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Effect of Supplementation of Different Levels of Azolla Plant Powder on The Productive Performance and Some Qualitative Characteristics of Eggs of Japanese Quail

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THIS STUDY was carried out in the poultry field of the animal production department / college of agriculture/ Kirkuk university form (18th Feb, 2022 until 18th April 2022), to investigate effect of different azolla plant powder on the egg production, and its quality of Japanese quail. Twenty male and sixty females at age 40 days were randomly allocated to five treatments (0% azolla, 4% azolla, 8% azolla, 4% azolla + Enzyme and 8% azolla + Enzyme). By using the electronic balance and digital clipper Vernier, the egg production and the egg quality traits were taken daily. The statistical software SAS was utilized to compute the mean, standard error, and significance using the General Linear Model (GLM). The discrepancies between the means were tested using the Duncan multiple range test. All the traits were significantly differing among the treatments ($p<0.05$). We conclude that adding azolla at 8% with enzyme was enhanced and increase the productivity and the egg quality traits of Japanese quail.

Keywords: Azolla, Quail, Egg, traits.

Introduction

Azolla is an aquatic fern, using as feed supplementation in poultry and mammals diet. As it is described by [1] Azolla has at least eight species, and the most common used is Azolla pinnata. The azolla firstly used as a green manure, but by the time used as saline soil reclaimed, biogas producer, and bio-mediator. Azolla meal was used successfully for chicken [2], quail [3], duck [4], and fish [5]. Moreover, it was used for the mammals feed such as cattle [6], and rabbits [7]. The ratio of protein in azolla ranged between (25-35) %, and it's rich by essential minerals, and vitamins [8]. Several study were done to study the effect of azolla on the growth, and egg production performance. [9], was finding in his study that adding azolla at 3% enhance the growth and FCR. Moreover, azolla rich by B carotene pigment, which effect on the yolk color in layer diet [10]. [11] reported that using azolla in layer diet resulted increasing in egg production, furthermore [12] was noticed adding azolla effected positively on the eggshell strength due to high level of calcium content of azolla.

Due to the small size, easy to breed, and small generation period, was make the Japanese quail frequently uses in poultry fields such as, nutrition [13, 14], and breeding [15]. The objective of the current study was to investigate the effect of different concentration of azolla on the egg production performance, and egg quality of Japanese quail.

Experimental

The study was conducted from February 18, 2022, until April 18, 2022, in the animal production department of Kirkuk University's college of agriculture. At 40 days of age, twenty males and sixty female birds were divided into five

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groups at random and given one of the following five treatments: 0% azolla, 4% azolla, 8% azolla, 4% azolla + Enzyme, and 8% azolla + Enzyme. Each group was devided for four replications, each with one male and three females, and the enzymes used were a-protease, B-glucanase, Xylanase, Ammylase, and Phytase. The birds had ad libitum food and water while they were mating in a battery system (Table 1).

Each bird's egg weight was measured every day using a sensitive electronic scale (0.01) g, and feed intake was calculated by weighing the bucket, the feed, and the feed both before and after it was consumed. This was done before the bucket was refilled. Every day, the amount of eggs produced was noted for every duplicate. After determining the egg form index, egg surface area, and egg volume [16] and measuring the external egg traits with a clipper Vernier (0.01) mm, the eggs were shattered in order to examine the inside egg traits using an electronic balance (0.01) g, as explained by [17]. The following equation was used to get the yolk to albumin ratio:

Yolk%= (yolk weight / egg whole weight) * 100

Albumin%= (Albumin weight/ egg whole weight) * 100

Egg Shape Index = (Breadth / Length) * 100

Egg Surface area = (3.155-0.0136*L+0.0115*B) *LB

Egg Volume = (0.6057-0.0018*B) * LB2

Where:

L= Length

B= breadth

The statistical software SAS [18] was utilized to compute the mean, standard error, and significance using the General Linear Model (GLM). The discrepancies between the means were tested using the Duncan multiple range test [19].

