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TRITICALE GRAINS AS SUBSTITUTE FOR YELLOW CORN IN LAYING JAPANESE QUAIL DIETS

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SUMMARY

This study was carried out at the Poultry Research Station, El-Azab, Fayoum, Egypt during the period from April to July 2010. The total number of the experimental birds (180) at 36 days of age was divided equally into five treatments (36 birds each), each treatment was equally subdivided into three replicates of 12 (eight female and four male) birds each. The present study was conducted to determine the efficiency of partial substitution (0,15,30,45 and 60%) of yellow corn (YC) by triticale grains (TG) on productive performance, egg quality, fertility%, hatchability% and economical efficiency of laying Japanese quail.

Results obtained could be summarized in the following: Feeding different levels of TG insignificantly (P>0.05) affected productive performance of laying Japanese quail. All of the dietary treatments surpassed (P≤0.05) the control in Haugh unit (HU) with the exception of quails fed diet containing 45% TG which were lower than the control. However, insignificant differences were detected in other egg quality characteristic as compared to the control diet. All of the dietary treatments significantly (P≤0.01) surpassed the control in fertility%, quails fed diet containing 45% TG had higher fertility% and quails fed diet containing 15% TG had higher hatchability%. Inclusion of TG in the laying Japanese quail diets at different levels caused a significant (P≤0.05) differences only in white blood cells (WBCs) count. The WBCs count was found to be significantly lower in quails fed control diet compared with other groups, while, insignificant effects were observed in the other blood constituents. Economical efficiency values during the period from 36 to 119 days of age was improved for quails fed all experimental diets containing TG as compared with those fed the control diet.

Generally, it can be concluded that TG can substitute YC in laying Japanese quail diets up to 60% to get the best performance and the highest economical and relative efficiency.

Keywords: *Triticale, laying Japanese quail, performance, egg quality, fertility and hatchability%.*

INTRODUCTION

Cereal grains (especially maize or yellow corn) is one of the most important part of feed ingredients as the major contributors of energy in poultry diet. In addition it's cost as the highest part of poultry ration (Scott, 1998 and Shivazad, 1998).

Yellow corn production in Egypt is not adequate to supply local requirements of feed, food and other industries, so it must depend on the imported YC. Some problems for YC production result from unsuitable climate, soil and irrigation conditions. So, it is important to search for other alternative cheap energy sources which can solve these problems. Because it could, not only reduce the diet price but also produce cheaper meat and egg (by obtain a greater growth rate with lower cost) for human consumption and save the human food such as wheat and other cereals (Abdelrahman *et al*., 2008 and Emam, 2010). Triticale, however, have been successfully grown in these conditions. Triticale is an artificial species with a very short history of just over 100 years. Triticale (*Triticale hexaploide L*) is a hybrid cereal cross of wheat (*Triticum aestivum L)* and rye (*Secale cereale L*). It possesses the hardiness qualities of rye, such as drought tolerance and disease resistance (Boros, 1999).

On the other hand TG can grow well in some areas where wheat does not, disease resistance of wheat with the vigor, hardiness, and high lysine content of rye and some varieties can make more efficient use of water and soil nutrients. Triticale can provide ecological benefits by diversifying crop production, reducing pests, protecting and improving soil by increasing organic matter (Emam,2010) and requires less agricultural chemicals such as fertilizer, agronomic chemicals, etc. (Çiftci *et al*.,2003).

The main non-starch polysaccharide (NSP) constituent in the endosperm cell walls of TG is pentosans (Petterson and Aman, 1988 and Flores *et al*., 1994) with some ß-glucan, such as in wheat and rye. All of these have been found in small amounts in TG, but at levels much lower than in rye. With modern TG, various anti nutritional factors (ANFs), such as non-starch polysaccharides (pentosans) and protease inhibitors, while higher than in most other cereal grains, seem to have no effect on the growth performance of livestock consuming diets containing TG (NRC, 1989; Van Barneveld and Cooper, 2002 and Emam, 2010).

Also, TG-based diets may cause self-feeders to "gum-up" a little, in which case proper adjustment and frequent checking may be required. The problem can be minimized by mixing TG with YC or grain sorghum, however, mixing TG with wheat will not solve this problem (Austin *et al.,* 1999 and Emam, 2010).

