UNIVERSITI PUTRA MALAYSIA

CROSSBREEDING OF THREE IRANIAN SHEEP BREEDS WITH RESPECT TO REPRODUCTIVE, GROWTH AND CARCASS CHARACTERISTICS

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By

MOHAMMAD REZA KIYANZAD

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the Requirement for the Degree of Doctor of Philosophy

February 2002
Dedication

To my parents, my dear wife and my children for their moral supports and encouragement.
CROSSBREEDING OF THREE IRANIAN SHEEP BREEDS WITH RESPECT TO REPRODUCTIVE, GROWTH AND CARCASS CHARACTERISTICS

By

MOHAMMAD REZA KIYANZAD

February 2002

Chairman: Dr. Jothi Malar Panandam
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In Iran, increasing demand for red meat, caused by increasing human population, pasture limitations and increasing cost of production, has become an impetus for sheep producers to change the system of farming and optimise meat production for more efficient output per unit livestock. One way to achieve the latter goal is by taking advantage of the effect of heterosis from crossbreeding.

Twenty seven rams and 473 ewes of three popular breeds of sheep in Iran, namely the Chal, Moghani and Zel, were crossed reciprocally. The reproductive performances of the ewes, and the growth performance, feed conversion ratio and carcass traits of the offspring, under an intensive system of management, were studied.

Zel ewes showed higher (P<0.05) overall apparent fertility, reproductivity and productivity compared Chal and Moghani ewes. However, when the problem
encountered by Zel rams in impregnating the bigger and fat-tailed breeds was taken into consideration, the breeds did not differ in ewe productivity and reproductivity. Zel ewes had relatively high pre-weaning lamb mortality, reducing their ewe efficiency.

Zel lambs had lower body weights and growth rates than Chal and Moghani. Their carcass had significantly (P<0.05) lower total dissectible fat and more lean meat and bone percentages. Lambs sired by Chal and Moghani were heavier than those sired by Zel. Feed conversion ratio was not affect by crossbreeding. Chal, Moghani and Chal-Moghani crossbreeds showed lower prime-cut (P<0.05) and higher fat-tail percent than the other breed groups. ZC (Zel ♂ x Chal ♀) had lower (P<0.05) weaning and finishing weights than CC (Chal ♂ x Chal ♀). Their carcass fat percentages did not show significant difference. ZM (Zel ♂ x Moghani ♀) had significantly (P<0.05) lower birth, weaning and finishing weights than MM (Moghani ♂ x Moghani ♀). MM, however, had higher carcass percent, but lower lean meat percent.

Zel ewes mated by Chal rams showed 26% higher (P<0.05) ewe efficiency than those mated by Zel. CZ (Chal ♂ x Zel ♀) had heavier weaning and finishing weights and more fat percentage in fat-tail but less intramuscular and subcutaneous fat percentages compared to ZZ (Zel ♂ x Zel ♀). Carcass lean meat and fat percentages were similar. Zel ewes mated to Moghani rams weaned 28.5% more kilograms of lambs than those mated to Zel rams. Weaning and finishing weights of
MZ (Moghani ♂ x Zel ♀) were heavier than ZZ, but they had higher carcass fat percentages.

The males were, generally, heavier (P<0.05) than females from birth to finishing. Twins did not differ from singles for finishing weight. Females showed significantly (P<0.05) higher prime-cut and lower fat-tail percentages. Lean meat, fat and bone percents were not affected by sex or litter size.

It may be concluded that it would be beneficial to cross Chal rams with Zel ewes to produce CZ commercial lambs. However, to increase the ewe efficiency and to reduce their pre-weaning lamb mortality, supplemented feeding during pre-weaning period should be practised. Lambs of both sexes may be used in the feedlot.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi kepeluan untuk ijazah Doctor of Falsafah

PEMBIAKBAKAAN KACUK TIGA BAKA BEBIRI IRAN MERUJUK KEPADA CIRI PEMBIAKAN, TUMBESARAN DAN KARKAS

Oleh
MOHAMMAD REZA KIYANZAD

Februari 2002

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Di Iran, peningkatan permintaan untuk daging merah, disebabkan pertambahan populasi manusia, limitasi pastura dan peningkatan kos pengeluaran, telah menjadi satu pencetus kepada penternak-penternak bebiri untuk menukar sistem perladangan dan mengoptimasikan pengeluaran daging dengan pengeluaran yang lebih efisien daripada setiap unit ternakan. Salahsatu jalan untuk mencapai matlamat yang kedua ialah dengan menggunakan kesan heterosis hasil pembiakbakaan kacuk.

