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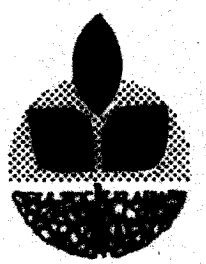

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P. L. Paradis, H. S. Nakaue, J. A. Harper and G. H. Arscott

REVIEW OF LITERATURE

Soybean meal has provided the major source of protein in Oregon poultry feeds for the past 30 years. More than 60,000 tons are used for this purpose each year in Oregon. Soybean meal obtained from the Midwest includes a freight cost of more than $40 per ton, an annual cost to poultrymen of about $2.5 million. This additional freight cost has generated much interest in the use of locally grown soybeans in an effort to reduce the cost of poultry feeds.

It has long been known that raw soybeans contain factors that affect the availability of nutrients to poultry or other monogastric animals. These factors may cause decreased fat and protein digestibility; decreased availability of the sulfur amino acids, methionine and cystine; reduced availability of some minerals; and interference with pancreatic enzymatic utilization.

Several workers have reported that feeding raw soybeans to growing birds causes a growth depression. With replacement pullets, this causes delayed sexual maturity and subsequent poor egg production (Lillie and Denton, 1966 and Ceballos et al., 1970).

The effects of feeding raw soybeans to laying pullets also have been extensively studied. Arscott (1975) showed that feeding raw soybeans to layers caused decreased egg production, feed consumption, poor feed conversion and caused pancreatic hypertrophy.

EXPERIMENTS WITH REPLACEMENT PULLETS

Experimental Procedure

During the first six weeks of age, the replacement chicks were not fed test rations. Four hundred and seven White Leghorn pullets (Babcock-300) were brooded together in a floor pen house. The chicks were equally divided into eight pens (10'x14' or 3m x 4.24m). A 56 inch electric hover was used as the heat source in each pen. The temperature under the hover was 95°F (35°C) the first week and was decreased by 5°F each week to 65°F (18.5°C).

Chicks were provided feed on filler flats for the first three to four days and then provided feed in three four-foot feed troughs. These feeders were gradually removed and replaced by three hanging tube feeders 16 inches (40 cm) in diameter per pen. A portable fountain-type waterer

was used initially and gradually removed in preference to automatic (Little Giants) waterers. A chick starter ration (20 percent protein) was fed ad libitum (free choice) to six weeks of age.

At six weeks of age, the birds were divided and half the population was transferred to another floor pen house containing eight pens (16' x 16' or 4.8m x 4.8m) with waterers and feeders as noted previously. There were four pens with 25 pullets per pen in each house, and the remaining pens for each house contained 50 pullets per pen.

Birds in the 25-pullet pens in each house were fed the 15.2 percent protein chick grower ration containing only extruded soybeans*(ESB) from 6 to 10 weeks of age, followed by a 13.5 percent protein chick developer ration containing the ESB from 11 to 21 weeks of age. The same feeding program was followed for the raw soybean (RSB) rations*. The pullets housed 50 to a pen were fed solvent soybean meal (SBM) rations for the same time periods. These rations are shown in Table 1.

The rations were isocaloric and isonitrogenous with barley utilized to equalize the energy levels of each ration. ESB and RSB were added to replace 100 percent of the protein contributed by SBM in the control ration. Feed and water were provided ad libitum throughout the test.

A step-down lighting program was followed from 6 weeks to 20 weeks of age with a decrease of 15 minutes per week of artificial light. One 40-watt incandescent light bulb was suspended eight feet (2.4m) over the center of each pen.

Body weights and feed consumption were measured at 6, 8, 10, 12, 18 and 21 weeks of age. Mortality was recorded daily and dead birds sent to the Oregon State University Diagnostic Laboratory for necropsy. Age of first egg was also recorded.

At 20 weeks of age, five pullets from each dietary treatment were sacrificed, and the pancreas, liver, kidney, gizzard, proventriculus and abdominal fat were excised and weighed. Each pullet was weighed just prior to sacrifice.

