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CROSSBREEDING EFFECTS ON SOME GROWTH AND CARCASS TRAITS IN JAPANESE QUAIL

by

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ABSTRACT: *A* crossbreeding experiment was carried out using four selected lines of Japanese quail, HBW_4&LBW_4 lines were established through selection for high and low body weight at 4 weeks of age and $HTEW_{10}$&$LTEW_{10}$ lines were established for high and low total egg weight laid by female during the first 10 weeks of laying. A total number of 1512 crossbred birds of quail produced from four mating groups among three hatches were used for the present study to estimate direct heterosis, direct additive and maternal effects on the growth traits and a total number of 24 crossbred birds of quail.

Growth traits such as Body weight was recorded at 0, 2, 4, 6 weeks of age (BW_0, BW_2, BW_4, BW_6) and average daily gain between the different growth period studied 0 - 2, 2 - 4, 4 - 6, 0 - 6 weeks of age (ADG_{0-2}, ADG_{2-4}, ADG_{4-6}, ADG_{0-6}).

Moreover carcass traits including slaughter weight (gm), meat, bone, giblets and dressing percentages (SW, M%, B%, G%, D%) also were recorded

Results of this experiment could be summarized as follow:

1-Crossing sires of HBW_4 with $HTEW_{10}$ dams had the highest body weights and body weigh gains recorded from hatch to 6 weeks of age followed by reciprocal crossing between sires of $HTEW_{10}$ with HBW_4 dams and the crossbreds produced from sired $LTEW_{10}$ with LBW4 dams had the lowest body weights and body weigh gains recorded from hatch to 6 weeks of age followed by reciprocal crossing between sires of $LTEW_{10}$ with LBW_4 dams.

2-Highly significant positive direct heterosis effect for most body weights recorded at different ages was observed except BW_4. Estimates of heterosis percentage for body weights were high at 0 and 2 weeks (25.8 and 31.2%) and declined to (11.9 and 17.2 %) for BW_4 and BW_6. However, estimates of heterosis percentage were high for ADG_{0-2}, ADG_{2-4} (15.6 and 14.9%) and declined to (6.1 and 9.6 %) for ADG_{0-6} and ADG_{4-6}.

3-Direct additive effect for body weights recorded at different ages and body weight gains calculated between different growth periods studied were significant and ranged between 4.41 for BW_0 and 32.18 for BW_4 and between

4.74 for ADG_{2-4} and 9.27% for ADG_{4-6}.

4-Maternal additive had a significant negative effect on most body weights and body weight gains studied, except BW_2 and ADG_{2-4} and they were ranged between -5.75 for BW_0 and -42.34 for BW_4 and between -0.10 for ADG_{0-6} and -0.26 for ADG_{4-6}.

5- Crossing sires of HBW_4 with $HTEW_{10}$ dams had the highest carcass performance followed by reciprocal crossing between sires of $HTEW_{10}$ with HBW_4 dams and the crossbreds produced from sired $LTEW_{10}$ with LBW_4 dams had the lowest carcass performance followed by reciprocal crossing between sires of $LTEW_{10}$ with LBW_4 dams.

6-Positive direct heterosis effect for most carcass traits studied was observed except M% and G%. Estimates of heterosis percentage for carcass traits were high for SW and B% (17.8 and 25.7%) and declined to (2.1 and 3.9%) for M% and G%.

7- Negative direct additive effect for most carcass traits studied were significant, except G% and D% and they were ranged between -7.2 for B% and -33.3 for SW.

8-Maternal additive had a significant effect on most carcass traits studied, except G% and D% and they were ranged between 6.3 for B% and 11.3 for SW.

INTRODUCTION

Quails have the advantages of rapid growth rate, good reproductive potential, short life cycle, low feed requirements, good meat taste, better laying ability and shorter time for hatching as compared with different species of poultry, so it is considered as a pilot animal for poultry breeding investigations.

