Egyptian J. Anim. Prod., (2004) 41(2):95-113

THE USE OF NIGELLA SATIVA OIL SEED MEAL IN JAPANESE QUAIL DIETS

S.S. Aboul Ela, A.I. Attia, M.M. Soliman and M. Fathi

Poultry Department, Faculty of Agriculture, Zagazing University, Zagazig, Egypt

SUMMARY

Two experiments were conducted to study the effect of substituting soybean meal (SBM) by nigella sativa oil seed meal (NSOM) at different levels on growing and laying Japanese quail performance. Each experiment included 6 treatment groups. Six experimental diets were formulated contained 0, 3, 6, 9, 12 and 15% NSOM in which replaced SBM at levels of 0.00, 8.82, 17.65, 26.47, 35.29, and 44.12% in growing period (Exp.1) and 0.00, 12.00, 24.00, -36.00, 48.00 and 60% in laying period (Exp.2). During the growing (1-6 weeks of age) and laying (8-20 weeks of age), diets were isocaloric and isonitregenous. The laying period was divided into three production phases.

Results showed that feeding graded levels of NSOM instead of SBM up to 44.12% (15% NSOM in the diet) did not cause any detrimental effects on live body weight, body wight gain, feed intak and feed conversion .Statistical analysis did not show any significant differences in giblets percentage. However, dressing and carcass percentages were significantly (P < 0.05) affected by NSOM diets. Quail chicks fed on diet containing 8.82% NSOM instead of SBM showed significant (P < 0.01) increased in digestion coefficients of DM, OM, CP, CF and NFE compared to the other treatment groups. Economical Efficiency during the growing period increased by feeding diets containing 8.82, 17.65, 26.47, 35.29 and 44.12 NSOM instead of SBM, respectively when compared with those fed the control diet (0.00% NSOM).

No significant difference was observed in egg mass among the experimental groups and control group during the first two phases or egg production. While, a significant decrease (P < 0.05) was recorded for egg mass during the last one (16-20 weeks). Fertility and hatchability were insignificantly increased by feeding hens on diets containing NSOM during all the production periods. Albumin was significantly (P < 0.05) increased while yolk % decreased (P < 0.01) in eggs from hens fed on NSOM instead of SBM from 12 to 60% . Economical Efficiency increased with increasing NSOM substitution for SBM up to 60.00% when compared with control.

From the nutritional and economical point substituting NSOM up to 44.12 (15.00% NSOM of the growing diet) and 60.00% (15.00% NSOM of the laying diet) forJapanese quail diets had no adverse effect on growth and laying performance. However, further investigations should be done to test complete substitution of SBM in laying Japanese quail diet.

Keywords: ***Nigella sative meal, soybean meal, Japanese quail, growth and laying performance***

INTRODUCTION

Feed represents the major cost of poultry production and accounts about 75% of total production cost. With increasing feeding cost of poultry, nutritionists are forced to look at agricultural by-products of less cost than the conventional feedstuffs. The waste residues of fruits and vegetables after processing could be used as sources of protein and energy in feeding animals and poultry. Recently, the application of non-conventional feedingstuffs in poultry nutrition in developing countries has received considerable attention.

Nigella sativa seed has been used as a natural remedy for a wide variety of illnesses for ever 2000 years. However, the residues after oil extractin is a good protein source for use in poultry diets, when adequately supplemented.

Nigella sativa oil seed meal (NSOM) contains most of the essential amino acids at adequate amounts for the substitution of soybean meal in practical diets (khalifah, 1995). The author did not found significant effect of NSOM on live weight gain and feed intake in broiler chicks when used as a protein source for partial replacement of soybean meal. Zeweil (1996) reported that NSOM can be used successfully as a protein replacement of soybean meal at levels up to 40% of Japanese quail diets, However higher levels of NSOM depressed body weight and feed conversion ratio.

This study was conducted to investigat of the effects of replacing varying levels of NSOM for soybean meal in grower and layer Japanese quail diets.

MATERIALS AND METHODS

The experimental work was carried out at Poultry Research Farm, Poultry Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt.

Experiment 1:

Growing period (1-6 weeks of age):

A total number of 270 unsexed one week old quail chicks were randomly destributed into six treatment groups of 45 chicks, each group included 3 replicates of 15 chicks each. Chicks of all experimental groups had nearly the same initial average weight.

Nigella sativa oil seed meal (NSOM) was incorporated in the diets with six levels (0.0, 3.0, 6.0, 9.0, 12.0 and 15.0%) which represents a replacement rates of 0.00, 8.82, 17.65, 26.47, 35.29 and 44.12% of soybean meal (SBM) in the basal diet. In such diets, in NSOM contributing 0.00, 3.99, 7.99, 11.98, 16.06 and 20.09% of dietary crude protein in growing period.

The experimental diets were formulated based on the NRC (1994) requirements for quail and were almost isocaloric and isonitrogenous as shown in Table 1. Chicks were grown in brooders battries with raised wire floors and exposed to 24 hours of a constant light. Feed and water were supplied *ad-libitum* throughout the experimental period.

Individual body weight was recorded at one, three and six weeks of age, feed consumption and viability rate were recorded during the periods 1-3, 3-6 and 1-6 weeks of age.

Table 1. Composition and calculated analyses of growing diets fed to Japanese quails (Expt.1)

Items	NSOM substitution % for SBM					
	0.00 % (Control)	**8.82 %**	**17.65 %**	**26.47 %**	**35.29 %**	**44.12 %**
Ingredients (%)						
Yellow corn	56.71	55.20	53.65	51.74	49.91	48.35
Soybean meal (44%)	34.00	31.00	28.00	25.00	22.00	19.00
Nigella sativa meal (32.81%)	0.00	3.00	6.00	9.00	12.00	15.00
Corn gluten meal (60%)	6.30	7.00	7.55	8.00	8.45	8.90
Bone meal	2.35	2.35	2.25	2.21	2.19	2.20
Wheat bran	0.00	1.00	2.10	3.60	5.00	6.10
Vit. & Min. Premix [(1)]	0.25	0.25	0.25	0.25	0.25	0.25
NaCl	0.20	0.20	0.20	0.20	0.20	0.20
Dl-Methionine	0.06	0.00	0.00	0.00	0.00	0.00
L-Lysine Hcl	0.13	0.00	0.00	0.00	0.00	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analyses [(2)]						
Crude protein %	24.05	24.05	24.02	24.03	24.03	24.01
ME (kcal / kg)	2901	2905	2910	2906	2903	2905
Crude fiber %	3.81	4.10	4.41	4.75	5.07	5.37
Calcium %	0.81	0.81	0.78	0.77	0.78	0.77
Avail. Phosphorus %	0.45	0.46	0.45	0.45	0.46	0.46
Lysine %	1.33	1.31	1.30	1.35	1.40	1.45
Methionine + Cystine %	0.90	1.05	1.31	1.54	1.76	1.99
Cost / Kg diet PT, (Local prices of 2003) [(3)]	116.88	111.71	109.15	106.38	103.61	100.86