Dua puluh tujuh bebiri jantan dan 473 bebiri betina daripada tiga baka yang popular di Iran, iaitu Chal, Moghani dan Zel, telah dikaeukkan secara silang. Prestasi pembiakan bebiri betina, dan prestasi tumbesaran, kadar penukaran makanan dan ciri-ciri karkas anak bebiri, di bawah sistem pengurusan intensif, telah dikaji.

Bebiri betina Zel telah menunjukkan kesuburan tampak keseluruhan, reproduktiviti dan produktiviti yang lebih tinggi (P<0.05) berbanding dengan bebiri betina Chal dan Moghani. Walau bagaimanapun, apabila masalah yang dihadapi oleh
bebiri jantan Zel membuntingkan baka yang lebih besar dan dengan ekor-lemak diambilkira, baka-baka tersebut tidak berbeza bagi produktiviti dan reproduksi betina. Bebiri betina Zel mempunyai mortiliti anak bagi tempoh pra-sapih yang tinggi secara relatif, mengurangkan kecekapan mereka.

Anak bebiri Zel mempunyai berat badan dan kadar tumbesaran yang lebih rendah daripada Chal dan Moghani. Karkas mereka mengandungi lemak yang boleh diasingkan yang lebih rendah secara bererti (P<0.05) dan peratus daging lembut dan tulang yang lebih. Anak bebiri dengan Chal atau Moghani sebagai induk jantan adalah lebih berat daripada yang mempunyai Zel sebagai induk jantan. Kadar penukaran makanan tidak dipengaruhi pembiakbakaan kacuk. Chal, Moghani dan kacukan Chal-Moghani menunjukkan potongan prima yang lebih rendah (P<0.05) dan peratus lemak ekor yang lebih tinggi daripada kumpulan anak bebiri yang lain. ZC (Zel x Chal) mempunyai berat sapih dan berat akhir yang lebih kurang (P<0.005) daripada CC (Chal x Chal). Peratus lemak karkas mereka tidak berbeza secara bererti. ZM (Zel x Moghani) mempunyai berat lahir, berat sapih dan berat akhir yang lebih rendah daripada MM (Moghani x Moghani). MM mempunyai peratus karkas yang lebih tinggi, tetapi peratus daging lembut yang lebih rendah.

Zel betina yang dikawankan dengan jantan Chal menunjukkan kecekapan betina yang 26% lebih tinggi (P<0.005) daripada yang dikawankan dengan jantan Zel. CZ (Chal x Zel) mempunyai berat sapih, berat akhir dan peratus lemak pada ekor-lemak yang lebih tinggi tetapi kurang peratus lemak intramaskular dan
subkutanos berbanding dengan ZZ (Zel \( \delta \times Zel \varphi \)). Peratus daging lembut dan lemak adalah serupa. Bebiri betina Zel yang dikawankan dengan jantan Moghani menyisapahkan 28.5% lebih kilogram anak berbanding dengan yang dikawankan dengan jantan Zel. Berat sapih dan berat akhir MZ (Moghani \( \delta \times Zel \varphi \)) lebih berat daripada ZZ, tetapi mereka mempunyai peratus lemak pada karkas yang lebih tinggi.

Jantan, secara umumnya, adalah lebih berat (P<0.05) daripada betina sejak lahir hingga berat akhirnya. Anak kembar tidak berbeza (P<0.05) daripada anak tunggal untuk berat akhir. Betina menunjukkan potongan prima yang tinggi dan peratus lemak ekor yang rendah secara bererti. Peratus daging lembut, lemak dan tulang adalah tidak dipengaruhi oleh jantina atau saiz perindukan.

Bolehlah disimpulkan bahawa kacukan antara bebiri jantan Chal dan betina Zel untuk menghasilkan anak bebiri komersial CZ akan membawa manfaat. Walau bagaimanapun, untuk meningkatkan kecekapan betina Zel dan mengurangkan kematian anak bebiri pada tempoh pra-sapih, pemberian makanan tambahan semasa tempoh pra-sapih patut diamalkan. Anak bebiri kedua-dua jantina boleh digunakan dalam fidlot.
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I certify that Examination Committee met on 28th February 2002 to conduct the final examination of Mohammad Reza Kiyanzad "Crossbreeding of Three Iranian Sheep Breeds with Respect to Reproductive, Growth and Carcass Characteristics" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