Crossing procedures usually lead to better economic performance due to the hybrid vigor. However crossbreeding is a very effective method for obtaining different combination of genetic materials where it results in increased heterozygosis and tend to cover up recessive genes, decreases breeding purity and eliminates families in one generation. Breeding usually improve the performance of the different characters by selection and or crossing, to obtain different degrees of heterosis. That is to say, by directing the additive and non-additive genes to better performance of the different traits. The additive nature of genetic variation for growth has resulted in dramatic body weight improvement in Japanese quail (Marks, 1978 & 1990 and Nestor *et al.*, 1982). Non additive genetic effect is important in meat and laying stocks because of the opportunities to combine stocks that complement each other. This allows the development of mating combinations for rapid growth, yield and other important economic traits (Marks, 1995).

Most available estimates of heterosis for body weight in Japanese quail were observed in reciprocal crosses of two quail lines, both selected for high body weight (Biak and Marks, 1993 and Marks, 1995) or crossing lines of high and low body weight (Gerken *et al.*, 1988; Barden and Marks, 1989 and Marks, 1993).

The main purpose of the present study was to evaluate the importance of heterosis, maternal and direct additive effects arising from crossing four selected lines of Japanese quail, HBW_4&LBW_4 and $HTEW_{10}$&$LTEW_{10}$ on growth and carcass traits.

MATERIALS AND METHODS

Data used in the present study were collected on the flock of four lines of Japanese quail HBW_4&LBW_4 which selected for high and low 4-weeks body weight, $HTEW_{10}$&$LTEW_{10}$ that selected for high and low total egg weight maintained by the Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt.

The fore mentioned lines of Japanese quail were used for producing four genetic crossbred groups, HBW_4 x $HTEW_{10}$, its reciprocal cross $HTEW_{10}$ x HBW_4 and LBW_4 x $LTEW_{10}$, and its reciprocal cross $LTEW_{10}$ x LBW_4.

Distribution of birds produced in each hatch and breed group are presented in Table (1).

Table (1): Distribution of birds produced from crossbreds among different lines and hatches .

Mating groups / Hatch	HBW_4 X $HTEW_{10}$		$HTEW_{10}$ X HBW_4		LBW_4 X $LTEW_{10}$		$LTEW_{10}$ x LBW_4		Total	
	M	F	M	F	M	F	M	F	M	F
1	84	80	75	78	85	87	52	50	296	295
2	76	66	72	68	52	50	50	48	250	232
3	72	75	56	52	48	45	45	46	221	218
Total	**232**	**221**	**203**	**198**	**185**	**182**	**147**	**144**	**767**	**745**

M: Males, F: Females.

Eggs were collected for hatch when the females were 10 to 12 weeks of age, marked and incubated for 15 days. After incubation the eggs were transferred to the Hatcher and 3 days later all chicks were removed from the Hatcher.

Immediately after hatch individual quail birds were permanently identified by wing - bands and placed in quail battery brooders, where they remained for 4 weeks period. All birds were housed in the same room in order to keep temperature, humidity, light intensity and other variables. At 5 weeks of age the males were separated from the females and at 6 weeks of age, birds were divided into four line groups.

All birds were sexed according to plumage color and pattern at the same time and were taken and moved to individual laying cages and stud matings started about two weeks later. Feed and water were provided ad libitum. The experimental diet contained 28% protein and 2920 k cal - ME/ Kg until two weeks of age and 25% protein with 2850 k cal - ME/Kg during 3-6 weeks of age, then changed to a ration contained 20% protein with 2820 K cal - ME / Kg during the egg production period.

Temperature started with 38 °c for the first week after hatching, then decreased 2-3 °c weekly to 26-28 °c at the fourth week of age till the end of brooding period.

Carcass traits:

From each genetic group, six birds (3 males and 3 females) were chosen randomly at 6 weeks of age to determine weights of all parts of carcass and its organs. Chosen birds were stowed for 3 hours, weighted and then slaughtered. Feather was removed by the dry method, and then carcass was eviscerated.

The following carcass traits were recorded :

1-Body weight at slaughter age (6 weeks) in grams (SW).

2-Carcass weight as well as weight of the edible giblets (heart, liver and empty gizzard) was recorded to the nearest 0.01 g.

3- Meat, bone, giblets were calculated as percent of carcass and neck weight, while dressing percentage was calculated as and carcass and neck weight relative to body weight (SW).

