Economic and productive comparsion among three rabbit breeds and their crosses under egyptian conditions

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ABSTRACT

This study was conducted on the data from the rabbit farm belonging to the Department of Animal Wealth Development, Faculty of Veterinary Medicine, Zagazig University, using three breeds (New Zealand White, Californian and Gabali). Two bucks and ten does from each breed were used in the experiment to compare between purebred, crossbred and their reciprocal crossbred. Studied traits include some productive traits (body weight and daily body gain), as well as economic traits (total cost, return, net profit and economic efficiency measures) till 12^{th} week of age.

The result of this study showed a significant difference between purebred, crossbred and their reciprocal crossbred in body weight and average daily gain. At 10^{th} and 12^{th} week of age. Purebred Gabali showed the highest body weight value (2008.58 and 2230.17 g), while Californian x New Zealand White showed the lowest value (1759.66 and 2012.66 g). New Zealand x Gabali showed the highest average daily gain value during 4-12 weeks (27.60 g) while, Californian x New Zealand showed the lowest value (22.72 g). New Zealand White showed the highest total cost and the lowest net profit (33.31 and 0.45 LE, respectively) at 12^{th} week of age, while New Zealand White x Gabali showed the lowest total cost and the highest net profit (23.32 and 9.49 LE, respectively). Although, Gabali showed the highest return value (33.45 LE) but New Zealand White x Gabali showed the highest net profit (11.57 LE) at 10^{th} week of age among all crosses and allover periods. In addition, New Zealand White x Gabali genotype showed the highest return/cost ratio, net profit/total cost ratio and the shorter capital return rate (1.68, 0.68 and 1.46, respectively).

Finally, we concluded that, there is productive and economic difference between purebred, crossbred and their reciprocal crossbred of Californian (C), New Zealand White (N) and Gabali (G) breeds. New Zealand White x Gabali genotype is the most profitable cross at 10^{th} week of age (optimum period for marketing the rabbit which showed the highest profit for this cross), so we recommended crossing New Zealand white buck (N) with Gabali (G) doe and marketing age at 10^{th} week of age.

crossbreds than in purebreds. Also the total returns and net profit were higher in crossbreds, than in purebreds and the crossbreds economically more efficient than the purebreds.

The effect of crossbreeding on rabbit profitability by improving litter size at birth and weaning weight and weight gain generally higher in crossbred than in the purebred rabbits so improve their economic performance ***(Niedzwiadek, 1978; Afifi and Khalil, 1990; Hamouda et al, 1990 and Ozimba and Lukefahr, 1991)***. Feed efficiency is one of the most commercially important traits because post-weaning feeding accounts for about 40 % of total cost ***(Armero and Blasco, 1992).***

In meat rabbit industry, there is a need to develop sire breeds and (or) lines to cross to available dam breeds to potentially enhance breed complementarity and heterosis benefits on postweaning fryer performance ***(Medellin and Lukefahr, 2001).***

Efficiency of rabbit meat production can be improved by taking advantage of the diversity of rabbit breeds through crossbreeding. ***(Piles et al, 2004).***

The aims of the present study were to compare the economic and productive effect of crossing and reciprocal crossing of two foreign rabbit breeds (New Zealand white and Californian) with local breed (Gabali). Also, determine the most profitable crosses and the optimum

INTRODUCTION

Rabbit meat characterized by nearly white meat, fine grained, palatable, high quality protein content, low in fat, cholesterol and caloric contents contain a higher percent of minerals than other meat, of good meat-to-bone ratio and are acceptable to general consumer in most countries of the world, so rabbits are convenient sources of palatable and nutritious meat ***(Owen, 1981 and Lukefahr et al, 1989).***

Production of one kilogram of rabbit meat is more economic than other animals as it require 25 % of the ration energy needed to produce the same amount of lamb or beef, and 30% in comparison with chicken production. ***(Lebas, 1981).***

Rabbits are potential source to improve food security and it may be the lowest cost answer related to the problem of hunger, under nourishment and rural poverty in developing countries. Among Arab countries, Egypt ranks as a number one in rabbit consumption as it reached to 1.5 kg/year per capita which is very low in comparison with other types of meat and in comparison with other countries like Italy which reached to 5.8 kg/year per capita**.** ***(FAO, 2001)***.

