# Synthesizing maternal and paternal lines of rabbits suitable for Saudi conditions through crossing program for Saudi with Spanish V-line rabbits: Overview for Results

**Maher H. Khalil and Abrahim H. Al-Homidan**
Department of Animal Production & Breeding, College of Agriculture & Veterinary Medicine, King Saud University, Buriedah P.O.Box 1482, Saudi Arabia

## ABSTRACT

A Five-year crossbreeding project involving Spanish maternal line called V-line (**V**) and Saudi Gabali (**S**) rabbits was carried out to produce new maternal and paternal lines to be used as parents in Saudi Arabia particularly in El-Qassim region. Ten genetic groups were produced through six generations. An animal model was used to estimate breeding values for economic traits to be used for selection across generations. In practice, synthetic lines of rabbits naming **Saudi 2** (as a maternal line) and **Saudi 3** (as a paternal line) were being formed in this project successfully to be convenient in Saudi Arabia and other hot climatic areas. The synthetic maternal line (**Saudi 2**) could be used in commercial scale as a pure line or to be crossed with other maternal males to get crossbred does, while the paternal line (**Saudi 3**) will be specialised in high rates of growth since the program is still currently running to attain more complete benefits of such project to synthesize new lines. These synthetic lines are characterized by high lactation associated with rich total solids in milk and heavier litter weight at weaning associated with lower feed conversion ratios of feed to milk and milk to litter gain and high carcass and meat qualities.

**Keywords:** Rabbits, Crossbreeding, maternal and paternal lines.

## INTRODUCTION

In Saudi Arabia, a national project was established recently for developing rabbit production and to detect the possibilities of producing meat rabbits under industrialized conditions (Khalil *et al.,* 2002). For this reason, special emphases were paid to construct a genetic improvement programme to develop new lines of meat rabbits convenient for hot climate Arabian countries. However, Table 1 shows maternal and paternal lines of rabbits developed allover the world as cited by Garreau et al (2004).

The objective of the present study was to evaluate genetically a crossbreeding project involving Spanish V-line rabbits and Gabali Saudi rabbits to synthesize new maternal and paternal lines in Saudi Arabia.

**Table 1: Experiments to synthesize new maternal and paternal lines of rabbits allover the world (Garreau et al, 2004).**

| Name of new line | Country | Origin of the new line | Selection criteria | No. of bucks and does used | *No. of generations obtained* |
|---|---|---|---|---|---|
| Line 1077 | France | NZW | Birth litter size + 63d weight | 33 and 121 | *34* |
| Line 1777 | France | Line 1077 | Birth litter size + weaning weight | 20 and 120 | *3* |
| Line 2066 | France | Great Russian x Californian | Birth litter size | 27 and 81 | *34* |
| Line A | Spain | NZW | Weaning litter size | 25 and 125 | *33* |
| Line V | Spain | Four lines | Weaning litter size | 25 and 125 | *30* |
| Line H | Spain | Hyper prolific V-line does | Birth litter size | 25 and 125 | *11* |
| Altex | USA | ¼ Californian, ¼ Champagne d' Argent, and ½ Flemish Giant | 70-day market weight | 20 and 80 | *8* |
| Botucatu | Hungary | Norfolk line | Weaning litter size + daily gain | 20 and 110 | *12* |
| Uruguay V Uruguay NZW | Uruguay | V line | Weaning litter size | 25 and 120 | *5* |
| Alexandria V | Egypt | V line | Weaning litter size | 45 and 130 | *6* |
| APRI synthetic | Egypt | Baladi red x V line | Weaning litter weight | 27 and 100 | *5* |
| Saudi-1, Saudi-2, Saudi-3 | Saudi Arabia | V line and Saudi Gabali | Weaning litter weight + 12 Week weight | 20 and 120 | *7* |