Statistical analysis:

Data of individual body weight, daily gains and carcass traits were analyzed using Henderson's Method III **(Henderson, 1984)** by using the following mixed model **(Harvey 1990).**

$$Y_{ikpmq} = \mu + G_i + S_k + SE_p + H_m + e_{ikpmq}$$

$$_{ikpmq} = \mu + MG_i + S_k + SE_p + H_m + e_{ikpmq}$$

Where:

Y_{ikpmq} = the observation on the kpmq th trait;

μ = overall mean, common element to observations,

G_i = fixed effect of the i^{th} mating groups,

S_k = random effect of k^{th} sire ,

SE_p = fixed effect of the p^{th} sex;

H_m =fixed effect of the m^{th} hatch,

e_{ikpmq} =random deviation of the q^{th} growth and carcass traits distributed, i.e. N.D (0, σ^2e).

Crossbreeding components for growth and carcass traits were estimated according to **Dickerson (1992).**

Pure lines differences:

$$PU_{HBW4 \times HTEW10} = [(HBW_4 x HBW_4) - (HTEW_{10} x HTEW_{10})].$$

Direct heterosis effect:

$$H^I_{HBW4 \times HTEW10} = [(HBW_4 \times HTEW_{10}) + (HTEW_{10} \times HBW_4) - (HBW_4 x HBW_4) - (HTEW_{10} x HTEW_{10})]$$

$$H^I\% = H^I \text{in units}/0.5[(HBW_4 x HBW_4) + (HTEW_{10} \times HTEW_{10})] \times 100.$$

Direct additive effect:

$$(G^I_{HBW4} - G^I_{HTEW10}) = [(HBW_4 \times HBW_4) + (HBW_4 \times HTEW_{10})] - [(HTEW_{10} \times HTEW_{10}) + (HTEW_{10} \times HBW_4)].$$

Maternal additive effect:

$$(G^M_{HBW4} - G^M_{HTEW10}) = (HBW_4 \times HTEW_{10}) - (HTEW_{10} \times HBW_4).$$

Where:

G^I and G^M represent direct additive and maternal additive effects, of the subscript breed (genetic) group.

RESULTS AND DISCUSSION

Crossbreeding effects:

Growth traits:

Least-square means and standard errors (S.E) for body weights recorded at different ages and daily weight gain calculated between different growth periods studied are given in Tables 2 & 3. The crossbreds produced from sired HBW_4 with $HTEW_{10}$ dams had the highest body weights and body weigh gains recorded from hatch to 6 weeks of age and the crossbreds produced from sired $LTEW_{10}$ with LBW_4 dams had the lowest body weights and body weigh gains recorded from hatch to 6 weeks of age, while the reciprocal crosses between these lines had intermediate values for body weights and body weigh gains recorded from hatch to 6 weeks of age. However, significant differences due to mating group (MG) on growth traits were observed. Results of significant effect of MG on growth traits of Japanese quail strains were also confirmed by different authors (Larson *et al.*, 1986, El-Naggar *et al.*, 1992, Barbour and Liibum, 1995; Mandour *et al.*, 1996; Bahie El-Deen *et al.*, 1998; Sherif *et al.*, 1998; Aboul-Hassan, 2001; Abdel-Ghany *et al.*, 2004 and Nofal, 2006)

Direct heterosis:

Estimates of direct heterosis calculated in units (g) and percentages (%) for body weights recorded at different ages and body weight gains calculated between different growth periods studied are presented in tables 2 & 3. However, these traits showed generally highly significant ($P<0.01$ or $P<0.001$) positive direct heterosis except BW_4 had non-significant effect. Estimates of heterosis percentage for body weights were 31.2 and 25.8% at 0 and 2 weeks, respectively. and declined to 17.2 and 11.9% for BW_4 and BW_6. The corresponding estimates of heterosis percentage for body weight gains were 15.6, 14.9, 9.6 and 6.1% for ADG_{0-2}, ADG_{2-4}, ADG_{4-6} and ADG_{0-6}, respectively. Such superiority of cross lines quail over their parental lines points to considerable non-additive genetic line effects.

Table 2. Least-square means of body weight traits among the different mating groups ± SE, direct heterosis (H^I), direct additive effect (G^I) and maternal additive effect (G^M).

