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EFFECT OF REPEATED BACKCROSSING FOR TWO GENERATIONS BETWEEN THE LOCAL BLACK BALADI AND WHITE NICHOLAS TURKEYS ON EGG PRODUCTION AND HATCH TRAITS 1- EGG PRODUCTION TRAITS

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ABSTRACT: The present study was carried out at the Maryout Research Station, Desert Research Center; Ministry of Agriculture to study a backcrossing experiment between two strains of turkey summarized Black Baladi (BB) and commercial White Nicholas (WW) as well as their reciprocal crosses through three successive years. Results were as follows:

1- There was a highly significant difference between the different genotypes for both of body weight (BWSM) and age (ASM) at sexual maturity, egg number (EN), rate of laying (RL%), egg mass production (EM), egg weight (EW), feed intake (FI1) (Kg /hen /52weeks), feed intake (FI2) (g /egg) and feed conversation (Kg feed /Kg egg) (FC) through the three studied generations. No significant differences between BB varieties were found through the three studied generations in all former traits. Although the WW pullets were heavier than BB ones in the first generation, it was decreased from one generation to another so, there was no significant difference between WW and backcross of (7/8W x 1/8B) in the 3thgenerations.
2- As for strait-bred differences, the results showed that WW variety was superior to BB population in the three studied generations for BWSM, ASM, EW and FI1, but the superiority was decreased at the second and the third generations. The pure BB variety had the highest values for (EN), (RL), (EM), (FI2) and (FC) compared to the different studied genotypes through the 1st, 2nd and 3thgenerations.
3- After two repeated backcrossing pullets of BB laid significantly the highest number of eggs (93.3egg) compared to the WW pullets and those of the backcrosses of 7/8W x 1/8B and 7/8B x 1/8W (55.5, 45.5 and 76.5egg, respectively,), The estimates of rate of laying (RL %) had the same trend which observed in EN of the different generations studied.

Key Words: Repeated backcrossing, turkeys, egg production traits

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4- After repeated backcrossing using BB as a sire-bred, (1/4B x 3/4W and 7/8 B x 1/8W) enhanced EN (65.3 and 76.5egg, respectively), RL% (16 and 0.21%), EM

(5.74 and 6.8 kg), FI2 (1.09 and 0.98 kg), and FC (12.4 and 11.1, respectively), compared to performance of the backcrossing which WW used as a sire-bred for the same traits. In general, the 3rd generations had better values compared to the other generations.

5- Considering maternal additive, direct additive effects, individual heterosis percentages (H 1 and H 2), and average degree of heterosis, estimates increased after two repeated backcrossing at the 3rd generation compared to both of the 1st and 2nd generations for all studied traits except those of FI2 and FC, moreover, H11 for RL and H1 and H2 for EW were decreased in the 3rd generation.
6- The values of maternal additive effect showed that pullets of the cross (½ B x ½ W), and backcrosses of (1/4B x 3/4W and 7/8 B x 1/8W) had better performance than those of ½ W x ½ B cross and 3/4 W x 1/4 B and 7/8 W x 1/8 B backcrosses for EN, RL, EM, FI1, FI2 and FC traits. Using ½ B x ½ W, 1/4B x 3/4W poults as a dam with BB toms as a sire–bred gave an advantage for these traits at the 2nd and 3rd generations. The values of direct additive effect indicated that using BB toms was better than WW toms for former traits, but using (1/2 W x 1/2 B) and (3/4 W x 1/4 B) poults as a dam with WW toms as a sire – bred increased BWSM, ASM and FI2 at the 1st -2nd and 3rd generations.
7- In general, the 3rd generation had the highest values of H1%, H2% and A.D.O.H % compared to those of the 1st and 2nd generations and had positive values for BWSM (5.1, 40.1 and 19.2%, respectively), ASM (0.7,15.5 and 7.7%), EW (1.8, 5.1 and 3.4%), FI1 (4.0, 30.2 and 15.4%), FI2 (16.6, 24.8 and 19.5%), and FC (13.4, 4.2 and 9.9%), respectively. On the other hand, negative values were found, for EN (-11.1, -3.5 and -6.5%, respectively), RL (-14.4, -4.5 and -8.3%) and EM except for H2%were had had positive value at the 2nd generation (-4.6, 2.2 and -2.6%, respectively). Pullets of (7/8 B x 1/8W) was surpassed those of (7/8 W x 1/8 B) for H 2% at the most former studied traits.

It could be concluded that the backcrosses between local Black Baladi as a sire parent with ½ B x ½ W and 1/4B x 3/4W as a dam parent enhanced most of the egg production studied traits.

INTRODUCTION

Commercial turkeys are usually produced by mating a sire line (or sire-line cross) selected for growth traits with a dam line (or dam-line cross) in which selection is balanced between growth and reproduction. With this system of mating, the growth of the offspring is usually between the parental means, and a greater number of offspring can be produced due to the reproductive capacity of the females utilized (Amin, 2003).Several studies on the effects of crossing or varieties of turkeys on reproductive traits were done. Nestor et al. (1997) showed that repeatedly backcrossed the repeated backcrossing of a dam line selected long-term for increased egg production was backcrossed to a to a sire line selected long-term for increased 16-wk BW and to a commercial sire line. The results of the 2 backcrosses were slightly different and it was suggested that limited repeated backcrossing of a dam line to a sire line may be an economically feasible method to greatly increase the BW of dam lines without unduly sacrificing reproductive capacity. Amin (1999) reported that crossing (BB) with (WW) exhibiting high egg production but inferior growth rate. Nestor et al. (2004) reported that used males from the large strain (WN) may be an effective method of increasing the mature body weight (six to seven months) of the light dam line stock. Early reports concerning heterosis for egg production in turkey have been negative, while no significant reciprocal effects were observed for any egg production traits. Nestor et al. (2006) found that after 3 generations of backcrossing, egg production was decreased over a 180-d production period. They added that for maximum gains per generation, backcrossing probably should be used for a maximum of 2 or 3 generations. Amin (2008b) found highly significant differences among the four genotypes in body weight at sexual maturity. Negative heterosis percentages were observed for the same trait. Pullets of (BB) laid significantly the highest number of eggs compared to the other genotypes and using WW toms in crossing decreased egg number of the reciprocal crosses, most of heterosis percentage estimates of egg production traits were negative at the different intervals studied. The BB pullets had the best feed conversation.

The available references cited inconsistent results which heterosis was evident in turkey crossing, direct additive and maternal effects in some crosses but not in others (Zaidan, 1982; Hassan et al., 1985; Amin, 1999; Emmersen et al., 2002 and Nestor et al., 2004). Working on chicken, Ghanem et al. (2008 and 2012), El-Dlebshany et al. (2013) and Taha and Abd El Ghany (2013) reported that crossing between developed strains or crossing between developed strain with foreign one improved most of the egg production traits.