Rabbit characterized by higher capital return rates and rapid capital cycle ***(El-Sheikh and Atallah, 1998)***. They concluded that, the crossbreds were superior to purebreds in weaning weight and its price value, and body weight values. Mortality rate was lower in

Studied Traits:

A. Productive traits:

1. Body weight:

Weights were recorded at different ages, first at weaning (4^{th} week of age), then recorded biweekly till marketing age (12^{th} week of age). ***(Russel, 1969 and MLC, 1974)***

2. Average daily gain:

It is the weight gain related to the number of days calculated.

B. Economic measures:-

1- Costs:

Variable costs which include the prices of drugs, vaccines, disinfectants, veterinary supervision, feed cost, labor cost, water electrolytes, electricity and miscellaneous costs ***(Elsayed, 2009)***.

Fixed costs collected according to ***Atallah (1997)*** which include animals, building and equipment depreciations or the rent. The depreciation rates were calculated for the building on 25 years and for the equipment on 5 years, but the value of rent were used directly during the calculation without depreciation rate. The depreciation rate calculated according to the following equation:

$$\text{Depreciation rate} = \frac{\text{Value of Asset}}{\text{Age of Asset (year)}}$$

While the depreciation of the animal was calculated according to the method of ***(Atallah, 1997, 2004)*** *and* ***El-Tahawy (2007)***.

Total costs inculdes the sum of the variable and fixed costs according to ***Tom (2000).*** period for marketing rabbits which gives the highest profit.

MATERIAL AND METHODS

This study was conducted on the data from the rabbit farm belonging to the Department Animal Wealth Development, Faculty of Veterinary Medicine, Zagazig University. Crossing three breeds Californian, New Zealand and Gabali. Two bucks and ten does from each breed were used in the experiment.

Flock management:

Rabbits were housed in an open sided house. Breeding animals were kept individually in triangular galvanized wire cages provided with nipple system for watering and manual feeder. Metal nest box was attached to the doe's cage. 3 X 3 full dilled crossing of New Zealand White (N), Californian (C) and Gabali (G).

Litters were weaned, ear tagged and separated in cages at 4 weeks of age. They were raised identically under the same managerial and nutritional conditions. Individual records were established for each breeding animal for recording all the data needed for the investigation. In addition, there is a litter production records. Rabbits of all ages were fed commercial pelleted ration obtained from ATEMEDA Company adlibitum. Bucks and does were apparently healthy and vaccinated against pasteurllosis and rabbit viral hemorrhagic disease (RVHD).

e_{ij} = Experimental error.

RESULTS AND DISCUSSIONS

A. Effect of purebred and crosses on Productive traits

1. Effect of purebred and crosses on body weight (g):

Table (1) showed the effect of purebred, crossbred and reciprocal crossbred of Californian (C), New Zealand White (N) and Gabali (G) breeds on body weight in different periods. There is a significant difference between purebred and crosses at 4th weeks. Purebred New Zealand White recorded the highest value (678.50 g), while GC recorded the lowest value (506.36 g). At 6th week of age, purebred Gabali showed the highest significant value (1230.40 g), while GC showed the lowest one (937.89 g). Meanwhile, at 8th week of age purebred Californian showed the highest significant value (1707.50 g), while CN showed the lowest value (1468.00 g). There is a significant difference among purebred and their crosses at 10th and 12th weeks of age. Purebred Gabali showed the highest value (2008.58 and 2230.17 g), while CN showed the lowest value (1759.66 and 2012.66 g).