Determined chemical composition of TG in the present study as compared with those of TG and YC reported by several studies is shown in Table (1). Proximal composition shows that TG are a good source of energy and protein. Its protein (CP) content ranges from 10.3 to 15.6%. The average reported protein content of TG of 12.95%, which is about 1.52 times the CP of corn. Triticale grains contain small amounts (1.75%) of ether extract (EE), ash (1.62%) with varying ranges of crude fiber (CF) from 2.22 to 4.70%. Carbohydrate (NFE) content ranges from 57.0 to 73.1%, with an average of 65.05% (Table 1).

The energy content of modern TG cultivars averages about 92 to 100% of that of maize or wheat for poultry (NRC, 1998; Boros, 2002; Van Barneveld, 2002; Van Barneveld and Cooper, 2002 and Emam, 2010). On the other hand the energy content ranges from 3005 to 3633Kcal/kg. The average reported energy content of TG is 3319 Kcal/kg, which is about 0.991 times the energy content of YC (Table 1).

Table (1): Proximate chemical composition of triticale grains (TG) as compared with yellow corn (YC).

	Items	DM%[1]	CP%[2]	EE%[3]	CF%[4]	Ash%	NFE%[5]	ME kcal/Kg
TG	The present study (determined)	89.50	12.30	2.50	4.70	1.90	68.10	3005[6]
	NRC 1994	90.00	14.00	1.50	4.00	--	--	3163
	NRC 1998	90.00	12.50	1.80	3.80	--	--	3180
	Eborn, 1996	89.49	13.50	2.09	--	2.23	72.13	3360
	Hermes and Johnson (2004)	88.60	11.20	1.50	3.30	1.70	70.90	--
	Chapman *et al.* (2005)	--	10.30-15.60	--	3.10-4.50	1.40-2.00	57.00-65.00	3346-3633
	Jozefiak *et al.* (2007)	89.69	11.10	1.14	2.22	1.63	62.43	--
	Nutrition Data (2007)	90.00	13.20	1.80	--	1.90	73.10	
	Leeson and Summers (2008)	--	15.40	1.00	4.30	--	--	3110
	Emam (2010)	90.50	12.50	1.90	4.3	1.00	70.80	3070
	Range	88.60-90.50	10.30-15.60	1.00-2.50	2.22-4.70	1.00-2.23	57.00-73.10	3005-3633
YC	NRC, 1994	89.00	8.50	3.80	2.2	--	--	3350

[1] Dry matter, [2] Crude protein, [3] Ether extract, [4] Crude fiber, [5] Nitrogen-free extract
[6]Calculated according to Janssen, 1989 by applying the equation:-
Triticale MEn (Kcal/kg) = (34.49 × CP) + (62.16 × EE) + (35.61 × NFE), --Non available

Triticale grains are good source of amino acids especially lysine (the average reported lysine content of TG is 0.39%, which is about 1.5 times the lysine content of YC). Minerals, especially the available phosphorus content of TG of 0.1%, which is about 1.25 times the available phosphorus of YC, calcium content of TG of 0.05%, which is about 2.50 times the calcium of YC and copper content of TG of 8mg/kg, which is about 2.67 times the copper content of YC (NRC, 1994). Because of triticale's higher lysine and minerals, especially the phosphorus content, producers who mix their diets using a soybean meal-premix can save 100 Libra soybean meal (44%) and 5 lb dicalcium phosphate per ton of diet over comparable corn-based diets, which gives further advantage to producers who mix their own diets from "scratch"(Myer and Barnett, 2000; Barnett *et al.*, 2006 and Emam, 2010).

On the other hand, TG are worth approximately four to eight% more than the purchase price of corn on an equal-weight basis because TG not only replaces all of the YC in a typical poultry diet, but also part of the soybean meal (or other protein supplement), this may decrease dietary costs (Heger and Eggum, 1991; Varughese *et al.*, 1996 and Emam, 2010). Michela and Lorenz (1976) reported that triticale's vitamin content is about the same as that of wheat.

Çiftci *et al*. (2003) reported that there were no significant effects of TG in combination with maize or wheat in laying hen diets on laying rate, egg weight, egg mass, feed intake or feed efficiency ($P>0.05$). Layer performance was not affected by the formulation of diets with 30% TG var. Bogo (Hermes and Johnson, 2004).

In contrast, Cuca and Avila (1973) and Chodhary and Netke (1976) reported that TG reduced hen performance when it replaced 100% of wheat, milo and maize. They determined that egg production and egg weight were reduced when 50 or 100% TG replacement was fed.

