EVALUATION OF MEAT AND EGG PRODUCTION TRAITS OF CROSSBRED THREE LINE OF LOCAL QUAIL

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ABSTRACT

The study aimed to know the productive efficiency of the hybrids produced by cross-breeding three different colors of local quail. The results showed that the highest value of hybrid vigor/heterosis was 4.5% of the body weight at 42 days of age for the quail resulting from the crossbreeding of brown males with white females. The highest value of hybrid vigor for the dressing percentage of quail, highest body and carcasses weight at marketing age, and the highest daily weight gain were recorded of crossing of desert-colored males with white females, which averaged 10.99%, 197.43 g/bird, 136.75 g/bird and 4.52 g/bird/day, respectively. Regarding egg production, the results of the statistical analysis also showed that the quail produced by crossbreeding desert males with white females gave the largest number of eggs (127.6 egg), the highest DEP (91.1%), and the highest egg weight (11.3 g/egg) with the best FCR (3.2 g feed/ g egg). In addition, the quail resulting from cross-crossing of desert males with white females reached sexual maturity at 34 days/bird with 0% of mortality in addition to a high hatchability rate of 87.08%. We conclude from the above that the best interbreeding was between desert males and white females for the economic characteristics of the local quail.

Keywords: quail, heterosis, carcass traits, EDP, crossing

INTRODUCTION

Quail *(Coturnix Japonica)* appears to be a high-quality meat and egg alternative to hens in commercial production today (4). Due to its small size, pathogen resistance, quick development, and simplicity of handling, short generation quail has become a popular laboratory bird for genetic research (7,8,17,22,29). In comparison to other poultry species, the number of color-related mutations in quail is still quite low. The majority of quail feather colors have only been documented and characterized (21). When compared to hens as a food source, quail farming offers greater advantages (2). Quails have been used to investigate different studies for several purposes since they are closely related to chickens (1,4). (16) conducted research in Pakistan and found substantial variations in body weight across four distinct quail strains. (15) found the same disparities for four distinct lines, according to results of (12). The live body weight of quail changes across generations and responds to selection by 15.7 percent at 42 days. (14) found that the live body weight of nine quail genotypes at 42 days' old did not differ significantly and ranged from 156.8–171.2 gm. The color of the plumage has an impact on the quality of the carcass (19,20). The white-colored birds had considerably larger breast and thigh weights (as averages) than the wild-type birds. According to (28) the carcass weight between the experimental groups were not significantly differences. (23) reported the crossing between three pure lines of quail did not change egg number, egg weight and age of first egg production. (18 and 20) were found significant differences among four crossing groups of quail for egg number, egg weight and mortality. Breeding and genetic development projects have been developed, and the poultry business has achieved tremendous and demonstrable superiority in creating better commercial kinds and strains as multinational corporations. As a result, commercial hybrid quail lines are developed by choosing individuals or groups based on each strain's independent performance, then mating the better strain in every feasible combination to find the superior hybrid for commercial exploitation (6). Due to the phenomena of heterosis, this technique is regarded as one of the contemporary breeding strategies, with the goal of obtaining a genetic synthesis that is differentiated by productive performance and outperforms pure lines (11). This study was aimed to evaluating some of the meat and egg production traits of crossbred local quail.