Traits / Mating groups:	No.	BW_0 Mean ± SE	BW_2 Mean ± SE	BW_4 Mean ± SE	BW_6 Mean ± SE
HBW_4 x $HTEW_{10}$	484	9.3 ± 0.10	49.0 ± 1.04	101.6 ± 6.03	187.7 ± 1.74
$HTEW_{10}$ x HBW_4	375	8.6 ± 0.11	47.8 ± 1.11	97.3 ± 7.05	183.8 ± 1.84
LBW_4 x $LTEW_{10}$	480	8.1 ± 0.09	41.8 ± 0.89	90.1 ± 7.05	178.9 ± 1.45
$LTEW_{10}$ x LBW_4	348	7.4 ± 0.09	40.1 ± 0.89	87.9 ± 7.05	170.2 ± 1.42
Pure breed effect		$10.66 \pm 0.10^{***}$	$7.71 \pm 0.90^{**}$	2.83 ± 9.83^{ns}	$19.24 \pm 1.37^{***}$
Direct heterosis (H^i) Unit		$2.44 \pm 0.14^{*}$	$9.86 \pm 1.24^{***}$	1.09 ± 13.55^{ns}	$22.42 \pm 1.88^{***}$
Percentage		31.2 %	25.8 %	17.2 %	11.9 %
Direct additive effect (G^i)		$4.41 \pm 0.14^{**}$	$7.91 \pm 1.24^{**}$	$32.18 \pm 13.55^{***}$	$23.07 \pm 1.88^{***}$
Maternal additive effect (G^m)		$-5.75 \pm 0.10^{*}$	-0.20 ± 0.86^{ns}	$-42.34 \pm 9.33^{*}$	$-8.83 \pm 1.30^{**}$

*=P< 0.05 or **= P< 0.01or ***= P< 0.001, ^{ns}=Non- significant.

BW0, 2, 4, 6 = Body weight at 0, 2, 4, 6 weeks of age, HBW_4&LBW_4=Lines were established to selection for High and low body weight at 4 weeks of age, $HTEW_{10}$&$LTEW_{10}$ =Lines were established to selection for high and low total egg weight.

Table 3. Least-square means of daily weight gain traits among the different mating groups ± SE, direct heterosis (H^I), direct additive effect (G^I) and maternal additive effect (G^M).

Traits / Mating groups:	No.	ADG_{0-2} Mean ± SE	ADG_{2-4} Mean ± SE	ADG_{4-6} Mean ± SE	ADG_{0-6} Mean ± SE
HBW_4 x $HTEW_{10}$	484	2.5 ± 0.09	4.2 ± 0.10	6.4 ± 0.11	4.3 ± 0.04
$HTEW_{10}$ x HBW_4	375	2.3 ± 0.09	4.0 ± 0.09	6.1 ± 0.11	4.1 ± 0.04
LBW_4 x $LTEW_{10}$	480	2.0 ± 0.11	3.7 ± 0.11	5.4 ± 0.13	3.5 ± 0.05
$LTEW_{10}$ x LBW_4	348	1.8 ± 0.12	3.4 ± 0.11	5.2 ± 0.14	3.3 ± 0.05
Pure breed effect		7.36 ± 0.08***	10.85 ± 0.11***	3.01 ± 0.09*	9.48 ± 0.04***
Direct heterosis (H^i) Unit		8.35 ± 0.10***	5.40 ± 0.15**	1.81 ± 0.13***	10.24 ± 0.06***
Percentage		15.6 %	14.9 %	9.6 %	6.1%
Direct additive effect (G^i)		5.21 ± 0.10**	4.74 ± 0.15***	9.27 ± 0.13**	7.57 ± 0.06**
Maternal additive effect (G^m)		-0.15 ± 0.07*	0.12± 0.10^{ns}	-0.26± 0.09*	-0.10 ± 0.27*

*=P< 0.05 or **= P< 0.01or ***= P< 0.001, ^{ns}=Non- significant.

ADG0-2, 2-4, 4-6, 0-6 = Average daily gain from 0-2 , 2-4 , 4-6 0-6 weeks of age.

In this respect, Bahie El-Deen et al.,(1998) and Aboul-Hassan (2001) observed that heterosis contrasts were significant for BW_0, BW_2 and BW_4 (P<0.001) and BW_6 (P<0.01).