The main objectives of the present study were to study the effect of backcrossing between the Black Baladi variety and the commercial White Nicholas line of turkeys for two generations on some egg production traits (egg number, egg rate, egg weight, egg mass production, egg consumption and feed conversion) throughout different periods of laying also, strait-bred differences, maternal additive, direct additive effects, heterosis percentages. Average degree of heterosis for the two parental strains and their crossbred for the three studied generations of these traits were estimated.

MATERIALS AND METHODS

The present study was carried out at the Maryout Experimental Station at El-Amria region, Desert Research Center, Ministry of Agriculture, through three successive years. The turkeys stock consisted of two strains, the local Black Baladi (BB) and a commercial White Nicholas (WW). Mating system for the three generations studied is presented in Table (1).

Table (1): Mating system for three generations studied

Generations	Sir	Dam	Progeny
G1	B x B	B x B W x W	B x B and ½ B x ½ W
	W x W	W x W B x B	W x W and ½ W x ½ B
G2	B x B	B x B ½ B x ½ W	B x B and 1/4B x 3/4W
	W x W	W x W ½ W x ½ B	W x W and 3/4 W x 1/4 B
G3	B x B	B x B 1/4B x 3/4W	B x B and 7/8 B x 1/8W
	W x W	W x W 3/4 W x 1/4 B	W x W and 7/8 W x 1/8 B

In the first generation, reciprocals were practiced between the (B x B) and (W x W) to get the F1 (1/2W x 1/2B and1/2 B x1/2 W), at the second generation, pullets of the F1 (1/2W x 1/2B) were backcrossed with toms of (W x W) and pullets of (1/2 B x1/2 W) were backcrossed with toms of(B x B) to get progeny (¾W×¼B) and (¾B×¼W), respectively. In the third generation, pullets of the two genotypes which produced from the second generation were backcrossed again with toms from both the pure lines to get (7/8W x 1/8 B) and (7/8B x 1/8 W), respectively. Hens were artificially inseminated twice during the week, at hatching, birds were pedigreed, wing banded and birds were reared on litter floor pens until 24 weeks of age. Poults were fed a starter ration contained 28% crude protein and 2860 Kcal ME/kg ration until 4weeks of age after that were fed with commercial forage mixtures (Table1). Conventional husbandry practices were followed. Feed and water supplied ad libitum. Poults were vaccinated according to vaccination program recommended birds at the Maryout Experimental station.

Table (2): Composition and calculated analyses of the experimental rations used during the different periods

Ingredient	Growing period			Reproductive period
	4 -8 weeks	8 -12 weeks	12 -20 weeks	
Yellow corn	438.00	575.00	660.00	744.00
Soybean meal	400.00	275.00	170.00	85.00
Concentrate[1]	100.00	100.00	100.00	100.00
Vegetable oil	30.00	20.00	23.00	-
Bone meal	22.00	22.00	30.00	16.00
Premix*	2.50	2.50	2.50	3.50
Salt	2.50	2.50	2.50	2.50
Limestone	-	-	-	36.50
Lysine	1.00	0.75	0.30	-
Methionine	-	0.25	-	-
Sand	4.00	2.00	2.70	12.50
Total	1000.00	1000.00	1000.00	1000.00
Calculated analysis				
ME k cal / kg	2860	2952	3066	2917
Crude protein %	26.50	22.50	18.50	15.20
C / P	107.90	131.50	165.70	191.90
Crude fiber %	3.00	2.70	2.39	2.10
Crude fat %	2.70	3.10	3.40	3.40
Lysine %	1.56	1.31	0.98	0.67
Methionine %	0.57	0.44	0.37	0.30
Calcium %	0.74	1.40	1.62	2.51
Phosphorus %	0.74	0.72	0.80	0.71

[1] Commercial product contains 33.40 % protein, 2240 k cal ME/ kg, 5.54 % fat, 1.76 % fiber, 6.23 % calcium, 2.69 % phosphorus and 0.11 linolice acid

Premix*: Provides per Kg of diet: Vit. A8000000IU, D3 160000IU, E 3000mg, K31500mg,B1750mg,B2250mg,B6750mg,B125000mg,Di.Ca.Pantothenate500mg, Choline Chloride 60000mg, Folic acid 100mg, Biotin 5mg, Mn 10000mg, I 240mg, Co 60mg, Zn 10000mg, Cu 1000mg, Fe 6500mg, Se 40mg, Ethoxyqnine5000mg, Ascorbic acid 500mg, carrier till1000gm.

All birds were sexed by the external characteristics. Egg production was recorded daily starting from sexual maturity (50% egg production) up to 52 weeks of age. Age at sexual maturity was estimated in days from hatching up to the day at which each breeding pen reached 50% of egg production also, body weight at sexual maturity were recorded. Average of 100 eggs were randomly chosen throughout every interval and weighted. Egg mass was calculated by multiplying the number of eggs per pullet by the mean egg weight in gram. Settable eggs were sanitized and stored in an egg cooler at approximately 13^{o}C and 70% RH .Eggs were incubated for 24 day at 37.5^{o}C and 60 % RH and then transferred into a hatch operating at 37.2^{o}C and 75 %RH.

The strait line difference, maternal additive and direct additive effect were calculated according to Dickerson (1992).

Average degree of hetesosis (ADOH %) was calculated according to Sinha and Khanna (1975) as follow:

$$ADOH\% = \frac{F_1 - MP}{MP} \times 100$$

Where
F_1 = mean of crosses,
MP = mid – parent,

1- Straits – line difference:-

$(G^i_B + G^m_B) - (G^i_W + G^m_W) = (B\times B) – (W\times W)$

2- Maternal additive effect (i.e. reciprocal crosses differences):-

a- In the first generation $F_1 = G^m_B – G^m_W = [(½B\times½W) – (½W\times½B)]$
b- In the second generation $F_2 = G^m_B – G^m_W = [(¾B\times¼W) – (¾W\times¼B)]$
c- In the third generation $F_3 = G^m_B – G^m_W = [(7/8B\times1/8W) – (7/8W\times1/8 B)]$

3- Direct additive effect (i.e. line group of sire differences):-

a- In the first generation $F_1 = G^m_B – G^m_W$
$= [(B\times B) + (½B\times½W)] – [(W\times W) + (½W\times½B)]$
b- In the second generation $F_2 = G^m_B – G^m_W$
$= [(B\times B) + (¾B\times¼W)] – [(W\times W) + (¾W\times¼B)]$
c- In the third generation $F_3 = G^m_B – G^m_W$
$= [(B\times B) + (7/8B\times1/8W)] – [(W\times W) + (7/8W\times1/8B)]$