MATRIALS AND METHODS

This study was conducted at the College of Agricultural Engineering Sciences – University of Raparin, during the period from September 1, 2020, until June 12, 2021. To obtain hybrids a total of 120 chicks were reared in battery brooders until 3 weeks of age and then were transferred to growing cages until 6 months. The birds were housed in 30 cages, each cage for male and female quails. The dimensions for the cages were 45cm × 30cm × 30 cm (length, width and height, respectively). The crosses of three lines were performed, namely White (W), Brown (B), and Desert (D), including six crosses of ♂W×D♀, ♂D×W♀, ♂W×B♀, ♂B×W♀, ♂B×D♀ and ♂D×B♀. After two months of starting egg production and at pick of egg production, eggs were collected separately from each group and the eggs were placed separately in the incubator. The incubation period for quails is 17– 18 days. After hatching, each offspring was identified manually for each cage, and these are the first generation. First generation of cross quail birds were used in this research. Feed and water were supplied ad libitum. The experimental diet contained 23% protein, 2980 Kcal - ME/Kg, and (%1.1) limestone (caco3) from day one, but increased limestone percentage (caco3) to (%3) during the egg production period (six weeks to twenty-six weeks). The temperature in the environment was 35-37°C for the first week, then dropped by around 2° C every week until it reached a low of 20-22° C at about 4 weeks, when the chicks were completely feathered. light was provided for 24 hours in the first week and decreased 2 hours weekly until five weeks of only 16-hour lighting and 8-hour darkness. The data was recorded for the studied traits of meat during the first six weeks, including: body weight, food consumption, weight gain, food conversion ratio, carcass traits, mortality. Data on egg production traits were collected during 20 weeks of age, including egg number, egg weight, age at first egg production, daily egg production (DEP%), food conversion ratio, mortality, fertility, and hatchability. Heterosis for some economic traits was calculated according to (30) by the formula:

H(%)=[(F1) -(P1+P2)/2]/[(P1+P2)/2] ×100

Statistical analysis:

To analyze the data for quail egg production, the PROC GLM (General Linear Model) procedure SAS, (26) was used. For fixed effects study was using the following model:

$$Y_{ij} = \mu + L_i + \varepsilon_{ij}$$

Where: observation Y ij = Egg production, egg number, egg weight/ chick weight, % Mortality, age first egg production, %Fertility, %Hatchability of j^{th} quail, of i^{th} lines crossing (Li i=1, ♂W×D♀, i=2, ♂D×W♀,i=3, ♂D×B♀ i=4, ♂B×D♀, i=5, ♂W×B♀, ,i=6, ♂B×W ♀); μ = Population mean; ε_{ij} = random error. It was assumed to be independently and normally distributed with dial mean zero and variance $\delta^2 e$

For the body weight, carcass weight, dressing % and carcass parts % the following model was used:

$$Y_{ijkl} = \mu + L_i + S_j + LS_{ij} + \varepsilon_{ijkl}$$

Where: Y ijkl= body weight, carcass weight , dressing % and carcass parts % l^{th} quail, of i^{th} lines crossing (Li, i=1, ♂W×D♀, i=2, ♂D×W♀,i=3, ♂D×B♀ i=4, ♂B×D♀, i=5, ♂W×B♀, ,i=6, ♂B×W♀); of j^{th} Sex (Sj, j=1, male and j=2, female), of kth interaction between lines crossing and sex (Kij, ij=1, ♂W×D♀ females, ij=2, ♂W×D♀male, i=3, ♂D×W♀,female i=4, ♂D×W♀,male ,i=5, ♂D×B♀ female i=6, ♂D×B♀ male, i=7, ♂B×D♀female i=8, ♂B×D♀ male, i=9, ♂W×B♀ female i=10, ♂W×B♀ female ,i=11, ♂B×W♀ female, i=12, ♂B×W♀ females) μ = Population mean; ε_{ijkl} = random error. It was assumed to be independently and normally distributed with mean zero and variance $\delta^2 e$ .In order to calculate the significant difference among means, Duncan's multiple ranges for a means were employed.

RESULTS AND DISCUSSION

1-Growth Traits

Live body weight and weight gain are important characteristics that must be studied when raising quail for meat production, because raising quail for meat production is to obtain high weights, as the amount of meat produced and the weights of carcasses and their main and secondary parts depends on body weight and increases directly with its increase (24). Table (1) shows means and standard error of body weight, daily weight gain, FCR and mortality six lines crossing of local quail.