These results are in agree with those obtained by ***El-Sheikh and Atallah, (1998)***. They reported that, There were significant differences among breed group in body weights ($P< 0.01$) at weaning, 45, 60, 75 and 90 days. Also, ***Hamouda et al (1990)*** concluded that the purebred litter size at weaning higher than that in

2- Total returns include returns from rabbit sale + Returns from fecal matter sale + culled dams. (According to the prices during the years of the study).

3- Net profit = Total returns - Total costs.

4- Efficiency measures of rabbit production.

The following efficiency measures were calculated according to ***Atallah (1997)***.

- Returns to total costs as a percentage.
- Percentage of net profit to total costs.
- Capital return rate $= \frac{\text{Net profit}}{\text{Investment costs}} X100$

C- Statistical analysis:-

Statistical Analysis System computer programme (**SPSS/PCT, 2008)** was utilized to analyze the obtained data. A number of preliminary analysis were done for checking, listing all data and testing the significance of factors studied for any of the dependent variables. One way ANOVA model used for analysis the data including body weight at different age, daily weight gains, total costs, return, net profit and economic efficiency measures using the following model. ***(Foster, 2001)***.

$Y_{ij} = \mu + G_i + e_ij$

Y_{ij} = An observed value.

μ = Overall mean.

G_i = Effect of genotype of rabbit.

Californian and NC genotype. Purebred Californian showed the highest value (52.68 g) while, CN showed the lowest value (26.69 g) at 6-8 weeks of age. Meanwhile, at 8-10 weeks of age NG showed the highest value (25.45 g) and GN showed the lowest value (18.48 g). Also, at 10-12 weeks of age NG showed the highest value (19.68 g), but purebred Californian showed the lowest one (10.76 g). The overall average daily gain 4-12 weeks showed significant differences between purebred and crosses, NG showed the highest value (27.60 g) and CN showed the lowest value (22.72 g). These results agreed with ***Reiad et al (1995); Shebl et al (1997) and El-Sheikh and Atallah, (1998); Eman (2011) and El-Bayomi et al (2012)***. They reported that crossbreeding yield higher litter weight more than purebred. In the same manner, ***Zajac et al (1996)*** reported that the average daily gain of rabbit crosses was ranged from 26 to 29 g. ***Gad (1998)*** who indicated that, Gabali rabbits are better to be used as a doe breed rather than a buck breed for improving post-weaning body weight and gaining weight. In addition, ***Abdel-Aziz (1998)*** found that, crossbreeding of NZW and Gabali rabbits was generally associated with the improvement of daily gain up to 15^{th} week of age.

B. Economic measures (total costs, return and net profit) and economic efficiency measures for purebred, crossbred and crossbred. The higher body weights of purebreds over crossbreds was also reported by ***Soliman (1983)*** who reported that purebreds have greater weight than crossbreds. In the same manner, ***Leuder et al (1988)*** found that, body weight at 70^{th} day of age for purebreds exceeded crossbreds. While, ***Heba (2004)*** reported that, purebreds non significant ($p > 0.05$) exceeded crossbreds in body weights at different ages. Also, ***Mohamed (2007)*** concluded that, the overall average of the purebred rabbit under investigation exceed that of crossbreds at most of ages studied (587.40 vs. 562.42 g, 1077.40 vs. 1094.75 g, 1583.13 vs. 1552.74, 1914.26 vs. 1890.04 g and 2147.66 vs. 2119.87 g), but these differences were non significant ($p > 0.05$). But ***Rania (2005)*** concluded that, body weight of purebreds significantly ($p < 0.05$) exceeded that of crossbreds at different ages. Our results in contrary with those obtained by ***Ozimba and Lukefahr (1991)*** they said that crossbred litter size at weaning higher than in purebred.