4- Heterosis percentage for crosses and backcrosses:-

<u>A-In the first generation (F_1)</u>

a- Heterosis percentage for (½ B x ½ W) crosses (H1%)

$$= \frac{[(½ W \times ½ B)] – ½ [(B \times B) + (W \times W)]}{½ [(B \times B) + (W \times W)]} \times 100$$

b- Heterosis percentage for (½ B x ½W) crosses (H2 %)

$$= \frac{[(½ B \times ½ W)] – ½ [(B \times B) + (W \times W)]}{½ [(B \times B) + (W \times W)]} \times 100$$

c-Average degree of heterosis (A.D.O.H %)

$$= \frac{½ [(B \times W) + (W \times B)] – ½ [(B \times B) + (W \times W)]}{\frac{1}{2} [(B \times B) + (W \times W)]} \times 100$$

<u>B-In the second generation (F_2)</u>

a- Heterosis percentage for backcross (¾W×¼B)

$$= \frac{[(¾W\times¼B)] - \frac{1}{2} [(W\times W) + (½W \times ½ B)]}{\frac{1}{2} [(W\times W) + (½W \times ½ B)]} \times 100$$

b- Heterosis in percentage for backcross (¾B×¼W)

$$= \frac{[(¾B\times¼W)] - \frac{1}{2} [(B\times B) + (½B \times ½ W)]}{} \times 100$$

$\frac{1}{2}$ [(B×B) + (½B x½ W)]

c- Average degree of heterosis percentage (A.D.O.H%)

$$= \frac{½ [(¾B x¼ W) + (¾W x¼ B)] – ¼ [(B x B) + (W x W) + (½ W x ½ B) + (½ B x ½ W)]}{¼ [(B x B) + (W x W) + (½ W x ½ B) + (½ B x ½ W)]} \times 100$$

C-In the third generation (F_3)

a- Heterosis percentage for backcross (7/8W×1/8 B)

$$= \frac{[(7/8W×1/8 B)] - \frac{1}{2} [(W×W) + (¾W x¼ B)]}{\frac{1}{2} [(W×W) (¾W x¼ B)]} \times 100$$

b- Heterosis in percentage for backcross (7/8 B×1/8 W)

$$= \frac{[(7/8 B ×1/8 W)] - \frac{1}{2} [(B×B) + (¾B x¼W)]}{\frac{1}{2} [(B×B) + (¾B x¼W)]} \times 100$$

c- Average degree of heterosis (A.D.O.H %)

$$= \frac{½ [(7/8B x 1/8 W) + (7/8W x 1/8 B)] – ¼ [(B x B) + (W x W) + (¾ W x ¼B) + (¾ B x ¼ W)]}{¼ [(B x B) + (W x W) + (¾ W x ¼B) + (¾ B x ¼ W)]} \times 100$$

Statistical analysis:

Data of all traits studied were analyzed using the following linear model (SAS) Institute, (1992)

$$Y_{ijk} = \mu + G_i + P_j + GP_{ij} + + e_{ijk}$$

Where:

Y_{ijk} = the observation of the $_{ijk}$ pullet,
μ = the overall mean,
G_i = fixed effect of i^{th} generation,
P_j = fixed effect of j^{th} genotype,
GP_{ij} = the interaction between the main factors effect,
e_{ijk} = the remainder error.

Significant differences among means were tested by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

1- Body weight at sexual maturity (BWSM):

Table (3) showed highly significant differences among the different genotypes for BWSM through the three studied generation. Body weight of the pullets of White Nicholas (WW) variety was significantly (P<0.01) higher and three times than those of the Black Baladi (BB) one, WW had the heaviest weight in the first generation but it decreased from one generation to another. There was no significant difference between WW weight and the backcross of (7/8 W x 1/8 B) in the third generation. No significant differences among the three studied generations for BWSM were found.

Using both of WW and BB varieties in the repeated backcrossing for two generations led to increase BWSM. However, using toms of WW for cross of ½W x ½ B and both of 3/4 W x 1/4 B and 7/8 W x 1/8 B) backcrosses which their averages were (5199 g,5700 g and 6380 g, respectively)in crossing led to increase BWSM through the three generations compared to using BB toms for cross of ½ B x ½ W and both of 1/4B x 3/4W and7/8 B x 1/8W) backcrosses, where averages of BWSM were (4145g, 5200g and 5680 g, respectively). These results agreed with those reported by Abaza (1983), Amin (1999) and Nestor et al. (2004) who found significant differences among the reciprocal crosses and purebred lines in body weight at sexual maturity. Amin (2008b) found highly significant differences among the four genotypes body weight at sexual maturity. Ghanem et al. (2008 and 2012); Amira et al. (2013) and Taha and Abd El-Ghany (2013) in chicken. There was significant (P<0.01) interaction between genotype and generation for this trait.

As for strait-bred differences, the results showed that WW variety was superior to BB one for BWSM through the three studied generations, but this superiority was decreased by generation (-6110 to -4500 and -3510, g) for the 1st, 2nd and 3rd generations, respectively. Concerning maternal additive, direct additive effects, heterosis percentages, and average degree of heterosis, the results listed in Table (1) indicate that there were an increase in values from one generation to another and the third generation had significantly (P<0.01) the highest value. The estimates of individual heterosis were 5.3 and 40.1 for 7/8 B x 1/8W and 7/8 W x 1/8 B backcrosses, respectively, while the value of degree of heterosis for the third generation was 19.2. The estimates of maternal additive effect showed that pullets of the cross of ½ W x ½ B, and 3/4 W x 1/4 B and 7/8 W x 1/8 B backcrosses had better BWSM than those of ½ B x ½ W, 1/4B x 3/4W and 7/8 B x 1/8W backcrosses. The values of direct additive effect indicated that using WW toms surpassed BB toms for BWSM in the three studied generations. Amin (2008b) found negative heterosis percentages for BWSM of both males and females (-18.55 % and -22.00 %), respectively.

2- Age at sexual maturity (ASM):

There were highly significant differences among the different studied genotypes for ASM, while no significant effect of generations on the same trait, Table (4). Pullets of WW variety were sexually matured later compared to the other genotypes in the first generation, but after two repeated backcrossing in the third generation, no significant differences among the WW variety and backcrosses of both of (7/8 W x 1/8 B and 7/8B x 1/8W) were found.

The values of strait-bred differences indicating that pullets of WW variety matured sexually later by 99 days compared with BB ones (315.0 vs.16.0d) at the first generation. However, this value decreased to 77 days in the 2nd and 3rd generations. Pullets of WW variety had the highest ASM compared to the other genotypes in the first generation, but after two repeated backcrossing no significant differences between WW variety and both of 7/8 W x 1/8 B and 7/8 B x 1/8 W backcrosses were found in the third generation. Similar results were found by Amin (1999, 2007, 2008a, 2008b, 2009) showing that White N pullets were significantly the heaviest at sexual maturity at the first generation compared to those of both of BB and the reciprocals crosses at either the second or the third generation. Ghanem et al. (2008 and 2012); El-Dlebshany et al. (2013) andTaha and Abd El-Ghany (2013) found highly significant differences among the four genotypes (pure, crosses and reciprocal crosses) in ASM in chicken.