[(1)] Grower Vit. & Min. Premix : Each 2.5 kg consists of Vit. A 12000.000 IU, Vit. D3 2000.000 IU, Vit. E 10 g, Vit. K3 2 g, Vit. B1 1000 mg, Vit. B2 4 g, Vit. B6 1.5 g, Vit. B12 10 mg, Pantothenic acid 10 g, Niacin 20 g, Folic acid 1000 mg, Biotin 50 mg, Cholin chloride 500g, Fe. 30 g, Mn. 40 g, Cu. 3 g, I 300 mg, Co. 200 mg, Se. 100 mg, and Zn.45g.
[(2)] Calculated according to NRC (1994).
[(3)] Based upon each unit weight (Kg) of yellow corn, soybean meal, Nigella sativa meal, corn gluten meal, Bone meal, wheat bran, Vit. & Min. Premix, NaCl, Dl-Methionine, and L-Lysine Hcl equals to 73.0, 175.0, 70.0, 180.0, 25.0, 40.0, 500.0, 10.0, 1600.0 and 1400.0 PT, respectively..

At 6 weeks of age, three males from each treatment were randomly chosen having an average body weight around the treatment mean, deprived from feed overnight, weighed then slaughtered and after complete bleeding, feather was removed. The carcass traits studied were, giblets (liver, gizzard, and heart), carcass and dressed weights (dressed weight = carcass weight + giblets) / 100g pre-slaughter weight.

At the end of the experiment, four males from each treatment were used to determine the digestion coefficients of nutrients and to calculate the nutritive values of the experimental diets. Also, an indirect digestion trial was carried out to evaluate the digestibility coefficients and feeding values of NSOM. Birds were housed in individual metabolism cages and fed the experimental diets for a period of three days to allow the birds to become adjusted to cages. Then, the excreta was quantitavely collected for a 5 day period during which feed intake was also daily recorded.

Chemical analysis of NSOM, experimental diets and excreta were carried out according to the official methods of analysis (A.O.A.C, 1990). Faecal nitrogen was determined according to the method outlined by Jakobsen *et al.*, (1960), while the urinary organic matter fraction was calculated according to Abou-Raya and Galal (1971). Nutritive value was calculated as metabolizable energy (ME). Metabolizable energy was calculated as 4.2 Kcal / g TDN as suggested by Titus (1961).

Experiment 2:
Laying period (8-20 weeks of age):

A total number of 96 hens and 48 cocks of Japanese quails of 8 weeks of age with nearly equal body weight and average egg production were randomly divided into 6 treatment groups (16 hens and 8 cocks in each group). Each group of birds was sub-divided into 8 replicates, each of 2 females and one male. Each replicate was housed in one cage. NSOM was incorporated in the diets with six levels (0.00, 3.00, 6.00, 9.00, 12.00 and 15.00%) which represents a replacement rats of 0.00, 12.00, 24.00, 36.00, 48.00 and 60.00% of SBM. In such diets, NSOM contributing 0.00, 4.79, 9.60, 14.36, 19.20 and 23.94 of dietary crude protein in laying period. The experimental diets were nearly isocaloric and isonitrogenous and covered the requirements of quail chicks at the laying period as recommended by NRC (1994).

Birds were fed *ad-libitum* and the fresh water was available all the time during the experimental period. Artificial light source was used, giving a total of 16 hours of light per day.

The experimental period (8-20 weeks) was divided into three production phases (8-12, 12-16, and 16-20 weeks of age), these phases represented the productive performance of layer curve. For each replicate, egg number and egg weight were recorded daily and feed intake was calculated weekly. Egg mass was calculated by multiplying egg number by average egg weight. Feed conversion ratio (g feed / g egg) was calculated after subtracting the male consumption (one third) from the total amount of the feed consumed. At the first and the third week of each experimental period, about 80 eggs from each treatment were collected and incubated. After hatching, chicks were counted and non-hatched eggs were broken to determine the percentages of fertility and hatchability. The hatchability was expressed as chicks hatched from fertile eggs.

Egg quality measurements (albumen%, yolk%, shell%, egg shape index%, yolk index% and shell thickness) were determined for every period at the second and the fourth week of each period, according to Shehata (2000). Two eggs were randomly taken from each replicate, being 96 eggs/treatment.

The economical efficiency (EEf.) was calculated from the input and output analysis based on the differences in both growth rate (Exp.1) or egg production (Exp.2) and feeding cost (Heady and Jensen, 1954).

Data of Exp. 1 and Exp. 2 were statisticaly analyzed using analysis of variance according to Snedecor and Cochran (1982), while the significant mean differences were determined by Duncan's Multiple Range Test (Duncan, 1955). The statistically model used was: $X_{ik} = \mu + B_i + E_{ik}$

Where : X_{ik} = any observation, μ = the overall mean, B_i = effect of dietary treatment (I = 1, 2, and 6) and E_{ik} = random error.

