

USING A MIXTURE OF SOYBEAN MEAL AND RICE BEAN MEAL IN LAYING HEN DIETS

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Abstract

This experiment determined the effect of a mixture of soybean meal (SBM) and rice bean seed meal (RBM) on the production performance of Luong Phuong laying hens. The experiment was carried out for 20 weeks with 264 hens and 36 roosters, divided into 4 treatments; each treatment (T) had 22 hens and 3 roosters and 3 replicates. The ratio between SBM and RBM from T1 to T4 was 100% SBM + 0% RBM, 70 + 30, 60 + 40, and 50 + 50 respectively. The diets of the treatments had the same metabolic energy and crude protein levels. As a result, the rank in order from the highest to the lowest of the indicators of laying rate, egg yield and hatching egg yield was T2> T3> T1> T4, of the criterion of class I chicks/ hatching eggs was T4> T3> T2> T1, of the criterion of feed consumption for class I chick production was T1> T4 and T2> T3. However, these indicators did not differ with statistical significance. From the research results, it was concluded that the mixture of SBM and RBM in the diets had a good effect on egg production, hatching egg quality and feed conversion for egg production of laying hens and a ratio of 60% SBM + 40% RBM in the diets of laying hens is considered appropriate.

Key words: Production performance, laying hens, soybean meal, rice bean seed meal

Introduction

Combining a variety of feed ingredients in general, and high – protein feed ingredients in particular in the diet of livestock are often paid attention by breeders because this combination uses a variety of feed sources to complement each other's nutrients, leading to better feed efficiency of animals. Several studies have combined soybean meal (SBM) with other protein – rich feeds in the form of partial replacement of soybean meal with these high – protein feeds. For example: SBM was replaced with sesame meal (Cheva – Isarakul et al, 1993), with cottonseed meal (Mustafa Erturk et al, 2004), with Rapeseed meal (Riyazi et al, 2008), with peanut meal (J. Lu et al, 2013), with Lupin meal (Gebremedhn Beyene et al, 2014 and 2015), with kidney bean (Taju Hussein et al, 2015a, 2015b; and Eva Straková et al, 2021), with Moringa oleifera leaf meal (Nhung et al, 2021) in the diet of laying hens. All of the above studies have shown good results. That is basis for this study using rice bean meal in combination with soybean meal in the diets of laying hens.

Rice beans (*Vigna umbellata*) are grown in some areas in Vietnam, mostly in the northern midland and mountainous areas. Rice bean seeds with 86% dry matter have 22.52% crude protein, 51.57% nitrogen - free extract and 2,696 kcal ME/kg and the crude protein of rice beans has a full range of amino acids with a balanced ratio (NIAS, 2001). Therefore, this study used rice beans as a source of protein – rich feed ingredients and combined rice beans with soybean meal in laying hen diets.

The aim of the study is to determine the effect of the mixture of soybean meal (SBM) and rice bean seed meal (RBM) on the production performance of laying hens and the appropriate ratio between soybean meal and rice bean in the diets.

Materials and methodology

The rice bean seeds used in this experiment were produced locally and the seeds were roasted and ground before use. Roasted rice bean seed meal with 91.68% dry matter had 24.63% crude protein and 2956 kcal metabolic energy/kg. The Luong Phuong laying hens were used for this experiment. The experiment was carried out at Thai Nguyen University of Agriculture and Forestry, Vietnam.

To make it easier for breeders to apply the research results, the simplest way to combine SBM and RBM was used, which was to combine the weight ratio of these two ingredients, for exemption: 70 kg SBM + 30 kg RBM.

The experiment was carried out with four different ratios between SBM and RBM in laying hen diets corresponding to 4 treatments (T), including T1: 100% SBM + 0% RBM (control), T2: 70% + 30%, T3: 60% + 40% and T4: 50% + 50%. Each mixture of SBM and RBM was considered as an ingredient used for incorporation into laying hen diets. The experiment was conducted with 264 laying hens and 36 roosters from 35 to 54 weeks of age, allotted into 4 treatments (T1, T2, T3, and T4), each consisted of 22 hens and 3 roosters with 3 repetitions.

The chemical component of mixtures (SBM + RBM) are presented in Table 1

Table 1. Chemical component of mixtures of soybean meal and rice bean meal

Categories	DM	CP	EE	CF	Lysine	Met.	Ca	P _{av.}	ME
T2: 70+30	90.01	38.56	1.23	6.03	2.48	0.52	0.39	0.40	2709
T3:: 60+40	90.25	36.57	1.14	5.90	2.37	0.50	0.39	0.39	2744
T4: 50+50	90.49	34.58	1.05	5.78	2.27	0.48	0.40	0.39	2780

Note: DM: dry matter, CP: crude protein, EE: ether extract, Met: methionine, Ca: calcium, Pav: available phosphorous, ME: metabolic energy.

