IV. SUMMARY

An experiment on New Zealand White (NZW) and Californian (CAL) rabbits was carried out to evaluate genetically some fur and postweaning growth traits of these two breeds raised under the Egyptian conditions. Data on 1234 offspring of NZW and 520 of CAL for postweaning fur traits along with 2291 offspring of NZW and 1628 of CAL for postweaning growth traits were collected from the experimental rabbitry of the Faculty of Agriculture at Moshtohor, Zagazig University, Banha Branch, Egypt for three consecutive years started in September 1989. Postweaning fur traits investigated were hair length and diameter, medulla diameter and percentage of medullation of down and guard hair. Postweaning growth traits investigated were body weight (at 5,6,8,10 and 12 weeks), daily gains (at the age intervals of 5-6, 6-8, 8-10 and 10-12 weeks) ,and livability (at the age intervals of 5-6, 6-8, 8-10 and 10-12 weeks). Variance components and sire heritabilities were estimated for these traits once by using **Henderson's** method and another time by using the **Restricted Maximum Likelihood (REML)**. A comparison between estimators obtained from the two methods was attempted. Linear method mixed models were used for analyzing such data. Sire transmitting abilities (**STA**) for these traits were estimated using two procedures the first was the best linear unbiased predictor (**BLUP**) and the second was the Animal Model (**AM**). Estimates of variance components estimated by **REML** were used in both procedure. The results obtained could be summarized as:

(i) Means and variation of postweaning growth and fur traits:

Most postweaning fur traits in CAL were slightly higher than those in NZW. The estimates at 8 and 12 weeks respectively, were of 2.37 vs 2.36 cm and, 3.05 vs 3.02 cm for hair length, 12.21 vs 12.18 μm, and 18.87 vs 18.83 μm for diameter of down hair , 62.28 vs 62.13 μm at 8 weeks for diameter of guard hair, 10.17 vs 10.15 μm, and 16.40 vs 16.35 μm for medulla diameter of down hair, 51.53 vs 51.41 μm at 8 weeks for medulla diameter of guard hair, 83.55 vs 82.17% and 82.57 vs 82.25% for percentages of medullation of down and guard hair at 8 weeks, respectively.

For both breeds, daily gain and livability were low at the first week after weaning (5-6 weeks), then increased during 6-8 weeks and decreased gradually with advancement of age during the periods of 8-10 and 10-12 weeks of age. Postweaning

growth in NZW was slightly higher than that in CAL. Livability in both breeds were similar.

Percentages of phenotypic variations in NZW and CAL for fur traits at earlier ages were slightly higher than at older ages with exception of hair length. The percentages of phenotypic variations (V%) for growth traits at earlier ages in NZW and CAL were higher than at older ages where (V%) ranged from 22.9 to 27.5%, 30.0 to 32.8% and 18.7 to 33.5% for body weight, daily gain and livability in NZW respectively, and 23.0 to 49.2%, 28.9 to 32.7% and 18.8 to 33.7% in CAL for body weight, daily gain and livability in CAL.

(ii) Non-genetic aspects:

Most fur and postweaning growth traits were significantly affected by year-season-parity and litter size at birth. Postweaning growth traits of NZW and CAL rabbits born during autumn are significantly higher than those rabbits born during winter and spring.

(iii) Variance components:

For most fur traits, the variance components estimated using **Henderson's** 3 and **REML** methods in both breeds were low. Estimates of sire component of variance obtained using **REML** method for most fur traits in NZW and CAL rabbits are relatively higher than those obtained using **Henderson's** method.

For both breeds, variances in all growth traits due to sire effect were high and significant except weight at 6 weeks in CAL. For most growth traits of both breeds, estimates of the sire component of variance obtained using **Henderson's** or **REML** methods were low. Percentages of variation due to sire for growth traits estimated using **Henderson's** method were low or somewhat moderate. The estimates for NZW rabbits ranged from 2.2 to 7.3% for body weight, 3.4 to 7.6% for daily gain and 3.9 to 7.0% for livability. The corresponding estimates in CAL ranged from 0.0 to 5.9% for body weight, 2.2 to 4.6% for daily gain and 1.7 to 3.8% for livability. As for **Henderson's** method, low or moderatly low estimates of sire variance component were obtained using **REML** for most growth traits. The estimates for NZW rabbits ranged from 1.2 to 12.5% for body weight, 3.7 to 13.1% for daily gain and 3.2 to 13.5% for livability. The corresponding estimates in CAL ranged from 1.7 to 6.3% for body weight, 1.7 to 4.4% for daily gain and 0.0 to 2.1% for livability. For most growth traits in NZW rabbits, estimates of sire component of variance obtained using **Henderson's** method are generally smaller than

those obtained using **REML** method. For **CAL** rabbits, inconsistent trend was observed.