Table 2. Composition and calculated analyses of laying diets fed to Japanese quails (Expt.2)

Items	NSOM substitution % for SBM					
	0.00% (Control)	12 %	24 %	36 %	48 %	60 %
Ingredients (%)						
Yellow corn	60.05	59.79	59.95	59.73	59.10	58.41
Soybean meal (44%)	25.00	22.00	19.00	16.00	13.00	10.00
Nigella sativa meal (32.81%)	0.00	3.00	6.00	9.00	12.00	15.00
Corn gluten meal (60%)	5.70	6.30	6.90	7.70	8.30	9.00
Bone meal	3.30	3.30	3.20	3.20	3.20	3.19
Limestone	3.80	3.80	3.90	3.90	3.95	3.95
Vit. & Min. Premix (1)	0.25	0.25	0.25	0.25	0.25	0.25
NaCl	0.20	0.20	0.20	0.20	0.20	0.20
Dl-Methionine	0.05	0.00	0.00	0.00	0.00	0.00
L-Lysine Hcl	0.15	0.16	0.10	0.02	0.00	0.00
Cotton oil seed	1.50	1.20	0.50	0.00	0.00	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analyses (2)						
Crude protein %	20.03	20.02	20.00	20.05	20.00	20.04
ME (kcal / kg)	2922	2931	2918	2916	2939	2965
Crude fiber %	3.22	3.43	3.65	3.86	4.07	4.27
Calcium %	2.51	2.51	2.52	2.52	2.54	2.53
Avail. Phosphorus %	0.55	0.55	0.55	0.55	0.55	0.55
Lysine %	1.08	1.14	1.13	1.100	1.13	1.18
Methionine + Cystine %	0.77	0.95	1.18	1.42	1.65	1.88
Cost / Kg diet PT, (Local prices of 2003) (3)	108.11	104.29	97.98	94.61	92.09	89.70

(1) Layer Vit. & Min. Premix : Each 2.5 kg of vitamin and mineral premix (commercial source pfiezer co.) : Vit. A. 12.00 Miu, Vit. E. 15.00 Kiu, Vit. D3 4.00 Miu, Vit. B1 1.00g, Vit. B2 8.00g. Pantothenic acid 10.87g, Nicotinic acid 30.00g, Vit. B6 2.00g, Vit. B12 10.00 mg, Folic acid 1.00g, Biotin 150.00 mg, Copper 5.00g, Iron 15.00g, Manganese 70.00g, Iodine 0.50g, Selenium 0.15g, Zinc 60.00g, and Antioxidant 10.00g.

(2) Calculated according to NRC (1994).

(3) Based upon each unit weight (Kg) of yellow corn, soybean meal, Nigella sativa meal, corn gluten meal, Bone meal, Limestone, Vit. & Min. Premix, NaCl, Dl-Methionine, L-Lysine Hcl and cotton oil seed equals to 73.0, 175.0, 70.0, 180.0, 25.0, 20.0, 500.0, 10.0, 1600.0, 1400.0 and 300.0 PT, respectively..

RESULTS AND DISCUSSION

Chemical composition, digestion coefficients and nutritive value of NSOM:

The chemical composition of NSOM was 90.67, 93.69, 32.16, 16.76, 15.60 and 29.17% for DM, OM, CP, EE, CF and NFE respectively and the corresponding digeston coefficient values were 71.76, 74.36, 83.33, 69.38, 16.23 and 45.03%. It is worthy noting that NSOM has a considerable amounts of CP and EE but it showed lower value of NFE and ash prcentage (6.31%). The higher value of EE is mainly due to the incomplete extraction of oil from seeds during processing of meal. These results are in good agreement with those obtained by Khalifa (1995), Zeweil (1996) and El-Ghamry *et al.* (1997) who noticed that black cumin meal has considerable amounts of CP and EE. The value recorded for protein was more and EE was less than those obtained by Salah (1997) These fluctuations in nutrient content of NSOM among different studies might be due to the seasonal factors, soil conditions, age of harvesting, locatin, environmental factors and method of oil extraction.

Digestibility coefficients of nutrients in NSOM are in agreement with those reported by Abd El-Maksoud (2001). The feeding value of NSOM in the present study was 2405 Kcal ME / Kg. Metabolizable energy (ME) is lower than that obtained by Khalifah (1995) and Zeweil (1996). It was 3005 Kcal ME / Kg. (Zeweil, 1995) in Japanese quail and 3185 Kcal ME / Kg. (Khalifa, 1995) in broiler chicks. Energy contents in NSOM is widely variable between authers, perhaps due to the different extration methods of oil from Nigella sativa seeds.

Experiment 1. Growing period:

Growth performance:

The results of growth performance of growing Japanese quails fed diets containing different levels of NSOM compared to the control diet are presented in Table 3.

The data indicated that replacing SBM by NSOM up to 44.12% (15% NSOM in the diet) did not produce any significant ($P < 0.05$) growth depression in body weight gain during the experimental periods (3-6 and 1-6 weeks of age) when compared with control diet (0.00 NSOM). The present results revealed also that quail fed diet containing 26.47% NSOM (9% in the diet) surpassed all treatments and gave the heaviest live body weight at 6 weeks of age and body weight gain during all the experimental periods. On the other hand, chicks fed NSOM to substitute 44.12% (15% NSOM in the diet) resulted in significantly ($P < 0.05$) lower body weight and in significantly body weight gain values at the same periods (Table 3).

Data in Table 3 showed that replacing SBM by NSOM up to 44.12% (15% NSOM in the diet) in quail diets did not significantly affect feed intake during 3-6 and 1-6 weeks of age. While it was significantly decreased when quails were fed diet containing NSOM replaced of 44.12% SBM (15% NSOM in the diet) during 1-3 weeks of age compared to the control birds.

The average values of feed conversion ratio are given in Table 3. The superior values of feed conversion were recorded at the first period of age (1-3 weeks of age) where the chicks are more efficient in utilizing feed nutrients to build up body tissues and growth. Feed conversion ratio improved significantly ($P < 0.05$) at 1-3 weeks of age in chicks fed diet containing NSOM replaced SBM compared to the control (Table 3).

There were insignificant differences in feed conversion among treatments during 3-6 and 1-6 weeks of age. However, feeding chicks on 44.12% NSOM (15% NSOM in the diet) recorded insignificantly the worse feed conversion compared with control during the whole experimental period (1-6 weeks of age).