RESULTS AND DISCUSSION

As indicated earlier, the White Leghorn pullet chicks were fed a 20 percent chicken starter ration from day-old to six weeks of age. After this preliminary period, the chicks were fed the three types of soybeans as the primary source of protein. Average body weights and feed conver-

* Raw and extruded soybean supplied by Oregon State Department of Agriculture and prepared by McDaniel Grain and Feed Company, McMinnville,Oregon.

sions for 8, 10, 12, 18 and 21 weeks of age are presented in Table 2. Except for the 12-week results for the RSB fed birds, feed conversions were significantly higher ($P < 0.05$) than the SBM treatment throughout the growing stage. ESB did not affect feed conversion. Body weights for the birds fed RSB were significantly lower ($P < 0.05$) than birds fed SBM for the first six weeks of the test (Table 2). Thereafter, no significant differences were observed, but numerically smaller body weights existed to 21 weeks of age. Body weights for chicks fed ESB were not affected throughout the growing phase.

Average pounds of feed consumed, age at first egg and mortality during the growing phase are listed in Table 3. Only small differences in feed consumption were observed. These data indicated that palatability was not responsible for the growth retardation because slightly more feed was consumed by RSB fed birds as compared to those fed SBM. Although there were no significant differences among the three soybean treatments on age of first egg, pullets fed RSB were sexually delayed by about eight days. ESB fed pullets reached sexual maturity in about the same time as SBM fed birds. Mortality was considerably higher for RSB fed birds than for those fed ESB or SBM.

Organ weights were measured at 21 weeks of age, and the data are summarized in Table 4. Only pancreatic and hepatic weights were significantly larger and smaller ($P < 0.05$), respectively, for pullets fed RSB and ESB than pullets fed SBM. Kidneys, gizzard, proventriculus and abdominal fat were not affected by feeding ESB or RSB.

EXPERIMENTS WITH LAYING HENS

Experimental Procedure

To demonstrate whether there was a prolonged or abrupt effect from feeding ESB and RSB during the rearing and laying phases, the laying hen experiment was designed so that pullets fed SBM during the growing phase were fed rations containing either SBM, ESB or RSB during the laying period. Pullets fed ESB during the growing phase were switched to SBM or maintained on ESB with or without supplemental methionine during the laying period. Similarly, pullets fed RSB during the growing phase were switched either to SBM or maintained on RSB with or without supplemental methionine during the laying period. The above changes resulted in nine dietary treatments. Laying rations were formulated to be isonitrogenous and isocaloric. Barley was incorporated in the ESB and RSB rations to equalize the energy levels (Table 5).

The pullets were housed individually in cages (12" x 18" or 4.8 cm x 7.1 cm) in a positive pressure thermostatically controlled ventilated windowless house. At housing time, the pullets were equally distributed to each lot or row depending on the treatment during the grow and lay

phases. Each row or replicate contained 15 individually housed pullets and each treatment was replicated twice. A total of 270 pullets were involved in the laying trial.

Feed was provided ad libitum for six 28-day periods. Water was restricted to eight 15-minute watering periods in approximately equal intervals from 4:15 am to 5:45 pm daily. Lights were provided 14 hours daily from 4 am to 6 pm. Ventilation rate was approximately 6,000 to 7,500 cubic feet per minute.

Egg production and mortality were recorded daily, and all dead birds were sent to the Veterinary Diagnostic Laboratory for necropsy. Egg weights, feed consumption, percent egg production and egg size were determined for each 28-day period. Body weights were determined at the end of periods 1, 2, 3 and 6.

Egg shell quality was measured by specific gravity readings at the end of periods 1, 3 and 6 using the procedure described by Arscott and Bernier (1961) which involves using salt solutions. Interior egg quality was measured by breaking out two eggs per day for each treatment for three consecutive days at the end of periods 1, 3 and 6. Each egg was weighed individually and broken out on a glass plate with a mirror below. The presence of meat and blood spots was noted, and the height of the thick albumen measured with a micrometer. Yolk color was matched to a Roche color fan. Very light yellow was given a score of 1 and very dark orange a score of 16. Haugh units were calculated with a slide rule, using the relationship of the weight of the egg and the albumen height. A high Haugh unit value was indicative of superior interior egg quality.

At the end of the feeding trial, three laying pullets from each dietary treatment were sacrificed and the liver, kidneys, pancreas, gizzard, proventriculus and abdominal fat were excised and weighed.

All data derived from both experiments were submitted to analysis of variance and Duncan's new multiple range test (Steele and Torrie, 1960).