# MATERIALS AND METHODS

**Animals and breeding plan:**

Five-year crossbreeding project was started in September 2000 in the experimental rabbitry, College of Agriculture and Veterinary Medicine, Al-Qassim University, to develop maternal and paternal lines of rabbits in Saudi Arabia. Rabbits used in this project represent one desert Saudi breed (Gabali, G) and one exotic breed (Spanish V-line, V). The procedure used to form the first synthetic maternal line (named **Saudi 1)** was to cross bucks of the Saudi Gabali with does of V line to get the $F_1$ cross, then does and bucks of $F_1$ cross were mated to get $F_2$ and then inter-se mating of $F_2$ was practiced to get four generations thereafter. The second synthetic maternal line (named **Saudi 2)** was being developed through crossing Saudi Gabali bucks and V line does to get the $F_1$ cross, then does of $F_1$ cross were backcrossed with bucks of V line and then the progeny of the backcross were inter-se mated for four generations. To develop the paternal line (named **Saudi 3**), V-line bucks were crossed with Saudi does to get the $F_1$

cross of ½V½S, then does of $F_1$ cross were backcrossed with Saudi bucks to get ¾S¼V and then the progeny of the backcross were inter-se mated for four generations to get $(¾S¼V)^2$. The animals for all genetic groups were being selected for litter weight at weaning and individual weight at 84 d using a BLUP methodology under an animal model. The bucks were randomly assigned to mate the does naturally with the restriction to avoid the matings of animals with common grandparents.

The breeding plan in the project permitted simultaneous production of ten genetic groups as shown in Table 2. A total number of 2441 litters were born by 854 does, fathered by 142 sires and mothered by 351 dams. Also, a total number of 10178 rabbits fathered by 106 sires and mothered by 621 dams were obtained.

Table 2: Genetic groups obtained in the project

| Sire | Dam | Progeny | Ordinal number (G) |
|---|---|---|---|
| V-Line (V) | V-Line (V) | V-line (V) | $G_1$ |
| Saudi (S) | Saudi (S) | Saudi (S) | $G_2$ |
| V | S | ½V½S | $G_3$ |
| S | V | ½S½V | $G_4$ |
| V | ½S½V | ¾V¼S | $G_5$ |
| S | ½V½S | ¾S¼V | $G_6$ |
| ½V½S | ½V½S | $(½V½S)^2$ | $G_7$ |
| ½S½V | ½S½V | $(½S½V)^2$ | $G_8$ |
| ¾V¼S | ¾V¼S | $(¾V¼S)^2$ | $G_9$ |
| ¾S¼V | ¾S¼V | $(¾S¼V)^2$ | $G_{10}$ |

**Traits evaluated**

Traits evaluated in this project were:

- Litter size at birth (LSB) and weaning (LSW)
- Litter weight at birth (LWB) and weaning (LWW)
- Preweaning litter survival (PLS)
- Total milk yield (TMY)
- Feed conversion ratios per weight of litter at weaning (as kg of feed per kg of litter weight at weaning, FCRLWW)
- Feed to milk conversion ratios (as kg of feed per kg of milk produced, FMCR)
- Feed to litter gain conversion ratios (as the amount of feed consumed divided by preweaning litter gain per litter, FLGCR)
- Milk to litter gain conversion ratios (as kg of litter gain per kg of milk suckle, MLGCR).
- Biweekly live body weights daily gain in weight from 4 weeks up to 12 weeks of age.
- Hot carcass and offal weights at 12 weeks of age and dressings out percentages
- Lean composition traits (meat, fat bones),
- Lean chemical analysis (DM, crude protein, ether extract and ash)

**Models of analysis**

The variance and covariance components of the random effects were estimated by the derivate-free multiple traits restricted maximum likelihood procedure (DFREML) using the VCE software (Kovač and Groeneveld, 2003). The animal model used in analyzing traits of the doe was (in matrix notation):

$$\mathbf{y = Xb + Z_a u_a + Z_p u_p + e}$$

Where y = vector of observed lactation trait for does, b= vector of fixed effects of genetic group of doe (ten levels), year-season of kindling (one year season every three months), and physiological status of the doe (five levels depending on the parity order and lactation state at the moment of insemination: 1 for nulliparous, 2 for primiparous lactating, 3 for multiparous lactating, 4 for primiparous non-lactating, 5 for multiparous non-lactating); $u_a$= vector of random additive effect of the does and sires, $u_p$= vector of random effects of the permanent environment (permanent non-additive effect); X, $Z_a$ and $Z_p$ are the incidence matrices relating records to the fixed effects, additive genetic effects, and permanent environment, respectively; and e= vector of random residual effects.

