John Arbuckle presentation given at the *Mother Earth News* Fair in Seven Springs, PA in September 2012 with a few additions by John Arbuckle.

Good afternoon, friends

How many of you are excited about Non-GMO alternatives for feeding laying hens?

How many of you are interested in becoming a little more indigenous to your watershed? Meaning come to live on what it offers you more than what some other watershed offers you?

And lastly how many of you are wanting to take a plunge into a different world than what the modern industrial complex is offering us ... but feel a little confused about how to go about that?

That's great: We all have something in common then.

So what I'd like to talk about today will involve some tables and graphs and a small bit of science but all that should be secondary. What I hope stands out is that it is very important to follow your hearts and dreams. The graduating class of 2040 is counting on it. The disciplined pursuit of what you think is exciting in farming is what allows the poetry and sophistication to return to agriculture. Ghandi said it best:, "I'm not looking for mass production. I'm looking for production by the masses."

So the title of this talk is *The Cheapest Way* to *get the Best Egg* including what practices can you do as a person involved in food production that costs the least and yields the highest quality food.

In the words of the title, cheap, refers to three points.

1. It is having a financially sustainable operation with the lowest acceptable overhead. Remember that high overhead means RISK and a lack of freedom in creativity.

2. It refers to effort expended. Excessively high and unremitting labor has no place in sustainable agriculture.

3. And lastly "cheap" is coming from the Earth's perspective. How much will we ask the Earth to give us to maintain the systems of our choosing?

I read a book in 2003 that hit me like a ton of bricks. It's called "Cultures of Habitat" by Gary Paul Nabhan. Its take home message is: what do I do to live within the limits of what MY habitat offers me. It's worth noting how formative thoughts and life changing inspiration come most often in a small, unassuming package. And that the way to keep inspiration alive in the long term is with a combination of stillness and direct tangible action. The way we focus on dealing with direct and tangible action is to encourage our on farm biological resources to flourish. Those biological resources are usually food or shelter related items that our animals can make use of that are gifts from the creative combinations of observant human beings and natures world.

The specifics of *this* start out with the questions;

1. How many bugs can my chicken eat? What do I do to encourage that?

2. What is the cheapest, simplest most local grain they can consume while not dropping egg production to unacceptable levels?

We start out with wheat. It's a small grain, chickens can swallow it without having to crack it. It's cheap. About 25% the cost of some organic rations. You can buy it directly from farmers. It is commonly higher protein than corn. Our wheat is 12% protein while most corn is only 8% protein. Chickens are looking for around 16% protein, so compared to modern corn wheat is already half way there. Even though *it's* half way there, it's still only half way there. It is lacking in about 4% protein and has an undersupply (meaning not enough) of many amino acids. Two important ones being methionine and lysine. Clearly wheat alone is almost never enough. Wheat plus rich pasture plus a skillful farmer seems to hold some promise though. Can chickens eat enough bugs and clover to make up for what the wheat is lacking? That is the question we will explore.

THE STUDY FROM DENMARK

In part I was moved to begin this summer's study by some information received from the National Alternative Agricultural Library out of Washington D.C. I had requested any information they had documenting the feeding of perennial fruit and nuts to laying hens. They sent me something totally different than that. It was a fabulous study done by the University of Aarhus, Denmark. In a nut shell, they planted 3 food plots for their hens. That means they deliberately cultivated a crop designed to be harvested by the animals not combines. The 3 plots were

1. Grass/ clover during spring.
2. Peas/hairy vetch/oats during summer.
3. Quinoa during fall.

This was a great way of increasing their on farm biological resources. After planting the food plots, they basically divided their flock in half: half receiving a formulated chicken feed, the other half receiving wheat and a supplement of oyster shells. Both populations where allowed equal access to food plots during the appropriate season. What did they find? (see slide 5)

We are focusing on the middle two lines of these graph egg production. It shows that with a significant down ward spike at the onset of feeding wheat to the wheat fed population that the two populations laid comparatively well for the remaining 2/3s of the experiment. That would seem to indicate that after a period of time where in the gizzard is allowed to strengthen (in the wheat fed group) -that highly productive modern layers would be able to forage to meet the undersupply of nutrition absent in the wheat. Anyone sitting close to me when reading this study would have seen the proverbial light bulb on above my head ....

So with it In mind that competitive egg production was possible with just wheat and food plots I wanted to try something similar here in America. BUT LOWER INPUT-LESS MECHANICAL-NOT REQUIRING A TRACTOR AND TILLAGE. That meant no tilled and planted food plot. We would none the less be cultivating our on farm biological resources but we would be doing so using cows not tractors. Our biological richness would come in the form of fly larva in cow pies. Short grass makes it easy for chickens to hunt insects and, after a hard grazing and a rain storm, the lack of a tall grass "canopy" would allow the red and white clover

"under story" to grow. I say this because I suspect that chickens can make use of clover much more than grass. The clover leaf is much lower in carbon and therefore much more digestible to an animal lacking a rumen. It seems to me that a chicken can get protein out of grass about as well as I can get a scoop of ice cream out of a bucket of sawdust.