____________________________
MOHAMMAD REZA KIYANZAD

Date: 11.03.2002
TABLE OF CONTENTS

DEDICATION ........................................................................................................... ii
ABSTRACT ............................................................................................................ iii
ABSTRAK ................................................................................................................ v
ACKNOWLEDGEMENTS ....................................................................................... vii
APPROVAL SHEETS ............................................................................................... xi
DECLARATION FORM .................................................................................................... xiii
LIST OF TABLE ........................................................................................................... xvi
LIST OF FIGURES ........................................................................................................ xix
LIST OF ABBREVIATIONS ......................................................................................... xxi

CHAPTER

1 INTRODUCTION ........................................................................................................ 1

1.1 Objectives of the Study ......................................................................................... 2
1.2 Research Hypothesis ............................................................................................ 3
1.3 Significance of the Study ....................................................................................... 3

2 LITERATURE REVIEW ............................................................................................ 5

2.1 Sheep Population and Mutton Production in Iran ................................................. 5
  2.1.1 Sheep Farming in Iran ..................................................................................... 6
  2.1.2 Three Sheep Breeds of Iran ............................................................................ 8
2.2 Economic Traits in Meat Sheep ........................................................................... 10
  2.2.1 Ewe Reproductive Performance .................................................................... 10
  2.2.2 Birth Weight .................................................................................................. 15
  2.2.3 Body Weight and Growth Rate .................................................................... 18
  2.2.4 Feed Conversion Ratio .................................................................................. 22
  2.2.5 Body Conformation and Carcass Traits ......................................................... 23
2.3 Carcass Composition in Iranian and Exogenous Breeds .................................... 25
2.4 Fat Composition in Sheep .................................................................................... 28
2.5 Crossbreeding ...................................................................................................... 32
  2.5.1 Heterosis ....................................................................................................... 35
  2.5.2 Genetic Basis for Heterosis .......................................................................... 38