2. Effect of purebred and crosses on average daily gain (g):

Table (2) showed the effect of purebred, crosses and reciprocal crosses of Californian (C), New Zealand White (N) and Gabali (G) breeds on average daily gain (g). There are significant differences among all genotypes in different periods. At 4-6 weeks of age average daily gain ranged from 26.60 to 43.19 g for . Purebred

the lowest net profit (4.15 LE) and GN showed the highest net profit (10.82 LE).

At 10th week of age, NG showed the lowest total cost value (17.09 LE), while purebred New Zealand White showed the highest value (24.27 LE). CN showed the lowest return value (26.39 LE) while, purebred Gabali showed the highest value (30.13 LE) and at the same time showed the lowest net profit (3.92 LE). Meanwhile, NG showed the highest net profit (11.57 LE) among all crosses and allover periods. At 12th week of age, purebred New Zealand White showed the highest total cost and the lowest net profit (33.31 and 0.45 LE), while NG showed the lowest total cost and the highest net profit (23.32 and 9.49 LE) although, purebred Gabali showed the highest return value (33.45 LE). These results attributed to the differences occurred in the variable costs especially feeding cost and this in agree with ***Armero and Blasco (1992).*** They reported that, feed efficiency is one of the most commercially important traits because post-weaning feeding accounts for about 40 % of total cost. Also, our results nearly similar to that obtained by ***El-Sheikh and Atallah (1998)*** they reported that, the total returns were differ significantly and ranged from 16.11 to 18.40 LE for purebred Californian and Californian x Rex genotypes. While, the net profit value showed significant differences among genotype groups.

reciprocal crossbred of New Zealand white (N), Californian (C) and Gabali (G) breeds at different age intervals (4-12 weeks)

1. Economic measures (total costs, return and net profit) for purebred, crossbred and reciprocal crossbred of New Zealand white (N), Californian (C) and Gabali (G) breeds at different age intervals (4-12 weeks).

Table (3) showed the effect of purebred, crossbred and reciprocal crossbred of Californian (C), New Zealand White (N) and Gabali (G) breeds on some economic measures include total costs, return and net profit (LE) at different age intervals (4-12 weeks). There were significant difference among purebred, crossbred and their reciprocal crossbred on some economic measures along all production period. Purebred New Zealand White showed the highest total cost value (12.40 LE) at 4th week of age, while, NG showed the lowest value (8.73 LE). Purebred Gabali showed the highest return value and net profit (18.46 and 8.35 LE), but purebred Californian showed the lowest value (14.68 and 3.20 LE,). At 8th week purebred New Zealand White recorded the highest total cost (19.47 LE) while, NG showed the lowest value (13.71 LE). Purebred Californian showed the highest return value (25.75 LE), but NG showed the lowest value (23.32 LE). Meanwhile, CN showed

Zealand White showed the lowest return/cost ratio, net profit/total cost ratio (1.21 and 0.21). Meanwhile, CN showed the longer capital return rate (5.65). These results in parallel to that obtained by ***El-Sheikh and Atallah (1998).*** They reported that, the percentages of Total returns to total costs, Net profit to total costs, capital return rate and the capital cycle for the crossbreds were preferable than for the purebreds.

In conclusion, there were economic and productive differences among purebred, crossbred and their reciprocal crossbred of Californian, New Zealand White and Gabali breeds. Crossing New Zealand white buck with Gabali doe (NG) is the most profitable crossbred, recording the highest net profit. Also, 10^{th} week of age is the optimum period for marketing showing the highest profit for this crossbred. So we recommended crossing between New Zealand white buck with Gabali doe and marketing age at 10^{th} week of age to obtain the highest net profit.

The net profit values were 14.44 and 12.15 LE/rabbit for Californian x Rex and purebred Californian. Meanwhile, their result differs from our result in the total costs that not differ significantly among the different genotypes. In addition, ***Roca (1996)*** reported that production and breeding costs of rabbit were lower than other animals.