The REML estimates of the variance components were used to solve the corresponding mixed models applying the procedure of generalised least squares (GLS) and using the PEST package (Groeneveld, 1990). The solutions got for estimable functions were used to get the estimates of crossbreeding genetic parameters for the lines used. These estimable parameters are representing the differences between direct genetic effects of the lines, differences between maternal genetic effects of the lines, individual heterosis, maternal heterosis and losses for genetic recombination as stated by Dickerson (1992).

## RESULTS AND DISCUSSION

**Genetic groups differences**

Deviations of each genetic group from Saudi Saudi Gabali ($G_i$-$G_2$) for different traits are presented in Table 3. These deviations are interesting to show the global performances for V-line, Saudi Gabali breed and their different crosses in order to identify the possibilities of using these rabbits as a pure stock or as a simple cross or to be used as a synthetic line. However, results of the present study indicate that involving V-line genes in crossbreeding program with Saudi Gabali rabbits in hot climate countries was associated with an improvement in most traits of the crossbred rabbits obtained.

Genetic groups of ½S½V and ¾S¼V recorded the highest performances in LSB, LSW, LWB, and LWW, while groups of ¾S¼V and $(¾S¼V)^2$ recorded the highest litter survival and milk yield. The least values in litter traits were recorded for group of $(¾V¼S)^2$. Feed conversion ratios ranged from 2.08:1 to 2.57:1 for FCRLWW, 1.54:1 to 1.79:1 for FMCR, and 2.43:1 to 3.15:1 for FLGCR (Table 3). Crossbred does of ¾S¼V recorded relatively higher feed consumption but with favourable feed conversion ratios compared to the other crossbred doe groups (Table 3).

Involving V-line genes in crossbreeding program with local rabbits in hot climate countries was associated with an improvement in post-weaning growth performance of the crossbred rabbits obtained. Groups of ¾V¼S and $(½S½V)^2$ were the highest in growth performance, while group of ½S½V was the lowest. In most cases, carcass traits

(HCW and OW), tissues compositions (MW, BW, and MBR) and meat quality traits (DM and ash) were in favour of the genetic group of $(¾S¼V)^2$ relative to the other groups.

Table 3: Deviations of each genetic group from Saudi Gabali rabbits $(G_i\text{-}G_2)^+$ for different traits