3- Egg number (EN) and rate of laying (RL%):

Results in Table (5) showed that, pullets of BB laid significantly the highest number of eggs (90.4egg/52weeks) compared to the other genotypes in the first generation. The BB pullets produced significantly ($P<0.01$) the highest egg number (EN) compared to the other genotypes and backcrossing improved EN of 7/8Bx1/8W (76.5egg/52weeks) at the 3rd generation Table (5). It can be explained this result that WW is not adapted to the environmental conditions in Egypt because it was imported from cold environment, while BB variety was adapted to the environmental conditions of Egyptian.

The first generation had the lowest value of strait-bred differences (29.6) while, both of the second and the third generations had the highest values which had nearly similar values of strait-bred differences (37.7 and 37.8, respectively).

Considering maternal additive, direct additive effects, heterosis percentages (H1 and H2), and average degree of heterosis all values were increased after two repeated backcrossing at the third generation (31, 68.8, -11.1, -3.5 and -6.55, respectively,) compared to those of the 1st and the 2nd generations. The values of maternal additive effect showed that pullets of the ½ B x ½ W cross and both of 1/4B x 3/4W and 7/8 B x 1/8W backcrosses produced higher eggs than those of ½ W x ½ B cross and 3/4 W x 1/4 B and 7/8 W x 1/8 B backcrosses at the three studied generations. Crossing of ½ B x ½ W and 1/4B x 3/4W poults with BB toms gave an advantage of EN. The values of direct additive effect indicated that using BB toms is better than WW toms for EN at all studied generations. Although all values of heterosis percentage and average degree of heterosis has increased after two repeated backcrossing but they were still negative values and ranged from (-3.5% to -33.6 %).

The analysis of rate of laying (RL%) showed that estimates RL had the same trend which observed in EN of the different generations studied, also, non-additive genetic variation (heterosis) and average degree of heterosis of RL of the different generations were negative and ranged between -4.5% and 36.6% (Table 6). Highly significant effects due to interaction between genotype and generation were found. Concerning the results of EN, it agreed with those reported by several authors (Zaidan, 1982; and Nestor et al., 2004) who found that genotypes of turkey were significantly differed in EN, moreover, Black Baladi was the better genotype of egg production as observed by Amin (1999) who reported that during the 84- d production the BB pullets laid significantly more eggs than WN by 13 eggs (44%). Amin (2007) found that BB variety recorded EN at 32-44 wks of age for the three years which studied to be 25, 29 and 37 eggs. Early report for egg production of turkey found negative heterosis (Nestor, 1995), while Nestor et al. (2004) found positive heterosis for egg production based on 84, 120 and 180-d of production and for rate of lay based on data for a 180-d production. Moreover, Emmerson et al. (1991) found that heterosis of egg production was 23% for 84-d and 37.9% for 180-d egg production. In contrary, no heterosis was observed for egg production for 84,180 or 250 d (Emmerson et al., 2002).

4- Egg weight (EW):

Results of Table (7) showed that WW pullets produced significantly the heaviest eggs during the 1st 2nd and 3rdgenerations (89.5, 90.1 and 89.1 g), respectively. There were no significant differences between EW of WW variety and backcrosses of 3/4W x 1/4B, 3/4B x1/4W, 7/8W x 1/8B and 7/8 B x 1/8W while pullets of BB variety had significantly the lowest EW at the 1st,2nd and 3thgenerations (82.6, 83.2 and 81.2g), respectively.

After two repeated backcrossing all values of strait-bred differences, maternal additive and direct additive effects were negative (-7.9,-1.3and -9.2), respectively, and decreased compared to the first generation .On the other hand, values of H1 % and H2% and A.D.O.H %, had positive values (0.64%, 0.64%, and 0.66%, respectively,) which increased by generation. These results indicated that backcross of (7/8 B x 1/8W) surpassed (3/4 W x 1/4 B) backcross in EW. The values of heterosis percentages (H1 and H2), and average degree of heterosis showed that backcrossing enhanced EW of 1/4Bx 3/4W, 7/8 B x 1/8W, 3/4 W x 1/4 B and 7/8 W x 1/8 B genotypes. Using both of BB and WW toms as a sire–bred at the 2nd and 3rd gave an advantage for EW where averages of their backcrosses were approximately equal. Godwin et al. (2005) reported egg weights ranged between 79.2 to 94.29 for hybrid EURO FP line of turkey. Significant differences between strains, lines and crossbreds in egg weight were reported on turkeys by Nestor et al. (1977 and 1997), Strong and Nestor (1980), Gad et al. (1991); Hulet et al. (1992), Nestor and Noble (1995) and Mostafa and Younis (2001) and Amin (2007 and 2008) and on chickens (Ghanem et al., 2008 and 2012; El-Dlebshany et al., 2013; andTaha and Abd El-Ghany, 2013). On the contrary, Nestor (1977) did not find any significant difference in the later trait between two random bred populations of turkeys. Several studies on the effects of crossing strains and varieties of turkeys on reproductive traits were done. Nestor, 1971; Zaidan, 1982; Hassan et al., 1985; Nestor et al., 2004;Khalil et al., 2004; Mohamed et al., 2005; Aly et al., 2005; Mustafa, 2011); working on turkeys and Hanan et al. (2012); El-Dlebshany et al. (2013) and Taha and Abd El-Ghany (2013) in chickens found highly estimates of direct additive and maternal effects for EW.

5- Egg mass (EM):

Results in Table (8) showed that the pure BB variety had significantly the highest value of EM in the 2ndgeneration (7.95 kg), while pullets of ½W x ½ B cross and both of 3/4 W x 1/4 B and 7/8 W x 1/8 B backcrosses had the lowest EM (4.6, 4.14 and 4.1kg), respectively. No significant deference was found between 3/4 W x 1/4 B and 7/8 W x 1/8 B backcrosses for EM. The pure BB at the 1st – 3rd and the rest crosses had intermediate means.

Results showed that the third generation had the highest value of strait-bred differences flowed by the first generation but the 2nd one had the lowest value (2.63, 2.0, and 0.71kg, respectively).