3 MATERIALS AND METHODS ............................................................................... 39

3.1 Experimental Stocks and Breeding Design ......................................................... 39
3.2 General Management .......................................................................................... 40
  3.2.1 Housing ......................................................................................................... 40
  3.2.2 Feeding .......................................................................................................... 41
  3.2.3 Hygiene and Health ....................................................................................... 44
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Livestock population of Iran in the last 30 years</td>
<td>5</td>
</tr>
<tr>
<td>2.2</td>
<td>Production, importation and per capita consumption of red meat in Iran</td>
<td>6</td>
</tr>
<tr>
<td>2.3</td>
<td>Some characteristics of the Moghani, Chal and Zel sheep breeds</td>
<td>9</td>
</tr>
<tr>
<td>2.4</td>
<td>Mean birth weight (kg) of some purebreed and crossbreed sheep</td>
<td>17</td>
</tr>
<tr>
<td>2.5</td>
<td>Body weight (kg) of some purebreed and crossbreed sheep</td>
<td>20</td>
</tr>
<tr>
<td>2.6</td>
<td>Means and standard deviations of live measurements on ten Iranian fat-tail sheep breeds</td>
<td>24</td>
</tr>
<tr>
<td>2.7</td>
<td>Carcass composition of some Iranian fat-tailed sheep breeds</td>
<td>27</td>
</tr>
<tr>
<td>2.8</td>
<td>Least square means and standard deviations of total saturated and unsaturated fatty acid percentage and unsaturated/saturated fatty acid ratio in three Iranian sheep breeds</td>
<td>30</td>
</tr>
<tr>
<td>2.9</td>
<td>Relative performance of in-vivo techniques and suitability for various uses</td>
<td>31</td>
</tr>
<tr>
<td>3.1</td>
<td>Sample size of each breed used in study</td>
<td>39</td>
</tr>
<tr>
<td>3.2</td>
<td>Mating plan used in the project</td>
<td>40</td>
</tr>
<tr>
<td>3.3</td>
<td>Ingredients and nutrient contents in diet of ewes</td>
<td>42</td>
</tr>
<tr>
<td>3.4</td>
<td>Dry matter (kg/day) offered to ewes of different body weight and stages of production</td>
<td>43</td>
</tr>
<tr>
<td>3.5</td>
<td>Ingredients and nutrient contents in lamb diet</td>
<td>43</td>
</tr>
<tr>
<td>3.6</td>
<td>Number of animals used in feedlot trial</td>
<td>49</td>
</tr>
<tr>
<td>3.7</td>
<td>Description of live and carcass traits measured</td>
<td>54</td>
</tr>
<tr>
<td>4.1</td>
<td>Least square analysis of variance for ewe reproductive traits</td>
<td>63</td>
</tr>
<tr>
<td>4.2</td>
<td>Means of reproductive performance of the three ewe breeds</td>
<td>66</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>4.3</td>
<td>Least square means and standard errors of litter size and litter weight</td>
<td>68</td>
</tr>
<tr>
<td>4.4</td>
<td>Least square analysis of variance for birth weight of the lambs</td>
<td>71</td>
</tr>
<tr>
<td>4.5</td>
<td>Least square means and standard errors of lamb birth weight (kg)</td>
<td>73</td>
</tr>
<tr>
<td>4.6</td>
<td>Least square analysis of variance for weaning weight</td>
<td>74</td>
</tr>
<tr>
<td>4.7</td>
<td>Least square analysis of variance for pre-weaning daily gain</td>
<td>77</td>
</tr>
<tr>
<td>4.8</td>
<td>Least square analysis of variance for finishing weight</td>
<td>80</td>
</tr>
<tr>
<td>4.9</td>
<td>Least square analysis of variance for average daily gain during feedlot period</td>
<td>83</td>
</tr>
<tr>
<td>4.10</td>
<td>Least square analysis of variance for body length</td>
<td>86</td>
</tr>
<tr>
<td>4.11</td>
<td>Least square means and standard errors of body length (cm)</td>
<td>87</td>
</tr>
<tr>
<td>4.12</td>
<td>Least square analysis of variance for lamb heart girth</td>
<td>89</td>
</tr>
<tr>
<td>4.13</td>
<td>Least square means and standard errors of heart girth (cm)</td>
<td>90</td>
</tr>
<tr>
<td>4.14</td>
<td>Least square analysis of variance for lamb height at wither</td>
<td>91</td>
</tr>
<tr>
<td>4.15</td>
<td>Least square means and standard errors of height at wither (cm)</td>
<td>92</td>
</tr>
<tr>
<td>4.16</td>
<td>Least square analysis of variance for feed conversion ratio</td>
<td>94</td>
</tr>
<tr>
<td>4.17</td>
<td>Lamb mortality with respect to dam breed and lamb breed group.</td>
<td>95</td>
</tr>
<tr>
<td>4.18</td>
<td>Least square analysis of variance for slaughter and carcass traits</td>
<td>97</td>
</tr>
<tr>
<td>4.19</td>
<td>Least square means and standard errors for slaughter and carcass traits (kg)</td>
<td>98</td>
</tr>
<tr>
<td>4.20</td>
<td>Least square analysis of variance for carcass component percentages</td>
<td>100</td>
</tr>
<tr>
<td>4.21</td>
<td>Least square means and standard errors of offal, carcass, meat, fat and bone percentages</td>
<td>102</td>
</tr>
<tr>
<td>4.22</td>
<td>Least square analysis for carcass measurements</td>
<td>105</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>4.23</td>
<td>Least square means and standard errors of carcass measurements.</td>
<td>106</td>
</tr>
<tr>
<td>4.24</td>
<td>Least square analysis of variance for prime-cuts, fat-tail, intramuscular fat and subcutaneous fat percents</td>
<td>107</td>
</tr>
<tr>
<td>4.25</td>
<td>Least square means and standard errors of prime-cuts, fat-tail, intramuscular and subcutaneous fat percentages</td>
<td>109</td>
</tr>
<tr>
<td>4.26</td>
<td>Least square analysis of variance for moisture, protein, chemical fat and ash percentages</td>
<td>110</td>
</tr>
<tr>
<td>4.27</td>
<td>Least square means and standard errors of chemical compositions of carcass</td>
<td>111</td>
</tr>
<tr>
<td>4.28</td>
<td>Estimates of heterosis (amount and percentage) for growth and carcass traits</td>
<td>116</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>3.1</td>
<td>Measurements on the live sheep</td>
<td>49</td>
</tr>
<tr>
<td>3.2</td>
<td>Longisimus dorsi sizes</td>
<td>52</td>
</tr>
<tr>
<td>3.3</td>
<td>Sites of cutting of lamb carcass and the parts produced</td>
<td>53</td>
</tr>
<tr>
<td>4.1</td>
<td>Ewe weights at purchase, before mating and after parturition</td>
<td>61</td>
</tr>
<tr>
<td>4.2</td>
<td>Least square means and standard errors of lamb weaning weight</td>
<td>76</td>
</tr>
<tr>
<td>4.3</td>
<td>Mean pre-weaning average daily gain of the lambs</td>
<td>78</td>
</tr>
<tr>
<td>4.4</td>
<td>Means of pre-weaning body weights of lambs</td>
<td>78</td>
</tr>
<tr>
<td>4.5</td>
<td>Overall means and standard errors of finishing weights for the nine lamb breed groups</td>
<td>82</td>
</tr>
<tr>
<td>4.6</td>
<td>Means of body weights during feedlot period</td>
<td>82</td>
</tr>
<tr>
<td>4.7</td>
<td>Means and standard errors of average daily gain during feedlot period for the nine lamb breed groups</td>
<td>85</td>
</tr>
<tr>
<td>4.8</td>
<td>Means of average daily gain during feedlot period for the nine lamb breed groups</td>
<td>85</td>
</tr>
<tr>
<td>4.9</td>
<td>Least square means of feed conversion ratios in the nine lamb breed groups</td>
<td>94</td>
</tr>
</tbody>
</table>
LIST OF ABBREVIATIONS