Table 3. Growth performance of Japanese quails (X±SE) as affected by dietary NSOM during the experimental period (1-6 weeks of age). (Exp. 1)

Item	NSOM substitution % for SBM						Sig.
	0.00 %	8.82 %	17.65 %	26.47 %	35.29 %	44.12 %	
Live body weight (g) at:							
1 week	15.53±0.36	15.20±0.40	15.00±0.42	14.77±0.35	15.31±0.39	15.14±0.47	NS
3 weeks	64.66±2.12[b]	71.64±1.64[a]	64.40±2.06[b]	68.26±1.48[ab]	69.26±1.77[ab]	60.96±1.83[c]	**
6 weeks	154.27±4.06[ab]	160.76±3.04[a]	162.41±2.90[a]	162.07±1.95[a]	157.07±3.50[a]	147.58±4.07[b]	**
Daily weight gain (g) from:							
1-3 weeks	3.51±0.36[bc]	4.03±0.22[a]	3.81±0.02[b]	3.82±0.34[b]	3.85±0.33[b]	3.27±0.58[c]	**
3-6 weeks	4.26±0.50	4.24±0.67	4.48±0.54	4.48±0.56	4.18±0.63	3.95±1.14	NS
1-6 weeks	4.00±0.17	4.16±0.44	4.21±0.33	4.22±0.37	4.00±0.80	3.68±0.60	NS
Daily feed intake (g) from:							
1-3 weeks	12.22±0.22[a]	12.22±1.24[a]	12.04±0.52[a]	11.48±1.11[b]	11.49±1.48[b]	10.22±1.48[c]	*
3-6 weeks	19.00±0.69	19.11±0.80	18.70±1.48	19.08±0.57	18.98±0.48	18.87±0.22	NS
1-6 weeks	16.28±0.69	16.28±0.65	15.81±0.57	16.23±0.66	15.98±0.34	15.41±0.43	NS
Feed conversion ratio (g feed / g gain) from:							
1-3 weeks	3.49±0.22[a]	2.99±0.04[c]	3.01±0.29[bc]	3.13±0.16[b]	2.99±0.55[c]	3.13±0.21[b]	*
3-6 weeks	4.46±0.42	4.52±0.61	4.19±0.82	4.27±0.53	4.56±0.75	4.86±1.28	NS
1-6 weeks	4.11±0.22	3.92±0.32	3.76±0.42	3.85±0.25	3.39±1.57	4.21±0.69	NS
Viability rate % from:							
1-3 weeks	100.00	100.00	100.00	100.00	100.00	100.00	
3-6 weeks	100.00	97.78	95.56	100.00	100.00	97.78	
1-6 weeks	100.00	97.78	95.56	100.00	100.00	97.78	
Economical efficiency:							
1-6 weeks	0.303	0.407	0.466	0.467	0.448	0.398	

Means in the same row bearing different letters are significantly ($P < 0.05$) different.
* $P < 0.05$, ** $P < 0.01$ and NS = Not significant

The results of growth perform`ance are in agreement with those obtained by Zeweil (1996) who reported that the performance of growing Japanese quails fed diet containing 15 or 30% NSOM instead of SBM protein were statistically ($P < 0.01$) improved compared to the control. While quail given diets containing NSOM at 45% instead of SBM protein was not different from that of the control chicks fed the SBM diet, except for feed conversion ratio, which was deteriorated. He added also that feed consumption, body weight gain and feed conversion ratio were depressed with increased replacement of SBM protein with NSOM protein at 60 or 75%. Similarly, Khalifah (1995) showed that when SBM was replaced with NSOM protein up to 50%, body weight gain of broiler chicks showed insignificant differences among various dietary treatments. Abou-Egla *et al.* (2001) indicated that the presence of low levels of NSOM caused a positive associative effect which acted in improving the performance of quail fed NSOM to replace 5 or 10% of SBM protein.

The present results indicated that when NSOM replaced SBM up to 44.12% (15% NSOM in the diet), it did not cause harmful effect on all parameters under study. This means that NSOM caused a positive associative effect, which acted in improving the performance of quail fed NSOM up to 15% or the diet. This improvement may be attributed to beneficial effect exerted by NSOM composition. It was reported that Nigella sativa may control and buffer the condition of the stomach and intestine (Nouroy, 1954). Also the improvement in body weight and feed conversion ratio may be due to the presence of a mixture of unsaturated fatty acids including linoleic and linolenic which have been postulated to be essential for growth (Murray *et al.*, 1993). In this regard, Babayan *et al.* (1978) stated that Nigella sativa L.oil seed contains linoleic and linolenic acids.

The average values of viability of quail chicks during the different growing periods as effected by NSOM replaced SBM are presented in Table 3. The viability of the experimental groups were 100% during the starter period and ranged from, 95.56 100.00% during the finisher and the whole experimental period. This values are within the range of viability during growth period. The improvement of the viability may be due not only to the increased level of active material (Nigellone) in diets, which has a protective action against diseases (Mahfouz and El-Dakhakhny, 1960) but also to the reduction of mold growth which inhibit the formation of aflatoxins (Ghazalah *et al.*, 1996).

These results are in agreement with those obtained by Abou-Egla *et al.* (2001) who found that mortality tended to be lower in Japanese quail chicks fed diets containing NSOM instead of 10% SBM.

Economical effeciency (EEf.):

The economical efficiency of the different experimental diets containing NSOM up to 44.12% (15% NSOM in the diet) were higher than that of the control diet. It is worthy noting that these were a benefit from substituting NSOM for SBM up to 44.12%.

Economical Efficiency during the whole experimental period increased by 34.32, 53.79, 54.12, 47.58 and 31.35% for NSOM diets containing 8.82, 17.65, 26.47, 35.29 and 44.12 NSOM instead of SBM, respectively compared with those fed the control diet (0.00% NSOM).

Carcass traits:

The average values of some carcass traits as percentage of the pre-slaughter weight of Japanese quail chicks as affected by NSOM levels replaced SBM are presented in Table 4.

Table 4. Some carcass traits, g /100g pre slaughter weight,± SE, as affected by dietary NSOM level at 6 weeks of age. (Exp. 1)

Item	Pre-slaughter wt. (g)	Dressing %	Carcass %	Giblets %
NSOM substitution % for diets				
0.00 %	155.27 ± 3.83^{c}	77.64 ± 1.38^{b}	71.92 ± 0.82^{c}	5.72 ± 0.56
8.82 %	161.32 ± 1.51^{a}	78.78 ± 1.38^{a}	73.11 ± 2.63^{a}	5.67 ± 1.40
17.65 %	162.30 ± 3.59^{a}	77.75 ± 0.24^{b}	72.30 ± 1.33^{ba}	5.45 ± 1.29
26.47 %	162.40 ± 4.70^{a}	77.84 ± 0.49^{b}	71.55 ± 0.76^{bc}	6.29 ± 0.94
35.29 %	158.23 ± 4.48^{b}	77.21 ± 0.77^{b}	71.27 ± 0.52^{c}	5.94 ± 0.24
44.12 %	143.15 ± 7.31^{d}	75.74 ± 3.23^{c}	69.06 ± 3.27^{d}	6.69 ± 0.67
Significance	**	*	*	**NS**