2. Economic efficiency measures for 10 weeks of purebred, crossbred and reciprocal crossbred for New Zealand white (N), Californian (C) and Gabali (G) breeds.

Table (4) showed the effect of purebred, crossbred and reciprocal crossbred of Californian (C), New Zealand White (N) and Gabali (G) breeds on economic efficiency measures. There were significant differences among all genotypes for economic efficiency measures. NG genotype showed the highest return/cost ratio, net profit/total cost ratio and the shortest capital return rate (1.68, 0.68 and 1.46, respectively) while, purebred New

Table (1): Body weight (g) of purebred, crossbred and reciprocal crossbred for New Zealand white (N), Californian (C) and Gabali (G) breeds at different age intervals (4-12 weeks).

Trait		Body weight (g)				
Age period		4th week	6th week	8th week	10th week	12th week
Genotype	N					
CC	25	606.61^{d} ± 3.46	978.94^{e} ± 9.45	1707.50^{a} ± 5.69	2006.44^{a} ± 7.00	2157.05^{c} ± 5.51
NN	27	678.50^{a} ± 6.93	1160.00^{b} ± 7.64	1627.50^{c} ± 6.93	1963.00^{b} ± 6.11	2179.00^{b} ± 7.00
GG	22	661.76^{ab} ± 6.43	1230.40^{a} ± 3.79	1641.17^{c} ± 4.16	2008.58^{a} ± 4.93	2230.17^{a} ± 6.11
CN	25	649.66^{b} ± 6.08	1105.33^{c} ± 5.77	1468.00^{f} ± 5.29	1759.66^{f} ± 6.08	2012.66^{f} ± 6.43
CG	20	527.23^{f} ± 4.62	1113.61^{c} ± 7.51	1551.53^{e} ± 6.08	1852.38^{e} ± 4.73	2052.07^{e} ± 6.81
NC	24	551.61^{e} ± 9.24	1156.23^{b} ± 7.51	1596.92^{d} ± 6.08	1910.07^{d} ± 6.43	2093.15^{d} ± 5.29
NG	19	531.42^{f} ± 4.93	1082.42^{d} ± 12.17	1546.42^{e} ± 5.69	1910.71^{d} ± 6.43	2187.57^{b} ± 6.43
GC	21	506.36^{g} ± 5.51	937.89^{f} ± 4.04	1550.00^{e} ± 7.64	1904.89^{d} ± 4.16	2107.52^{d} ± 4.36
GN	20	625.50^{c} ± 5.69	1124.30^{c} ± 5.03	1674.06^{b} ± 6.43	1941.75^{c} ± 3.79	2191.25^{b} ± 4.36

Means within the same column carrying different superscripts are significantly different al level ($p < 0.05$).

Table (2): Average daily gain (g) of purebred, crossbred and reciprocal crossbred for New Zealand white (N), Californian (C) and Gabali (G) breeds at different age intervals (4-12 weeks).).

