	Item
20	2 x 4 x 12' boards
1	2 x 6 x 12' boards
6	1 x 3 x 12' boards
1	Stanley staple gun
1	Staples T50
1 pkg (3-pack)	3.5" door hinges
2 rolls	2' x 25' poultry wire net

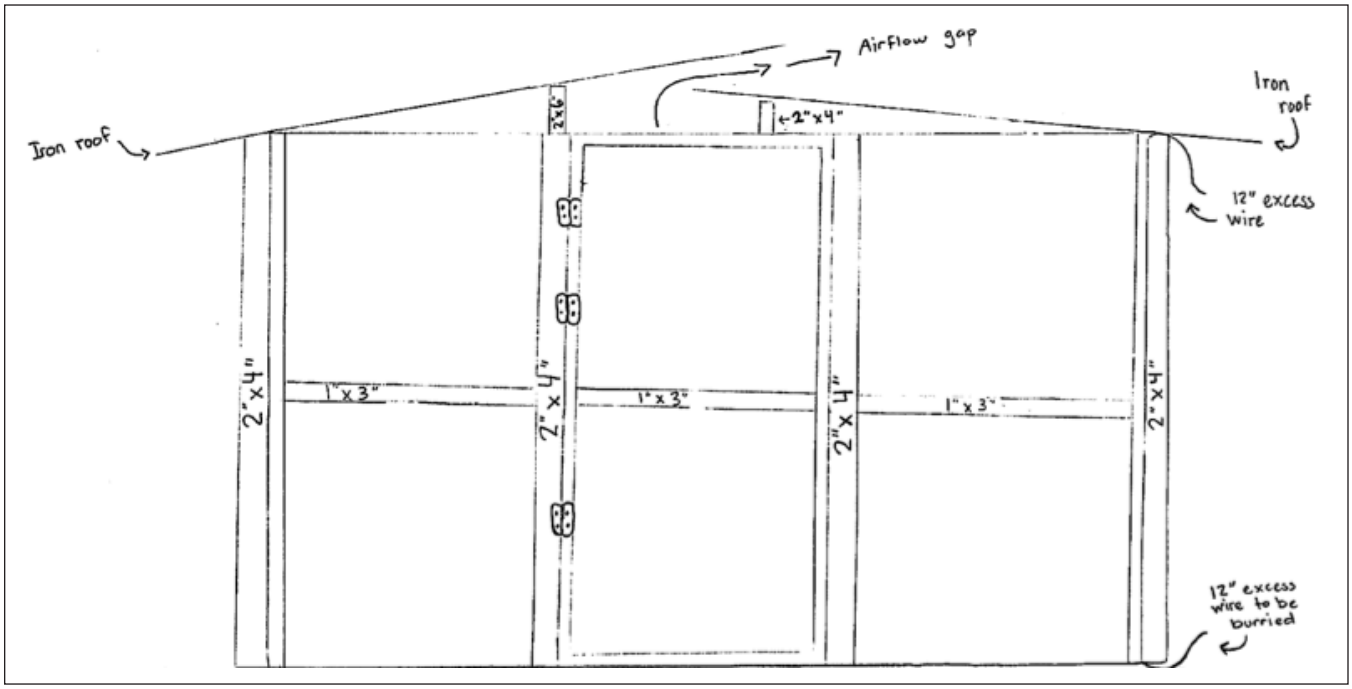

Figure 1: Hubbell Bubble Coop diagram by Keala Cowell

2 rolls	**4' x 50' poultry wire net OR 1 roll, 6' x 100'**
1 box (100 pieces)	**3" wood screws**
1 box (100 pieces)	**2" wood screws**
1 box (100 pieces)	**2" roof screws**
1	**Wire cutter (optional)**
1	**18V Compact Cordless Impact Driver (optional)**
12	**8' 24-gauge galvanized or plastic rooftop standard**
1	**5-gallon plastic bucket with cover**
4 pkgs (6-packs)	**24" Suntuf Horizon plastic closures with Woodtite fasteners**

