

## **Abstract**

In recent years, organic production in the poultry industry has become a popular alternative to the conventional (inorganic) way of producing eggs. Organic products, such as eggs, are produced using methods that do not involve modern synthetic inputs such as pesticides and chemical fertilizers. Many consumers prefer to buy organically produced eggs rather than inorganically produced eggs, due to the belief that organic eggs are larger. This study was conducted to verify the validity of this theory by comparing egg size in hens fed organically and inorganically. This research would allow producers to learn whether organic production is more effective than inorganic production. Previous research looked into nutrient values found in organic products; whereas this study focused on the effect of organic feed on egg size. This experiment utilized 150, twenty four week old, free range Plymouth Rock and Rhode Island Red hybrid hens for over 76 days. The control group contained 140 hens and the experimental group contained ten hens. Eggs were collected every day. Eggs collected on Tuesday's and Fridays were used for data. Eggs from each group were then weighed and averaged. The results showed that overall, on average; the organic eggs were 1.6 grams larger than the inorganic eggs.

## **Introduction**

Hens used for egg production are important in today's society. Hens produce eggs which are the ideal protein for the human body. The type of feed is a major factor when raising layer hens. Some farmers prefer organic feed because they believe that it is effective at producing larger eggs than conventional feed. Organic products are a major topic in society at the moment. Many people believe organic food is better for human and production animal consumption. While others argue that inorganic foods are just as healthy and have the same effects as organic foods.

## Literature Review

Poultry production is a major and diverse segment of United States agriculture. It includes turkeys and chickens raised for meat as well as hens raised for egg production. The United States is the world's largest poultry producer and the second-largest egg producer (USDA Economic Research Service). Hens produce eggs which are major sources of protein, a nutrient which contains amino acids that build the body. Many farmers who are in the poultry industry raising layer hens have to consider many factors. Such factors include the type of feed and feed effectiveness. For years the debate over organic versus inorganic feed has been taking place. Some farmers believe that organic chicken feed is effective at producing larger eggs than inorganic chicken feed.

In the last decade organic products in the market economy have expanded immensely due to consumer's new viewpoint on the way food is produced. Many United States farmers are highly urged to go organic. Products which have been produced organically are viewed, by the average consumer, as healthier, better for the environment, and better for human and production animal consumption. This view also correlates with the belief that organic feed is more nutritious, and, therefore allows the hens to lay more and/or larger eggs. Many nutrients are needed for development of the egg and each have a different affect on the egg.

### *Egg Size According to Hen Age*

Research has shown that when it comes to eggs, size is the deciding factor for consumers. "Many workers have reported an age effect on egg size and composition traits" ( Tharrington). The age of hen's maybe a major factor that influences the size of eggs produced. The possibility

of yolk size becoming a factor to the different sizes of egg has been proven false. The type of feed is irrelevant to the size of the yolk. The size of the egg affects the proportion of the yolk and other contents inside the egg. “Highly heritable differences in egg composition between inbred lines and their crosses, such as percentage yolk, were not related to egg size. It has been concluded that egg size accounted for most of the differences in proportion of yolk, albumen, and total albumen solids” (Tharrington). However there are other factors that influence egg size.

### *Vaccinations*

A Factor which contributes to different egg sizes are vaccines that are given to layer hens, for medical purposes. This also could have an effect on the organic quality of the egg; certain Medicines and steroids if found in the hens system will be considered non-organic. “The differences between organic and conventional egg and poultry meat production are discussed, with emphasis on housing and management requirements, feed composition and the use of veterinary prophylactic and therapeutic drugs”(Berg,2001 ). Essential nutrients, such as calcium, are needed to produce the best quality eggs.

### *Nutrients*

In order to promote a correct and legitimate result of egg production hens need the appropriate Amount of nutrients in their feed. “Selenium is a dietary essential nutrient for laying hens. It is essential for the antioxidant enzyme glutathione peroxidase, which protects the cells by destroying free radicals.” (Payne, 2005) It is essential to provide the necessary nutrients to hens so that the results of the eggs size will improve and raise production rates as well. There have

been previous studies on chicken feed and the effect it has on chickens. According to these studies, there are many factors that can contribute to the outcome of the results when conducted. “Six groups of organically fed hens were studied for egg production, feed parameters, and egg quality from 20 to 31 weeks of age” (Hammershoj, 2005).