Means in the same column within each parameter bearing different letters are significantly ($P<0.05$) different.
* $P < 0.05$, ** $P < 0.01$ and NS = Not significant

The results revealed no significant differences in giblet percentages. However, dressing and carcass percentages were significantly ($P< 0.05$) affected by NSOM replaced SBM in the diets. Quail chicks fed diet contained 8.82% NSOM instead of SBM (6% NSOM in the diet) gave significantly ($P< 0.05$) higher dressing and carcass percentages than the other groups or the control, except the carcass percentage of quails fed 17.65 and 26.47% NSOM replaced SBM in which the diffeences were not significant. While chicks fed diet contained 44.12% NSOM instead of SBM (15% NSOM in the diet) resulted in significantly ($P<0.05$) lower dressing and carcass percentages than the other groups or the control. The variation in carcass percentages among different treatments may be due to the significant effect of treatments of pre-slaughter weight. Also, dressing percentages were different among the experimental treatments, which could be attributed to the significant effect of treatments on both pre-slaughter weight and carcass weight.

These results agreed with those obtained by Abou-Egla *et al.* (2001) who found that the low level of substitution (5%) of SBM by NSOM caused in significant increases in pre-slaughter weight and carcass weight. However the carcass weight of quail fed 10 or 20% NSOM instead of SBM and those fed SBM diet (control) were not significantly differ. They also showed significant differences ($P <0.01$) in carcass weight and dressing percentages of quail fed 40% NSOM instead of SBM compared with the other experimental groups.

Khalifa (1995) working in broiler chicks reported that carcass and organs percentages were not significantly affected by replacing soybean meal with NSOM up to 50% in broiler diets.

Digestibility coefficients:

The average values of digestibility coefficients of the different nutrients and feeding values of the experimental diets are presented in Table 5.

Table 5. Digestion coefficients and feeding values (X± SE) of experimental diets as affected by dietary NSOM level

Level of substitution	Digestion coefficients %						Feeding values	
	DM	OM	CP	EE	CF	NFE	TDN %	ME (Kcal/Kg)
0.00 %	77.67±0.34^{c}	80.51±0.19^{b}	82.80±0.37^{b}	77.85±0.99	23.52±0.51^{a}	86.07±0.12^{b}	71.92±0.59	3021±24.92
8.82 %	78.58±0.48^{a}	81.06±0.41^{a}	83.87±0.44^{a}	78.66±1.03	22.43±0.51^{b}	86.99±0.42^{a}	72.38±1.25	3040±52.52
17.65 %	77.22±0.48^{c}	79.83±0.52^{c}	82.93±0.30^{b}	77.22±0.69	21.00±0.48^{cd}	86.75±0.36^{a}	70.75±7.62	2972±319.77
26.47 %	75.83±0.34^{b}	78.78±0.34^{d}	81.06±0.24^{c}	77.67±0.42	21.04±0.61^{c}	85.89±0.46^{b}	72.10±1.10	3028±46.34
35.29%	74.35±0.23^{d}	77.32±0.22^{e}	80.05±0.13^{d}	76.04±1.02	20.26±0.46^{d}	84.68±0.33^{c}	70.21±0.81	2949±34.31
44.12 %	74.11±0.57^{d}	77.15±0.47^{e}	79.80±0.33^{d}	78.01±0.59	21.66±0.61^{bc}	84.56±0.60^{c}	70.36±1.45	2955±60.67
Significance	**	**	**	NS	**	**	NS	NS

Means in the same column within each parameter bearing different letters are significantly ($P < 0.05$) different.
** $P < 0.01$ and NS = Not significant

Results obtained showed that the digestibility coefficients of OM, DM, CP, CF, and NFE were significantly (P <0.01) affected by NSOM in quail diets.

There were no significant differences in digestibility values of EE among the different experimental diets. On the other hand, quail chicks fed diet containing 8.82% NSOM replaced SBM increased significant (P< 0.01) increase in digestion coefficient values of DM, OM, CP, CF and NFE compared either other treatment groups or control. However, increasing the dietary NSOM more than 17.65% instead of SBM decreased digestion coefficients of the nutrients (Table 5). The diet contained 35.29 and 44.12% NSOM instead of SBM recorded the lowest values of nutrients digestion coeficint values than those of other experimental diets. The positive response in protein digestibility with low level of NSOM in diets may be due to some compounds present in NSOM. The reduction in CP digestibility with increasing the level of NSOM in diets may be attributed to the presence of anti-microbial and anti-fungal agents such as Nigellone, thymoqiunone and thymohydroquinone (Rathee *et al.*, 1982 and Hanafy and hatem, 1991). Similarly, Abou-Egla *et al.*, (2001) indicated that quail fed diet containing NSOM instead of 5% SBM digested crude protein more efficiency (P < 0.01) than the control group, however, it decreased significantly (P <0.01) in the group fed NSOM instead of 40% SBM. Zeweil (1996) found that the digestion coefficients of OM and EE decreased at the highest level of NSOM in the diet of Japanese quail.

Regarding the nutritive values, it is clear that TDN and ME values were decreased insignificantly by increasing NSOM more than 26.47% NSOM instead of SBM (9% NSOM in the diet). These results are in agreement with those obtained by Zeweil (1996) who found that metabolizable energy was not affected significantly by different NSOM treatments in Japanese quail. The reduction in TDN% may be attributed to the decrease in the digestibility of CP and NFE.

Experiment 2. Laying period:

Productive performance:

Data in Table 6 show that egg number was not significantly affected by NSOM percentages during 8-12, 12-16 and 8-20 weeks of age and it was significantly influenced during 16-20 weeks of age. Egg number at 16-20 weeks of age significantly (P < 0.05) decreased by 5.00, 3.33 and 5.00% in hens fed the diets contained 36.00, 48.00 and 60.00% NSOM substituted for SBM, respectively compared with those fed the control diet.

Insignificant differences in egg weight during 8-12 and 16-20 weeks of age and significant effect during the other periods among hens fed NSOM diets were detected compared with those fed the control diet. Egg weight at 12-16 weeks of age significantly decreased by 2.16 and 2.99% in hens fed diets contained 48.00 and 60% NSOM instead of SBM, respectively compared with those fed the control diet (0.00% NSOM). The corresponding values during the whole experimental period (8-20 weeks of age) were 1.27 and 2.46%, respectively.

No significant difference was observed in egg mass among the experimental groups and control during the first two phases. While a significant decrease (P< 0.05) was recorded for egg mass during the last one (16-20 weeks).

