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ORIGINAL ARTICLE

Analysis Bio-economic system in Rural and Industrial breeding Systems Sheep

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ABSTRACT
The main purpose of this research was to determine Bio-economic model of two Kabudeh Fars and Zel Mazandran sheep in Iran. These results suggests that despite a 109 percent increase in industrial breeding system costs than rural breeding system, absolute profit in industrial breeding system was 1418054 Rsl. compared to rural breeding system (1071631 Rsl.) per ewe.
Key Words: *Economic Coefficients, Bio-economic model, Sheep*

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INTRODUCTION

Based on the Iranian undersecretary of animal science and breeding, ministry of Agriculture, report, there was 51336000 sheep in Iran by the year 2012 are which mostly raise in two prominent system in Iran: Rural and Nomad systems. Approximately, 22.6 percent of sheep kept in Nomad system whereas 77.4 percent is distributed in farm and rural breeding management systems. Based the Iranian Animal Breeding organization report there are several important factors which imply why sheep breeding decreases during these days in Iran.

1. Breeders tend to change their living system to more comfortable style.
2. National project inhibition against deserts to improve balance between pastures and deserts.
3. Increased forbidden lands to avoid erosion and pasture lost.
4. Dependence of this breeding system to Precipitation.

The general aim of genetic improvement of farm animals is the increase in efficiency of production [5]. Choice of traits to be included in the breeding goal should be based on the relative contribution of each trait to the overall efficiency of production usually evaluated from an economic perspective [11]. The sheep industry will die if we were not able to find a newel breeding strategy to replace by current breeding systems. In Iranian 5th national extension and expansion project, government anticipated a decrease will be per sheep and goat which by the year 2015 it will 4966000. Also, they investigated other domestic animals will increase in number. Additionally, they claimed that number of native cow and heifer will decrease which they anticipated a strategy for it. Sheep and goat productions are widespread in the Mediterranean regions, in particular in the South of Italy and represent an important resource for the economy of hill and mountain areas, in which other economic activities are difficult to develop. Moreover, small ruminants' husbandry has a role in protecting the territory and prevent rural exodus of the population towards the urban and peri-urban areas. In recent decades, the setup of a breeding program was started for sheep [20]. Based on these observations, similar prohibitions needs for sheep and goat industry, too. The importance of meat in Iranian daily diet, increase in meat price are the main reasons for improve sheep industry in Iran. Based on previous study, the aim of current study was to analysis bio-economic system in rural and industrial breeding systems sheep in Iran. A benefit of the approach presented in this study, was parallel to previous studies [20].

MATERIAL AND METHODS

The data used in this study is belongs to 2 main Iranian sheep strain named Kabudeh-Fars in Marvdasht region and Zel Mazandaran in Mazandaran province. Biological data include: flock body weight, reproductive, survival and economical traits e.g. feeding and cure expenses and incomes.

Introducing the data to the model

1. Rural breeding system

In this study biological data: time table of food stuff usage (pasture, stall feeding and birth date) and some economic data collected by answer sheet forms that provided to the flock owners. Then the desired flocks selected as a powerful and constant flocks under supervision of Iranian Breeding Organization. The main concern was to determining bio-economic model in realistic condition in rural system. The ideal condition (availability of nutritional requirements based on NRC suggestions) used just as a basement indicator to estimate nutritional costs and income from dung. It is important to note that the real data which obtained from the farmers used in bio-economic model [18-20].

1. Industrial breeding system

In this system, data used as the same as rural breeding system.

Expenses and profits of sheep industry include:

1. Feeding costs (forage and concentrate), farm (if it is not ownership). The data used in this study related to those moths of year which animals feed on farm or on rental lands. On the other moths, sheep feed on natural pastures and the flock owners just have to pay to rancher. This portion of cost is calculated in wage part while in industrial system animals feed by owners in 365 days of year.
2. Extra costs include: rancher wage, wool sniping, veterinary expenses, hygiene, vaccination, electricity, gas and water bills, and equipment repair costs e.g. car.
3. In both system (rural and industrial) farmer have to build stall. Despite in rural system animal kept only 100 days in stall (compared to industrial system, 365 days in stall); stall costs are same for both system.
4. Incomes include: ram or ewe marketing, wool and dung.