The crossing groups differed significantly in terms of body weight at first-day, FCR, and mortality, and the group (♂D×W♀) had the best FCR and the highest mortality. However, body weight and average daily weight gain at age 42 days are the only valuable differences. High body weight and weight gain in group (♂D×W♀) are (197.4 gm. and 4.5gm., respectively). The results agree with (8) showed insignificant differences between six cross groups of local quail at body weight 42 days, but had valuable differences and the superior group was (♂W×D♀) on the other crossing groups it was reached (195.08 g). These findings contradict those of (5), who discovered that line crossings significantly affected Japanese quail and Pharaoh quail at body weight 42 days. Additionally, contrary to (24)'s findings, local quail line-cross groups exhibited notable variations, and desert sir with other line colors had higher body weight (white and brown). In terms of mortality (23) found adverse results, there were no discernible variations between the cross groups of quail.

2- Carcass traits

Table (2) displays the mean ± standard error of meat production traits (live body weights, carcass weights, dressing percentage, and main carcass cuts percentage) of local quail crossing lines as affected by genotype, sex, and their interaction. The results appeared to show significant differences between all crossing groups for carcass weight (g), dressing%, breast% and thigh%. The highest carcass

Table 1. Mean ± standard error of growth traits and Mortality of line crosses of local quail.

Traits	Body weight(g)		Daily weight	FCR	ortality
	day	42 day	;ain(g)		
s Crossing	***	NS	NS	***	**
'W× D♀	±0.03 a	..48±1.91 a	7±0.04 a	9±0.09 b	9±0.47 bc
D × W♀	:0.03 b	'.43±1.86 a	2±0.04 a	4±0.04 b	3±2.85 a
'D × B♀	:0.02 b	5.07±2.8 a	7±0.06 a	ı±0.09 a	5±0.14 abc
'B × D♀	±0.06 c	2.56±2.7 a	1±0.06 a	ı±0.15 a	5±1.9 ab
'W × B♀	±0.06 c	3.22±2.7 a	3±0.06 a	5±0.18 a	±0 c
'B × W♀	±0.02 d	..79±1.93 a	7±0.04 a	'4±0.1 a	4±2.48 a

Ns = Non-significant; *=significant at (*P≤0.05*); **=highly significant (*P≤0.01*). ***=highly significant (*P≤0.001*
litters within each column differ significantly

Table 2. Means ± standard error of some carcass traits of line crosses of local quail at 42 days.