| Doe traits | $G_1$-$G_2$ | $G_3$-$G_2$ | $G_4$-$G_2$ | $G_5$-$G_2$ | $G_6$-$G_2$ | $G_7$-$G_2$ | $G_8$-$G_2$ | $G_9$-$G_2$ | $G_{10}$-$G_2$ |
|---|---|---|---|---|---|---|---|---|---|
| **Litter traits:** | | | | | | | | | |
| LSB, *young* | 1.19 | 1.08 | 1.12 | 1.1 | 0.99 | 0.71 | 0.69 | 0.02 | 0.03 |
| LSW, *young* | 1.02 | 0.35 | 1.45 | 1.19 | 1.54 | 1.04 | 1.4 | 0.08 | 0.90 |
| LWB, *g* | 26.9 | 41.1 | 53.7 | 41.7 | 39.9 | 13.8 | 29.9 | 4.4 | 12.9 |
| LWW, *g* | 29.9 | 554 | 588 | 136 | 578 | 167.0 | 192 | 37 | 260 |
| PLS, *litter* | 0.5 | 4.7 | 7.2 | 2.8 | 9.1 | 5.5 | 8.4 | 6.3 | 11.9 |
| **Lactation traits:** | | | | | | | | | |
| TMY, *g* | 542 | 831 | 627 | 476 | 929 | 575 | 493 | 535 | 753 |
| MLGCR | -0.20 | -0.15 | -0.10 | -0.12 | -0.10 | -0.22 | -0.08 | -0.20 | -0.18 |
| **Feeding parameters**: | | | | | | | | | |
| FCRLWW | 0.11 | 0.23 | 0.26 | 0.42 | 0.13 | 0.52 | 0.16 | 0.62 | 0.45 |
| FMCR | -0.38 | -0.16 | -0.04 | 0.06 | -0.13 | -0.19 | -0.05 | -0.12 | -0.14 |
| FLGCR | 0.25 | 0.29 | 0.32 | 0.58 | 0.16 | 0.74 | 0.19 | 0.88 | 0.59 |
| **Body weight (g):** | | | | | | | | | |
| W4 | -53 | 43 | -50 | -29 | -39 | -24 | -35 | -13 | -4 |
| W6 | -52 | -37 | -41 | 48 | 38 | 65 | 4 | 8 | 29 |
| W8 | 9 | 58 | -2 | 88 | 61 | 93 | 21 | 34 | 47 |
| W10 | 72 | 69 | 37 | 130 | 71 | 122 | 22 | 43 | 74 |
| W12 | 149 | 109 | 76 | 129 | 94 | 157 | 37 | 57 | 88 |
| **Daily gain in weight (g/d):** | | | | | | | | | |
| DG412 | -5.7 | -3.6 | -2.5 | -4.0 | -0.6 | 0.4 | -0.9 | -1.1 | -0.6 |
| **Carcass traits:** | | | | | | | | | |
| HCW | 1194 | 110 | 103 | 95 | 121 | 131 | 124 | 46 | 145 |
| DP | 53.4 | -1.9 | -0.2 | -0.5 | -0.5 | 0.4 | 0.1 | -1.6 | -0.5 |
| OW | 89.6 | 13.9 | 11.4 | 13.3 | 15.8 | 11.6 | 6.6 | 6.9 | 9.6 |
| **Tissues composition of carcass:** | | | | | | | | | |
| MW | 838.7 | 75.0 | 64.6 | 59.2 | 79.3 | 86.1 | 87.4 | 67.1 | 93.9 |
| FW | 28.4 | -0.2 | 3.6 | -3.5 | -0.2 | -0.8 | -3.5 | -4.4 | 2.0 |
| BW | 241.5 | 25.9 | 26.2 | 15.8 | 5.7 | 7.1 | 38.5 | 36.4 | 30.8 |
| MBR | 3.61 | -0.07 | -0.06 | -0.02 | 0.24 | 0.30 | -0.11 | -0.27 | -0.28 |
| **Meat quality:** | | | | | | | | | |
| MP | 71.4 | 1.2 | 0.6 | 0.2 | -0.1 | -0.3 | -0.9 | -0.9 | -0.6 |
| DM | 28.63 | -1.22 | -0.59 | -0.19 | 0.14 | 0.26 | 1.03 | 0.98 | 0.64 |
| CP | 21.8 | -0.7 | 0.0 | 0.0 | 0.7 | 0.4 | 0.6 | 0.1 | -0.4 |
| EE | 4.98 | -0.29 | -0.47 | -0.6 | -0.99 | -0.45 | -0.63 | -0.99 | -0.73 |
| Ash | 1.97 | -0.13 | -0.03 | 0.39 | 0.75 | 0.31 | 1.31 | 1.99 | 1.88 |

[+] See Table 1 to identify different genetic groups.

Tissues measurements of the carcass (LW, BW, FW, and MBR) in V-line and crossbred rabbits have shown some differences (P<0.05) in favour of crossbreds (Table 3). In this concept, MBR was improved with the improvement of maturity and consequently crossbred rabbits had better MBR than V-line rabbits (Pla *et al*, 1996). Although the fat content of the carcass in rabbits is low relative to the other animals, fat deposited in the carcass of crossbred rabbits was higher than that in V-line rabbits (Table 3). Chemical components of the lean in terms of DM, CP, EE and contents were in favour of crossbreds relative to the purebred ones (Table 3).