Specific Cuts

Take eight 2 x 4 x 12' boards and cut in half
Take two 2 x 4 x 12s boards and cut two 44" pieces and two 68.5" pieces for door
Note: Leftover 2x4s will be used for door braces

Instructions for Constructing the Hubbell Bubble

1. Buy or gather all listed materials.
2. Cut eight 2 x 4 x 12' boards in half to make sixteen 72" pieces.
3. Lay out frames as in plan (Fig. 1), predrill for screws and assemble walls.
4. From two 2 x 4 x 12' boards, cut two 68.5" pieces and two 44" pieces.
5. Predrill and assemble door as shown in plan.
6. Screw door hinges in place. Hang door.
7. Use two leftover 2x4 pieces, cut at 45° angle, for braces for door.
8. Measure frame from top down at 3-foot level and mark all around building.
9. Wrap first roll of chicken wire around top of frame tightly at the 3-foot line.
10. Staple chicken wire to frame, leaving 12" extending up from the top of building.
11. Cut corners at top of frame with wire cutters so wire can be bent in or out of the building.
12. Wrap second roll of chicken wire around bottom, again leaving 12" extending below frame (this will later be buried for rodent control). Cut wire at corners so wire can be wrapped around building, and staple chicken wire to frame.
13. Make opening for door by cutting along edge. There is no need to cut the wire along the side of the door that is hinged.
14. Close off spacing at 3-foot level between rolls of chicken wire with leftover tie wire.
15. Secure three 1 x 3 x 12' boards on the outside of house at the 3-foot level with 2-inch screws.
16. The fourth 1 x 3 x 12 will need to be measured and cut to into 3 pieces to fit the opening of the door.
17. On the inside of the building, staple chicken wire to the 1 x 3 x 12's.
18. Extend one 2 x 6 x 12 and one 2 x 4 x 12 across top of frame to support the pitch of the roof. Use 3" wood screws to fasten to main frame. Both pieces should stand on top of frame as in plans.
19. Using 2 galvanized *or* plastic roofing position the roof in the center, with equal overhang at each side.
20. Attach woodtite fasteners and roof with 2" screws, being sure to have only one corrugation (ridge) overlap between roofing irons.

Setting the dry litter floor system for Natural Farming poultry house

1. 3"-thick layer of dry green waste (sawdust, hay, or straw)
2. Inoculate with IMO-4 as a light top dressing at 1 pound per 30 square feet
3. Spray with a 1:1000 Lactic Acid Bacteria (LAB) solution to activate.
4. The system does not need to be cleaned; however, if you want to use the compost, you can remove up the one half of the spent litter and replace with new green waste after a year. You do not need to re-inoculate.
5. If litter becomes wet due to rain and goes anaerobic and starts to smell, spray litter with 1:1000 LAB solution.

Choosing Chickens

When choosing a breed of poultry, considerations include the number and color of eggs produced, the breed's temperament, its noise level, and its adaptability to confinement. Table 1 gives a list of the more popular breeds in Hawai'i and their salient characteristics.

Starting Chicks

In a Natural Farming System, newly hatched chicks do not go directly into the chicken coop. During the first month an enclosed structure called a "brooder" is needed in order to maintain temperature regulation, water, and feed. In the case of broilers, the chicks are maintained in the brooder for nearly three weeks until they are sufficiently feathered to withstand climatic conditions. On the other hand, layers should remain in a brooder until 5 to 6 weeks of age, since the first couple of weeks will determine the long-term survival, health, and development of the flock. The brooder should be prepared at least 24 hours before receiving chicks.