Investigated animal flocks in this study are presented in figure 1.

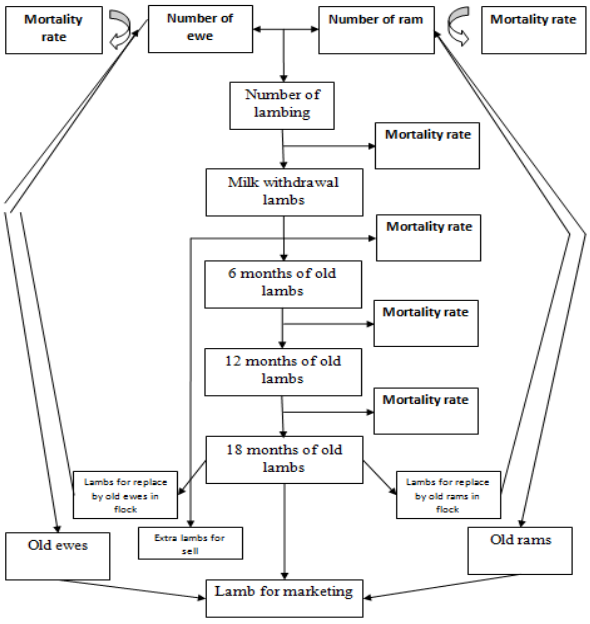

Fig 1. Investigated animal flocks in this study

Calculation of system profits

To calculate system profits, Microsoft excel software had used.

1. Flock sex in this study was: ewe, ram, 3, 6, 12 and 18 months lambs.
2. Calculation of income per a ewe in year has done using equation 1 **[6, 7, 12, 15]**.

Equation 1: Income from each ewe

$$P_e = \sum_{i=1}^{6}\left[N_i \times f_i \times (1-m_i) \times Lw_i \times Pm_i\right] + \sum_{i=1}^{6}\left[N_i \times f_i \times C_i \times P_{w_i}\right] + \sum_{i=1}^{6}\left[N_i \times f_i \times O_i \times P_o\right]$$

P_e= income per ewe
i= Animal groups
N_i= number of animal in group i to donor ewe
f_i= fraction of animal in group i which have role in group profit
m_i= mortality rate in group i
Lw_i= LBW of animals in group i in marketing time
Pm_i= price of each Kg of LBW in in group i
C_i= wool production (Kg) of each animal in in group i
Pw_i= price of each Kg of wool in group i
3. Calculation of constant and inconstant costs per a ewe in year has done using equation 2, 3 and 4 **[6, 7, 12, 15]**.
Equation 2: Nutritional costs

$$C_f = \sum_{i=1}^{6}\left[N_i \times \left(Rf_i \times L_i \times \Pr_i \times Z_i\right)\right] + \sum_{i=1}^{6}\left[N_i \times Ps_i\right]$$

N_i= number of animals in group i to donor ewe
Rf_i= total nutritional needs in hand feed system
L_i= days in hand feed system in group i
Pr_i= price of each unit of energy in ration of in group i
Z_i= ratio of provided energy from hand feed system in group i
Ps_i= price of pasture forages in group i

Equation 3: Nun-nutritional costs

$$C_h = \sum_{i=1}^{6}\left[N_i \times P_{lb} \times L_{mi}/100\right] + \sum_{i=1}^{6}\left[N_i \times C_{wc} \times Lmi\right] + \sum_{i=1}^{6}\left[N_i \times Wb \times L_{mi}\right] + \sum_{i=1}^{6}\left[N_i \times Sh\right]$$

P_{lb}= rancher wage per month for each 100 sheep
L_{mi}= number of months animals kept in group i
C_{wc}= hygiene and cure price of each animal
Wb= cost of water, electricity in month per animal
Sh= cost of wool sniping

Equation 4: Constant costs

$$C_{FCF} = \sum_{i=1}^{n}\left(P/S\right)$$

P= total investment in each unit which includes in constant prices
S= time duration of each unit includes in constant prices
i= units include in constant prices

3. Calculation of yearly profit has done using equation 5.

Equation 5: Flock profit

$$P_{flock} = \left[N_f \times \left(R_f - C_f\right) - C_{FCF}\right]$$

P_{flock}= profit of flock in a year
N_f= number of donor ewe
R_f= income from each ewe per year
C_f= yearly costs of each donor ewe per year
C_{FCF}= constant cost of flock in a year

Flocks composition and functional parameters is presented in table 1.