Traits		Live body weight (g)	Carcass weight(g)	Dressing %	Breast%	Thigh%
Lines Crossing		NS	***	***	***	***
♂W× D♀		181.94±3.52 a	129.76±1.86 c	71.64±0.72 b	31.65±0.4 c	19.11±0.25 bc
♂D × W♀		190.53±4.5 a	136.75±2.46 ab	72.04±0.72 b	31.7±0.34 c	19.15±0.22 bc
♂D × B♀		187.15±4.82 a	130.06±2.57 c	69.86±0.59 c	32.9±0.41 ab	19.5±0.17 ab
♂B × D♀		182.32±3.05 a	131.17±1.76 bc	72.11±0.62 b	33.79±0.32 a	19.95±0.18 a
♂W × B♀		188.4±4.93 a	137.64±2.46 a	73.45±0.76 a	32.43±0.35 bc	18.6±0.24 c
♂B × W♀		188.75±3.48 a	135.9±1.78 ab	72.25±0.75 ab	33.2±0.21 ab	18.87±0.28 bc
sex		***	***	***	NS	***
Female		200.37±2.05 a	137.91±1.27 a	68.92±0.27 a	32.83±0.22 a	18.8±0.15 b
Male		172.19±1.47 b	128.49±1.09 b	74.67±0.27 b	32.41±0.21 a	19.63±0.1 a
sex * Crossing		***	***	***	***	***
F	♂W× D♀	194.77±2.82 bc	135.17±2.11 abc	69.42±0.66 ed	31.55±0.39 e	18.48±0.36 e
M	♂W× D♀	169.11±4.62 d	124.36±2.44 cd	73.86±1.04 bc	31.76±0.71 cde	19.75±0.3 ab
F	♂D × W♀	208.41±4.46 a	143.4±3.57 a	68.73±0.35 edf	31.8±0.4 cde	18.63±0.38 ed
M	♂D × W♀	172.65±2.57 d	130.11±2.17 bcd	75.35±0.32 ab	31.6±0.57 de	19.68±0.11 abc
F	♂D × B♀	206.95±6.02 ab	138.51±3.75 abc	67.01±0.51 f	33.65±0.61 ab	18.92±0.19 bcde
M	♂D × B♀	167.35±2.81 d	121.61±1.97 d	72.71±0.35 c	32.15±0.5 bcde	20.07±0.2 a
F	♂B × D♀	189.42±4.11 c	131.62±1.96 abcd	69.65±0.8 ed	34.25±0.49 a	20.05±0.34 a
M	♂B × D♀	175.22±3.76 d	130.72±2.99 abcd	74.57±0.27 ab	33.32±0.4 abc	19.84±0.15 ab
F	♂W × B♀	201.25±7.2 abc	141.45±3.72 ab	70.56±0.81 d	32.35±0.7 bcde	18.45±0.37 e
M	♂W × B♀	175.55±4.45 d	133.83±2.99 bc	76.33±0.54 a	32.51±0.15 bcde	18.76±0.32 cde
F	♂B × W♀	202.54±3.7 abc	138.91±2.78 abc	68.57±0.43 ef	33.24±0.23abcd	18.22±0.43 e
M	♂B × W♀	174.95±2.6 a	132.9±2.01 bcd	75.94±0.33 a	33.15±0.3 abcde	19.51±0.29 abcd

Ns = Non-significant; *=significant at (*P≤0.05*); **=highly significant (*P≤0.01*). ***=highly significant (*P≤0.001*).
different litters within each column differ significantly

weight (g) dressing percentage was in group W×B♀, while ♂B×D♀ was superior to other crossing groups in breast% and thigh%. Sex affected all the traits significantly except of breast% which was a non-significant difference, and males outperformed females for dressing% and thigh% they were (74.6% and 19.6%, respectively).While the opposite is true for live body weight and carcass weight. For the effect of interaction between lines crossing and sex, the interaction (female and ♂D×W♀) had the highest live body weight and carcass weight (208.4 g. and 143.4g., respectively), while the interaction (male and W×B) had the highest dressing percentage (76.3%) and the highest breast and thigh percentage in the interaction (female and ♂B×D♀) were (34.2% and 20.5%, respectively). The results agreed with (12) showed significant differences among crossing groups for dressing percentage and thigh percentage, with the higher percentage in the crossing group The results disagree with (26) showed significant differences between crossing groups for live body weight and non-significant differences between crossing groups for dressing percentage. (desert male*white female) being (64.71% and 16.06% respectively).

3- Egg production traits: The results of egg production characteristics are presented in Table (3). There were significant differences among crossing groups for all traits: number of eggs, daily egg production (DEP%), egg weight, and feed convention to egg ratio. However, there were non-insignificant differences between crossing groups for feed convention ratio (FCR). The crossing groups (♂D×B♀) had the highest average egg weight (11.7 g) and the (♂D×W♀) crossing groups had the highest egg number and DEP% than other groups (127.6 eggs and 91.1% respectively) and the best FCR in the (♂B×D♀) group was (3.1). The current findings contradict the findings of (3 and 23), which found no significant differences in egg number and egg weight between crossing groups. While the results were in accordance with (18 and 20), there were developed 4 Japanese quail by using 13 generations of reciprocal crossing between lines (AA) and (BB) and significant differences were found between the four crossing groups for egg number and egg weight.

Table (4) represented the means and standard error for mortality and reproductive traits (Age first egg production, fertility, hatchability). The results revealed significant differences between groups of crossing for mortality rate and reproductive traits, except for fertility traits. crossing groups of (♂D×W♀) and (♂B×D♀) were significant differences with others that they did not record any dead birds and started egg production at an earlier age (34 days and 35.4 days, respectively).