### *Feed (Blue Lupin)*

Another experiment was conducted dealing with chickens their feed. Researchers used a feed called Blue Lupin, which consisted of no carrot or corn. “The main effect of lupin is that it decreases amino enzymes that are what hens need to properly lay eggs however it is high in protein. It’s an improvement in egg production; however the taste portion of the egg was proven distasteful to consumers. Lupin is also known as a good supplement for soybean and is the main protein source in organic poultry feed” (Hammershoj, 2005). The different kinds of feed also have major effect on the outcome of eggs during the experiment.

In order to obtain the highest quality eggs and proper production feed must contain zinc, manganese, and selenium. “These metal complexes may improve egg production and decrease mortality and stress” (Fernandes, 2012). According to Fernandes’s These nutrients are very important in order to produce high quality eggs as well as proper egg production. It essential to be sure that feed containing these necessary metal complexes are in both organic and inorganic feed.

The contents of the eggs also have a significant impact on the weight and size of the egg, the feed and conditions the hens that are kept in also effects the contents of the egg. “Egg weight is genetically linked to all three of the major components: shell, albumen, and yolk” (T.A.Scott,

2000). In this experiment conducted the sizes of the egg both coincide with each other; one affects the other, and can influence change in the results.

However one article introduced that, “Solids contents of whole egg, white, and Yolk varied within a narrow range among egg sized” (AHN, 2012). This researcher concluded that the egg size has the most influence on the content mass of the egg. There has to be different types of feed that cause the change of the size on the eggs before the White and yolk are even created. “In 2011, total egg production (including 13 billion hatching Eggs) was valued at \$7.4 billion. Geographically, U.S. table egg production is concentrated in the Midwest, with pockets of production in Pennsylvania, California, and Texas” (Greene and Cowon, 2012). This state’s how important egg production is within the United States of America As well as how much people in the U.S depend on the production of eggs.

## **Materials and Methods**

### *Facility*

This experiment consisted of 150, Twenty four week old, free range, Rhode Island Red and Plymouth Rock hybrid hens, over 76 days. The control group, which contained 140 hens, was fed inorganic feed and the experimental group, which contained ten hens, was fed organic feed. Both groups of hens were housed in the John Bowne High School Poultry Facility. The hens were housed with identical lighting and heating conditions as well as ventilation systems. The standard temperature of the facility was approximately 85°Fahrenheit. The total area of the room is approximately 6000 square ft. The experimental group was housed in a coop located in the corner of the room measuring 76 inches in height, 84 inches in width and 84 inches in length; for a total area of 7056 square inches. The coop was constructed utilizing two pieces of plywood,

nine wood supports, duct tape, poultry netting, nails and three cinderblocks. The plywood was nailed to the wood supports using a hammer, which extended towards the ceiling of the room. Using duct tape and nails, the poultry netting was attached to the top of the supports to create the enclosure. Three cinderblocks were used to stabilize and support the plywood. The coop contained twelve nesting boxes and was bedded with straw. It was cleaned on a weekly basis. To provide hydration, a 5 liter water dispenser was provided at all times. The control group used the remainder of the room which is approximately 64,944 square inches in size. In the control group, the coop contained a 16 foot long perch, three sets of nesting boxes, making a total of 48 nesting boxes; which were bedded with straw. The bedding was changed once a month. The coop contained an automatic water dispenser system.