RESULTS AND DISCUSSION

Average body weight, average egg production, feed conversion and daily feed consumption for the six 28-day periods are listed in Table 6. Body weights were significantly smaller ($P < 0.05$) for layers fed either RSB or ESB from six weeks of age and from 22 weeks of age (Treatments 3, 5, 8) than SBM fed layers (Treatment 1). Except for Treatment 5, average egg production, feed conversion and daily feed consumption followed the same trend as the body weight for the RSB fed layers.

When layers were fed RSB during the growing phase and then switched to SBM, they performed normally (Treatment 7). This would indicate that the RSB effect was not permanent and that production would probably return to normal. Layers which were fed SBM during the growing phase, and then switched to ESB (Treatment 2) during the laying phase, were not affected. Addition of methionine to the ESB rations significantly increased ($P < 0.05$)

body weight when compared to the same ration without methionine. When methionine was added to RSB layer rations, body weights were not significantly different from those fed the same ration without methionine. However, egg production, feed conversion and daily feed consumption were significantly improved ($P < 0.05$) by methionine addition to RSB rations. These responses appeared intermediate between layers fed RSB from six to 21 weeks of age.

Data on the number of days needed to reach 50 percent production, average egg weight, average specific gravity and mortality are listed in Table 7. Shell quality (specific gravity) and mortality were not significantly influenced by feeding the three types of soybeans. Although average egg weights were not significantly different among all dietary treatments (Table 7), the egg grade data (Table 8) indicate that RSB fed layers produced more medium and large eggs than either the SBM or ESB fed layers (Treatments 1, 5, 8). Indirectly, the egg weight may be reflected by the age at 50 percent production as presented in Table 7. Layers fed RSB took longer to reach 50 percent egg production than ESB or SBM fed layers (Treatments 1, 5, 8). The addition of methionine to the RSB ration did not accelerate the age of layers to attain 50 percent production.

Interior egg quality data are presented in Table 8. Haugh units (interior egg quality) were significantly better ($P < 0.05$) for the layers fed RSB rations (Treatments 3 and 8) during the laying period than the other dietary treatments. These differences can be explained. The layers fed RSB rations laid eggs at a less intense rate than layers on the other treatments, thus allowing them to metabolically produce better albumen quality. ESB fed to layers did not influence the Haugh units when compared to SBM fed layers. Layers fed ESB and RSB rations produced significantly lighter ($P < 0.05$) egg yolk color than the layers fed SBM (Treatments 1, 4, and 7). This difference is due in part to inclusion of barley to replace part of the corn in the ESB and RSB rations.

Organ weight data are listed in Table 9 for layers sacrificed after feeding on the three soybean treatments for six months. No effects on kidneys, gizzard, proventriculus and abdominal fat were found among the dietary treatments. Similar to the replacement chickens, layers fed RSB from either six to 21 weeks or from 22 weeks of age (Treatments 3 and 7) had significantly larger ($P < 0.05$) pancreata than either ESB or SBM fed layers. However, unlike the replacement chickens, pancreatic weight was not affected when layers were fed ESB rations. Layers fed RSB during the growing period and then SBM during the laying period (Treatment 7) had normal pancreatic size comparable to the control group (Treatment 1). Liver weights were significantly smaller ($P < 0.05$) for layers fed either RSB or ESB during the growing and laying periods than SBM fed layers. Layers fed RSB during the growing phase and then switched to SBM in the laying phase (Treatment 7) had liver size comparable to the control group (Treatment 1). This indicates that the RSB effect did not premanently affect liver weight.

SUMMARY

An experiment was carried out with replacement pullets and with laying pullets involving the feeding of three types of soybeans (SBM, ESB and RSB). The Pacific Northwest grown soybeans used in this experiment were found to be acceptable for feeding replacement and laying pullets, if properly processed. Extruded soybeans were as effective as solvent extracted soybeans in supporting growth and egg production. Raw soybeans were found to be inferior to extruded and solvent soybeans. Feeding raw soybeans to replacement pullets caused growth retardation, poor feed conversion, pancreatic hypertrophy, liver atrophy and delayed sexual maturity. Similar effects were observed from feeding raw soybeans to laying pullets, including reduced egg production. Supplemental methionine in raw soybean rations for layers increased egg production over unsupplemented raw soybean rations. No prolonged retarded effect caused by RSB was indicated when birds fed RSB were switched to SBM rations.