Maeda *et al.*, (1988) and Sato *et al.*, (1990) indicated the presence of heterotic effects in body weights of quail recorded at different ages. Marks (1995) crossing lines of quails selected long-term for increased body weight, but that was dependent on both environments and age as well as the genetic of populations. He crossed medium weight quails (selected for high BW_4) and quails of heavy strain and reported that considerable heterosis was present for body weights.

Damme (1994) reported heterosis for BW_1 to BW_6 ranged between 0.6 and 2.7% , and it was significant for BW_2. Bahie El-Deen *et al.*, (1998) reported that heterosis percentage estimates for body weight were high at BW_2 (30.2%) and declined to (11.8%) at BW_6. Heterosis contrast were significant for BW_2, BW_4 (P<0.001) and BW_6 (P<0.01) but non for ADG_{2-6}. Furthermore, Bahie El-Deen (1994) and Nofal (2006) when crossing two lines of quails, one selected for high BW_6 and the other line was selected for high egg production noticed negative heterosis for growth traits.

On the contrary, Gerken *et al.*, (1988) reported that heterosis was not significant for body weight from 25 to 49 days of age in diallel crosses among two randombred control lines and a line selected for large body weight.

Direct additive effect:

Direct additive effect for body weights recorded at different ages and body weight gains calculated between different growth periods studied were significant (P<0.01 or P<0.001) and they were 4.41, 7.91, 32.18 and 23.07% for BW_0, BW_2, BW_4 and BW_6 (Table, 2). The corresponding estimates of direct additive effects were 5.21, 4.74, 9.27 and 7.57% for ADG_{0-2}, ADG_{2-4}, ADG_{4-6} and ADG_{0-6}, respectively (Table, 3).

Growth performance of quails sired by HBW_4 line were significantly superior to those quails sired by $HTEW_{10}$ line (Tables, 2 and 3). The same trend was also concluded by Bahie El-Deen *et al.*, (1998) and Nofal (2006). They reported that direct additive effect on body weight at market age of M-sired quails was significantly different from quails sired by E-line. Sire-line linear contrasts indicate that E-sired quails were significantly superior in BW_6 ($P<0.05$) and ADG_{2-6} ($P<0.01$). At 4 weeks of age, direct genetic effects were also pronounced in favour of E-sires, while at early ages, M-sires were better than E-sires. Aboul-Hassan (2001) reported that body weights and body weight gains of Brown sired quails was significantly different from quails sired by White strain. Sire-line linear contrasts indicate that W-sired quails were significantly superior in most growth traits studied ($P<0.01$) except BW_0 and BW_2 was in favour of sired by B strain.

Maternal additive effect:

Maternal line effects (expressed as the differences between reciprocal crosses) on most body weights and body weight gains studied were statistically significant ($P<0.05$ or $P<0.01$ or $P<0.001$) except BW_2 ADG_{2-4}. Growth performance of quails mothered by $HTEW_{10}$ line were significantly superior to those quails mothered by HBW_4 line (Tables, 2 & 3). However, it may be effective to use HBW_4 quails as a line of dams in crossbreeding programs for producing quails with heavy weights and increased gains. The same trend was observed by Bahie El-Deen *et al.*, (1998).

An evidence for the significant maternal effects on body weight was obtained by Biak and Marks (1993). They reported significant reciprocal effects between the HW with LW and LW with HW crosses in diallel crosses of Japanese quail lines divergently selected for BW.

On the contrary, Chahil *et al.*, (1975) reported the absence of maternal effects in BW5 in a 3 x 3 diallel cross of 3 random mating populations of quail. Nofal (2006) crossed M line (selected for meat production) and E line (selected for egg production) and reciprocal crosses reported that maternal additive had non significant effect on all growth traits (BW_0, BW_6 and ADG_{0-6}). However, this insignificant influence of maternal additive could be expected since this component is being diminished as birds advance in age.