Therefore, the objectives of the current study were to determine the efficiency of partial substitution of YC by TG in laying Japanese quail diets on productive performance, egg quality, fertility%, hatchability% and economical efficiency.

MATERIALS AND METHODS

This study was carried out at the Poultry Research Station, El-Azab, Fayoum, Egypt during the period from April to July 2010 to study the efficiency of partial substitution of YC by TG in laying Japanese quail diets on performance, egg quality, fertility%, hatchability% and economical efficiency. The total number of the experimental birds (180) at 36 days of age was divided equally into five treatments (36 birds each), each treatment was equally subdivided into three replicates of 12 (eight ♀ and four ♂/replicate) birds each.

The experimental treatments were as follows:

1-Quails were fed the control diet (D_1). 2-15% of YC in D_1 was substituted by TG.

3-30% of YC in D_1 was substituted by TG. 4-45% of YC in D_1 was substituted by TG.

5-60% of YC in D_1 was substituted by TG.

Quails were fed laying experimental diets (mash) from 36 to 119 days of age (Table 2) and its were individually weighed to the nearest gram at the start of experiment, wing-banded and randomly allotted to the dietary treatments. Quails were raised in electrically heated batteries with raised wire mesh floors and had a free access to the mash feed and fresh water from nipple drinkers throughout the experiment. Photoperiod and temperature during the experiment were 16h and 21◦C, respectively. Batteries were placed into a room provided with continuous fans for ventilation.

Table (2): Composition of the experimental diets.

Items,%	Level of yellow corn substitution%				
	0	15	30	45	60
Yellow corn, ground	62.00	52.70	43.40	34.10	24.80
Triticale grains, ground	0.00	9.30	18.60	27.90	37.20
Soybean meal (44%CP)	22.30	22.35	22.30	22.30	22.30
Corn gluten meal	7.65	7.00	6.40	5.80	5.20
Calcium carbonate	5.50	5.50	5.50	5.50	5.50
Sodium chloride	0.30	0.30	0.30	0.30	0.30
Vit. and Min. premix [1]	0.30	0.30	0.30	0.30	0.30
Di-calcium phosphate	1.30	1.30	1.30	1.30	1.30
Vegetable oil [2]	0.35	0.95	1.60	2.20	2.80
DL–Methionine	0.10	0.10	0.10	0.10	0.10
L-Lysine HCl	0.20	0.20	0.20	0.20	0.20
Total	100.0	100.0	100.0	100.0	100.0
Calculated analysis [3]%:					
Crude protein	20.07	20.04	20.00	19.98	19.97
Ether extract	3.08	3.54	4.05	4.52	4.98
Linoleic acid	1.74	1.93	2.15	2.35	2.54
Crude fiber	3.02	3.25	3.47	3.70	3.92
Calcium	2.52	2.52	2.52	2.52	2.52
Available phosphorus	0.35	0.36	0.36	0.36	0.36
Methionine	0.46	0.46	0.46	0.46	0.46
Methionine+Cystine	0.80	0.80	0.80	0.80	0.80
Lysine	1.04	1.04	1.05	1.05	1.06
ME, kcal./Kg	2901	2900	2903	2903	2902
Cost (£.E./ton) [4]	2053.3	2040.0	2028.3	2016.3	2004.3
Relative cost [5]	100.0	99.35	98.78	98.20	97.61

[1]Each 3.0 Kg of the Vit. and Min. premix manufactured by Agri-Vet Company, Egypt contains: Vit. A, 10000000 IU; Vit. D3 2000000 IU; Vit. E, 10.0 g; Vit. K3, 1.0 g; Vit. B1, 1.0 g; Vit. B2, 5.0 g; Vit. B6, 1.5 g; Vit. B12, 10.0 mg; choline chloride, 250.0 g; biotin, 50.0 mg; folic acid, 1.0 g; nicotinic acid, 30.0 g; Ca pantothenate, 10.0 g; Zn, 50.0 g; Cu, 4.0 g; Fe, 30.0 g; Co, 100.0 mg; Se, 100.0 mg; I, 300.0 mg; Mn, 60.0 g, and completed to 3.0 Kg by calcium carbonate.
[2]Mixture from 75% soybean oil and 25% sunflower oil.
[3]According to NRC, 1994 and determined values for triticale grains as shown in Table (1).
[4]According to the local market price at the experimental time.
[5]Assuming the price of the control group equal 100.