A  Maximum width of the longissimus muscle at cross-section posterior to the last rib

B  Maximum depth of the longissimus muscle at cross-section posterior to the last rib

BL1 Body length at birth

BL2 Body length at weaning

BL3 Body length at finishing

BW Birth weight

C  Chal

C₁ Subcutaneous fat thickness over the point of greatest depth of the longissimus muscle posterior to the last rib

Ca  calcium

CC  Chal(♂) x Chal(♀)

CCW Cold carcass weight

CF  Chemical fat

CM  Chal(♂) x Moghani(♀)

C-M Reciprocal crosses of Chal and Moghani breeds

CZ  Chal(♂) x Zel(♀)

C-Z Reciprocal crosses of Chal and Zel breeds

DE  Digestible energy

df  degree of freedom

DM  dry matter

EBW Empty body weight
EE   Ewe efficiency
EE_{MWE}   Ewe efficiency based on metabolic weight of ewe exposed
EE_{MWL}   Ewe efficiency based on metabolic weight of lambed ewes
F_{1}   first filial generation
FADG   Feedlot average daily gain
FCR   Feed conversion ratio
FW   Finishing weight
GR   True depth of soft tissue over 12th rib, 11 cm from the dorsal midline on intact cold carcass.
HCW   Hot carcass weight
HG1   Heart girth at birth
HG2   Heart girth at weaning
HG3   Heart girth at Finishing
HW1   Height at wither at birth
HW2   Height at wither at weaning
HW3   Height at wither at finishing
M   Moghani
MC   Moghani_(♂) x Chal_(♀)
ME   Metabolizable energy
MM   Moghani_(♂) x Moghani_(♀)
MS   mean square
MZ   Moghani_(♂) x Zel_(♀)
M-Z   Reciprocal crosses of Moghani and Zel breeds
NFE   Nitrogen free extract
NGR  Measurements of GR with a 22-gauge hypodermic needle over the 12th rib, 12-cm from the dorsal midline.

P    phosphorus

PADG Pre-weaning average daily gain

SS  sum of square

SW  Slaughter weight

UGR Ultrasonic Measurements of GR

WW  Weaning weight

Z    Zel

ZC  Zel (♂) x Chal (♀)

ZM  Zel (♂) x Moghani (♀)

ZZ  Zel (♂) x Zel (♀)
CHAPTER 1
INTRODUCTION

In Iran, red meat is one of the common sources of protein. The average red meat consumption per capita is 14 kg (Kiyanzad and Monem, 1999). The main sources of red meat are cattle, buffalo, sheep and goat. Meat from these sources, however, is not sufficient to meet the demand.

Sheep population in Iran is 50 million, comprising of 26 genetic groups. Meat production by sheep and goat amounts to 57% of the total red meat production in the country (FAO, 1998; Osfoori and Fesus, 1996). Sheep are kept for meat, wool, milk and pelt. Although there has been an increase in production over the years, the country aims only not for self-sufficiency, but also to be able to export mutton (Kiyanzad and Monem, 1999; FAO, 1997; Yalcin, 1979).

Periodical drought, overgrazing, lack of management of pasture, use of pasture plants by clans and villagers as fuel and use of pasture area for crop cultivation over the last four decades has caused the pasture capacity to be reduced. On the other hand, increasing demand for red meat, limitation faced by animal food producers (land use for other purposes, climatic conditions, etc.) and increasing cost of production, has become an impetus for livestock producers to change the system of production. The traditional sheep keeping practices are no longer viable or economical. It has become a necessity to adopt the intensive or semi-intensive system of farming and to use more productive animals or breeds so that sheep