Carcass traits:

Least-square means and standard errors (S.E) for carcass traits studied slaughter weight (gm), meat, bone, giblets and dressing percentages (SW, M%, B%, G%, D%) are given in Table (4). The crossbreds produced from sired HBW4 with HTEW10 dams had the highest carcass traits except B% and the crossbreds produced from sired LTEW10 with LBW4 dams had the lowest carcass traits except B%, while the reciprocal crosses between these lines had intermediate values for carcass traits studied. However, significant differences due to mating groups (MG) on carcass traits were observed. The same trend was reported by Shalan (1998). On the other hand, Sharaf et al., (2006) when they crossed three colored varieties of Japanese quails (Brown, Golden and White) stated that carcass traits did not express any significant values between purebreds, crossbred and reciprocals, while edible percentages were the highest in purebreds (8.99%).

Direct heterosis:

Estimates of direct heterosis calculated in units (gram) and percentages (%) for carcass traits studied are presented in Table (4). However, these traits showed highly significant ($P<0.01$ or $P<0.001$) positive direct heterosis estimated as 27.0, 6.8 and 8.5 for SW, B and D %, while M% and G% showed non significant direct heterosis estimated as 1.5 and 1.7, respectively .

Direct additive effect:

Direct additive effect on all carcass traits studied were non-significant. Estimates of carcass traits of quails were in favour of HBW_4-sire to those quails sired by $HTEW_{10}$ line (Table, 4).

Maternal additive effect:

Maternal line effects (expressed as the differences between reciprocal crosses) on all carcass traits studied were non-significant. Estimates of carcass traits of quails mothered by $HTEW_{10}$ line were in favour of to those mothered by HBW_4 line (Table, 4).

In conclusion, crossing of HBW_4 line sires with $HTEW_{10}$ line dams was associated with an improvement in all growth traits and carcass traits .

Table 4. Means of carcass traits among the different mating groups ± SE, direct heterosis (H^I), direct additive effect (G^I) and maternal additive effect (G^M).

Traits / Mating groups:	No.	SW(gm) Mean ± SE	M% Mean ± SE	B% Mean ± SE	G% Mean ± SE	D% Mean ± SE
HBW_4 x $HTEW_{10}$	6	188.7 ± 3.14	65.3 ± 4.87	13.3 ± 4.26	8.4 ± 0.42	74.8 ± 1.58
$HTEW_{10}$ x HBW_4	6	186.0 ± 3.27	63.8 ± 4.02	13.7 ± 4.26	7.2 ± 0.74	72.2 ± 1.36
LBW_4 x $LTEW_{10}$	6	155.5 ± 3.54	56.3 ± 4.54	15.5 ± 4.26	6.4 ± 0.63	64.7 ± 1.22
$LTEW_{10}$ x LBW_4	6	152.8 ± 3.84	52.8 ± 4.14	17.8 ± 4.26	6.0 ± 0.60	62.8 ± 1.18
Pure breed effect		$-32.0 \pm 5.43^{***}$	$-9.5 \pm 5.63^{**}$	-0.8 ± 6.02^{ns}	-1.2 ± 0.45^{ns}	-0.3 ± 1.31^{ns}
Direct heterosis (H^I) Unit		$27.0 \pm 7.69^{***}$	1.5 ± 7.96^{ns}	$6.8 \pm 8.52^{**}$	1.7 ± 0.63^{ns}	$8.5 \pm 1.85^{**}$
Percentage		17.8	2.1	25.7	3.9	10.3
Direct additive effect (G^I)		$-33.3 \pm 7.69^{***}$	$-20.0 \pm 7.96^{***}$	$-7.2 \pm 8.52^{**}$	-1.7 ± 0.63^{ns}	-1.5 ± 1.85^{ns}
Maternal additive effect (G^m)		$11.3 \pm 5.42^{***}$	$10.5 \pm 5.63^{***}$	$6.3 \pm 6.02^{**}$	0.5 ± 0.45^{ns}	1.2 ± 1.31^{ns}

**= P< 0.01or ***= P< 0.001, ^{ns}=Non- significant.

SW=Slaughter weight, M%= Meat percentage, B%= Bone percentage, G%= Giblets percentage, D%= Dressing percentage.

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الملخص العربي

تأثيرات الخلط على بعض صفات النمو وصفات الذبيحة فى السمان اليابانى

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تم إجراء تجربة خلط بإستخدام أربعة خطوط منتخبة من السمان اليابانى لمدة ثلاثة أجيال :

الخط الأول منتخب لصفة وزن الجسم العالى عند عمر ٤ أسابيع (HBW_4).