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Table 1. Composition of diets fed replacement pullets

Ingredient	SBM		ESB		RSB	
	Grower (6-10wks)	Developer (10-21wks)	Grower (6-10wks)	Developer (10-21wks)	Grower (6-10wks)	Developer (10-21wks)
	%	%	%	%	%	%
Corn, yellow	40.0	35.0	5.0	10.0	5.0	10.0
Barley, Pac. Coast	46.2	46.2	67.2	68.2	67.2	68.2
Soybean meal (44% protein)	17.0	12.0	-	-	-	-
Soybean, extruded	-	-	21.0	12.0	-	-
Soybean, raw	-	-	-	-	21.0	12.0
Alfalfa meal (17% protein)	2.5	2.5	2.5	2.5	2.5	2.5
Limestone flour	1.0	1.0	1.0	1.0	1.0	1.0
Defluorinated phosphate	2.5	2.5	2.5	2.5	2.5	2.5
Salt, iodized	.50	.50	.50	.50	.50	.50
Vitamin premix[1]	.15	.15	.15	.15	.15	.15
Trace mineral mix[2]	.05	.05	.05	.05	.05	.05
Nopgro[3]	.10	.10	.10	.10	.10	.10
Calculated Analyses						
Protein (%)	15.30	13.54	15.20	13.54	15.25	13.55
M.E. (kcal/kg)	2754.4	2736.8	2756.6	2736.8	2756.6	2736.8
Calcium (%)	1.18	1.18	1.21	1.20	1.21	1.20
Phos. (%)	.90	.90	.97	.95	.97	.95
Lysine (%)	.82	.94	.94	.81	.94	.81
Methionine (%)	.22	.22	.26	.26	.26	.26
Met. + Cys.(%)	.46	.43	.54	.48	.54	.48

1. Contributes/kg of ration the following: vit. A, 2488 I.U.; vit. D, 826 I.C.U.; riboflavin, 2.48 mg; d-pantothenic acid, 4.13 mg; niacin, 16.52 mg; choline, 143 mg; vit. B_{12}, 4.12 mg; vit. E, .83 I.U.; vit. K, .41 mg; folacin, .17 mg.

2. Contributes/kg of ration the following: Ca, 97.5 mg; Mn, 60 mg; Fe, 20 mg; Cu, 2 mg; I, 1.2 mg; Zn, 27.5 mg.

3. Gratuitously from Diamond Shamrock, Cleveland, Ohio.

Table 2. Average body weight (B.W.) and feed conversion (F.C.) at 8, 10, 12, 18 and 21 weeks of age for replacement pullets fed solvent soybean meal (SBM), extruded (ESB) and raw (RSB) full-fat soybeans[1,2]

Treatment	8 wks		10 wks		12 wks		18 wks		21 wks	
	B.W. (lbs)	F.C.	B.W. (lbs)	F.C.	B.W. (lbs)	F.C.	B.W. (lbs)	F.C.	B.W. (lbs)	F.C.
SBM	1.41^{a}	3.23^{b}	1.85^{a}	3.65^{b}	2.21^{a}	4.28^{a}	3.28^{a}	5.75^{b}	3.37^{a}	6.29^{b}
ESB	1.37^{a}	3.40^{a}	1.78^{b}	3.77^{b}	2.16^{a}	4.24^{a}	2.98^{a}	5.76^{b}	3.37^{a}	6.32^{b}
RSB	1.29^{b}	3.58^{a}	1.68^{c}	4.03^{a}	2.06^{b}	4.26^{a}	2.88^{a}	6.27^{a}	3.18^{a}	6.94^{a}

1. Values with differing superscripts are significantly different ($P < 0.05$).

2. All pullets were fed the solvent soybean meal for the first six weeks. Average body weights at the time the experiment started were 0.99 pounds.

Table 3. Average feed consumed, age of first egg and mortality at 21 weeks of age for replacement pullets fed solvent soybean meal (SBM), extruded (ESB) and raw (RSB) full-fat soybeans[1]

Treatment	Average total feed consumed per bird (lbs)	Average age at 1st egg (days)	Mortality (died/started)
SBM	21.5[a]	135[a]	2/206
ESB	21.3[a]	137[a]	1/101
RSB	22.1[a]	143[a]	5/100

1. Values with differing superscripts are significantly different ($P < 0.05$).

Table 4. Average organ weights at 21 weeks of age for replacement pullets fed solvent soybean meal (SBM), extruded (ESB) and raw (RSB) full-fat soybeans