Considering the maternal additive and direct additive effects, it could be seen that poults of ½ B x ½ W cross and 1/4B x 3/4W backcross crossed with toms of BB variety gives an advantage of EM at all generations studied. The third generation had the highest values of the maternal additive and direct additive effects (2.7 and 5.33), respectively, flowed by the second generation (1.6 and 2.32), respectively, while the first generation had the lowest values (0.9 and 2.9), respectively. The H1%, H2% and AD.O.H% had negative values in the three studied generations (except H2% in both of the 2nd and 3rd generations which had positive values (0.3 and 2.2, respectively). Similar results were found by Amin (1999) for the BB turkey during 84-d of egg production which surpassed the WN by approximately 0.6kg (25%) per pullet. This superiority may encourage the poultry breeders in Egypt to use the Black Baladi turkey in any crossbreeding program for the purpose of enhancing egg production of turkeys. Several authors found significant differences genotypes concerning EM in turkeys (Nestor, 1971; Zaidan, 1982; Hassan et al., 1985; Nestor, 1997, Gad et al., 1991; Hulet et al., 1992, Nestor and Noble, 1995; Mostafa and Younis, 2001; Khalil et al., 2004; Amin, 2007and 2008 and Harvenstein, et al., 2007) and Ghanem et al. (2008 and 2012); El-Dlebshany et al. (2013) and Taha and Abd El-Ghany (2013) in chickens

6- Feed intake (FI) and feed conversation (FC):

Means and standard errors for feed intake (kg/hen/52weeks), Strait-bred differences, maternal additive, direct additive effects, heterosis percentages, average degree of heterosis for the two parental strains and their crossbred for the three generations are presented in Table (9).The WW pullets consumed more amount of ration compared to the other three genotypes in the first generation but FI was decreased in both of the second and the third generations (92.7, 80.0 and75.1kg, respectively). While BB pullets consumed about a half of ration than those of WW throughout the same three generations (50.2, 45.9 and 44.7kg), respectively. It can be explained this result that WW had the heaviest weight in the first generation but it decreased from one generation to another. Moreover, it is not adapted to the environmental conditions in Egypt because it was imported from cold environment, while BB variety was adapted to the environmental conditions of Egyptian.

Values of Strait-bred differences, maternal additive and direct additive effects and heterosis percentages,(H1% , H2% and A.D.O.H %) were varied in increasing from one generation to another and the best result was found in the third generation (-30.4,-7,4.0%,30.2%and15.4%), respectively.

Considering feed intake (kg/egg), no significant differences were found among the three studied generations Table (10). Highly significant differences were found among genotypes through the three generations where the FI of pullets of pure WW, and (½ W x ½B) cross and both of backcrosses of 3/4 W x 1/4 B and 7/8W x 1/8B were approximately three times that consumed by the BB pullets through the three studied generations. Pullets of backcrosses of 1/4B x 3/4W and 7/8B x 1/8W were nearly double those consumed by the BB pullets. Highly significant effect due to the interaction between genotype and generation was found. The results in Table (10) showed that values of maternal additive effect pointed to that pullets of the ½ W x ½B cross and backcrosses of 3/4 W x 1/4 B and 7/8 W x 1/8 B at the 2^{nd} and 3^{rd} generations consumed more amount of ration than those of 1/2B × 1/2W cross and both of 1/4B x 3/4W and 7/8B x 1/8W backcrosses. Using pullets of both of 1/2W x 1/2B cross and (3/4W x 1/4B) backcross with White Nicholas toms gave increase in feed intake for all studied generations.

The values of direct additive effect indicating that using Black Baladi toms in crossing with different genotypes had performance in FI better than those of White Nicholas toms for feed intake at all generations studied but the direct additive effect decreased from one generation to another. Considering the third generation, the 7/8 B x 1/8W backcross had superior heterotic effect than the 7/8 W x 1/8B backcross for feed intake.

Concerning feed conversation (Kg. feed/Kg.egg) (FC), significant differences were found among the different studied genotypes and wide range was found throughout the different generations, Table (11). The BB pullets had the best FC which the averages of the 1^{st}, 2^{nd} and 3^{rd} generations were (6.7, 5.8 and 5.9), respectively, but those of backcrossing of 3/4W x 1/4B and 7/8W x 1/8B had the highest values of FC (18.3 and 19.0), respectively. Pullets of (1/2B × 1/2W), (1/4Bx3/4W) and (7/8B x 1/8W) had intermediate averages (12.4, 12.4 and 11.1), respectively, for the same trait. The superiority of FC for the BB pullets may be related to the little amount of ration which consumed and it is surpassed the other genotypes in egg production.

The estimates of direct additive and maternal additive effect showed that using BB toms in crossing and backcrossing had better result concerning feed conversion than WW toms. The estimates of heterosis (H1%, H2% and A.D.O.H %) were positive at the three generations. Estimate of H1% was decreased by generation; both of H2% and A.D.O.H% were increased in the second generation, and then increased in the third one. Differences between several genotypes or lines with respect of FI were reported by Zaidan (1982) and Nestor (1997), moreover, Amin (1999) found that during 84d of production the daily FI of Black Baladi was less than White Nickolas by about46% (150.46 vs. 277.24 g/hen) and had best FC (4.8 vs. 11.84). Godwin et al. (2005) using Hybrid EIIRO FP of turkey found that feed intake (g/bird/day) was 308 g at 14 wk of lay. Amin (2009) found that The BB pullets had the best feed conversion while WN had the highest value (8.23 vs. 25.62) in the whole interval studied. Significant differences between strains, lines and crossbreds in feed intake and feed conversion were reported by Nestor et al. (1972 and 1997), Strong and Nestor (1980); Gad et al. (1991); Hulet et al. (1992), Nestor and Noble (1995); Mostafa and Younis (2001) and Amin (2007, 2008a and 2008b). On the contrary, Nestor (1977) did not find any significant difference in feed conversion between two random bred populations of turkeys which used. Several studies on the effects of crossing strains and varieties of turkeys on reproductive traits were done. The results were inconsistent which indicated that heterosis was evident in turkey. (Nestor, 1971; Zaidan, 1982; Hassan et al., 1985; Nestor et al., 2004Khalil et al., 2004; Mohamed et al., 2005; Aly et al., 2005); Mustafa (2011) found highly estimates of direct additive and maternal effects for native breeds. Similar results were found by Ghanem et al. (2008 and 2012) and El-Dlebshany et al. (2013) in chicken. Moreover, Taha and Abd El-Ghany (2013) found in chicken that El- Salam x Mandarah cross recorded the highest significant averages for most of egg production traits. Direct additive effect was negative for most of the studied traits but maternal heterosis was positive for most of the studied traits of egg production, also, positive estimates of heterosis were recorded for most of egg production traits.

It could be concluded that using cross or backcross of local Black Baladi as a sire parent with pullet of White Nickolas and their crosses enhanced egg production traits, also, improved both of feed intake and feed conversion through the three studied generations.