Making a brooder and setting it up: The brooder can be made from a large cardboard box, plastic tote/storage box, water trough, or plastic kiddie swimming pool (see Figure 1). If you're handy and would like to construct a wooden box, that will also work. The size of the brooder will depend on the number of chicks; generally, around 1–1.5 sq. ft. per chick is considered adequate. When using containers with low sides, such as a kiddie pool, it's

Figure 1. Brooder; picture courtesy S. Fox

Table 1. Popular Poultry Breeds in Hawai'i

Breed	Origin	Color	Purpose	Mature-Weight Hen	Mature-Weight Rooster	Eggs/Week	Egg Size - Color
Rhode Island Red	Rhode Island	Rust-colored	Dual Purpose	6.5 lbs	8.5 lbs	5	XL - Brown
New Hampshire Red	New Hampshire	Chestnut red	Dual Purpose	6.5 lbs	8.5 lbs	3	L - Brown
Leghorn	Italy	White	Egg-laying	4.4–5.1 lbs	5.3–6.0 lbs	4	XL - White
Ameraucana	United States	Multi-colored	Egg-laying	5.5 lbs	6.5 lbs	3	M - Lt. Blue
Araucana	Chile	Multi-colored	Dual Purpose	5-6 lbs	6-7 lbs	3	M - Lt. Blue
Orpington	England	Multi-colored	Dual Purpose	7.9–10.6 lbs	7.9–10.6 lbs	3	M - Brown
Australorp	Australia	Black/Blue/White	Dual Purpose	5-6 lbs	6–7 lbs	5	L - Brown
Plymoth Rock	United States	Multi-colored	Dual Purpose	6.6–7.5 lbs	7.5–9.5 lbs	4	L - Brown/Pink
Silkie	Unkown	Multi-colored	Ornamental	2 lbs	2.25 lbs	3	S - Tinted/Cream
Wyandotte	United States	Multi-colored	Dual Purpose	6 lbs	8.5 lbs	3	M - Brown

best to make a taller "wall" by wrapping chicken wire or a cardboard wall around your container to keep chicks from climbing over and fleeing the brooder. As birds become older and start to become more mobile and to fly, adding chicken wire or a mesh cover over the top of the brooder is prescribed to prevent birds from escaping.

The brooder bedding/litter: The bedding for your homemade brooder should be an absorbent litter such as untreated pine wood shavings, ground-up corncobs, shredded paper towels, straw, or other similar materials, inoculated with IMO. Do not use cedar, treated wood shavings, or flat slick-surface newspapers when raising chicks, since baby chicks have difficulty getting their footing on slippery surfaces, and these can lead to permanent leg deformities called splayed legs. After choosing a bedding type, fill the bottom of your container 2"–3" deep with the litter and inoculate with a 1:1000-dilution LAB spray.

The heat source: The brooder ought to be heated to prevent chilling when raising baby chicks. A simple solution is a standard heat lamp with a 250-watt bulb and a thermometer (see Figure 2). The temperature for baby chicks' first week after hatching should be approximately 95 degrees; gradually decrease the temperature by 5 degrees for each week thereafter. To accomplish this, hang the heat lamp centrally over the top of the brooder, starting at approximately 18" above the floor (if using the 250-watt bulb). Adjust the brooder's temperature by raising or lowering the heat lamp as needed. The chicks will let you know whether it is too hot or too cold. If birds are all huddled directly under the lamp, they are too cold; simply lower the lamp. If birds are spread out at the edges of your brooder, they are too hot; raise the lamp.

Figure 2. Heat source; picture courtesy S. Fox

The feeder: The feeder in a brooder can be as simple as a shallow dish. However, the chicks will climb in it, scratch in it, poop in it, and possibly tip it over, and it could be quite mucky. There are a number of commercially made chick feeders that allow the chicks to eat but prevent them from messing their food. The size of a feeder will depend on the number of baby chicks. There should be enough space for all chicks to eat at the same time, so having 2 or 3 feeders spread around the brooder is recommended for a large number of birds.

The water source: The chickens' water source can also be a simple shallow dish or quart bottle cover; however, when raising chicks, fill dish with marbles or small pebbles to prevent hatchlings from drowning or getting too wet or chilled. The placement of water within the chicken brooder is important. Place water source close to the heat supply—not close enough that the water gets heated, since chicks do not like to drink warm water, but not too far away, either, since chilled chicks may not want to leave the heat to go drink. When familiarizing birds with the brooder, each chick should be introduced to the water supply by dipping its beak directly into the water.