The experimental diets were supplemented with minerals and vitamins mixture, DL-methionine and L-Lysine HCl to cover the recommended requirements according to NRC (1994). The composition and chemical analyses of the experimental diets are shown in Table (2) and were formulated to be iso-nitrogenous and iso-caloric, containing about 20% CP and 2900 Kcal ME/Kg diet.

Quails were individually weighed to the nearest gram at weekly intervals during the experimental period. At the same time, feed intake (FI,g/bird) was recorded and feed conversion (g feed/g egg), crude protein conversion (CPC, g protein/g egg), caloric conversion ratio (CCR) and performance index (PI) were also calculated.

Eggs were daily collected and weighed, monthly egg production (EP,%), egg number (EN), egg weight (EW, g) and egg mass (EM, g) were calculated per each replicate for 12-weeks laying period. Feed intake (FI, g/bird) was monthly recorded to determine monthly FCR, CPC and CCR were also calculated for 12-weeks laying period.

Three batches of eggs (No=27 egg/treatment) were collected from the 5 treatments pens monthly to study the hatchability and incubated at Chick Master hatchery. Fertility was determined by candling at seven days of incubated period. The averages of the fertility% (fertile eggs/total eggs x100) and hatchability% (hatched chicks/total eggs x100) of the three batches were calculated.

Egg quality was assessed in 27 eggs/treatment (nine eggs/replicate collected monthly) during the last three days of the month. Egg shape index was estimated as the maximum width to its length. At sampling, eggs were individually weighed to the nearest 0.1g and broken onto a flat surface, where the height of the albumen to the nearest 0.1mm was measured half way between the yolk and the edge of the inner thick albumen by using an electronic albumen height gauge. The yolk was separated from the albumen and weighed and yolk color was determined by comparing each yolk to a Roche yolk color fan. The same person performed all of the yolk color determinations. Haugh unit scores were calculated according to Haugh (1937), the shells were dried at room temperature for three days and weighed, shell thickness was measured by Ames shell thickness gauge to the nearest mm.; the weight of the albumen was calculated as the difference between the weight of the egg and the weight of the yolk and shell.

At the end of the experiment, blood samples were collected from 5 hens/pens and taken randomly from the brachial vein and then transferred to heparinized tubes and placed on ice. Hemoglobin concentration (Hb), red blood cells (RBC`s) count and white blood cells (WBC`s) count, lymphocyte (LYMP), basophil, eosinophil, neutrophils by using ABX.

Economical efficiency of egg production was calculated from the input-output analysis which was calculated according to the price of the experimental diets and eggs produced. The values of economical efficiency were calculated as the net revenue per unit of total cost.

Statistical analysis of results was performed using the General Linear Models (GLM) procedure of the SPSS software (SPSS, 1999), according to the follow general model: $Y_{ik}= \mu+T_i+ e_{ik}$

Where: Y_{ik}: observed value; μ: overall mean; T_i: treatment effect (i: 1 to 5) and e_{ik}: random error. Treatment means indicating significant differences ($P\leq0.01$ and $P\leq0.05$) were tested using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Laying hens productive performance:

The effect of partial substitution of YC by TG in laying Japanese quail diets on egg production (EP%), egg number (EN), mean egg weight (EW), total egg mass (EM), total feed intake (FI), feed conversion ratio (FCR), crude protein conversion (CPC) and caloric conversion ratio (CCR) are shown in Table (3). There were insignificant differences among treatments in productive performance of laying Japanese quail, numerically, regarding to EW, EM, FCR, CPC and CCR all of the dietary treatments surpassed the control, on the other hand, as the level of substitution increased, egg weight increased.

Table (3): Effects of triticale grains (TG) as substitute for yellow corn (YC) in Japanese quail diets on laying performance.