Result and Discussion

The mean and standard error for the egg productivity performance by using different concentrations of azolla are shown in table 2. All the traits were significantly differing among the treatments ($p<0.05$). Hen day% was higher when the concentration of azolla was 8% and treated with enzyme, which was (87.21) %. The egg mass was also higher when the azolla concentration was 8% and treated with enzyme, which was (8.15). The feed intake (FI), and FCR was better when the azolla concentration was 8% and treated with enzyme (35.25, and 4.59) respectively. Our result agrees with [20], which used azolla in the diet of layer chicken and observed increase of egg production. Also [21] found that adding 100g/bird/day increase the egg production, but [22] noticed non-significant differences in feed consumption when he used the azolla in Japanese quail diet.

The mean and the standard error for the internal egg traits that treated with different levels of azolla are shown in table 3. The egg weight mean was significant among the treatments ($p<0.05$). It was higher when the azolla concentration 8%, in both with out and within enzyme (9.53, and 9.33) g respectively. The albumin weight also was differing significantly among the treatment, which was higher when the azolla concentration 4% (5.58) g, and lower when add enzyme to the 4% of azolla (4.55) g. The yolk weight was higher when the azolla level 8% with added enzyme (4.01) g, and lower in both 0% and 4% concentrations (3.14, and 2.97) g respectively. The eggshell weight was higher when the azolla concentration was 8% and treated with enzyme. The albumin ratio was higher in both the control and 4% concentration of azolla (59.38, and 63.95) % respectively. Yolk ratio was higher in both 4%, and 8% Azolla that treated with enzyme (40.42, and 43.28) % respectively. The eggshell ratio was higher when the azolla was 8% and treated with enzyme (8.59) %. [23] Found in their study, that using azolla up to 6% in the diet of laying quail did not effect on the egg production, FCR, and egg quality traits, also [24], found in their study who used 10% of azolla meal in laying hen that the egg quality traits did not effected significantly by the level of azolla. But [25], found in his study significant differences in egg weight, and the internal egg traits.

Mean and standard error for the external egg traits that treated with different levels of azolla are shown in table 4. All the traits were significantly differing ($p<0.05$). The egg length was higher when the azolla concentration 8% and treated with enzyme (33.79) mm, and lower in both 4% azolla treated and non-treated with enzyme (31.58, and 31.71) mm. The egg breadth was higher when the azolla was 8% concentration without enzyme (25.67) mm. The egg shape index was high when the azolla 8% and treated with enzyme (73.88) %. The egg surface area (ESA) was higher when the azolla concentration was 0%, and 8% in both treated and non-treated with enzyme (2464.17,

2545.46, and 2509.50) mm2 respectively. The egg volume (EV) was also like the egg surface area, which was (11656.97, 12193.03, and 11782.26) mm3 respectively. The eggshell thickness was higher when the azolla concentration was 0%, which was (0.24) mm. [25], found that using the azolla with up to 7.5% were significantly differ in all the egg external traits.

The mean and standard error of the productivity performance by using different concentration of azolla are shown in table 5. The non-fertilized and fertilized eggs were did not differ significantly among the treatments ($p>0.05$). The dead embryo was higher when the concentration of azolla was 0%, and the live chicks were high in all the treatments except when the azolla concentration was 0%.

Conclusion

We conclude that adding azolla at 8% with enzyme was enhanced and increase the productivity such as (H.D.%, egg mass, Feed intake, and FCR), and the egg internal and external traits of Japanese quail.

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Conflicts of interest

The authors declared no competing interests

TABLE 1. The percentage and chemical composition of rations of experiment birds.

