

# Effects of various winter diets on chicken egg quality

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## Introduction

Grand View Farm is an organic farm in Forest Hill, Maryland. During warmer months, the egg-laying hens have access to a field for grazing. In winter, however, the hens are placed in a hoop house and fed only grains. Customers have been complaining about the winter eggs because yolks had pale yellow yolks instead of the nice orange found in the summer.

Egg yolk color is determined by the concentration of carotenoids, which are yellow and red pigments (Islam & Schweigert, 2015). These pigments can be found in different plants, and when added to hens' diets, the pigments can change the yolk's appearance. The color can be measured with a device similar to the Roche Yolk Color Fan, or by measuring the concentration of carotenoids present in the yolk. Another factor of egg quality is shell thickness. The added protein of mealworms to the diet can change the properties of the shells (Ketka & Tumova, 2016). Thicker eggshells are preferred because they are less likely to break during transport.

The purpose of this project was to determine if adding fresh microgreens and mealworms to an otherwise grain-only diet is enough to emulate the summer diets of the hens enough to increase the egg quality in winter. It was predicted that this addition will increase the orangeness of the yolk and the thickness of the shell.

## Materials and Methods

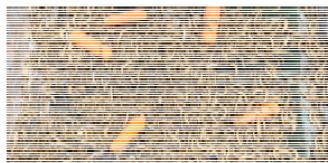
**Microgreens:** Due to temperature control issues with the farm's greenhouse, triticale microgreens were grown offsite (Figure 1). The goal was to be able to produce 5,565 g of fresh microgreens every week during testing, while remembering that it takes two weeks for triticale to grow.

**Mealworms:** Mealworms were being bred offsite while procedures were being written down carefully to eventually transfer them to the farm. Months before the study began, mealworms were being raised (Figure 2) in order to reproduce at a rate that would allow for 840 mealworms to be collected every week of the study.



Figure 1 (left): Offsite set up of triticale growth

Figure 2 (below): Harvest tray of mealworms with baby carrots for moisture



## Materials and Methods (continued)

**Testing Protocol:** The hens were separated into four groups for the duration of the experiment. The three experimental groups each contained ten layer hens. The first group (MG) received microgreens and grain feed (Figure 3), totaling 530 g of triticale per day for the entire group to share. The second group (MW) received mealworms and grain feed, totaling 80 mealworms per day. The third group (MG + MW) received both supplements as well as grain feed, totaling 265 g of triticale and 40 mealworms per day. The final group, the control, consisted of the remaining hens and were only given grain feed.

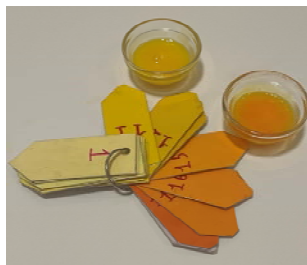
**Measurements:** Taking inspiration from the Roche Yolk Color Fan, a similar device was constructed using paint sample swatches. For this project, the name of the new device was the "YolkSpec" and it contained a gradient of 18 possible yolk colors, where the higher the number is, the more orange the yolk is.

The study ran for 11 weeks, beginning January 30<sup>th</sup>, and ending on April 15<sup>th</sup>. Every week, three eggs were collected from each group for testing. These tests included obtaining the hardness of the shells using a portable hardness tester, and "YolkSpec" color value (Figure 4). A total of 144 eggs were tested, with 48 eggs coming from each group.



Figure 3 (left): Hens in the Microgreen Only group after being fed

Figure 4 (below): The YolkSpec being used to measure the orangeness of two well-mixed egg yolks

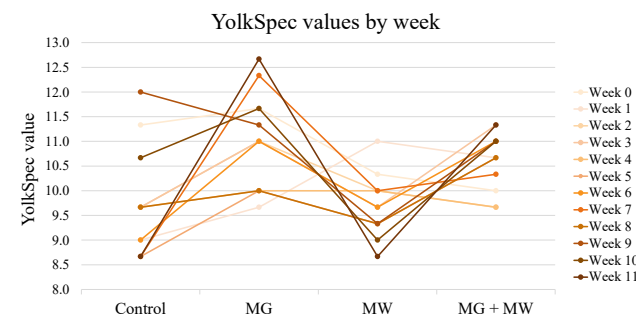


## Results

With a mean orange level of 11 for the microgreen only group, compared to the mean orange level of 10 for the control group, it was observed that the addition of triticale does make egg yolks more orange.

It was also observed that mealworms did not improve the shell thickness of the eggs. The eggshell hardness means were lower with the mealworm supplement ( $M = 87$ ) than the control group ( $M = 90$ ).

## Results (continued)



Graph 1 (above): YolkSpec average values from Week 0 (lightest orange) through Week 11 (darkest orange). For visual ease, only values from 8 to 13 are shown. The chicken groups with any microgreen supplement added to the diet increased in YolkSpec values each week. The mealworm supplement only decreased in yolk color.

## Discussion

The purpose of this experiment was to determine if there was a significant difference in egg quality with various winter diets. Supplementing the diet with microgreens increased the orange hue of the eggs, indicating an increase in beta carotene and xanthophyll. It is possible that there are more reasons besides the supplemented diet alone that eggshell quality remained unchanged, including the age of hens and the type of grain feed (Ledvinka et al., 2012). The nutrient content in the feed was different this year, containing less fiber than in previous years. The hens were also younger on average compared to previous years.

Though eggshell quality wasn't affected, Grand View Farm plans to continue using mealworms in future years because they offered the hens natural enrichment.

## References

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