So with a few exceptions we set about to run a study slightly similar to the University ofr Aarhus.

The exceptions were: 1. We sprouted our wheat: a relatively simple 3 or 4 day process. (see slide 6) It clearly increased the palatability of the wheat. In hind sight, I don't know if this sprouting process was a net gain to the animals. (see slide 7.) It seems that for whatever gains in protein that the sprouting process may have added the increased weight and volume of water within the soaked grain seemed to detract from the "as fed" protein and carbohydrate load.

2. We used two breeds of chicken. (see slide 8) One was the modern production hybrid: the Red Sex Link. The other was a wonderful old standby: the Rhode Island Red.

So a moment of clarity here: We had four flocks on pasture at the same time.

A. One of modern hybrids eating chicken feed.

B. One of modern hybrids eating wheat.

C. One of Rhode Island Reds eating chicken feed.

D. One of Rhode Island Reds eating wheat.

Each flock had its own portable pen which looks a lot like Joel Salatin's portable broiler pens only we build them 3 feet tall instead of 2 feet. This creates a cooler environment around the chickens head and we think the comb can more effectively radiate heat away from the body. The chickens used these pens as a sun/storm shelter and night time predator shelter. Each flock had its own portable electric fence. (see slide 10) This flotilla of poultry followed a herd of 19 beef cows which were rotationally grazed on 5 acre paddocks. (see slide 9) The chickens followed 5 days behind the cows. These chicken pens and fences were moved 2X per week to allow for maximum availability of forage and insects.

This went marvelously well for the first 5 weeks. During this time our wheat fed chickens were the most profitable flocks. Combined they were laying 24% less eggs while enjoying a 55% reduced feed bill. In business terms their gross profit was lower but their net profit was higher. Beginning in early June we were lucky enough to see how these management techniques held up during intense heat and drought. Northern Missouri had the hottest most dry summer since 1911. On our farm the last rain of 1 inch or more fell in mid May. We didn't see another storm or 1 inch or more until the third week of August. (see slide 11)) With few egg-ceptions in a 90 day run our average daily high was in the upper 90's with several spike to almost 110 degrees F (see slide 12). This is not weather that chickens enjoy. I have found chickens to be more sensitive to heat than to cold. For me, August is a more limiting time of year than January. With this heat and lack of moisture we also saw a dramatic decline in insect populations. A field entomologist from the University of Missouri told me they were experiencing a 99% decline in insects caught in nocturnal light traps. This turns out to be a significant detail if

you are a wheat fed chicken. During this dry time we found we could not move the portable electric fences because the hardness of the ground prevented efficient pounding of the posts. We discontinued the use of the portable electric fences and beat a hasty retreat away from the cows and into a shady fence row. For the rest of the experiment we moved the portable pens daily and did not allow the hens to leave them. (see slide 13)

What did we observe? Population "0", the wheat fed Rhode Island Reds fared poorly in the heat. They picked each others' tail feathers and moved on to each others' toes. This sort of cannibalism lasted for a 4 week period after which we noticed signs of healing and re-growth. (see slide 14.) Also as a measure of animal welfare, we recorded 3 rounds of live chicken weights. We guessed that if the wheat fed chickens were significantly underweight, that would be a clear sign of malnourishment. (see figure J). We did not find that. While the Hen weights of the wheat fed groups were slightly lower, they were not significantly lower (see slide 15).

What else did we observe? Study all 6 of the scatter graphs (see slides 16-23). We see similar trends: good starting point; low production during the heat wave; rebounding production after the cooler temperatures and rain returned. If I may make a guess, my guess would be that in a more "normal" weather year, one where we got an inch of rain every week except in August and did not have more than 35 consecutive days of 95· weather or above that, we would have got similar data as the University of Aarhus for the modern hybrids as they did for their modern hybrids in their study. Of course the rate of production effected the cost effectiveness of the experiment. We found “B” to be the cheapest to produce, but over the course of the summer the difference in price was too small to be helpful since they laid so few eggs (see slide 24). It is worth noting that during the “agreeable” weather of late spring they were the clear winner in cost effectiveness.

If we are interested in minimum input egg production, it's worth looking at the past. The government literature pre-1900 cites the Big Three as keys to egg production. The Big Three refers to:

1. Pasture and whatever the animals can gather while on pasture.
2. Some milk product, waste milk or whey.
3. Grain: usually a mix of corn and a small grain like wheat or barley.

An important detail here is that pre-World War Two small farm egg production is listed as being about 30% of what it is today. Previously, I thought that old fashioned dual purpose breeds laying 80 eggs a year made this low input feeding program possible because they needed less nutrition to produce fewer eggs. Currently I don’t believe that’s true. The wheat only fed hybrids laid a lot better than the wheat only fed heritage. That leads me to believe that modern hens take to the low input diet better due to either better feed efficiency. It also seems that they do not have a diminished ability or desire to forage. In reference to nutrient density of the eggs from each population, our findings show that there was not a statistically important difference. It was explained that the eggs were roughly equally nutritious.