Table (3): Means ±standard errors for body weight at sexual maturity, g, strait-bred differences, maternal additive, direct additive effects, heterosis percentages, and average degree of heterosis for the two parental strains and their crossbred for three generations

Generations	Traits / Genotype	Body weight at sexual maturity ,g	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage		
						H 1	H 2	A.D.O.H.
1	Parental strains		-6110	-1054	-7164	-13.2	-30.8	-22.0
	B x B	2935±8.60 ^{g}						
	W x W	9045±28.5^{a}						
	Reciprocal crosses							
	½ W x ½ B	5199±71.6 ^{e}						
	½ B x ½ W	4145±53.5 ^{f}						
	Overall mean	5331±32.3						
2	Parental strains		-4500	-500	-5000	-9.9	4.69	10.4
	B x B	2950±29.2 ^{g}						
	W x W	7450±36.8 ^{b}						
	Reciprocal crosses							
	3/4 W x 1/4 B	5700±44.2 ^{d}						
	1/4B x 3/4W	5200±31.5 ^{e}						
	Overall mean	5325±29.9						
3	Parental strains		-3510	-700	-4210	5.3	40.1	19.2
	B x B	2910±41.3 ^{g}						
	W x W	6420±38.5 ^{c}						
	Reciprocal crosses							
	7/8 W x 1/8 B	6380±45.6 ^{c}						
	7/8 B x 1/8W	5680±66.7 ^{d}						
	Overall mean	5347±59.8						

- The first parent of each cross was the sire,
- H 1%, H 2 and A.D.O.H. = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- g): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of the genotype and the generation was significant at ($p \leq 0.01$).

Table (4): Means± standard errors for age at sexual maturity, day, strait-bred differences, maternal additive, direct additive effects, heterosis percentages, and average degree of heterosis for the two parental strains and their crossbred for three generations

Generations	Traits / Genotype	Age at sexual maturity, day	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage H 1	H 2	A.D.O.H
1	Parental strains		-99	-19	-118	9.23	2.07	5.6
	B x B	216.0 ±0.93 d						
	W x W	315.0±1.20a						
	Reciprocal crosses							
	½ W x ½ B	290.0±0.92 b						
	½ B x ½ W	271.0±1.37 c						
	Overall mean	273.1±1.90						
2	Parental strains		-77.8	-3	-80.8	-4.1	13.6	4.0
	B x B	220.2±5.41 d						
	W x W	298.0±4.32 b						
	Reciprocal crosses							
	3/4 W x 1/4 B	282.0±3.22 c						
	1/4B x 3/4W	279.0±4.77 c						
	Overall mean	270.1±6.11						
3	Parental strains		-77	-3	-80	0.7	15.9	7.7
	B x B	213.0±6.11 d						
	W x W	290.0±5.95 b						
	Reciprocal crosses							
	7/8 W x 1/8 B	288.2±3.92 b						
	7/8 B x 1/8W	285.0±5.88 b c						
	Overall mean	269.0±3.78						

The first parent of each cross was the sire,

- H 1%, H 2 and A.D.O.H = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- d): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of the genotype and the generation was significant at ($p \leq 0.01$).

Table (5): Means± standard errors for egg number (egg / hen / 52weeks), Strait-bred differences, maternal additive, direct additive effects, heterosis percentages, and average degree of heterosis for the two parental strains and their crossbred for three generations

Generations	Traits / Genotype	Egg number	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage		
						H 1	H 2	A.D.O.H
1	Parental strains							
	B x B	90.4±2.1[a]	29.6	10	39.6	-33.6	-20.4	-27.0
	W x W	60.8±1.4[d]						
	Reciprocal crosses							
	½ W x ½ B	50.2±1.1[e]						
	½ B x ½ W	60.2±1.2[d]						
	Overall mean	65.5±1.6						
2	Parental strains							
	B x B	95.5±2.2[a]						
	W x W	57.8±1.9[d]	37.7	18.4	56.1	-13.1	-16.1	-14.9
	Reciprocal crosses							
	3/4 W x 1/4 B	46.9±0.9[e]						
	1/4B x 3/4W	65.3±1.1[c]						
	Overall mean	66.4±2.1						
3	Parental strains	93.3±1.8[a]						
	B x B	55.5±0.8[d]						
	W x W		37.8	31.0	68.8	-11.1	-3.5	-6.5
	Reciprocal crosses							
	7/8 W x 1/8 B	45.5±0.7[e]						
	7/8 B x 1/8W	76.5±2.2[b]						
	Overall mean	67.7±1.8						

- The first parent of each cross was the sire,
- H 1%, H 2 and A.D.O.H = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- e): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of genotype and the generation was significant at ($p \leq 0.01$).

Table (6): Means± standard errors for rate of laying %, Strait-bred differences, maternal additive, direct additive effects, heterosis percentages, and average degree of heterosis for the two parental strains and their crossbred for three generations

Generations	Traits / Genotype	Rate of laying %	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage		
						H 1	H 2	A.D.O.H
1	Parental strains		9	3	12	-36.59	-36.6	-29.3
	B x B	25±1. 20 [a]						
	W x W	16±0. 90 [d]						
	Reciprocal crosses							
	½ W x ½ B	13±0. 60 [e]						
	½ B x ½ W	16±0. 91 [d]						
	Overall mean	18±0. 80						
2	Parental strains		11	5	16	-10.3	-16.3	-13.9
	B x B	27±1. 10 [a]						
	W x W	16±0. 90 [d]						
	Reciprocal crosses							
	3/4 W x 1/4 B	13±0. 80 [e]						
	1/4B x 3/4W	18±0. 70 [c]						
	Overall mean	18±0. 70						
3	Parental strains		11	9	2	-14.3	-4.5	-8.3
	B x B	26±1. 20 [a]						
	W x W	15±1. 0 [d]						
	Reciprocal crosses							
	7/8 W x 1/8 B	12±.0.90 [e]						
	7/8 B x 1/8W	21±1.00 [b]						
	Overall mean	19±0.91						

The first parent of each cross was the sire,

- H 1%, H 2 and A.D.O.H. = heterosis and average degree of heterosis for crosses through the three studied generations.
- (a- e): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of genotype and the generation was significant at ($p \leq 0.01$).

Table (7): Means± standard errors for egg weight, g, Strait-bred differences, maternal additive, direct additive effects, heterosis percentages, average degree of heterosis for the two parental strains and their crossbred for three generations

Generations	Traits / Genotype	Egg weight g.	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage		
						H 1	H 2	A.D.O.H
1	Parental strains		-6.9	0.01	-6.89	0.63	0.64	0.6
	B x B	82.60 ±1.60 [c]						
	W x W	89.50±0.90 [a]						
	Reciprocal crosses							
	½ W x ½ B	86.59±1.30 [b]						
	½ B x ½ W	86.60±1.10 [b]						
	Overall mean	86.32±0.97						
2	Parental strains		-6.9	-0.1	-7.0	-0.3	3.7	1.6
	B x B	83.20±1.19 [c]						
	W x W	90.10±1.14 [a]						
	Reciprocal crosses							
	3/4 W x 1/4 B	88.10±0.90 [a]						
	1/4B x 3/4W	88.00±1.14 [a]						
	Overall mean	87.35±1.01						
3	Parental strains		-7.9	-1.3	-9.2	1.8	5.1	3.4
	B x B	81.20±0.99 [c]						
	W x W	89.10±1.09 [a]						
	Reciprocal crosses							
	7/8 W x 1/8 B	90.20±0.98 [a]						
	7/8 B x 1/8W	88.90±1.09 [a]						
	Overall mean	87.08±0.91						

The first parent of each cross was the sire,

- H 1%, H 2 and A.D.O.H = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- c): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of the genotype and the generation was significant at ($p \leq 0.01$).