Items	Level of YC substitution%					SEM[1]
	0	15	30	45	60	±
Egg production (EP)%	56.47	64.29	57.29	56.10	62.50	7.20
Egg number (EN)	379.5	432.0	385.0	377.0	420.0	48.4
Mean egg weight (EW,g)	9.69	9.75	9.84	10.14	10.43	0.17
Total egg mass (EM,g)	3675.9	4210.4	3788.6	3818.5	4387.2	495.4
Total feed intake (FI,g)	15686.4	16531.4	15713.8	16304.9	16791.1	591.3
Feed conversion ratio (FCR,g feed/g egg)	4.41	3.93	4.15	4.27	4.01	0.61
Crude protein conversion (CPC)	0.884	0.787	0.830	0.852	0.800	0.12
Caloric conversion ratio (CCR)	12.78	11.39	12.05	12.38	11.62	1.78

[1]Pooled SEM

These results are in harmony with some experimental results who demonstrated that TG can substituted in place of maize or wheat (Kim *et al*., 1976; Castanon *et al.*, 1990; Righter and Lemser, 1993 and Çiftci *et al*., 2003), wheat or sorghum (Weber *et al*., 1972), wheat or rye (McNab and Shannon, 1975) and barley (Karunajeewa and Tham, 1984) without any negative effects on hen performance.

Also, much of the early work with TG in layers was to understand its value as a replacement for other typical feed grains such as YC, wheat and milo. Fernandez *et al.* (1973) performed similar experiments and found that egg production was not affected when TG composed up to 85% of a TG-based diet. Other reports have shown varying production effects of replacing some portion of the diet with TG (McNab and Shannon, 1975; Karunajeewa, 1978 and Leeson and Summers, 1987). Layer performance was not affected by the formulation of diets with 30% TG var. Bogo (Hermes and Johnson, 2004). While, these results disagree with those of Cuca and Avila (1973) and Chodhary and Netke (1976).

Egg quality:

Effect of partial substitution of YC by TG in laying Japanese quail diets on egg quality are shown in Table (4). It is clear that, partial substitution of YC by TG significantly influenced (P≤0.01 and P≤0.05) EW and HU score. All of the dietary treatments surpassed the control in EW. On the other hand, as the level of substitution increased, EW increased. Also, all of the dietary treatments surpassed the control in HU by the exception of quails fed diet containing 45% TG which were lower than the control. However, insignificant differences were detected in other egg quality characteristic as compared to the control diet.

Numerically, as expected, egg yolk color score was lower (insignificant) in YC–TG diets than the control diet. Low egg yolk color can be attributed to a lack of carotenoids in TG, as reported by Karunajeewa (1978) and Castanon *et al.* (1990). Inclusion of TG in the diets at different levels caused insignificant increase in shell thickness with the exception of quails fed diet containing 15% TG which were slightly lower than the control.

Table (4): Effects of triticale grains (TG) as substitute for yellow corn (YC) in laying Japanese quail diets on egg quality, fertility and hatchability%.

Items	Level of YC substitution%					SEM[1]
	0	15	30	45	60	±
Egg quality						
Egg weight, g	10.22^{C}	11.07^{B}	11.14^{B}	11.69^{AB}	12.24^{A}	0.31
Yolk color	6.45	5.76	6.10	5.88	5.92	0.44
Shell thickness, mm	0.184	0.183	0.196	0.192	0.187	0.01
Albumen%	62.72	61.13	60.96	59.80	62.27	0.96
Yolk%	28.82	30.76	30.32	31.98	29.72	0.95
Shell%	8.46	8.11	8.72	8.21	8.01	0.22
Yolk index%	44.68	44.88	46.93	44.48	44.46	0.95
Shape index%	78.99	80.31	78.95	78.31	77.98	0.73
Haugh unit	83.19^{ab}	85.31^{a}	86.20^{a}	81.57^{b}	83.75^{ab}	1.10
Fertility and hatchability%						
Fertility	79.69^{C}	82.35^{AB}	82.00^{AB}	83.67^{A}	81.63^{B}	0.58
Hatchability	56.25^{B}	60.00^{A}	56.00^{B}	59.18^{A}	53.06^{C}	0.58

[1]Pooled SEM

a, …b, and A,… C, values in the same row within the same item followed by different superscripts are significantly different (at P ≤ 0.05 for a to b ; P ≤0.01 for A to C).

In this respect, Hermes and Johnson (2004) reported that hens fed TG in the diet had significantly (P≤0.05) lower (paler) yolk color compared with those fed the control diet. On the other hand, yolk color was reduced in eggs laid by hens fed 30% TG in the diets for 28 days. Yolk color indicates the level of pigment in the feed, an issue of consumer preference as opposed to grade or quality.