After a person has picked their breed of choice, the next question is how do I get the chicken to self harvest the greatest percentage of its food that it can from pasture. In this arena, the chicken is at a definite disadvantage compared to a cow or sheep. Cows and sheep are ruminants. They have four stomachs; the first one is able to break down cellulose in grass. A chicken cannot do that. A chicken asked to live exclusively on pasture will just be trying to stay alive and will lay relatively few eggs. This is true unless the pasture is exceptionally rich in insect life as is the case in the tropics. There are a few intriguing possibilities in insect

farming. Both black soldier fly production (see slide 25) and red wiggler worm production (see slide 26) hold promise both as a daily supplement and a back up for times of decreased outdoor insect populations. I currently have no experience with these strategies but suspect that their viability is linked mostly to the ability to acquire food scraps conveniently.

Our best opportunity for pasturing chickens of course is in spring, summer and fall. During those times, the easiest strategy is to create a bit of bug habitat and easy hunting grounds for the hens. Here are two ways we like:

1. Leave sheets of ply wood on the ground for several days, then uncover after they are circled with the portable fence and chickens released. That will give them the quickest opportunity to harvest a few insects and worms. This works best for small flocks between 6 and 15 hens in size.

2. For large flocks, the best pasture managements would involve keeping the pH close to neutral. That allows clover to grow. Keeping soil at a good level of fertility. This helps both grass and clover AND insect populations. Rotational grazing of cows. The fly larva in their manure can be harvested by the hens. Allow the hens access to fence rows, bushes and a diversity of habitats particularly in hot weather. Lastly, leave strips of Mohawk like lines of tall grass, about 12 inches wide, when you mow or graze pasture. The tall grass offers the insects a false sense of security and the hens will be able to harvest them from the grass strip more efficiently. Most importantly diligent and frequent moves of their day range will offer maximum availability of both vegetation and insects.

As we went about this study many ideas popped into our head. Some of them are:

1. Don't try feeding exclusively whole grains when insect populations are low: that means during an extreme summer drought, during winter OR during a time when the farmer is not moving his flock frequently enough on to new pasture.

2. Don't reinvent the wheel that somebody else has already done-meaning research your ingredients. In researching your ingredients, you'll find something called the maximum inclusion rate; that is the level above which something negative happens. Flax, cotton seed meal and fish emulsions all have maximum inclusion rates you should know about when blending feed.

3. Don't confuse the "as fed" percent protein with the dry weight Percent protein. For example, milk is only 30% protein when dried to powder. If it is feed as a liquid it is closer to 3% protein. Black soldier fly larva is commonly listed as 60% protein but it is not always adequately clear that this is dried black soldier fly larva NOT the live, water full, "as fed" larva.

4. If mixing ingredients by hand for a small flock you may not want to try and mix tiny quantities of ingredients into a more massive quantity of ingredients, for example, salt into sprouted wheat. The probability of reaching even distribution is about zero. Instead, consider a free choice feeding system for small quantity Ingredients.

5. Chickens fed exclusively on wheat or small grains must have access to grass in order to maintain the bright yellow yolk color. Wheat fed only hens not rotated frequently enough will have very, very pale, mostly white yolks.

6. Make sure the ingredients you are feeding are less valuable than eggs.

7. Keep a detailed log book of what you are doing. Without recording feed consumption, egg production, weather and the date, there will be no way of communicating specifics which is how we evolve a system.

8. Give a complete and balanced non-GMO chicken feed when you judge they need it.

9. Bear in mind that the limiting quantities of vitamins, minerals and amino acids is known information. (see slide 27). In that, there would appear to be little room for flexibility. What is not known is the million and one ways for chicken farmers to get there. The habitat that you live in and your ability to invent effective and low labor systems for processing ingredients will open up the window of possibility in terms of what you can feed laying hens. Black walnuts, sunflower seed, carrots and fermented corn silage are ingredients that have shown promise. Another for example: I know a guy who raised 6 pound Cornish cross meat chickens in 10 weeks feeding exclusively sprouted wheat and road kill deer. It works. Look at this last table. It shows the necessary levels of nutrition for an egg laying hen to be at peak performance. So when you look at this table, I would encourage people not to see an overwhelming screen of numbers. I would encourage people to see the equivalent of a cross word puzzle. Look at it like it was a Rubics Cube, something fun to solve. This table is a bulls eye to practice aiming for. This table is a riddle and the question is: What will my farm and watershed offer me that I can balance this riddle with? Crack the riddle and Monsanto and the petro chemical companies become a little more obsolete. Crack the riddle as a form of non cooperation with the empire. Crack the riddle and start becoming indigenous to your home again.

Perennially yours,

John Arbuckle.