الخط الثانى منتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ١٠ أسابيع الأولى من الإنتاج ($HTEW_{10}$).

الخط الثالث منتخب لصفة وزن الجسم المنخفض عند عمر ٤ أسابيع (LBW_4).

الخط الرابع منتخب لصفة وزن البيض الكلى المنخفض المنتج خلال الـ١٠ أسابيع الأولى من الإنتاج ($LTEW_{10}$) حيث تم خلط ذكور الخط (HBW_4) مع إناث الخط ($HTEW_{10}$) والتلقيح العكسى بين الخطين وذكور الخط (LBW_4) مع إناث الخط ($LTEW_{10}$) والتلقيح العكسى بين الخطين.

تم أخذ عدد ١٥١٢ طائر خليط تم إنتاجها خلال ثلاث فقسات متتالية وذلك لتقييم الأداء الإنتاجي والتناسلى وصفات الذبيحة فى الطيور الخليطة وقياس تأثير كل من الخلط والتأثيرات المضيفة المباشرة والأمية على الخلطان للصفات الآتية:

أ - صفات النمو وتشمل: أوزان الجسم عند عمر الفقس و ٢ و ٤ و ٦ أسابيع ومعدلات النمو اليومية خلال الفترات الآتية : صفر-٢ و ٢-٤ و ٤-٦ و صفر-٦ أسبوع .

ب - صفات الذبيحة وتشمل: وزن الذبح والنسب المنوية لكل من اللحم – العظم – الأجزاء المأكولة – التصافي .

وقد أوضحت الدراسة النتائج الآتية :

أ – بالنسبة لصفات النمو :

صاحب الخلط بين ذكور الخط المنتخب لصفة وزن الجسم العالى عند عمر ٤ أسابيع وإناث الخط المنتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ١٠ أسابيع الأولى من الإنتاج تفوق فى صفات أوزان الجسم عند الأعمار المختلفة وكذلك فى صفات معدلات النمو اليومية خلال فترات النمو المختلفة تلاها الخلط العكسى بين ذكور الخط المنتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ١٠ أسابيع الأولى من الإنتاج وإناث الخط المنتخب لصفة وزن الجسم العالى عند عمر ٤ أسابيع بينما أدى الخلط بين ذكور الخط المنتخب لصفة وزن

الجسم المنخفض عند عمر ٤ أسابيع وإناث الخط المنتخب لصفة وزن البيض الكلى المنخفض المنتج خلال الـ ١٠ أسابيع الأولى من الإنتاج إلى إنخفاض طفيف فى صفات أوزان الجسم عند الأعمار المختلفة وكذلك فى صفات معدلات النمو اليومية خلال فترات النمو المختلفة تلاها الخلط العكسى بين ذكور الخط المنتخب لصفة وزن البيض الكلى المنخفض المنتج خلال الـ ١٠ أسابيع الأولى من الإنتاج وإناث الخط المنتخب لصفة وزن الجسم العالى عند عمر ٤ أسابيع.

كانت قوة الخلط المباشرة عالية المعنوية فى معظم صفات وزن الجسم المدروسة من عمر الفقس حتى عمر ٦ أسابيع ما عدا صفة الوزن عند ٤ اسابيع وكانت نسبة الخلط لهذه الصفات مرتفعة عند عمر الفقس وعمر ٢ أسبوع (٢٥,٨ و ٣١,٢%) وإنخفضت إلى (١١,٩ و ١٧,٢%) عند عمر ٤ و ٦ أسابيع وكذلك كانت قوة الخلط المباشرة عالية المعنوية فى صفات معدلات النمو اليومية خلال فترات النمو المختلفة وكانت نسبة الخلط لهذه الصفات مرتفعة فى فترتى النمو من الفقس حتى عمر ٢ أسبوع ومن ٢- ٤ أسابيع (١٥,٦ و ١٤,٩%) وإنخفضت إلى (٩,٦ و ٦,١%) فى فترتى النمو من ٤-٦ أسبوع ومن الفقس - ٦ أسابيع.