### *Diet*

The control group was fed *Nutrena NatureWise 16% Layer Feed* (inorganic food), once a day. The feed contained 16% crude protein, 6.0% crude fiber, 2.5% crude fat; the same feed and schedule the hens had been acquainted upon their arrival to the facility. The experimental group was fed *Nature's Best Organic Layer Pellets* (organic feed); once every other day. The feed contained 16% crude protein, 5.5% crude fiber, and 4.25% crude fat. The feed was distributed using a 10.5 liter feeder. Previously the hens had consumed the feed used in the control group, thus, the new organic feed had to be introduced to them over a span of twenty two days. For the




## Results

Analysis of the data verified that the hens fed organic feed produced eggs that were on average grams larger than the hens fed inorganic feed. After averaging the data of the fourteen trials conducted the organic hens produced eggs that on average were 64.7 grams in size and the Inorganic hens produced eggs that were on average 63.1 grams in size, a difference of 1.6 grams.

### Trial Averages

Organic Eggs weight (grams)	Inorganic eggs weight (grams)
Trial 1 average :67.0	Trial 1 average :63.2
Trial 2 average: 56.6	Trial 2 average :65.5
Trial 3 average: 64.2	Trial 3 average :66.2
Trial 4 average :66.5	Trial 4 average :64.5
Trial 5 average: 69.0	Trial 5 average :65.0
Trial 6 average :64.1	Trial 6 average :58.0
Trial 7 average :62.0	Trial 7 average :65.0
Trail 8 average :67.4	Trial 8 average :58.4
Trail 9 average :64.6	Trial 9 average : 68.2
Trail 10 average :66.5	Trial 10 average: 60.2
Trail 11 average: 62.4	Trial 11 average: 63.0



Trail 12 average: 66.2	Trail 12 average :62.2
Trail 13 average :64.6	Trail 13 average :65.7
Trail 14 average :64.6	Trail 14 average :58.4
Average of all trials :64.7	Average of all trails : 63.1

### **Discussion and Conclusion**

Based on the data collected it has been proven that organic feed causes layer hens to produce larger eggs, however this result may be influenced by the factor that the hens in the experimental group had escaped backed into the population of the control group everyday and had access to inorganic feed. Another factor that may have impacted our results was that during our research pen sustained damages. The pen had been significantly damaged twice during the experiment and repairs may have stressed the hens. The poultry facility had been cleaned out twice throughout the Experiment which could have created a stressful situation for the hens in the experimental group because they were placed in cages, temporarily, which may have influenced their production.

### **References**

- AHN, D. U., S. M. KIM, and H. SHU. "Effects of Egg Size and Strain and Age of Hens on the Solids Content Pf Chicken Eggs." N.p., 1997. Web. 5 Dec. 2012.
- Berg, C. "Health and Welfare in Organic Poultry Production." *Acta Vet. Scand. Suppl.* 95 (2001): 37-45. Print.

Fernandes, J. IM. "Effects of Organic Mineral Dietary Supplementation on Production Performance and Egg Quality of White Layers." *Brazilian Journal of Poultry Science*. N.p., Jan.-Feb. 2008. Web. 5 Dec. 2012.

Greene, Joel L., and Tadlock Cowan. *Table Egg Production and Hen Welfare: The UEP-HSUS Agreement and H.R. 3798*. N.p.: n.p., n.d. 14 May 2012. Web. 5 Dec. 2012.

Hammershoj, M., and S. Steinfeld. "Effects of Blue Lupin on Organic Layer Diets and Supplementation with Foraging Material on Egg Production and Some Egg Quality Parameters." *Poultry Science* 84 (2005): 723-33. Print.

Nollet, L., J. D. Van Der Klis, M. Lensing, and P. Spring. "The Effect of Replacing Inorganic With Organic Trace Minerals in Broiler Diets on Productive Performance and Mineral Excretion." *Poultry Science* 16 (2007): 592-97. Print.

Payne, R. L., T. K. Lavergne, and L. L. Southeren. "Effect of Inorganic Versus Organic Selenium on Hen Production and Egg Selenium Concentration." *Poultry Science* 84 (2005): 232-37. Print.

Scott, A. T., and F. G. Silversidest. "The Effect of Storage and Strain of Hen on Egg Quality." *Poultry Science* 79 (2000): 1725-729. Print.

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