Ingredients	control	Azolla 4%	Azolla 8%	Azolla 4% + Enzyme	Azolla 8% + Enzyme
Wheat	34.72	43.05	44.12	43.05	44.12
corn	24.70	14.50	11.00	14.50	11.00
oil	3.50	4.20	4.50	4.20	4.50
soybean meal 44%	30.00	27.00	25.00	27.00	25.00
azolla	0.00	4.00	8.00	4.00	8.00
lysin	0.08	0.15	0.20	0.15	0.20
Methionine	0.20	0.20	0.23	0.20	0.23
DCP	0.60	0.70	0.75	0.70	0.75
Limestone	6.00	6.00	6.00	6.00	6.00
T. Salt	0.10	0.10	0.10	0.10	0.10
Colin clorid	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Energy Kcal/Kg	2897	2908	2905	2908	2905
Protein %	20.2	20	20.01	20	20.01
Lysin %	1.05	1.045	1.034	1.045	1.034
Methionin %	0.48	0.46	0.47	0.46	0.47
Ca %	2.511	2.526	2.533	2.526	2.533
Available phosphorous %	0.303	0.302	0.298	0.302	0.298

TABLE 2. The mean and standard error for the egg productivity performance by using different concentrations of azolla.

Traits	Control Azola 0%	Azola 4%	Azola 8%	Azola 4%+Enzyme	Azola 8%+Enzyme
Hen Day %	73.82±3.39 ^{b}	69.39±4.00 ^{b}	75.04±4.43 ^{b}	78.04±3.81 ^{ab}	87.21±3.87 ^{a}
Egg mass g/bird/day	6.62±0.31 ^{b}	6.07±0.30 ^{b}	7.09±0.37 ^{b}	6.84±0.30 ^{b}	8.15±0.39 ^{a}
FI g/bird/ day	36.67±0.07 ^{a}	35.95±0.05 ^{b}	35.84±0.01 ^{b}	35.59±0.10 ^{c}	35.25±0.05 ^{d}
FCR bird/day	7.21±0.52 ^{a}	6.45±0.50 ^{ab}	5.25±0.43 ^{bc}	5.98±0.49 ^{abc}	4.59±0.40 ^{c}

Means with different superscripts in each row differ significantly (P<0.05).

TABLE 3. Mean and standard error for the internal egg traits that treated with different levels of azolla.

Traits	Control Azola 0%	Azolla 4%	Azolla 8%	Azolla 4%+Enzyme	Azolla 8%+Enzyme
EW (g)	8.84±1.82 ^{b}	8.74±0.98 ^{b}	9.53±1.04 ^{a}	8.70±2.63 ^{b}	9.33±1.14 ^{a}
AlW (g)	5.18±1.11 ^{ab}	5.58±2.98 ^{a}	5.06±1.73 ^{abc}	4.55±0.83 ^{c}	4.67±2.52 ^{bc}
YW (g)	3.14±3.12 ^{c}	2.97±2.86 ^{c}	3.36±2.11 ^{b}	3.48±1.98 ^{b}	4.01±3.06 ^{a}
EShW (g)	0.69±1.12 ^{b}	0.66±0.78 ^{b}	0.72±1.05 ^{b}	0.71±1.47 ^{b}	0.80±0.63 ^{a}
Al %	59.38±2.04 ^{a}	63.95±2.72 ^{a}	53.21±1.84 ^{b}	52.30±1.99 ^{b}	50.12±2.07 ^{b}
Y %	35.91±1.11 ^{b}	34.60±2.09 ^{b}	35.53±3.24 ^{b}	40.42±2.64 ^{a}	43.28±1.82 ^{a}
ESh %	7.87±1.48 ^{ab}	7.66±1.03 ^{ab}	7.60±1.72 ^{b}	8.28±2.17 ^{ab}	8.59±1.22 ^{a}

EW=Egg weight, AlW= Albumin weight, YW= Yolk weight, EShW= Eggshell weight, Al%=Albumin%, Y%=Yolk%, ESh%=Eggshell%. Means with different superscripts in each row differ significantly (P<0.05).