Table 6. Productive performance of Japanese quails (X±SE) as affected by dietary NSOM level during the experimental period (8-20 weeks of age). (Exp. 2)

Items	NSOM substitution % for SBM						Sig.
	0.00 %	12.00 %	24.00 %	36.00 %	48.00 %	60.00 %	
Egg number from:							
8-12 weeks	18.76±0.06	18.48±0.11	18.76±0.11	18.76±0.93	18.76±0.11	18.48±0.08	NS
12-16 weeks	22.40±0.13	22.40±0.09	22.40±0.09	22.68±0.09	22.96±0.07	23.24±0.04	NS
16-20 weeks	16.80±0.12^{a}	17.64±0.10b^{a}	17.92±0.18^{a}	15.96±0.16^{b}	16.24±0.17^{b}	15.96±0.15^{b}	*
8-20 weeks	57.96±0.07	58.80±0.07	58.80±0.07	57.12±0.06	57.96±0.06	58.80±0.06	NS
Egg weight (g) from:							
8-12 weeks	11.17±0.64	11.25±1.23	11.21±1.03	11.04±0.59	11.24±0.68	11.05±1.02	NS
12-16 weeks	12.02±0.65^{a}	11.91±0.36^{b}	12.01±0.32^{ab}	11.96±0.45^{ab}	11.76±0.36^{c}	11.66±0.35^{d}	**
16-20 weeks	12.13±0.33	11.94±0.87	11.94±0.35	11.91±0.90	10.65±9.97	11.73±0.36	NS
8-20 weeks	11.78±0.40^{a}	11.71±0.39^{ab}	11.73±0.35^{a}	11.64±0.39^{b}	11.63±0.42^{b}	11.49±0.36^{c}	**
Egg mass from:							
8-12 weeks	7.48±0.73	7.43±0.99	7.51±1.20	7.40±0.85	7.53±1.12	7.29±1.39	NS
12-16 weeks	9.62±1.84	9.53±1.08	9.61±1.24	9.69±1.21	9.22±0.93	9.68±0.66	NS
16-20 weeks	7.28±1.48^{a}	7.52±1.18^{a}	7.64±2.13^{a}	6.79±1.77^{b}	6.18±1.88^{b}	6.69±1.83^{b}	*
8-20 weeks	8.13±1.04	8.20±0.74	8.21±0.89	7.92±0.69	8.02±0.51	8.04±0.73	NS
Feed conversion ratio (g feed / g egg) from:							
8-12 weeks	3.25±0.32	3.23±0.44	3.21±0.51	3.28±0.43	3.21±0.46	3.31±0.64	NS
12-16 weeks	2.87±0.55	2.91±0.32	2.87±0.36	2.85±0.36	2.88±0.29	2.87±0.21	NS
16-20 weeks	3.65±0.77	3.52±0.58	3.49±1.16	3.91±1.01	3.87±0.98	3.78±1.07	NS
8-20 weeks	3.22±0.40	3.19±0.29	3.15±0.37	3.27±0.29	3.26±0.19	3.26±0.31	NS
Viability rate % from:							
8-20 weeks	100.00	100.00	100.00	100.00	100.00	100.00	
Economical efficiency:							
8-20 weeks	0.753	0.824	0.901	0.873	0.943	1.004	

Means in the same row bearing different letters are significantly ($P < 0.05$) different.

* $P < 0.05$, ** $P < 0.01$ and NS = Not significant

Zeweil (1996) found that productive performance (egg number, egg weight, egg mass and feed conversion) was not different between control Japanese quail hens fed SBM diet and hens fed Nigella sativa meal at 15.00, 22.50, 30.00 or 37.50% of dietary crude protein. No significant effects were observed by El-Ghamry *et al.* (1997) on egg production, egg mass and feed conversion among Bovan brown layer hens fed SBM diet and hens fed NSOM at levels up to 75.00% (up to 46% of the diet).

It is worthy noting that viability percentage was 100% during the whole experimental period. Similar results were reported by Zeweil (1996).

Economical efficiency (EEf.):

The economical efficiency values of substituting NSOM for SBM are presented in Table 6. There was a benefit at different levels of substitution. The economical efficiency values of the groups fed 0.00, 12.00, 24.00, 36.00, 48.00 and 60.00% NSOM instead of SBM were 0.753, 0.824, 0.901, 0.873, 0.943 and 1.004, respectively. It is clear that EEf. increased with increasing NSOM substitution for SBM up to 60.00% compared with the control.

Reproductive performance:

The effect of the experimental diets on fertility and hatchability of Japanese quail eggs as influenced by levels of NSOM are presented in Table 7. Quail hens fed NSOM showed no significant difference among the fertility and hatchability values compared to the control during all the experimental periods except at 12-16 weeks of age in which a significant increase ($P < 0.05$) was recorded for the fertility percentage at all the levels of NSOM substitution compared with the control. At 12-16 weeks of age, fertility percentage significantly increased by 1.01, 1.76, 2.70, 1.48 and 4.02% in hens fed diets contained NSOM at levels of 12.00, 24.00, 36.00, 48.00 and 60.00% substitute for SBM compared with control (0.00 % NSOM).

Fertility and hatchability were insignificantly ($P< 0.05$) increased by feeding hens on diets containing NSOM during all the experimental periods. This may be due to the presence of high level of fatty acids such as linoleic, oleic and lenolenic acids (Murray *et al.*, 1993). The amounts of these essential fatty acids in yolk are ultimately related to the intake from the diet, and dietary deficiencies of linoleic acid are associated with a reduction in egg output and lipid content of the yolk with an increase in early embryo mortality. In severe deficiency, linoleic and arachidonic fatty acids could not be detected in the yolk and hatchability was reduced to zero (Pearson, 1989), as yolk lipid is the main source of energy for the developing of embryo and accounting for between 84 and 98% of the material oxide.

Egg quality:

Egg quality characteristics as overall means of different weeks of the experimental periods are presented in Table 8.

The results showed that albumin and yolk percentages were significantly ($P< 0.05$ or $P < 0.01$) affected by NSOM level in quail hen dies. Albumin was significantly ($P < 0.05$) increased while yolk % decreased ($P < 0.01$) in eggs of hens fed NSOM instead of SBM from 12 to 60%.