Fertility and hatchability%:

Effect of partial substitution of YC by TG in laying Japanese quail diets on fertility and hatchability% are shown in Table (4). All of the dietary treatments significantly (P≤0.01) surpassed the control in fertility%, quails fed diet containing 45% TG had higher fertility and quails fed diet containing 15% TG had higher hatchability%. While, quails fed diet containing 0 and 60% TG had lower fertility and hatchability%, respectively (Table 4).

Blood constituents:

Some blood constituents analyses are summarized in Table (5). Inclusion of TG in the laying Japanese quail diets at different levels caused a significant (P≤0.05)

Table (5): Effects of triticale grains (TG) as substitute for yellow corn (YC) in laying Japanese quail diets on some blood parameters.

Items		Level of YC substitution%					SEM[1]
		0	15	30	45	60	±
Hemoglobin (g/dL)		10.95	10.55	10.30	10.95	11.85	0.61
Red blood cells count [2]		3.21	2.88	2.67	3.11	3.90	0.37
White blood cells count [2]		10.60^b	11.50^b	13.65^{ab}	16.30^a	12.15^b	0.83
Total leucocytes/cmm		40.50	49.00	46.50	56.00	52.50	5.13
Differential count%	Neutrophils	17.00	18.00	21.50	21.50	18.50	3.12
	Lymphocyte	75.00	74.50	69.50	69.50	73.50	2.45
	Monocytes	4.50	4.50	3.50	4.50	4.00	0.45
	Eosinophils	3.50	3.00	5.50	4.50	4.00	0.87
	Basophils	0.00	0.00	0.00	0.00	0.00	0.00
	Blast cells	0.00	0.00	0.00	0.00	0.00	0.00
Blood index	Hematocrit (HCT)%	40.50	38.50	35.50	37.50	45.00	2.65
	Mean corpuscular volume (MCV) μ^2	118.0	134.2	133.7	124.6	115.4	10.2
	Mean corpuscular hemoglobin (MCH) µµg	34.15	36.65	38.60	36.50	30.35	2.48
	Mean corpuscular hemoglobin concentration (MCHC)%	26.10	26.05	28.40	26.95	26.30	1.47

[1]Pooled SEM , [2] 10^6/ ML

a, …b, values in the same row within the same item followed by different superscripts are significantly different (at P ≤ 0.05 for a to b).

differences only in white blood cells (WBCs) count, while, insignificant (P≥0.05) effects were observed in the other blood constituents being, hemoglobin, red blood cells count, total leucocytes, all differential count% (neutrophils, lymphocyte, monocytes, eosinophil, basophil and blast cells) and blood index (hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC%).

The WBCs count was significantly (P≤0.05) lower in quails fed control diet compared with other groups. Numerically, partial substitution of YC by TG improves (P>0.05) total leucocytes (cmm) and neutrophils% when compared with those fed the control diet (Table 5). It can be concluded that partial substitution of YC by TG in the diets is important for increase number of WBCs and for proper development and function of immune system that could help in improving productive, physiological or immunological performance of poultry. In this respect, Emam (2010) reported that inclusion of TG in the broiler diets at different levels caused a significant (P≤0.01) differences in red blood cells count, lymphocyte and neutrophils, while, insignificant effects were observed in the other blood constituents being hemoglobin, haematocrit, MCV, TLC, neutrophils, eosinophil and basophil.

Economical efficiency (EEf):

Results in Table (6) show that EEf values during the period from 36 to 119 days of age was improved of quails fed all experimental diets containing TG as compared with those fed the control diet. Quails fed diet containing 60% TG had the best economical and relative efficiency values being 2.269 and 121.86%, respectively followed by quails fed diet containing 15% TG (2.131 and 114.44%, respectively) then quails fed diet

Table (6): Effects of triticale grains (TG) as substitute for yellow corn (YC) in laying Japanese quail diets on economical efficiency.