Table (8): Means± standard errors for egg mass production (Kg/hen/52weeks), Strait-bred differences, maternal additive, direct additive effects, heterosis percentages, average degree of heterosis for the two parental strains and their crossbreds for generations

Generations	Traits / Genotype	Egg mass (Kg)	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage H 1	H 2	A.D.O.H
1	Parental strains		2	0.9	2.9	-29.2	-15.4	-22.3
	B x B	7.50±0.83 [b]						
	W x W	5.60±0.81 [e]						
	Reciprocal crosses							
	½ W x ½ B	4.60±0.61 [f]						
	½ B x ½ W	5.50±0.71[e]						
	Overall mean	5.80±0.570						
2	Parental strains		0.71	1.61	2.32	-16.1	0.3	-7.3
	B x B	7.95±0.93 [a]						
	W x W	5.24±0.60 [f]						
	Reciprocal crosses							
	3/4 W x 1/4 B	4.13±0.55 [g]						
	1/4B x 3/4W	5.74±0.78 [d]						
	Overall mean	5.80±0.450						
3	Parental strains		2.63	2.7	5.33	-9.6	2.2	-2.6
	B x B	7.57±0.76 [b]						
	W x W	4.94±0.63 [f]						
	Reciprocal crosses							
	7/8 W x 1/8 B	4.10±0.87 [g]						
	7/8 B x 1/8W	6.80±0.66 [c]						
	Overall mean	5.89±0.580						

The first parent of each cross was the sire,

- H 1%, H 2 and A.D.O.H = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- g): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of the genotypes and the generation was significant at ($p \leq 0.01$).

Table (9): Means ± standard errors for feed intake (kg. /hen/ 52weeks), Strait-bred differences ,maternal additive, direct additive effects, heterosis percentages, average degree of heterosis for the two parental strains and their crossbred for the three generations

Generations	Traits / Genotype	Feed intake	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage		
						H 1	H 2	A.D.O.H
1	Parental strains		-42.5	-0.2	-42.7	-4.27	-4.55	-4.4
	B x B	50.2±1.4[d]						
	W x W	92.7±3.3[a]						
	Reciprocal crosses							
	½ W x ½ B	68.4±1.9 [c]						
	½ B x ½ W	68.2±1.3 [c]						
	Overall mean	69.8±1.6						
2	Parental strains		-34.8	-4.1	-38.9	1.3	25.2	11.6
	B x B	45.9±2.1 d						
	W x W	80.7±1.9 [b]						
	Reciprocal crosses							
	3/4 W x 1/4 B	75.5±1.7[b]						
	1/4B x 3/4W	71.4±1.5[c]						
	Overall mean	68.4±1.4						
3	Parental strains		-30.4	-2.7	-33.1	4.0	30.2	15.4
	B x B	44.7±1.8 d						
	W x W	75.1±1.7 [c]						
	Reciprocal crosses							
	7/8 W x 1/8 B	78.3±1.3 [b]						
	7/8 B x 1/8W	75.6±1.2[bc]						
	Overall mean	68.0±1.1						

- The first parent of each cross was the sire,
- H 1%, H 2 and A.D.O.H = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- e): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of the genotype and the generation was significant at ($p \leq 0.01$).

Table (10): Means± standard errors for feed intake (Kg. feed /egg) Strait-bred differences, maternal additive, direct additive effects, heterosis percentages, average degree of heterosis for the two parental strains and their crossbred for three generations

Generations	Traits / Genotype	Feed intake	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage H 1	Heterosis percentage H 2	Heterosis percentage A.D.O.H
1	Parental strains		-0.97	-0.23	-1.2	31.4	9.18	20.3
	B x B	0.55±0.02 [d]						
	W x W	1.52±0.90 [a]						
	Reciprocal crosses							
	½ W x ½ B	1.36±0.14 [b]						
	½ B x ½ W	1.13±0.06 [c]						
	Overall mean	1.14±0.19						
2	Parental strains		-0.91	-0.51	-1.42	16.4	35.4	23.4
	B x B	0.48±0.07 [e]						
	W x W	1.39±0.60 [b]						
	Reciprocal crosses							
	3/4 W x 1/4 B	1.60±1.00 [a]						
	1/4B x 3/4W	1.09±0.50 [c]						
	Overall mean	1.03±0.05						
3	Parental strains		-0.87	-0.74	-1.61	16.6	24.8	19.5
	B x B	0.48±0.07[e]						
	W x W	1.35±0.09 [b]						
	Reciprocal crosses							
	7/8 W x 1/8 B	1.72±0.08 [a]						
	7/8 B x 1/8W	0.98±0.09 [c]						
	Overall mean	1.01±0.11						

- The first parent of each cross was the sire,
- H 1%, H 2 and A.D.O.H = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- e): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of the genotype and the generation was significant at ($p \leq 0.01$).

Table (11): Means± standard errors for feed conversation (Kg. feed /Kg. egg), Strait-bred differences, maternal additive, direct additive effects, heterosis percentages, average degree of heterosis for the two parental strains and their crossbred for the three generations

Generations	Traits / Genotype	Feed conversion	Straight bred difference	Reciprocal effect	Direct Additive effect	Heterosis percentage		
						H 1	H 2	A.D.O.H
1	Parental strains		-9.9	-2.5	-12.4	27.9	6.4	17.2
	B x B	6.7±0. 13 [a]						
	W x W	16.6±0.41 [c]						
	Reciprocal crosses							
	½ W x ½ B	14.9±0.68 [cd]						
	½ B x ½ W	12.4±0.56 [b]						
	Overall mean	12.60±0.22						
2	Parental strains		-9.6	-2.9	-12.5	20.8	69.2	39.0
	B x B	5.80±0.22 [a]						
	W x W	15.4±0.22 [c]						
	Reciprocal crosses							
	3/4 W x 1/4 B	18.3±0.22 [d]						
	1/4B x 3/4W	12.4±0.22 [b]						
	Overall mean	11.8±0.22						
3	Parental strains		-9.3	-7.9	-17.2	13.4	4.2	9.9
	B x B	5.90±0.22 [a]						
	W x W	15.2±0.22 [c]						
	Reciprocal crosses							
	7/8 W x 1/8 B	19.0±0.22 [d]						
	7/8 B x 1/8W	11.1±0.22 [b]						
	Overall mean	11.5±0.22						

- The first parent of each cross was the sire,
- H 1%, H 2 and A.D.O.H = heterosis and average degree of heterosis for crosses through the three studied generations,
- (a- d): Means at the same column of the different genetic groups are significantly differed at $p \leq 0.05$,
- The differences among the three generations were not significant,
- Interaction between both of the genotype and the generation was significant at ($p \leq 0.01$).