Table 7. Reproductive performance (X±SE) of Japanese quails as affected by dietary NSOM level during the experimental period (8-20 weeks of age). (Exp. 2)

Item	Fertility %				Hatchability %			
	8-12 Weeks	12-16 Weeks	16-20 Weeks	8-20 Weeks	8-12 Weeks	12-16 Weeks	16-20 Weeks	8-20 Weeks
NSOM substitution % for SBM								
0.00 %	72.74±11.35	83.21±0.98^{d}	80.98±1.46	79.01±3.75	68.13±9.20	79.87±3.22	77.30±1.51	75.08±4.42
12.00 %	73.64±10.07	84.05±0.09^{c}	80.95±0.46	79.55±3.46	69.40±13.21	81.01±0.65	77.38±0.54	75.92±4.76
24.00 %	74.51±9.53	84.68±0.93^{c}	81.28±2.56	80.18±1.88	66.99±5.04	82.01±0.65	77.62±0.58	75.49±0.97
36.00 %	74.35±10.41	85.46±0.17^{b}	80.67±0.82	80.14±3.80	66.76±5.12	80.55±0.12	76.69±3.38	74.57±2.70
48.00 %	74.29±10.12	84.44±2.21^{c}	82.56±2.96	80.27±1.57	67.74±8.00	80.25±3.36	76.50±0.21	74.64±1.52
60.00 %	73.62±8.09	86.56±1.01^{a}	83.45±0.23	80.90±2.60	68.22±10.36	80.13±2.11	75.26±2.90	74.29±2.18
Significance	NS	*	NS	NS	NS	NS	NS	NS

Means in the same column within each parameter bearing different letters are significantly ($P < 0.05$) different.
* $P < 0.05$ and NS = Not significant.

Table 8. Egg quality (X±SE) of Japanese quail as affected by dietary NSOM level during the experimental periods (8-20 weeks of age). (Exp. 2)

Item	Albumen %	Yolk %	Shell %	Egg shape index %	Yolk index %	Shell thickness (mm)
NSOM substitution % for SBM						
0.00 %	50.86±2.16[b]	30.20±2.02[b]	18.95±3.68	70.08±1.87	50.70±2.27	0.24±0.02
12.00 %	52.58±2.57[a]	28.46±2.22[a]	18.97±3.67	70.34±5.25	51.83±2.27	0.24±0.02
24.00 %	52.87±3.65[a]	27.84±1.61[c]	19.25±4.10	70.28±1.64	51.42±2.04	0.24±0.01
36.00 %	52.14±3.08[a]	29.23±0.74[d]	18.63±3.43	70.83±1.39	51.60±2.27	0.24±0.02
48.00 %	52.14±3.08[a]	28.63±1.47[a]	19.30±4.26	70.87±2.33	51.51±1.73	0.24±0.01
60.00 %	52.07±3.06[a]	28.58±0.87[a]	19.18±3.44	70.93±1.55	51.47±0.94	0.24±0.01
Significance	*	**	NS	NS	NS	NS

Means in the same column within each parameter bearing different letters are significantly ($P < 0.05$) different.
* $P < 0.05$, ** $P < 0.01$ and NS = Not significant.

No significant differences were observed in average shell %, egg shape index %, yolk index % and shell thickness (mm) at the different levels of NSOM substitution with SBM compared with the control. The previous results are partially in agreement with those obtained by Zeweil (1996) who reported that egg yolk %, albumin %, shell %, yolk index % and shell thickness were not different in control Japanese quails hens fed the soybean meal compared to those fed NSOM at levels up to 75% of dietary SBM. Similar results obtained also by El-Ghamry *et al.* (1997).

From the nutritional and economical point substituting NSOM up to 44.12 (15.00% NSOM of the diet) and 60.00% (15.00% NSOM) of the diet in growing and laying Japanese quail diets had no adverse effect on their growth and laying performance. However, further investigations should be done to test complete substitution of SBM in laying Japanese quail.

REFERENCES

Abd El-Maksoud, A.M., 2001. Nutritive evaluation of some agro-industrial by-products and its utilization in feeding broiler chicks. Ph.D. Thesis, Poultry Dept., Fac. Of Agric., Zagazig University, Egypt.

Abou-Egla, EL., S.G.K. Genedy, A.E Abou-Zeid and H.S. Zeweil, 2001. Nigella sativa oil seed meal as a non-traditional source of plant protein in Japanese quail diets. Egypt. Poult. Sci. J, 21: 107-125.

Abou-Raya, A.K. and GH. Galal, 1971. Evaluation of poultry feeds in digestion trials with reference to some factors involved. A.R.E, J. Animal Prod., 11(1): 207-221.

Association of Official Analytical Chemists, AOAC, 1990. Official Methods of Analysis. 14th Ed. Published by A.O.A.C, Washington, DC, USA.

Babayan, V.K., D. Koottungal, and G.A. Halaby, 1978. Proximate analysis, fatty acid and amino acid composition of Nigella sativa seeds. J. Food Sci., 43 (4): 1314-1315.

Duncan, D.B., 1955. Multiple Range and Multiple F Tests. Biometrics, 11: 1-42.

El-Ghamry, A.A, L.D. Abd El-Samee and M.R. Ibrahim, 1997. Effect of feeding Black cumin (Nigella sativa) meal and rice polishings at different levels on the laying performance and some blood plasma constituents. Egyp. J. Nutr. and Feed, 1: 311-320.

Ghazalah, A.A. and Faten, A. Ibrahim, 1996. The possibility of using some edible and aromatic oils in the nutrition of Muscovey ducks. Egypt. Poult. Sci. J, 16: 305-328.

Hanafy, M.S.M. and M.E Hatem, M.E., 1991. Studies on the antimicrobial activity of Nigella sativa seed (black cumin). J. of Ethnopharmacology, 34 (2-3): 275-278.

Heady, E.O. and H.R. Jensen, 1954. Farm Management Economics. Prentic-Hall, Inc. Englewood Cliffs, N.J.

Jakobsen, D.E., S.K. Gertovey and H. Nielson, 1960. Digestibility trials with poultry. 322 Bertning fra forsg slabooratoriel udgbet of statens. Husdyrbugsudvaly-Kobengaven.

Khalifa, M.M.M., 1995. Nigella sativa oil seed meal as a protein supplement in broiler diets. M. SC. Thesis, Faculty of Agric. Alexandria Univ.

Mahfouz, M. and M. El-Dakhakhny, 1960. Some chemical and pharmacological properties of the new antiasthmatic drug "Nigellone". Egypt. Pharm. Bull. 24,:411-424.

Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell, 1993. Textbook Harper's Biochemestry. Pages 232-240, twenty-third edition, Appleton and longe, Norwalk, Connecticut Los Altos, California.

National Research Council NRC, 1994. Nutrient Requirements of Poultry 9th ed. National Academy of Sci. Washington, D,C., USA.

Nouroy, J., 1954. Contribution a etude de la pharmacopee marocaine traditionelle (drogues vegetales). MSc.Thesis, Univ. Paris jouve, edition, Paris. (Cited from Abou-Egela *et al.*, 2001)

Pearson, R.A., 1989. Influence of nutritional factors on hatchability. In Recent Developments in Poultry Nutrition. Editors PP. 276-291 D.J. Cole and W. Haresignn, Butterworths, London.

Rathee, P.S., S.H. Mishra and R. Kaushal, 1982. Antimicrobial activity of essential oil, fixed oil and unsaponifable matter of Nigella sativa L. Indean J. Pharmac. Sci,. 44: 8-10.

Salah, M.M.I., 1997. Some studies on fish nutrition. Msc. Thesis, Fac. of Agric. Zagazig Univ., Egypt.

Shehata, M.M., 2000. Using some aquatic plants in feeding chicks. Ph. D. Thesis, Fac. of Agric. Zagazig University, Egypt.

Snedecor, C.W. and W.C. Cochran, 1982. Statistical Methods. 7th ed. Iowa State Coll Press Ames IA.

Titus, H.W., 1961. The Scientific Feeding of Chickens. 5th Ed. Danvil, Illinois, U.S.A

Zeweil, H.S., 1996. Enzyme supplements to diets of growing Japanese quail. Egypt. Poult. Sci. J, 16: 535-557.

استخدام كسب بذور حبة البركة في علائق السمان الياباني

صلاح الدين سيد أبو العلا، عادل إبراهيم عطية، مصطفى محمد سليمان، محمد فتحي

قسم الدواجن - كلية الزراعة - جامعة الزقازيق

أُجريت تجربتان لدراسة تأثير إحلال كسب بذور حبة البركة محل كسب بذور فول الصويا بمستويات مختلفة على أداء السمان النامي والبياض. استخدم في هذا البحث ٢٧٠ كتكوت سمان ياباني غير مجنس عمر أسبوع ، ١٤٤ (٩٦ أنثى + ٤٨ ذكر) من الأمهات والآباء ، كُونت ٦ علائق تجريبية تحتوي على صفر ، ٣ ، ٦ ، ٩ ، ١٢ و ١٥ % من كسب بذور حبة البركة لتحل محل كسب بذور فول الصويا بمستويات صفر ، ٨,٨٢ ، ١٧,٦٥ ، ٢٦,٤٧ ، ٣٥,٢٩ ، ٤٤,١٢ % في فترة النمو (التجربة الأولى) و صفر ، ١٢ ، ٢٤ ، ٣٦ ، ٤٨ ، ٦٠ % في فترة إنتاج البيض (التجربة الثانية). وكانت العلائق التجريبية خلال فترة النمو (١-٦ أسابيع) وإنتاج البيض (٨-٢٠ أسبوع) متساوية في الطاقة والبروتين.

وفيما يلي ملخصاً لأهم ما توصلت إليه هذه الدراسة من نتائج:

أولاً: التجربة الأولى:

١- لم يكن للتغذية على مستويات متدرجة من كسب بذور حبة البركة لتحل محل كسب بذور فول الصويا حتى ٤٤,١٢ أي تأثيرات ضارة على وزن الجسم والزيادة فيه والغذاء المأكول ومعدل التحويل الغذائي.

٢- لم يُظهر التحليل الإحصائي أي فروق معنوية في نسبة الأحشاء ومع ذلك تأثرت نسبة التصافي والذبيحة معنوياً باستبدال كسب بذور حبة البركة محل كسب بذور فول الصويا في العلائق.

٣- أظهرت كتاكيت السمان التي غُذيت على علائق تحتوي ٨,٨٢ % كسب بذور حبة البركة محل كسب بذور فول الصويا زيادة معنوية في معامل هضم كلاً من المادة الجافة والعضوية ، البروتين الخام ، الألياف الخام والكربوهيدرات الذائبة مقارنة بالمعاملات الأخرى و عليقة المقارنة.

٤- زيادة الكفاءة الاقتصادية خلال الفترة التجريبية (١-٦ أسابيع) بالتغذية على علائق تحتوي على كسب بذور حبة البركة بمستويات ٨,٨٢ ، ١٧,٦٥ ، ٢٦,٤٧ ، ٣٥,٢٩ ، ٤٤,١٢ محل كسب بذور فول الصويا عند مقارنتها بالكتاكيت التي غُذيت على عليقة المقارنة.

ثانياً:التجربة الثانية:

١- لم يُلاحظ أي اختلافات معنوية بين المجاميع التجريبية في كتلة البيض خلال أول فترتين تجريبيتين (٨-١٢ ، ١٢-١٦ أسبوع) بينما حدث زيادة معنوية في كتلة البيض خلال الفترة التجريبية الأخيرة (١٦-٢٠ أسبوع).

٢- زادت نسبة الخصوبة والفقس زيادة غير معنوية بتغذية إناث السمان الياباني على علائق تحتوي على كسب بذور حبة البركة خلال كل الفترات التجريبية.

٣- زادت نسبة الألبيومين معنوياً بينما انخفضت نسبة الصفار في البيض الناتج من إناث غُذيت على علائق تحتوي على كسب بذور حبة البركة محل بذور فول الصويا .

٤- زادت الكفاءة الاقتصادية بزيادة إحلال كسب بذور حبة البركة محل كسب بذور فول الصويا حتـــى ٦٠ % عندما قورنت بالكنترول.

بصفةٍ عامة يُستخلص من نتائج التجربة من الوجهة الغذائية والاقتصادية أنه يمكن إحلال كسب بذور حبة البركة محل كسب فول الصويا حتى ٤٤,١٢% في علائق السمان النامي ، ٦٠ % في علائـــق إنتـــاج البيض دون أي تأثير ضـار على الأداء الإنتاجي للطيور ، ومع ذلك يجب إجراء مزيد من الأبحاث لاختيـــار الاستبدال الكامل لكسب بذور فول الصويا بكسب حبة البركة في علائق إنتاج البيض للسمان الياباني.