Making a Self-Waterer for a Chicken Coop for Older Birds

Materials List

Amount	Item
1	5-gallon bucket with lid (make sure bucket has a handle)
3	Poultry water nipples with grommets (can be purchased locally)
1	11/32" drill bit and drill

Instructions

1. Drill holes in the bottom of the sealed bucket with an 11/32" drill bit. We suggest three holes, spaced at equal distance apart, for maximum efficiency.
2. When installing nipples, a rubber grommet should accompany each nipple. Place rubber grommet in drilled hole first, followed by the actual nipple. Wetting the nipple first eases the application. Apply pressure and push until nipple snaps into bucket. Three nipples evenly spaced per bucket are recommended (see Figure 3).
3. Hanging or fastening your drinker will depend on the location and application. We recommend using rope, cable, or chain and adjust hanging height for waterer to the size of the birds.
4. Fill with clean water and cover.

Birds will adjust quickly to a nipple drinker; however, one or two birds must be trained how to use it before others will learn. Once the nipple drinker is installed, tap the nipple to get some water on your finger and introduce the water onto a bird's beak. Repeat this a couple of times. Chickens are naturally curious and will be drawn to the orange color of the nipples or the glistening of the water. Once one bird learns, the others will follow suit. The bucket should hold water for several days but should be checked, refilled, and cleaned periodically.

Making a Simple Laying Box

Materials List

Item
Ruler
Medium-point permanent ink marker pen
Box cutter
Tall 18-gallon plastic tote bin with cover
Straw

Instructions

1. On longer side of tote, mark an 8.5"x 8.25" rectangle using ruler and pen.
2. Using box cutter, cut out door by following lines drawn on plastic bin. Remove cut rectangle.
3. Open cover of bin and fill with straw, replace cover.
4. Layer box is finished and can be placed where needed.

The basic purpose of a laying or nest box is to encourage hens to lay their eggs in a clean cubicle in relative peace and privacy. A properly built nest box assures that eggs are kept in a good environment for collection or hatching. Chickens are not particular about where they lay their eggs; however, a suitable nest box in which to

Figure 3. Self-watering system; picture courtesy Mike Hubbell

Figure 4. Homemade layer box; picture courtesy Julius Ludovico

lay eggs can make things flow more smoothly when you go to harvest eggs. Most chicken experts recommend an average of one layer box per five birds. Layer boxes need to be cleaned out and refilled with clean bedding periodically. Old bedding may be used as compost.

Feeding the Natural Farming Way

Chicken nutrition and feeding is an important part of production. Chicks through 8 weeks old require starter feed containing 20% protein; however, before introducing a commercial diet, day-old NF chicks are fed only uncooked grains of whole brown rice for three days. After the third day, dried bamboo leaves and commercial feed are then introduced *ad labium*. This Natural Farming practice tends to strengthen the animals' ability to digest the feeds that are used in NF poultry production.

Since chickens will eat almost anything, feeding your hens a complete and balanced diet is essential to prevent deficiencies and health problems. It is probably easiest to base the diet on good-quality commercial poultry pellets. If you are going to mix your own diet, great effort may be required to produce well-balanced diets, especially certified organic diets.

However, in NF a wide range of foods can be offered to make up their balanced diet. In addition to the pellets, a variety of fresh fruit and vegetables are mixed into the ration and provided daily. Examples of raw vegetables that can be fed include bok choy, spinach, chickweed, cabbage, and some vegetable peels. Fruits include banana, guava, coconut, papaya, etc. In addition, table foods such as cooked rice, rolled oats, cooked pasta, cooked beans and other legumes, and bread can be offered occasionally. On the other hand, citrus, raw potatoes, onions, raw peanuts, chocolate, avocados, and raw meat, as well as stinky moldy food, should never be added to the diet. If you are unsure about the safety of a particular foodstuff, check with your local veterinarian and/or an experienced chicken owner first.

Chickens are also able to obtain some of their nutrients from insects, worms, and plants when on pasture, thus reducing costs. In confinement operations, grit from crushed oyster shells is a useful addition to your chicken ration to provide the calcium needed by laying hens to produce healthy eggs. Tables 2 and 3 provide more in-depth information about poultry nutrient requirements in a commercial diet for egg layers or broilers.