The proportions of feed ingredients and nutritive values of the diets are presented in Table 2

According to the diets in Table 2 and the ratio between SBM and RBM of treatments, the ratio of RBM in the diet from T1 to T4 was 0%, 7.14%, 10.20%, and 13.65% respectively.

Laying hens were accessed to feed libitum, other bird management programs were performed similarly in all treatments and were performed after Van et al. (2015). Monitoring parameters include laying rate, the yield of eggs and hatching eggs, some parameters of hatching eggs, and some parameters of

feed for the production of eggs and chicks, which were performed after Doan et al. (2011). Statistical analysis was performed after Dzung et al. (2018).

Table 2. Ingredients and nutritive values of all diets

Categories	T1	T2	T3	T4
Yellow corn	55.50	51.70	50.00	48.20
Rice bran	12.00	12.00	12.00	12.00
Fish meal	3.00	3.00	3.00	3.00
Soybean meal	20.00	-	-	-
SBM+RBM	-	23.80	25.50	27.30
Other Additives	9.50	9.50	9.50	9.50
ME, Kcal/ Kg	2750	2748	2747	2746
CP	17.16	17.09	17.09	17.04
EE	4.23	4.07	4.00	3.93
CF	3.59	3.65	3.68	3.72
Lysine	0.93	0.94	0.95	0.96
Methionine	0.35	0.36	0.36	0.36
Ca	3.39	3.39	3.40	3.41
Pav.	0.43	0.43	0.43	0.43

Note: Other Additives: 0.07% Methionine, 7.93% CaCO₃, 0.50% NaCl, 0.50% Vitamine premix, 0.50% Mineral premix; SBM: soybean meal, RBM: Rice bean seed meal; ME, CP, EE, CF Ca, Pav., as noted in Table 1.

Result and discussion

The average laying rate of the hens

The average laying rate of the hens at all stages and the whole experimental period is presented in Table 3.

Table 3. The average laying rate in stages (%)

Week old	T1 100 + 0	T2 70 + 30	T3 60 + 40	T4 50 + 50	SE M	P
35 – 38	72.08	72.29	72.19	72.02	0.352	0.793
39 - 42	68.94	69.15	69.05	68.58	0.463	0.847
43 - 46	65.58	65.85	65.75	65.20	0.186	0.911
47 – 50	62.07	63.04	62.77	61.91	0.198	0.379
51 – 54	58.60	58.87	58.71	58.39	0.185	0.685
35 – 54	65.47	65.84	65.69	65.22	1.189	0.943

Table 3 showed that the laying rate of the treatments decreased according to laying weeks. However, this rate of T2 and T3 decreased more slowly while that of T1 and T4 decreased more rapidly, thereby leading to the average laying rate of T2 and T3 was greater than T1 and T4. This indicator ranked from

the highest to the lowest as $T2 > T3 > T1 > T4$, but there was no significant difference among treatments ($P > 0.05$).

Mustafa Eraturk et al. (2004) studied to replace SBM with cottonseed meal from 0% (control) to 17.5% and reported that the 7.5% substitution rate had the highest laying rate and then gradually decreased. Ta ju Hussein et al. (2015a) replaced SBM with processed kidney bean meal with levels from 0% (control) to 100% and found that the laying rate of 25 and 50% replacement levels was greater than control, while that of 75 and 100% was smaller than that of the control, but only level of 100% was a statistically significant difference from the control. Nhung et al. (2021) replaced 0, 30, 40 and 50% protein of SBM with protein of Moringa oleifera leaf meal in laying hen diets and reported that the laying rate of 30 and 40% replacement levels was greater than the control, while that of 50% was smaller than that of the control with a statistically significant difference. However, Riyazi et al. (2008) replacing SBM with Rapeseed meal and Gebremedhl Beyene et al. (2014) replacing SBM with processed Lupin meal found that the laying rate of hens were not different between among treatments.

Egg productivity and egg yield

Egg yield of treatments and average egg productivity per hen during the whole experimental period were presented in Tale 4.

Table 4. Egg productivity and egg yield

Indicators	Unit	T1 100 + 0	T2 70 + 30	T3 60 + 40	T4 50 + 50	SEM	P
Egg yield	eggs/ T	6048	6084	6070	6026	78.422	0.110
Egg productivity	eggs/ hen	91.8	92.2	92.0	91.3	0.261	0.280
Compare	%	100	100.6	100.4	99.5	--	--
H.E. yield	eggs/ T	5876	5912	5901	5853	87.749	0.142
H.E. ratio	%	97.16	97.17	97.21	97.13	0.180	0.969
H.E. productivity	eggs/ hen	89.0	89.6	89.4	88.7	0.292	0.360
Compare	%	100	100.7	100.4	99.7	--	--

Note: H.E.: Hatching Egg; T: Treatment

As shown in Table 4, the egg yield of T2 and T3 was greater than that of T1 and T4 because the laying rate of T2 and T3 was greater than that of T1 and T4. The average egg productivity per hen of the treatments had the same trend as the egg yield. The results showed that the mixture of SBM and RBM had a good effect on egg and hatching egg yield, but did not make a significant difference in these parameters among treatments.