**Direct and maternal additive effects**

Estimates of direct additive effects for most litter traits and lactation and feeding parameters were significantly moderate in favour of V-line does (Table 5). However, line V is a maternal line of rabbits selected for litter size at weaning, being the animals genetically evaluated by a BLUP methodology under an animal-repeatability model (Estany *et al.,* 1989).

The moderate estimates of direct additive effects ranged from 0.3 to 26.1 % for litter and lactation traits, and from -18.6 to 12.6 % for feeding parameters. Such superiority of V-line does in direct additive effects is due to the long history of selection in this breed for litter size at weaning in Spain and for the fact that the average for this trait is high (Estany *et al*., 1989). Therefore, V-line rabbits could produce, lactate and converse feed efficiently under hot climatic conditions of Saudi Arabia.

Most estimates of direct additive effects for body weights were in favour of **V**-line rabbits (Table 4). These differences in direct additive effects for body weights and gains among the two breeds lead to state that V-line rabbits could be used in crossbreeding programmes in Saudi Arabia and other hot climatic countries.

Maternal additivity in V-line were favourable in most cases for pre-weaning litter traits (Table 4); indicating that crossing of V-line rabbits as dam-breed with G rabbits as a sire-breed gave an advantage in the litter performance to be larger in litter size, heavier in litter weight, and higher in survival rate. The maternal superiority of V-line rabbits for most pre-weaning traits compared with other standard breeds has been demonstrated in some European studies (e.g. Garcia *et al.*, 2000).

V line showed unfavorable decrease in maternal genetic effects for post-weaning body weights in comparison with the Saudi rabbits (Table 4). This is due to the consequences of that litter size in V-line was higher and for the fact also that both breeds are medium-sized (Baselga, 2002; Khalil et al, 2005). In most cases, the estimates of direct and maternal genetic effects for carcass traits were in favour of V line, but these estimates were in favour of Saudi Saudi Gabali for meat quality traits.

Direct genetic effects were moderate with 5.6, 11.4, 4.7, and 11.5% in favour of V-line rabbits for HCW, OW, MW, and BW, respectively. On the other hand, the estimates for meat compositions traits were somewhat low and ranged from 1.0 to 6.6% in favour of Saudi Saudi Gabali rabbits. V line rabbits were higher in direct additive effects for offal and bone weights than the Saudi Saudi Gabali rabbits, respectively and the estimate for dressing out percentage was lower (-1.3 %). V-line rabbits had slightly more direct additive effects for moisture content in the lean than Saudi Saudi Gabali rabbits (Table 5), so V line presented less direct additive effects for dry matter of the lean than Saudi Saudi Gabali. Maternal additive effects for most carcass traits were not significantly in favour of **V**-line dams (Table 4).

**Direct and maternal heterosis**

Estimates of direct heterosis ranged from 1.0 to 10.8 % for litter and lactation traits, and 3.6 to 12.9 % for feeding parameters as shown in Table --. Heterotic effects were evidenced for litter size, litter weight, and milk yield in most of the possible crossbred does obtained. Consequently, both producers and processors in the Arabian area could potentially benefit economically through using commercial production of crossbred does.

**Table 4: Percentages of direct and maternal additive effects for different traits**

| Trait | Direct additive effects | Maternal additive effects |
|---|---|---|
| **Litter traits:** | | |
| LSB, *young* | 13.1 | 3.1 |
| LSW, *young* | -1.3 | 15.7 |
| LWB, *g* | 6.1 | 3.5 |
| LWW, *g* | 0.3 | 5.3 |
| PLS, *litter* | 13.4 | 12.4 |
| **Lactation traits:** | | |
| TMY, *g* | 7.2 | 3.2 |
| MLGCR | 26.1 | 0.8 |
| **Feeding parameters:** | | |
| FCRLWW | 1.1 | 2.6 |
| FMCR | -18.6 | -1.8 |
| FLGCR | 12.6 | 1.9 |
| **Body weight and gain(g):** | | |
| W4 | 0.1 | 14.5 |
| W6 | 0.0 | 7.3 |
| W8 | 4.1 | 4.6 |
| W10 | 5.9 | 2.5 |
| W12 | 8.1 | 2.0 |
| DG412 | 13.9 | 6.7 |
| **Carcass traits:** | | |
| HCW | 5.6 | 1.8 |
| DP | -2.4 | 0.3 |
| OW | 11.4 | 2.7 |
| **Tissues composition of carcass:** | | |
| MW | 4.7 | 2.0 |
| FW | -0.8 | 0.6 |
| BW | 11.5 | 0.1 |
| MBR | -5.1 | -0.2 |
| **Meat quality:** | | |
| MP | 1.0 | 0.0 |
| DM | -2.7 | 0.0 |
| CP | -1.5 | -1.5 |
| EE | -6.6 | 4.9 |
| Ash | -3.6 | 3.2 |