	Grams/100 grams body weight[1]					
Treatment	Pancreas	Liver	Gizzard	Proventriculus	Kidney	Abdominal Fat
SBM	.1880[c]	2.314[a]	1.804[a]	.250[a]	.589[a]	2.36[a]
ESB	.2463[b]	1.947[b]	2.042[a]	.262[a]	.600[a]	2.63[a]
RSB	.3406[a]	1.834[b]	1.900[a]	.271[a]	.641[a]	1.52[a]

1. Values with differing superscripts are significantly different ($P < 0.05$).

Table 5. Composition of laying pullet rations

Ingredient	SBM	ESB		RSB	
		wo/met.	w/met.	wo/met.	w/met.
	%	%	%	%	%
Corn, yellow	69.5	33.5	33.45	33.5	33.45
Barley, Pac. Coast	-	30.0	30.0	30.0	30.0
Soybean meal (44% protein)	19.0	-	-	-	-
Soybean, extruded	-	25.0	25.0	-	-
Soybean, raw	-	-	-	25.0	25.0
Alfalfa meal (17% protein)	2.5	2.5	2.5	2.5	2.5
Defluorinated phosphate	1.9	1.9	1.9	1.9	1.9
Limestone Flour	3.3	3.3	3.3	3.3	3.3
Oyster shell	3.3	3.3	3.3	3.3	3.3
Salt, iodized	.25	.25	.25	.25	.25
Vitamin premix[1]	.20	.20	.20	.20	.20
Trace mineral mix[2]	.05	.05	.05	.05	.05
d, l Methionine	-	-	.05	-	.05
Calculated Analyses					
Protein, (%)	15.5	15.5	15.5	15.5	15.5
M.E. (kcal/kg)	2836	2842	2840	2842	2840
Calcium (%)	3.23	3.25	3.25	3.25	3.25
Avail. Phos.(%)	.45	.48	.48	.48	.48
Lysine (%)	.74	.78	.78	.78	.78
Methionine (%)	.24	.23	.28	.23	.28
Met. + Cys. (%)	.51	.51	.56	.51	.56

1. Contributes/kg of ration the following: vit. A, 3304 I.U.; vit. D, 1111 I.C.U.; riboflavin, 3.3 mg; d-pantothenic acid, 5.51 mg; niacin, 22.01 mg; choline, 191 mg; vit. B_{12}, 5.51 mg; vit. E, 1.1 I.U.; vit. K, .55 mg; folacin, .22 mg.

2. See Table 1 for minerals contributed.

Table 6. Effect of feeding solvent extracted (SBM), extruded (ESB) and raw (RSB) full-fat soybeans to White Leghorn layers for six months on body weight, egg production, feed conversion and consumption, egg weight and specific gravity[1]

Treatment No.	Soybeans		Mean body wt.	Mean egg prod.	Mean feed conv.	Mean feed/ day/
	Grow phase	Lay phase	(lbs.)	(%)	(feed/ doz.)	bird (lbs.)
1.	SBM	SBM	$3.75^{d,e}$	$74.0^{c,d}$	$4.04^{a,b}$	$.245^{e}$
2.	SBM	ESB	$3.75^{d,e}$	$76.5^{c,d}$	3.73^{a}	$.237^{c}$
3.	SBM	RSB	3.40^{a}	$55.8^{a,b}$	4.66^{c}	$.211^{a}$
4.	ESB	SBM	$3.73^{c,d,e}$	77.7^{d}	3.76^{a}	$.241^{d}$
5.	ESB	ESB	$3.55^{a,b,c}$	$74.6^{c,d}$	3.77^{a}	$.233^{b}$
6.	ESB	ESB + met.	3.80^{e}	$75.5^{c,d}$	3.66^{a}	$.229^{b}$
7.	RSB	SBM	$3.75^{d,e}$	70.5^{c}	$4.36^{b,c}$	$.250^{f}$
8.	RSB	RSB	$3.6^{b,c,d}$	50.3^{a}	5.19^{d}	$.211^{a}$
9.	RSB	RSB + met.	$3.45^{a,b}$	60.9^{b}	4.53^{c}	$.228^{b}$

1. Values with different superscripts are significant at $P<0.05$.

Table 7. Effect of feeding solvent extracted (SBM), extruded (ESB) and raw (RSB) full-fat soybeans to White Leghorn layers for six months on body weight, egg weight, specific gravity, mortality and age at 50 percent production[1]