Regarding fertility and hatchability, there were non-significant differences between groups for fertility, but highly significant differences among groups for hatchability, and the highest percentage in group (♂B×D♀) was 90%. The present results are in disagreement with results of (13 and 25) that reported no significant differences between three line-crossing groups among two generations for hatchability. While the results were in accordance about mortality, that showed significant differences between crossing groups of three lines of quail and the

Table 3. Means± standard error of egg production characteristics of line crosses of local quail

Traits	Number of egg	DEP%	Egg weight(g)	FCR
Lines Crossing	***	***	***	NS
♂W× D♀	118.1±1.2 b	84.3±0.9 b	10.7±0.1 c	3.3±0.1 a
♂D × W♀	127.6±1 a	91.1±0.7 a	11.3±0.1 b	3.2±0 ab
♂D × B♀	117.4±1.4 b	83.8±1.0 b	11.7±0.1 a	3.2±0.03 ab
♂B × D♀	116.4±2.1 b	83.1±1.5 b	11.2±0.1 ab	3.1±0.06 b
♂W × B♀	124±1 a	88.5±0.7 a	10.9±0.06 cb	3.3±0.02 a
♂B × W♀	126.4±0.2 a	90.3±0.1 a	11.1±0.08 cb	3.2±0.06 ab

Ns = Non-significant; *=significant at (*P≤0.05*); **=highly significant (*P≤0.01*). ***=highly significant

Table 4. Means± standard error of mortality and reproductive traits of line crosses of local quail

Traits	**Mortality%**	**Age first egg(day)**	**Fertility%**	**Hatchability%**
Lines Crossing	***	**	NS	***
♂W× D♀	8.33±3.55 a	39.66±0.3 a	79.5±1.4 a	83.9±1.9 a
♂D × W♀	0±0 b	34±0 d	70.4±0.8 a	87.08±0.1 a
♂D × B♀	6.25±2.79 ab	38.75±0.38 a	67.04±5.2 a	64.8±6.5 b
♂B × D♀	0±0 b	35.4±0.27 c	71.7±3.1 a	90±1.7 a
♂W × B♀	12.5±3.22 a	39±0.25 a	77.2±3.5 a	68.4±2.06 b
♂B × W♀	5±2.29 ab	36.8±0.55 b	70.9±5 a	70±4.07 b

Ns = Non-significant; *=significant at (P≤0.05); **=highly significant (P≤0.01). ***=highly significant (P≤0.001 , different litters within each column differ significantly higher mortality in the crossing group (white female with brown male), which is 19.3%. Also, the present results are in agreement with results of (18) that proved significant differences between crossing groups of two quail lines for the age of starting first egg production.

Table 5. Heterosis (Hybrid vigor) percentage for Body weight and Dressing percentage of three Line Crosses of local quail.

Crossing groups	♂W × B♀	♂B × W♀	♂W× D♀	♂D × W♀	♂B × D♀	♂D × B♀
Body weight	-6.1	4.5	3.4	0.8	-5.1	-3.4
Dressing %	3.69	5.22	1.17	10.99	5.5	1.02

4-Heterosis (Hybrid vigor) Table (5) The result shows the percentage of heterosis (Hybrid vigor) for body weight and dressing percentage of quail. The results showed that the highest value of hybrid vigor/heterosis was 4.5% of the body weight at 42 days of age for the quail resulting from the crossbreeding of brown males with white females. The highest value of hybrid vigor for the dressing percentage of quail was recorded of crossing of desert-colored males with white females it was 10.99%. The results agree with (10 and 27) that showed significant differences between cross-breeds and had the highest heterosis percentage for dressing percentage (8.5%).The results contradict (14) by showing no significant differences in body weight and feed conversion ratio between crossing groups of three quail lines.

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