Estimates of maternal heterosis in most cases are favourable and indicating that crossbred dams had considerable maternal heterotic effects in terms of larger litter size, heavier litter weight at birth and weaning, favourable feed conversion ratio, and efficient milk to litter gain conversion ratio than their crossbred daughters.

The estimates of direct heterosis for body weights were mainly positive and ranging from 1.3 to 4.5 %, but the estimates for maternal heterosis were mainly negative and ranging from 0.2 to 5.3 %. The negative estimates of maternal heterosis for body weights and gains (Table 5) indicate that crossbred dams had little or adverse heterotic maternity over their purebred dams in these growth traits.

Hot carcass, offal, fat and bone weights showed favorable positive estimates of direct heterosis (Table 5). Most estimates of heterosis obtained from experiments in USA, Egypt, Italy and France (Lukefahr et al., 1982& 1983a and b; Masoero et al., 1985; Brun and Ouhayoun, 1989; Abdel-Ghany et al., 2000a&b; Khalil and Afifi, 2000) indicated that crossbreeding in rabbits was associated with a little improvement in the carcass performance.

**Table 5: Percentages of direct and maternal heterosis for different traits.**

| Doe traits | Direct heterosis | Maternal heterosis |
|---|---|---|
| **Litter traits:** | | |
| LSB, *young* | 8.5 | 10.0 |
| LSW, *young* | 2.0 | 11.4 |
| LWB, *g* | 10.8 | 4.3 |
| LWW, *g* | 3.0 | 4.8 |
| PLS, *litter* | 4.1 | 0.2 |
| **Lactation traits:** | | |
| TMY, *g* | 5.8 | 1.2 |
| MLGCR | 1.0 | 7.0 |
| **Feeding parameters:** | | |
| FCRLWW | 3.9 | 4.9 |
| FMCR | 5.7 | 3.8 |
| FLGCR | 3.6 | -6.8 |
| **Body weight (g):** | | |
| W4 | 4.5 | -5.3 |
| W6 | 2.8 | -0.7 |
| W8 | 2.6 | -0.4 |
| W10 | 1.5 | 0.1 |
| W12 | 1.3 | -0.2 |
| **Daily gain in weight (g/d):** | | |
| DG412 | 5.2 | -3.0 |
| **Carcass traits:** | | |
| HCW | 3.1 | -5.2 |
| DP | 0.4 | 0.3 |
| OW | 5.1 | -6.9 |
| **Tissues composition of carcass:** | | |
| MW | 2.2 | -2.3 |
| FW | 13.4 | -18.7 |
| BW | 3.4 | -4.8 |
| MBR | -1.3 | 2.5 |
| **Meat quality:** | | |
| MP | 0.0 | 0.4 |
| DM | 0.1 | -1.0 |
| CP | 1.3 | -0.4 |

| | | |
|---|---|---|
| EE | -5.4 | -3.7 |
| Ash | 1.4 | -2.4 |

**Direct recombination effects**

Estimates of recombination loses for most were non-significant. These estimates of recombination loses were mostly different to estimates of direct hetrosis. These estimates of recombination loses reported that there is a potential advantage to use crossbred does and bucks including V-line genes to develop parental lines (maternal and paternal lines having more available heterosis) to be used in hot climate countries.

Comparing estimates of direct recombination losses with direct heterosis in this work, we found that estimates of direct heterosis for the majority of the studied traits were generally larger than the estimates of direct recombination effects.