Items		Level of YC substitution%				
		0	15	30	45	60
Price/k feed (L.E.)	a	2.0533	2.0400	2.0283	2.0163	2.0043
Total feed intake (Kg)	b	15.686	16.531	15.714	16.305	16.791
Total feed cost (L.E.)	a x b = c	32.209	33.724	31.872	32.876	33.654
Total egg mass (Kg)	d	3.6759	4.2104	3.7886	3.8185	4.3872
Price/Kg eggs (L.E.)	e	25.080	25.080	25.080	25.080	25.080
Total price of eggs (L.E.)	d x e = f	92.192	105.60	95.018	95.768	110.03
Net revenue (L.E.)	f – c = g	59.983	71.873	63.146	62.892	76.377
Economical efficiency (EEf.)	g / c = h	1.8623	2.1312	1.9812	1.9130	2.2694
Relative EEf.	r	100.00	114.44	106.39	102.72	121.86

a……… (based on average price of diets during the experimental time).
e……....(according to the local market price at the experimental time).
g /c..…...(net revenue per unit feed cost).
r……..….(assuming that economical efficiency of the control group equals 100).

containing 30% TG (1.981 and 106.39%, respectively) then quails fed diet containing 45% TG (1.913 and 102.72%, respectively) when compared with the control group.

These results are in harmony with those obtained by Belaid (1994) who showed in economic studies of layer that the inclusion of TG leads to cost savings resulting from the complete replacement of maize and from a considerable reduction of soybean meal in the diets. Triticale grains is worth approximately 4 to 8% more than the purchase price of corn on an equal-weight basis because TG not only replaces all of the corn in a typical swine diet, but also part of the soybean meal (or other protein supplement), this may decrease dietary costs (Myer and Barnett, 2000).

Generally, it can be concluded that TG can substitute YC in laying Japanese quail diets up to 60% without any adverse effect on egg quality, fertility and hatchability%. Also, it has recorded the best performance and the highest economical and relative economical efficiency. Triticale grains may be an attractive option for laying Japanese quail production when the availability of maize or YC is limited and its prices are elevated due to drought or other conditions.

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حبوب التريتيكال كبديل للأذرة الصفراء في علائق السمان الياباني البياض

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اجريت هذه الدراسة بمحطة بحوث الدواجن بالعزب-الفيوم- مصر في الفترة من ابريل إلي يوليو ٢٠١٠ . استخدم عدد ١٨٠ طائر سمان ياباني عمر ٣٦ يوم قسمت عشوائياً إلي ٥ معاملات (٣٦ طائر /معاملة) كل معاملة تشتمل علي ٣ مكررات و١٢ طائر بكل مكرر(٨ إناث و ٤ ذكور). الهدف من الدراسة هو تقييم استبدال جزء من حبوب الذرة الصفراء (صفر، ١٥، ٣٠، ٤٥ و ٦٠%) بحبوب التريتيكال وتأثيرها على الأداء الإنتاجى وجودة البيض والكفاءة الاقتصادية للسمان الياباني البياض. **وتتلخص أهم النتائج المتحصل عليها فيما يلي**: لم يكن هناك أي تأثير معنوي لاستخدام مستويات مختلفة من حبوب التريتيكال علي الأداء الإنتاجي للسمان الياباني البياض. كانت جميع المعاملات التجريبية أعلي في قيم وحدات Hough من مجموعة المقارنة فيما عدا السمان المغذي علي عليقة تحتوي علي ٤٥% تريتيكال والتي كانت ذات قيم أقل من مجموعة المقارنة، بينما لم يكن هناك أي فرق معنوي في صفات جودة البيضة الأخرى عند مقارنتها بمجموعة المقارنة. كانت جميع المعاملات التجريبية أعلي في نسبة الخصب من مجموعة المقارنة فكان للسمان المغذي علي عليقة تحتوي علي ٤٥% تريتيكال أعلي نسبة خصب والسمان المغذي علي عليقة تحتوي علي ١٥% تريتيكال أعلي نسبة فقس. كان هناك زيادة معنوية فقط في عدد كرات الدم البيضاء نتيجة لاحتواء العليقة علي مستويات مختلفة من حبوب التريتيكال، بينما لم يكن هناك أي فرق معنوي في مكونات الدم الأخرى. فكان للسمان المغذي علي عليقة المقارنة أقل في عدد كرات الدم البيضاء بالمقانة بالمجموعات الأخرى. كانت أعلي كفاءة اقتصادية ونسبية خلال الفترة من ٣٥ إلي ١١٩ يوم من العمر للسمان المغذي علي جميع علائق التريتيكال عند مقارنتها بتلك المغذاة علي عليقة المقارنة.

الاستنتاج: يمكن إحلال حبوب التريتيكال بديلا عن الذرة الصفراء حتى ٦٠% في علائق السمان الياباني البياض للحصول علي أحسن أداء إنتاجي وأعلي كفاءة اقتصادية ونسبية.