The percentage of hatching eggs of the treatments was similar and this rate was consistent with research results of Trung (2017) and Nhung, (2021) who also studied on Luong Phuong laying hens, that rate ranged from 96 to 97.3%.

Some parameters of hatching eggs

The results of monitoring some indicators of hatching eggs were presented in Tale 5.

Table 4 data showed that the ratio of embryos/ incubated eggs, of chicks/ embryo eggs, of class I chicks/ chicks tends to increase slightly from T2 to T4. However, there was no significant difference

in the above criteria among treatments. Even so, the regular increase of these indicators leads to the question of whether certain bioactive substances had a positive effect on embryo development.

Nhung et al. (2021) replacing SBM with *Moringa oleifera* leaf meal reported that the parameters of hatching eggs of experimental treatments were significantly higher than those of the control. This is understandable because *Moringa oleifera* leaf meal is rich in carotenoids which has a good effect on

Table 5. Some parameters of hatching eggs

Indicators	Unit	T1 100 + 0	T2 70 + 30	T3 60 + 40	T4 50 + 50	SEM	P
Number of H. E.	eggs/ T	1800	1800	1800	1800	--	---
Number of E. E.	eggs/ T	1724	1723	1727	1728	135.291	0.999
Rate of E.E./ H.E.	%	95.78	95.72	95.94	96.00	2.255	0.999
Number of chicks	chicks/ T	1550	1554	1566	1568	145.038	0.964
Rate of chicks/ E. E.	%	89.91	90.19	90.68	90.74	1.439	0.905
Class I Chicks	chicks/ T	1515	1519	1536	1537	150.014	0.940
Rate of C.I C./Chicks	%	97.74	97.75	98.08	98.02	0.656	0.947
Class I chicks/ H. E.	%	84.17	84.39	85.33	85.39	0.502	0.940
Compare	%	100	100.3	101.4	101.4	---	---

Note: H.E.: Hatching eggs, E.E: eggs with Embryos, C.I C.: Class I Chicks, T: Treatment

embryo development. However, when Gebremedhl Beyene et al. (2015) replaced SBM with processed Lupin meal, the results on the parameters of incubated eggs were similar among treatments.

Feed for the production of eggs and chicks

Based on egg yield, hatching egg ratio in Table 4 and chicks class I/ hatching egg ratio in Table 5, the number of hatching eggs and class I chicks of each treatment was calculated. Feed consumption for production of eggs, hatching eggs and class I chicks was also calculated based on the above data, the results were presented in Table 6.

Table 6. Some parameters of feed for the production of eggs and chicks

Indicators	Unit	T1 100 + 0	T2 70 + 30	T3 60 + 40	T4 50 + 50	SEM	P
Feed intake	kg/ T	1344	1344	1344	1344	--	--
Eggs / T ⁽¹⁾	eggs/ T	6048	6084	6070	6026	130.544	0.439
Hatching eggs	eggs/ T	5876	5912	5901	5853	100.706	0.200
Class I chicks	chicks/ T	4946	4989	5035	4998	138.886	0.284
Feed/ 10 eggs	kg	2.22	2.21	2.21	2.23	0.143	0.437
Feed/ 10 H.E. ⁽²⁾	kg	2.29	2.27	2.28	2.30	0.117	0.218
Feed/ 10 C. I C. ⁽³⁾	kg	2.72	2.69	2.67	2.69	0.223	0.280
Compare	%	100	98.9	98.2	98.9	--	--

Note: (1) T: Treatment; (2) H.E; Hatching egg; (3) C. I C: class I chicks

The data in Table 6 showed that the feed intake was the same, but the number of eggs, hatching eggs and class I chicks varied among treatments, so the feed consumption for the production of eggs, hatching eggs, class I chicks was different. In increasing order, the feed consumption for producing 10 eggs was T2 and T3 < T1 < T4, for producing 10 hatching eggs was T2 < T3 < T1 < T4, for producing 10 class I chicks was T3 < T2 and T4 < T1. However, these criteria were not significantly different among treatments.

Conclusion

The mixture of SBM and RBM in the diets of Luong Phuong laying hens had a good effect on laying rate, egg production, hatching egg quality and feed consumption for egg and chick production. From the results of the study, it is recommended that the SBM and RBM ratio should be 60% + 40% in the diets for laying hens.

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