Trait		Average daily gain (g)					
Age period		4 - 6	6 - 8	8 - 10	10 - 12	4-10	4 - 12
Genotype	N	weeks	weeks	weeks	weeks	weeks	week
CC	25	26.60 ^{e} ± 0.60	52.68 ^{a} ± 1.27	20.71 ^{bcd} ± 0.64	10.76 ^{d} ± 0.38	31.11^{a} ± 0.55	25.84 ^{b} ± 0.61
NN	27	34.39 ^{cd} ± 1.21	33.89 ^{d} ± 0.61	23.46 ^{ab} ± 0.35	15.43 ^{bc} ± 1.28	28.54^{a} ± 1.32	25.01 ^{b} ± 0.55
GG	22	40.62 ^{ab} ± 1.18	30.20 ^{de} ± 1.58	25.39 ^{a} ± 1.10	15.83 ^{bc} ± 0.76	29.93^{a} ± 0.81	26.14 ^{ab} ± 0.53
CN	25	32.55 ^{cd} ± 0.69	26.69 ^{e} ± 0.87	20.05 ^{cd} ± 0.95	18.07 ^{ab} ± 1.11	24.67^{b} ± 1.93	22.72 ^{c} ± 0.38
CG	20	41.88 ^{ab} ± 1.14	32.07 ^{d} ± 1.53	20.70 ^{bcd} ± 1.50	14.26 ^{c} ± 0.51	29.45^{a} ± 1.12	25.41 ^{b} ± 0.41
NC	24	43.19 ^{a} ± 1.79	31.98 ^{d} ± 1.54	21.87 ^{bc} ± 1.01	13.08 ^{cd} ± 1.17	30.19^{a} ± 0.80	25.69 ^{b} ± 0.36
NG	19	39.36 ^{b} ± 1.30	33.71 ^{d} ± 1.37	25.45 ^{a} ± 0.98	19.68 ^{a} ± 1.31	30.65^{a} ± 1.36	27.60 ^{a} ± 0.72
GC	21	30.82 ^{d} ± 0.63	44.37 ^{b} ± 2.14	24.71 ^{a} ± 0.53	14.47 ^{c} ± 1.26	31.08^{a} ± 1.53	26.69 ^{ab} ± 0.47
GN	20	35.63 ^{c} ± 1.30	39.91 ^{c} ± 1.52	18.48 ^{d} ± 0.46	17.82 ^{ab} ± 0.81	29.25^{a} ± 1.26	26.10 ^{ab} ± 0.47

Means within the same column carrying different superscripts are significantly different al level ($p < 0.05$).

Table (3): *Economic measures (total costs, return and net profit) of purebred, crossbred and reciprocal crossbred for New Zealand white (N), Californian (C) and Gabali (G) breeds at different age intervals.*
Means within the same column carrying different superscripts are significantly different al level ($p < 0.05$).