TABLE 4. Mean and standard error for the external egg traits that treated with different levels of azolla

Traits	Control Azola 0%	Azola 4%	Azola 8%	Azola 4%+Enzyme	Azola 8%+Enzyme
EL (mm)	32.29±4.61 ^{bc}	31.58±2.13 ^{c}	33.06±2.75 ^{ab}	31.71±3.01 ^{c}	33.79±2.38 ^{a}
EB (mm)	25.36±2.75 ^{ab}	24.71±1.82 ^{c}	25.67±2.26 ^{a}	24.92±3.84 ^{bc}	24.91±1.16 ^{bc}
ESI (%)	78.65±1.28 ^{a}	78.39±2.93 ^{a}	77.82±1.01 ^{a}	78.81±2.72 ^{a}	73.88±1.38 ^{b}
ESA (mm^2)	2464.17±2.01 ^{a}	2348.89±1.19 ^{b}	2545.46±2.91 ^{a}	2378.18±2.77 ^{b}	2509.50±1.05 ^{a}
EV (mm^3)	11656.97±1.03 ^{a}	10835.46±1.71 ^{b}	12193.03±0.95 ^{a}	11057.39±1.32 ^{b}	11782.26±1.51 ^{a}
ETh (mm)	0.24±0.01 ^{a}	0.21±0.01 ^{b}	0.22±0.01 ^{b}	0.21±0.01 ^{b}	0.21±0.01 ^{b}

EL=Egg length, EB= Egg breadth, ESI=Egg shape index, ESA=Egg surface area, EV=Egg volume, Eth= Eggshell thickness. Means with different superscripts in each row differ significantly (P<0.05).

TABLE 5. The mean and standard error of the productivity performance by using different concentration of azolla

Traits	Control 0%	Azola 4%	Azola 8%	Azola 4%+Enzyme	Azola 8%+Enzume
NF (%)	20.18±7.82 ^{a}	5.88±4.15 ^{a}	10.18±5.76 ^{a}	13.98±8.07 ^{a}	14.28±5.40 ^{a}
F (%)	79.83±7.82 ^{a}	94.13±4.15 ^{a}	89.85±5.76 ^{a}	86.03±8.07 ^{a}	85.73±5.40 ^{a}
D (%)	67.20±11.01 ^{a}	11.35±7.20 ^{b}	37.90±12.05 ^{b}	18.95±6.32 ^{b}	20.88±7.98 ^{b}
L (%)	32.80±11.01 ^{b}	88.65±7.20 ^{a}	62.10±12.05 ^{a}	81.05±6.32 ^{a}	79.13±7.98 ^{a}

NF=Non-fertilized, F=Fertilized, D=Dead, L=Live. Means with different superscripts in each row differ significantly (P<0.05).

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تأثير إضافة مسحوق نبات الأزولا في علائق طائر السمان على الأداء الإنتاجي وبعض الصفات النوعية للبيض

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أجريت هذه الدراسة في حقل الدواجن التابعة لقسم الإنتاج الحيواني / كلية الزراعة / جامعة كركوك للفترة من (١٨ شباط ٢٠٢٢ ولغاية ١٨ نيسان ٢٠٢٢)، لمعرفة تأثير استخدام نسب مختلفة من نبات الأزولا المجفف على أداء إنتاج بيض السمان الياباني، وجودة البيض . تم توزيع عشرين ذكرًا وستين أنثى في عمر ٤٠ يومًا بشكل عشوائي لخمسة على خمسة معاملات تجريبية (٠٪ أزولا، ٤٪ أزولا، ٨٪ أزولا، ٤٪ أزولا + إنزيم، و٨٪ أزولا + إنزيم). باستخدام الميزان الإلكتروني والفيرنا الرقمي، تم أخذ إنتاج البيض وسمات جودة البيض يوميا، و استخدام النموذج الخطي العام GLM ضمن برنامج SAS لحساب المتوسط و الخطأ القياسي واستخدام اختبار دنكان متعدد المدى لاختبار الفروق بين المتوسطات. وكانت جميع الصفات تختلف معنويا بين المعاملات P<٠,٠٥. نستنتج أن إضافة الأزولا بنسبة ٨٪ مع الإنزيم أدى إلى تحسين الإنتاجية وصفات جودة البيض لطائر السمان الياباني.

الكلمات الدالة: ازولا، سمان، بيض، الصفات.