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الملخص العربى

تأثير الخلط الرجعى لمدة جيلين بين الرومى المحلى الأسود و النيوكلس الأبيض على صفات إنتاج البيض والفقس

١- صفات إنتاج البيض

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أجريت هذه الدراسة في محطة بحوث مريوط التابعة لمركز بحوث الصحراء وزارة الزراعة لمدة ثلاث سنوات بهدف دراسة نتائج الخلط الرجعى لذكور كل من الرومي النيوكلس الأبيض WW والرومي المحلى الأسود BB مع إناث كل من خليط (B x W) وخليط (W x B) على الترتيب لمدة جيلين من الخلط الرجعى وأوضحت النتائج الاتى:-

١- يوجد فروق معنوية كبيرة بين التراكيب الوراثية المختلفة فى صفات وزن الجسم عند البلوغ الجنسى (BWSM) ، والعمر عند البلوغ الجنسى (ASM)، عدد البيض (EN) ، معدل وضع البيض(RL%) ،كتلة البيض (EM) ، وزن البيضة ,(EW) العلف المأكول (كجم/دجاجة/٥٢ أسبوع) (FI1) ، العلف الماكول (جرام / بيضة) (FI2) و الكفاءة الغذائية لإنتاج البيض (كجم.علف/كجم بيض) (FC) خلال الثلاث أجيال التى تم دراستها . لا يوجد فروق معنوية بين (BB) خلال الثلاث أجيال التى تم دراستهم فى كل الصفات السابقة على الرغم من أن دجاجات (WW) كانت الأثقل وزناً فى الجيل الأول من (BB) إلا أنه أنخفض من جيل إلى آخر حتى أصبح لا يوجد فروق معنوية بينها وبين الخليط الرجعى 7/8W x1/8B فى الجيل الثالث .

٢- دلت النتائج على أن دجاجات الرومى WW تفوقت على دجاجات BB فى الثلاث أجيال التى تم دراستها فى صفات BWSM، ASM، EW، FI1 و FI2 ولكن هذا التفوق أنخفض فى الجيل الثانى والثالث بينما متوسطات الرومى BB كان الآعلى فى صفات EN, RL,EM, FI2 ,FC مقارنة بالتراكيب الوراثية الأخرى فى الجيل الأول والثانى والثالث.

٣- بعد جيلين من الخلط الرجعى وجد أن دجاجات الرومى BB تضع عدد بيض أعلى (٩٣,٣بيضة) مقارنة بالتراكيب الوراثية WW، (7/8 W x1/8 B و7/8 B x 1/8 W) (٥٥,٥، ٤٥,٥ و٧٦,٥ بيضة على الترتيب). قياسات RL % أخذت نفس أتجاه عدد البيض فى مختلف أجيال الدراسة.

٤- الخلط الرجعى بأستخدام BB كأب مع دجاجات (1/4B x 3/4W و7/8B x1/8W) كأمهات أدى الى زيادة EN (٧٦,٥و٦٥,٣بيضة على الترتيب)، RL% (٠,١٦و٠,٢١ على الترتيب)، EM (٥,٧و٦,٨ كجم على الترتيب) FI2,(١,٠٩ و٠٩٨. جرام على الترتيب) و FC (١٢,٤و١١,١ جرام على الترتيب) مقارنة بأداء الخليط الرجعى عند

أستخدام ذكورWW مع التراكيب الوراثية 3/4 W x 1/4 B و7/8 W x 1/8 B كأمهات فى نفس الصفات. بصفة عامة كان الجيل الثالث الأفضل فى القيم مقارنة بالأجيال الأخرى .

٥- وبالنظر للتأثير الأموى والأبوى المضيف ، نسب قوة الهجين الفردية H1 وH2 و نسب متوسط درجة قوة الهجين فقد أرتفعت قيمتها بعد مرتين من الخلط الرجعى مقارنة بالجيل الأول والثانى فى كل الصفات التى تم دراستها فيما عدا صفتى FI2 و FC علاوة على H1 لصفة RL و H1 وH2 لصفة EW قد أنخفض فى الجيل الثالث.

٦- قيم التأثير الأموى المضيف تدل على أن النسل الناتج عن تزاوج الخليط ½W x B ½ وكلا من الخليط الرجعى 1/4 B x 3/4 W و 7/8Bx1/8W كان أفضل فى الآداء من النسل الناتج عن تزاوج الخليط ½ B x W ½ وكل من الخليط الرجعى 3/4W x1/4B و7/8W x1/8 B فى صفات FC , FI1,FI2,EM, RL, EN. إستخدام دجاجات الرومى (½ W x B ½ و1/4B x 3/4W) كأمهات مع ذكور BB يؤدى إلى تحسين فى الصفات السابقة فى الجيل الاول والثانى والثالث. قيم التأثير الأبوى تدل على أن أستخدام الرومى BB كذكور حقق تحسين فى تلك الصفات عنه بأستخدام ذكور WW فى الصفات السابقة ولكن أستخدام دجاجات (1/2W x1/2 B) و(3/4Wx1/4 B) مع ذكور WWحقق زيادة فى ASM،BWSM وFI2 فى الأجيال الثلاثة.

٧- بصفة عامة حقق الجيل الثالث أفضل قيم لنسب قوة الهجين الفردية H1 وH2 ونسب متوسط درجة قوة الهجين مقارنة بالجيل الأول والثانى وكانت القيم موجبة لصفات BWSM (٤٠,١،٥,١و١٩,٢%) ، ASM (٠,٧، ١٥,٥ و٧,٧%) EW، (١,٨، ٥,١ و٣,٤ %) FI1، (٤,٠، ٣٠,٢ و١٥,٤ %) ، FI2 (١٦,٦، ٢٤,٨ و١٩,٥ %) و FC (١٣,٤، ٤,٢، ٩,٥ %) على الترتيب. وعلى الجانب الآخر وجدت قيم سالبة لصفات EN (-١١ ،-٣,٥ و-٦,٥%) ، RL (-١٤,٤ ،-٤,٥ و-٨,٣ %) وEM فيماعدا H2 (-٤,٦، ٢,٢ و-٢,٦ %) كانت موجبة فى الجيل الثانى . دجاجات 7/8 B x 1/8W تفوقت على دجاجات (7/8 W x 1/8 B) فى قيم النسبة المئوية لقوة الهجين الفردية H2% فى معظم الصفات التى تم دراستها .

يمكن أن نستخلص مما سبق أن أستخدام خلط رجعى بين ذكور BB مع دجاجات ½ W x B ½ و 1/4B x 3/4W يؤدى الى تحسين معظم صفات إنتاج البيض التى تم دراستها.