Trait		Economic measures (LE)											
Age period		6 weeks			8 weeks			10 weeks			12 weeks		
Genotype	N	Total cost	Return	Net profit	Total cost	Return	Net profit	Total cost	Return	Net profit	Total cost	Return	Net profit
CC	25	11.49 ^{b} ± 0.21	14.68 ^{d} ± 0.31	3.20 ^{d} ± 0.21	18.03 ^{b} ± 0.38	25.75 ^{a} ± 0.32	7.72 ^{d} ± 0.32	22.48 ^{b} ± 0.26	30.10 ^{a} ± 0.56	7.62 ^{d} ± 0.36	30.68 ^{b} ± 0.40	32.36 ^{bc} ± 0.21	1.68 ^{d} ± 0.16
NN	27	12.40 ^{a} ± 0.25	17.40 ^{b} ± 0.35	5.00 ^{c} ± 0.44	19.47 ^{a} ± 0.26	24.52 ^{cd} ± 0.15	5.05 ^{f} ± 0.22	24.27 ^{a} ± 0.25	29.45 ^{ab} ± 0.38	5.17 ^{e} ± 0.14	33.13 ^{a} ± 0.44	32.69 ^{ab} ± 0.25	0.45 ^{e} ± 0.01
GG	22	10.11 ^{c} ± 0.17	18.46 ^{a} ± 0.26	8.35 ^{a} ± 0.28	15.87 ^{c} ± 0.40	24.80 ^{bc} ± 0.15	8.93 ^{bc} ± 0.41	19.78 ^{c} ± 0.32	30.13 ^{a} ± 0.44	10.35 ^{bc} ± 0.25	27.00 ^{d} ± 0.42	33.45 ^{a} ± 0.17	6.45 ^{c} ± 0.33
CN	25	11.49 ^{b} ± 0.31	16.58 ^{bc} ± 0.21	5.09 ^{c} ± 0.21	18.03 ^{b} ± 0.35	22.19 ^{g} ± 0.17	4.15 ^{f} ± 0.22	22.48 ^{b} ± 0.46	26.39 ^{d} ± 0.42	3.92 ^{f} ± 0.38	30.68 ^{b} ± 0.36	30.19 ^{e} ± 0.26	0.49 ^{e} ± 0.03
CG	20	9.19 ^{de} ± 0.26	16.70 ^{bc} ± 0.26	7.51 ^{a} ± 0.36	14.43 ^{de} ± 0.35	23.44 ^{ef} ± 0.26	9.01 ^{bc} ± 0.27	17.98 ^{de} ± 0.35	27.79 ^{c} ± 0.49	9.80 ^{c} ± 0.42	24.55 ^{f} ± 0.26	30.78 ^{de} ± 0.32	6.23 ^{c} ± 0.31
NC	24	11.03 ^{b} ± 0.21	17.34 ^{b} ± 0.25	6.32 ^{b} ± 0.27	17.31 ^{b} ± 0.12	24.06 ^{de} ± 0.23	6.75 ^{e} ± 0.22	21.58 ^{b} ± 0.35	28.65 ^{bc} ± 0.44	7.07 ^{d} ± 0.22	29.45 ^{c} ± 0.26	31.40 ^{d} ± 0.25	1.95 ^{d} ± 0.33
NG	19	8.73 ^{e} ± 0.32	16.24 ^{c} ± 0.23	7.50 ^{a} ± 0.44	13.71 ^{e} ± 0.29	23.32 ^{f} ± 0.15	9.61 ^{b} ± 0.38	17.09 ^{e} ± 0.26	28.66 ^{bc} ± 0.44	11.57 ^{a} ± 0.27	23.32 ^{g} ± 0.25	32.81 ^{ab} ± 0.31	9.49 ^{a} ± 0.35
GC	21	9.65 ^{cd} ± 0.35	14.07 ^{d} ± 0.26	4.42 ^{c} ± 0.24	15.15 ^{cd} ± 0.21	23.39 ^{f} ± 0.25	8.25 ^{cd} ± 0.25	18.88 ^{cd} ± 0.40	28.57 ^{bc} ± 0.25	9.69 ^{c} ± 0.32	25.77 ^{e} ± 0.40	31.61 ^{cd} ± 0.45	5.84 ^{c} ± 0.33
GN	20	9.19 ^{de} ± 0.31	16.87 ^{bc} ± 0.35	7.67 ^{a} ± 0.33	14.43 ^{de} ± 0.21	25.25 ^{ab} ± 0.12	10.82 ^{a} ± 0.41	17.98 ^{de} ± 0.38	29.13 ^{a} ^{bc} ± 0.21	11.14 ^{ab} ± 0.16	24.55 ^{f} ± 0.26	32.87 ^{ab} ± 0.31	8.32 ^{b} ± 0.28

Table (4): *Economic efficiency measures for 10 weeks of purebred, crossbred and reciprocal crossbred for New Zealand white (N), Californian (C) and Gabali (G) breeds.*

Trait		Economic efficiency measures for 10 weeks		
Age period		Returns/cost %	Net profit/total cost %	Capital return rate
Genotype	N			
CC	25	$1.34^{d} \pm 0.04$	$0.34^{e} \pm 0.01$	$2.90^{c} \pm 0.08$
NN	27	$1.21^{e} \pm 0.02$	$0.21^{f} \pm 0.01$	$4.62^{b} \pm 0.32$
GG	22	$1.52^{bc} \pm 0.02$	$0.52^{cd} \pm 0.01$	$1.89^{d} \pm 0.11$
CN	25	$1.17^{e} \pm 0.02$	$0.17^{g} \pm 0.01$	$5.65^{a} \pm 0.26$
CG	20	$1.54^{bc} \pm 0.05$	$0.54^{c} \pm 0.01$	$1.81^{d} \pm 0.11$
NC	24	$1.33^{d} \pm 0.02$	$0.33^{e} \pm 0.01$	$3.01^{c} \pm 0.08$
NG	19	$1.68^{a} \pm 0.03$	$0.68^{a} \pm 0.01$	$1.46^{d} \pm 0.04$
GC	21	$1.51^{c} \pm 0.03$	$0.51^{d} \pm 0.01$	$1.92^{d} \pm 0.06$
GN	20	$1.62^{ab} \pm 0.03$	$0.62^{b} \pm 0.01$	$1.59^{d} \pm 0.03$

Means within the same column carrying different superscripts are significantly different al level ($p < 0.05$).