(iv) Sire heritability estimates:

For fur traits except hair length in both breeds, sire heritabilities estimated using **Henderson's** and **REML** methods were low or somewhat moderate. For hair length in both breeds, heritabilities estimated using **Henderson's** and **REML** methods are generally moderate or high. In NZW rabbits, sire heritabilities estimated using **Henderson's** method were smaller than the corresponding estimates obtained by **REML**, while a reverse trend was observed for CAL rabbits. For both breeds and both ages, heritabilities estimated using **Henderson's** and **REML** methods from 0.139 to 0.962 vs 0.357 to 0.832 for hair length, 0.032 to 0.109 vs 0.038 to 0.304 for diameter of down hair, 0.038 to 0.058 vs 0.051 to 0.142 for diameter of guard hair, 0.041 to 0.129 vs 0.046 to 0.356 for medulla diameter of down hair, 0.042 to 0.070 vs 0.057 to 0.174 for medulla diameter of guard hair, 0.009 to 0.087 vs 0.008 to 0.132 for percentages of medullation of down hair and 0.033 to 0.050 vs 0.047 to 0.074 for percentages of medullation of guard hair.

Sire heritabilities estimated using **Henderson's** and **REML** methods for most growth traits in NZW and CAL rabbits were low or somewhat moderate. Most heritabilities estimated using **Henderson's** method for all growth traits in NZW rabbits are higher than the corresponding estimates in CAL rabbits. These heritabilities ranged from 0.087 to 0.299 in NZW vs 0.00 to 0.277 in CAL for body weight, 0.137 to 0.304 in NZW vs 0.087 to 0.184 in CAL for daily gains and 0.154 to 0.281 in NZW vs 0.072 to 0.154 in CAL for livability.

As for **Henderson's** method, heritabilities estimated using **REML** method in NZW rabbits are higher than those corresponding estimates in CAL rabbits. These estimates ranged from 0.049 to 0.501 in NZW vs 0.0 to 0.256 in CAL for body weight, 0.142 to 0.518 in NZW vs 0.070 to 0.178 in CAL for daily again and 0.106 to 0.502 in NZW vs 0.021 to 0.088 in CAL for livability.

(iiv) Sire transmitting ability (STA):

For most fur traits in both methods of sire evaluation, the largest differences were recorded by NZW and the lowest differences were observed for CAL. The STA estimated for NZW and CAL rabbits using **BLUP** are nearly similar to those estimated using Animal Model for fur traits except hair length . For STA estimated for all sires using **BLUP** and Animal Model in both ages of the study in NZW rabbits, there was a

little average difference of 0.151 vs 1.53 cm for hair length, 0.95 vs 0.99 μm for diameter of down hair, 3.37 vs 3.45 μm for diameter of guard hair, 1.0 vs 1.03μm for medulla diameter of down hair, 3.47 vs 3.49 μm for medulla diameter of guard hair, 1.25 vs 1.68% for percentages of medullation of down hair and 0.93 vs 1.39% for percentages of medullation of guard hair. For **BLUP** method, the largest absolute differences in **STA** for most fur traits in NZW and CAL rabbits were recorded by the smallest number of sires. An opposite trend was observed by Animal Model procedure where the largest absolute differences were recorded by the largest number of sires. Among all sires, percentages of sires which had positive estimates of **STA** using **BLUP** and Animal Model in both breeds and both ages were, the largest average of percentages of positive estimates of STA recorded by Animal Model, followed by **BLUP**. Among all fur traits, the largest percent of positive **STA** was recorded for hair diameter of down hair followed by hair length, medulla diameter of down hair, medulla diameter of guard hair, while the lowest percent was recorded for hair diameter of guard hair.

For the two methods of sire evaluation, the differences between minimum and maximum values of STA for body weight in NZW at 5, 6, 8, 10 and 12 weeks were 138.9, 251.8, 137.7, 78.8 and 136.2 grams using **BLUP** with A^{-1} vs 143.3, 165.3, 106.2, 72.8 and 118.2 grams using Animal Model, respectively. The same trend of differences was observed for daily gain (8.69, 3.96, 3.28 and 6.23 grams using **BLUP** with A^{-1} vs 6.30, 4.41, 3.94 and 6.56 grams using Animal Model) and for livability (0.296, 0.259, 0.228 and 0.149 using **BLUP** vs 0.302, 0.267, 0.242 and 0.154 using Animal Model). For all sires list in both breeds, the largest differences were obtained by **BLUP** method in most traits and the lowest differences were observed by Animal Model, i.e. both methods have the same trend in evaluation of sires for postweaning growth (body weight, daily gain and livability). For most growth traits in CAL rabbits, the differences in **STA** using **BLUP** were slightly higher than those using Animal Model. When considering the first top ten sires in both breeds, the lowest differences in **STA** were recorded by Animal Model procedure. Except for later age in CAL rabbits, the largest absolute differences in most growth traits between **BLUP** with A^{-1} vs Animal Model for NZW and CAL rabbits were recorded by the smaller number of sires. For body weight at different ages, there were about 81 or 85% of the sires (47 sires out of 59 for NZW) and CAL were 77 or 80% (30 sires out of 39) representing an absolute difference of <40g. For daily gains in both breeds, the largest number of sires was found in the class of smallest absolute difference in **STA** and the smallest number of sires was found in the class of largest absolute difference. Among all growth traits, percentages of positive estimates of **STA** were nearly similar in both breeds, i.e. the difference between the two methods are small in NZW and CAL rabbits.