The Foothills Farm Fermented Feed Study

Quantifying the impact of feed hydration and fermentation on poultry nutrition and farm economics

A Farmer-Rancher project funded by Western SARE
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Background

Feed is the single largest cost in poultry-raising, particularly for farmers trying to use organic feeds or other sustainably sourced feeds. Farmers for whom animal welfare is a top priority are also looking for feeds that best support the health of their animals. Fermented feed may help to address both these concerns. Fermentation is the action of microbes to break down complex molecules in feed ingredients and may make it easier for animals to absorb nutrients from their feed. Feed can be fermented simply by soaking in water for a time and allowing microbes from the atmosphere and on the surface of grains to become active. Lab studies with both meat and egg birds has shown that fermented feed can perform better than dry feed in poultry, supporting their health and enhancing productivity. But the lab is a controlled environment; are differences detectable in a lab also detectable in a pastured flock? And is it practical to provide fermented food to hundreds of birds at a time?

A note on feed safety: in feed fermentation, there is a risk that unhealthy bacteria will proliferate and cause toxicity. This risk can be mitigated by maintaining low pH in the fermenting mixture (e.g. by adding a mild acid such as apple cider vinegar or fruit pomace). Read as much information as you can before you ferment, to optimize your process.

Objective

The Foothills Farm Fermented Feed Study, funded by a Western SARE Farmer-Rancher Grant, was established in 2018 to compare the performance of Dry and Fermented feeds in terms of feed efficiency and whole-season productivity in pastured laying hens. We included a Hydrated feed treatment so that we could distinguish the effect of simply adding water to the feed from the effect of the fermentation process.

Methods

The diets in the study were:

- Dry feed, presented to the birds as-is;
- Fermented feed, soaked in water at a ratio of 3.2 parts feed to 4 parts water for 48 h prior to feeding;
- Hydrated feed, soaked in water at a ratio of 3.2 parts feed to 3.3 parts water just prior to feeding.

All feeds were prepared from the same complete mixed ration.

The birds used for the study were Golden Sexlink laying hens. One hundred chicks arrived at Foothills Farm on 10th Oct 2018, at one day of age. They were brooded together and fed with dry feed. At 13 weeks, the birds were transitioned to pasture. At 16 weeks, on 30th Jan 2019, feeding of the experimental diets began.

The birds were separated into nine experimental groups. One group consisted of ten hens in a pasture house. Each pasture house was assigned to be fed with Dry, Fermented or Hydrated feed. There were three houses (replicates) assigned to each type of feed. The houses were arranged in a 3 x 3 grid with each feed type represented once in each row and each column.

A predetermined weight of feed was delivered to each house daily. Hens had access to drinking water *ad libitum*. At weekly or two-weekly intervals, leftover feed was collected and weighed, allowing the calculation of feed consumed during that period. Eggs were collected and counted daily. Between June and October 2019, on nine occasions, a sample of eggs was collected from each house and weighed to estimate egg size in each treatment. Feed and egg measurements reported in this document were taken between 3rd Mar and 10th Oct 2019. Data were analyzed statistically using Linear Mixed Effects models with Diet as a fixed effect and 'row' and 'column' of the pasture-house grid as random effects. The threshold for determining statistical significance of diet overall and of pairwise differences between diets was $\alpha = 0.05$.

Results

1. Egg production and egg weight

Egg production was similar across diets in the spring. In the summer and fall, Fermented-diet birds laid significantly more eggs than Dry- or Hydrated-diet birds (Table 1).

Table 1. Eggs per hen per day, average by season; mean ± standard deviation[1, 2]

	Dry	Fermented	Hydrated
Spring	0.67 ± 0.20	0.66 ± 0.24	0.58 ± 0.23
Summer	0.73 ± 0.12 **b**	0.84 ± 0.12 **a**	0.65 ± 0.11 **c**
Fall	0.79 ± 0.12 **b**	0.87 ± 0.13 **a**	0.68 ± 0.07 **c**

[1]'Spring' = March 3 - June 7; 'Summer' = June 8 - Sep 5; 'Fall' = Sep 6 to October 9.

[2]Values in the same row bearing different letter subscripts are significantly different from each other.

Hens on the Dry diet first reached full production (0.8 eggs per bird per day) in 153 days on average. This was significantly faster than hens on the Fermented diet, and 14 days faster than hens on the Hydrated diet. However, birds on the Fermented diet sustained full production longest: 155 days, compared to 125 days for Dry-feed hens and 92 days for Hydrated-feed hens.

Birds fed Hydrated feed tended to lay heavier eggs throughout the year (71.6 g per egg, compared to 68.6 g for Dry feed and 69.3 g for Fermented feed). However, all these weights classify as USDA 'Extra Large' size, and therefore are probably economically equivalent.

2. Feed consumption

Feed consumption was similar across diets in spring and summer. In fall, it was significantly greater in Dry-feed birds (159 g per bird day) than in Hydrated (136 g) or Fermented-feed birds (144 g). Feed collection was difficult to measure in the field and results should be interpreted with caution. Evaporation of water from Hydrated and Fermented feed troughs during the time between feed delivery and leftover-feed collection (up to 14 days) may have inflated feed consumption values in these diets.

3. Feed efficiency

In this study, feed efficiency was defined as grams of feed consumed per egg produced. Feed per egg values were obtained by dividing daily feed consumption by daily egg production. Feed efficiency was significantly greater in Fermented-diet birds than Dry- or Hydrated-feed birds in summer and fall (Table 2).

Table 2. Feed per egg, grams dry basis; mean ± standard deviation

	Dry	Fermented	Hydrated
Spring	195 ± 56	213 ± 94	225 ± 87
Summer	196 ± 35 **b**	174 ± 30 **c**	221 ± 42 **a**
Fall	207 ± 42 **a**	163 ± 28 **b**	206 ± 22 **a**

Conclusions

- In the early part of the year, Dry feed tended to perform better than Hydrated or Fermented. It is possible that hens in Hydrated and Fermented diet groups took time to acclimate when they were switched from dry feed.
- Later in the year, hens on the Fermented diet produced the most eggs, most consistently; Hydrated-diet hens laid fewer, heavier eggs.
- Our data suggest that Fermented feed represented a 13% saving in feed quantity compared to Dry feed in the Summer, and 27% saving in the Fall. The next step will be to determine overall impact on farm economics when labor and egg sales are taken into account.

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