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الملخص العربى

مقارنة إقتصادية وإنتاجية بين ثلاث سلالات من الأرانب وخليطهم تحت الظروف المصرية

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أجريت هذه الدراسة على ثلاث سلالات هى الكاليفورنين، النيوزيلاندى الأبيض والجبلي بواقع ذكرين وعشرة أناث لكل سلاله لعمل مقارنه بين السلالات النقية وخليطها والخلط العكسي لبعض الصفات الإنتاجية (وزن الجسم ومعدل الزيادة اليومي فى الوزن) وكذلك الصفات الاقتصادية (التكاليف الكلية، العائد، صافي الربح ومقاييس الكفاءه الإقتصادية) خلال عمر ١٢ أسبوع.
ظهرت نتائج هذه الدراسة وجود إختلافات معنوية بين السلالات النقية والخلط والخلط العكسي فى أوزان الجسم ومتوسط الزيادة اليومية للوزن. أظهر الجبلى أعلي قيم لزيادة وزن الجسم فى الأسبوع ١٠ و١٢ من العمر (٢٠٠٨،٥٨ و٢٢٣٠،١٧ جم). بينما أظهر خليط الكاليفورنين × النيوزيلاندى الأبيض اقل قيم لوزن الجسم (١٧٥٩,٦٦ و٢٠١٢,٦٦ جم). أظهر خليط النيوزيلاندى الأبيض× الجبلي أعلي قيمة لمتوسط الزيادة اليومى خلال الفتره من ٤-١٢ أسبوع (٢٧,٦٠ جم)، بينما أظهر خليط الكاليفورنين × النيوزيلاندى الأبيض أقل قيمة (٢٢,٧٢ جم). أظهر النيوزيلاندى الأبيض أعلى تكاليف كليه وأقل صافي ربح فى الأسبوع ١٢ من العمر (٣٣,٣١ و٠,٤٥ جنية)، بينما أظهر خليط النيوزيلاندى الأبيض× الجبلي أقل تكاليف كلية وأعلى صافي ربح (٢٣,٣٢ و٩,٤٩ جنية). بالرغم من أن الجبلي النقى حقق أعلى قيمة عائد (٣٣,٤٥ جنية) إلا أن خليط النيوزيلاندى الأبيض× الجبلي فى الأسبوع العاشر من العمر أظهر أعلى صافي ربح (١١,٥٧ جنية) بين كل الخطوط النقية والخليطة وفى كل فترات التربية، كذلك أظهر أعلى نسبة عائد/تكاليف، صافي ربح/التكاليف الكلية وأقصر معدل لعودة رأس المال (١,٦٨، ٠,٦٨ و١,٤٦ على الترتيب).
خلصت هذه الدراسة لوجود فروق إنتاجية وإقتصادية بين السلالات النقية وخلطها والخلط العكسي لسلالات الكاليفورنين، النيوزيلاندى الأبيض والجبلي. حقق النمط الجيني النيوزيلاندى الأبيض× الجبلي أعلى صافي ربح عند عمر ١٠ أسابيع (الفتره المثلى لتسويق الأرانب لأنها المحققه لأعلي صافي ربح). ولهذا ننصح بعمل خلط ما بين ذكور النيوزيلاندى الأبيض مع إناث الجبلي على أن يتم التسويق عند عمر ١٠ أسابيع.