كان للتأثير المضيف المباشر تأثيرا معنويا على صفات وزن الجسم المدروسة من عمر الفقس حتى عمر ٦ أسابيع تراوح من (٤,٤١) بالنسبة لصفة وزن الجسم عند عمر الفقس إلى (٣٢,١٨) بالنسبة لصفة وزن الجسم عند عمر ٤ أسابيع وكذلك كان للتأثير المضيف المباشر تأثيرا معنويا على صفات معدلات النمو اليومى المدروسة خلال فترات النمو المختلفة تراوح من(٤,٧٤) بالنسبة لصفة معدل النمو اليومى فى الفترة من عمر ٢-٤ أسبوع إلى (٩,٢٧) بالنسبة لصفة معدل النمو اليومى فى الفترة من ٤-٦ أسابيع.

كان لتأثير الأم المضيف تأثيرا معنويا سالبا على معظم صفات وزن الجسم المدروسة ماعدا صفة وزن الجسم عند عمر ٢ أسبوع وتراوح هذا التأثير من (-٥,٧٥) بالنسبة لصفة وزن الجسم عند عمر الفقس إلى (-٤٢,٣٤) بالنسبة لصفة وزن الجسم عند عمر ٤ أسابيع وكذلك كان لتأثير الأم المضيف تأثيرا معنويا سالبا على معظم صفات معدلات النمو اليومى المدروسة خلال فترات النمو المختلفة ما عدا صفة معدل النمو اليومى فى الفترة من ٢-٤ أسابيع وتراوح هذا التأثير من (-٠,١٠) بالنسبة لصفة معدل النمو اليومى فى الفترة من عمر الفقس حتى عمر ٦ أسبوع إلى (-٠,٢٦) بالنسبة لصفة معدل النمو اليومى فى الفترة من ٤-٦ أسابيع .

ب – بالنسبة لصفات الذبيحة :

صاحب الخلط بين ذكور الخط المنتخب لصفة وزن الجسم العالى عند عمر ٤ أسابيع وإناث الخط المنتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ١٠ أسابيع الأولى من الإنتاج تفوق فى كل صفات الذبيحة المدروسة تلاها الخلط العكسى بين ذكور الخط المنتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ١٠ أسابيع الأولى من الإنتاج وإناث الخط المنتخب لصفة وزن الجسم العالى عند عمر ٤ أسابيع بينما أدى الخلط بين ذكور الخط المنتخب لصفة وزن الجسم المنخفض عند عمر ٤ أسابيع وإناث الخط المنتخب لصفة وزن البيض الكلى المنخفض المنتج خلال الـ١٠ أسابيع الأولى من الإنتاج إلى إنخفاض فى كل صفات الذبيحة المدروسة .

كانت قوة الخلط المباشرة عالية المعنوية فى معظم صفات الذبيحة ماعدا صفتى النسبة المئوية للحم والأجزاء المأكولة من الذبيحة لم يكن لقوة الخلط المباشرة تأثيرا معنويا عليها وكانت نسبة الخلط لهذه الصفات مرتفعة بالنسبة لصفتى وزن الذبيحة والنسبة المئوية للعظام (١٧,٨ و

٢٥,٧%) وإنخفضت إلى (٢,١ و ٣,٩%) بالنسبة لصفتى النسبة المنوية للحم والأجزاء المأكولة من الذبيحة .

كان للتأثير المضيف المباشر تأثيرا معنويا سالبا على معظم صفات الذبيحة المدروسة تراوح من(-٧,٢) بالنسبة لصفة النسبة المنوية للعظام إلى (-٣٣,٣) بالنسبة لصفة وزن الذبيحة بينما لم يكن له تأثير معنوى على صفتى النسبة المنوية للأجزاء المأكولة والنسبة المنوية للتصافى فى الذبيحة .

كان لتأثير الأم المضيف تأثيرا معنويا على معظم صفات الذبيحة المدروسة وتراوح هذا التأثير من(٦,٣) بالنسبة لصفة النسبة المنوية للعظام إلى (١١,٣) بالنسبة لصفة وزن الذبيحة ماعدا صفتى النسبة المنوية للأجزاء المأكولة من الذبيحة والنسبة المنوية للتصافى لم يكن لتأثير الأم المضيف تأثيرا معنويا عليها .