Table 2: Nutrient Requirements of Growing Pullets [a]

Age (in wks)	0–6	6–12	12–18	18–1st Egg
Egg Layers				
Body weight (g)[b]	**450**	**980**	**1,375**	**1,475**
Protein	18	16	15	17
Arginine	1.0	0.83	0.67	0.75
Lysine	0.85	0.60	0.45	0.52
Methionine	0.30	0.25	0.20	0.22
Methionine + cystine	0.62	0.52	0.42	0.47
Threonine	0.68	0.57	0.37	0.47
Tryptophan	0.17	0.14	0.11	0.12
Calcium	0.90	0.80	0.80	2.00
Phosphorus, available	0.40	0.35	0.30	0.32
Brown-Egg Layers				
Body weight (g)[b]	**500**	**1,100**	**1,500**	**1,600**
Protein	17	15	14	16
Arginine	0.94	0.78	0.62	0.72
Lysine	0.80	0.56	0.42	0.49
Methionine	0.28	0.23	0.19	0.21
Methionine + cystine	0.59	0.49	0.39	0.44
Threonine	0.64	0.53	0.35	0.44
Tryptophan	0.16	0.13	0.10	0.11
Calcium	0.90	0.80	0.80	1.8
Phosphorus, available	0.40	0.35	0.30	0.35

[a] Requirements are listed as percentages of diet. Nutrient levels should be adjusted to meet specific strain requirements, level of feed intake, and body weight and skeletal development.

[b] Average body weight at end of each period.

The Merck Veterinary Manual 10th Edition. 2010.

Table 3: Nutrient Requirements of Broilers [a]

Age (in wks)[b]	0–3	3–6	6–8
kcal AME_n/kg diet[c]	3,200	3,200	3,200
Crude protein[d]	23.00	20.00	18.00
Arginine	1.25	1.10	1.00
Glycine + serine	1.25	1.14	0.97
Histidine	0.35	0.32	0.27
Isoleucine	0.80	0.73	0.62
Leucine	1.20	1.09	0.93
Lysine[e]	1.10	1.00	0.85
Methionine	0.50	0.38	0.32
Methionine + cystine	0.90	0.72	0.60
Phenylalanine	0.72	0.65	0.56
Phenylalanine + tyrosine	1.34	1.22	1.04
Proline	0.60	0.55	0.46
Threonine	0.80	0.74	0.68
Tryptophan	0.20	0.18	0.16
Valine	0.90	0.82	0.70

[a] Requirements are listed as percentages of diet.

[b] The 0- to 3-, 3- to 6-, and 6- to 8-wk intervals for nutrient requirements are based on chronology for which research data were available; however, these nutrient requirements are often implemented at younger age intervals or on a weight-of-feed-consumed basis.

Always ensure your chickens have access to cool, fresh, clean water at all times of the day. Clean your watering equipment regularly, because dirty watering containers can harbor diseases and attract pests.

Challenges

Natural Farming poultry farmers can meet the demands of a growing segment of consumers seeking farm-fresh products. However, the lack of local processing facilities is the main obstacle that producers will need to overcome, either by building their own handling plant, retrofitting existing facilities, or working collaboratively to gain access to mobile processing units. All labeling of poultry products should follow the guidelines established by the US Food and Drug Administration (FDA) Food Labeling Guide. For more information visit http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/FoodLabelingGuide/default.htm

Conclusion

Hawai'i consumers are increasingly interested in products they perceive as naturally produced or environmentally friendly, which provide a high level of nutrition and good flavor and are associated with improved welfare of animals. Natural Farming addresses many waste-management challenges, including fly and odor nuisances and utilizing agricultural wastes to produce animal feeds. Since the poultry housing used in this system can be constructed with very little capital and land area, it places such enterprises within economic reach of many in struggling communities. NF Poultry production can provide new opportunities for employment and positive lifestyles, while posing little or no risk to the environment and contributing to self-sufficiency in the state by creating a supply of fresh, locally produced food. For further information and the next workshop, contact your County Extension Service.

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