Treat. No.	Soybeans		Age at 50% production (days)	Mean egg wt. (gms)	Mean specific gravity	Mortality (dead/started)
	Grow phase	Lay phase				
1.	SBM	SBM	153^{a}	59.3^{a}	1.0842^{a}	5/30
2.	SBM	ESB	153^{a}	57.9^{a}	1.0869^{a}	0/30
3.	SBM	RSB	$158^{a,b,c}$	56.0^{a}	1.0855^{a}	0/30
4.	ESB	SBM	$155^{a,b}$	58.3^{a}	1.0859^{a}	0/30
5.	ESB	ESB	$157^{a,b,c}$	58.7^{a}	1.0857^{a}	0/30
6.	ESB	ESB + met.	$155^{a,b}$	58.7^{a}	1.0850^{a}	1/30
7.	RSB	SBM	$164^{b,c}$	58.5^{a}	1.0846^{a}	0/30
8.	RSB	RSB	$166^{b,c}$	57.1^{a}	1.0868^{a}	2/30
9.	RSB	RSB + met.	168^{c}	58.1^{a}	1.0856^{a}	1/30

1. Values with different superscripts are significant at $P < 0.05$.

Table 8. Effect of feeding solvent extracted (SBM), extruded (ESB) and raw (RSB) full-fat soybeans to White Leghorn layers after six months on interior egg quality and egg grade[1]

Treat. No.	Soybeans		Haugh units	Yolk[2,3] color	Mean egg grades[4]		
	Grow phase	Lay phase			Extra large (%)	large (%)	medium (%)
1.	SBM	SBM	70.9[a,b]	9.9[b]	30.9	35.4	26.2
2.	SBM	ESB	76.7[b,c]	8.3[a]	31.5	35.4	30.4
3.	SBM	RSB	80.9[c]	8.3[a]	18.2	34.4	36.5
4.	ESB	SBM	71.7[a,b]	10.2[b]	27.0	37.6	31.4
5.	ESB	ESB	76.5[b,c]	7.9[a]	30.9	31.3	31.1
6.	ESB	ESB+met.	77.9[b,c]	7.8[a]	34.0	32.7	29.1
7.	RSB	SBM	67.6[a]	9.9[b]	30.8	33.7	28.2
8.	RSB	RSB	81.5[c]	8.3[a]	23.8	30.4	37.3
9.	RSB	RSB+met.	77.8[b,c]	7.6[a]	33.3	32.5	25.3

1. Values with different superscripts are significantly different at $P<0.05$.
2. Roche color fan. 1=light yellow; 16=dark orange
3. For period 6 only.
4. Average of 6 periods.

Table 9. Effect of feeding solvent extracted (SBM), extruded (ESB) and raw (RSB) full-fat soybeans to White Leghorn layers for six months on organ size

Treat. No.	Soybeans		Ave.[1] body wt. (gms)	Organ Weights (gms/100gms B.W.)[1]					
	Grow phase	Lay phase		Pancreas	Liver	Kidney	Gizzard	Provent.	Abdominal Fat
1.	SBM	SBM	1541[a]	.1865[a]	2.99[c]	.6251[a]	1.47[a]	.313[a]	3.78[a]
2.	SBM	ESB	1682[a]	.1812[a]	1.65[a]	.5936[a]	1.37[a]	.287[a]	4.03[a]
3.	SBM	RSB	1707[a]	.3275[b]	2.13[a]	.6832[a]	1.63[a]	.273[a]	4.32[a]
4.	ESB	SBM	1810[a]	.1574[a]	2.18[a,b]	.5805[a]	1.34[a]	.277[a]	4.31[a]
5.	ESB	ESB	1626[a]	.1887[a]	1.68[a]	.5569[a]	1.49[a]	.277[a]	5.17[a]
6.	ESB	ESB+met.	1825[a]	.1695[a]	1.85[a]	.6495[a]	1.41[a]	.220[a]	4.80[a]
7.	RSB	SBM	1862[a]	.1700[a]	2.56[b,c]	.5369[a]	1.13[a]	.233[a]	4.28[a]
8.	RSB	RSB	1661[a]	.2949[b]	1.98[a]	.6726[a]	1.52[a]	.263[a]	2.91[a]
9.	RSB	RSB+met.	1618[a]	.3025[b]	2.01[a]	.6689[a]	1.63[a]	.247[a]	3.25[a]

1. Values with different superscripts are significantly different at $P < 0.05$.