## CONCLUSIONS

1. Synthetic lines of rabbits using V line and Saudi Saudi Gabali rabbits are being formed in this project successfully to be convenient in Saudi Arabia and other hot climate areas. Results obtained here for the lines involved in the crossbreeding plan of the project were encouraging factors in this concept since V line showed higher growth than Saudi Gabali and the maternal genetic effects for post-weaning growth were in favour of the local breed. These synthetic lines have the adaptability to be reproducing efficiently in different systems of production of hot climates and they have also good capability to grow profitably in these hot areas. So, these synthetic lines could be used in commercial farms as a pure line or to be crossed with maternal males to get crossbred does. Moreover, the second cross between the crossbred females and males of paternal lines specialised in high rates of growth is currently running to attain more complete benefits of such crossbreeding project.
2. The favourable estimates of direct and maternal heterosis obtained for different traits would be an encouraging factor for the rabbit producers in hot countries to use crossbred does and dams on commercial scale. This notation was evidenced here since crossbred does or dams recorded considerable maternal heterotic effects in most traits studied in terms of larger litter size, heavier litter weight, higher litter survival, favourable lesser feed conversion ratio, and efficient milk to litter gain conversion ratio than their crossbred daughters.
3. Non-significant recombination effects for most traits obtained here in the present project gave an impression to conclude that crossbred does resulting from crossing V-line with Saudi Saudi Gabali rabbits were associated with little recombination losses which in turn had not adverse effects on the results of the program. Therefore, the synthetic maternal lines to be developed will be characterized by heterotic effects on pre-weaning doe traits such as litter size, litter weight, litter survival, lactation and feed conversion.

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# استنباط طرز أبوية وأمية من الأرانب تلائم ظروف المملكة من خلال برنامج تهجين لأرانب الجبلي السعودي والطرز V الأسباني: نظرة للنتائج

**ماهر حسب النبي خليل ، إبراهيم بن حمد الحميدان**
**قسم إنتاج الحيوان وتربيته - كلية الزراعة والطب البيطري بالقصيم- جامعة القصيم - بريدة**
**ص.ب. 1482 المملكة العربية السعودية**

**الملخص العربي والخلاصة:**

أجري برنامج تهجين بين الطرز الأسباني V-line مع الأرانب السعودية الجبلية (S) لمدة ستة أجيال خلال خمسة سنوات لاستنباط طرز جديدة من الآباء يمكن استخدامها كآباء بمنطقة القصيم خاصة وأرجاء المملكة عامة. أنتجت عشرة مجاميع وراثية خلال هذه الأجيال وتم تقييم الحيوانات وراثيا باستخدام النموذج الوراثي للحيوان Animal Genetic Model وحيد الصفات لتقدير القيم الوراثية لكل حيوان لاستخدامها في الانتخاب عبر الأجيال. توصلت الدراسة من الناحية التطبيقية إلى أنه من خلال تهجين الأرانب الجبلية السعودية (S) مع الطرز الأسباني (V-line) ومع الانتخاب لمدة ستة أجيال متتالية والتقييم الوراثي للمجموعات الوراثية الناتجة أمكن استنباط طرز أمي Maternal line سمي "سعودي 2" وتركيبه الوراثي$(¾V¼S)^2$ وتم أيضا استنباط واحد من الطرز الأبوية الجديدة Paternal line سمي "سعودي 3" وتركيبه الوراثي $(¾S¼V)^2$ . وجدير بالذكر هنا اعتبار هذه الطرز كأصول وراثية مستنبطة تناسب إنتاج الأرانب على النطاق التجاري والتقليدي تحت ظروف المناخ الحار في المملكة وفي البلدان الحارة الأخرى. تميزت هذه الطرز بإدرارها العالي من اللبن مصحوبا بمكونات عالية من الجوامد الكلية وبإنتاج خلفة ذات وزنا ثقيلا عند الفطام مصحوبة بمعامل معتدل لتحويل العلف إلى لبن وتحويل اللبن إلى لحم مع مواصفات جيدة للذبيحة ومكونات اللحم .

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