Table 1. Flocks composition and functional parameters

Parameter	Rural System	Industrial System
Number of ewe	920	4600
Number of ram	44	100
Pregnancy rate	97	99
Gestation rate (%)	99	99
Twining rate (%)	11	20
Number of lambing per year	1	1.35

Number of lamb per gestation	1.11	1.20
Ewe mortality rate (%)	99	98
Ram mortality rate (%)	96	98
Mortality rate before milk withdrawal (%)	97	98
Mortality rate before 6 months (%)	99	99
Mortality rate of replaced ewes (%)	98	99
Mortality rate of replaced rams (%)	98	99
Birth weight (Kg)	3.8	3.4
Body weight in milk withdrawal (Kg)	20	19
Body weight of female lamb in 6 months (Kg)	28	29
Body weight of female lamb in 6 months (Kg)	31	37
Body weight of female lamb in 12 months (Kg)	34	35
Body weight of female lamb in 12 months (Kg)	41	48
Ewe body weight (Kg)	49	45
Ram body weight (Kg)	60	55
Management parameters		
milk withdrawal age (month)	3	3
wool sniping per year	1	1
Years for ewe in flock	6	6
Years for ram in flock	5	5
Food intake Parameters		
Days in hand feeding	90	365
Feed energy cost per ewe (Mega j/Rls.)	537	562
Feed energy cost per ram (Mega j/Rls.)	643	593
Feed energy cost per lamb until 3 months (Mega j/Rls.)	742	809
Feed energy cost per lamb until 6 months (Mega j/Rls.)	643	663
Feed energy cost per lamb until 12 months (Mega j/Rls.)	537	663
Management costs		
Drug, vaccine and veterinary	52173	30000
Worker (per 100 animal/month/Rls.)	3750000	1400000
Wool sniping (per animal/month/Rls.)	50000	50000
Water, electricity and gas expenses (per animal/month/Rls.)	8144	25891
Price of Incomes		
Live body weight price (Kg/Rls.)	95000	95000
Excess ewe price per live body weight (Kg/Rls.)	75000	75000
Excess ram price per live body weight (Kg/Rls.)	75000	75000
Wool price (Kg/Rls.)	40000	40000
Dung price (Kg/Rls.)	1000	1000

RESULTS AND DISCUSSION

As seen in previous parts, some portion of observed difference is related to strain differences between Kabudeh Fars and Zel Mazandran sheep and not to systems which the obvious one is lamb marketing age. In Zel Mazandran lamb marketing age is 8-9 months whereas in Kabudeh Fars is 5-6 months. Also, in Zel Mazandran flocks, to improve the lamb body weight and productivity farmers used to cross breed Zel Mazandran ewes with Afshari ram. The first and obvious improvement after changing rural system to industrial system is to improve pregnancy rate. The studied flocks have 56 percent more lambing in industrial system compared to rural system.

The second indicator for industrial system is the profitably of this system than rural breeding system. In this system rancher wage is 32 percent less than rural system. The difference in performance which belongs to reproduction management is the main quota for industrial system. Also, in industrial system animals kept in stall and annual dung is much more compared to rural system. The most important factor which implies industrial system is better than rural breeding system is nutrition costs which it was 187 percent better than rural system. Based on the results, despite a 109 percent increase in costs in industrial system in comparision to rural system, absolute economical profit in industrial system was 1418054 Rls. compared to rural system 1071631 Rls. per ewe (tables 1 and 2).

Table 1. Analysis Bio-economic system in industrial breeding system in Kabudeh Fars and Zel Mazandran Sheep in Iran

	3 months animals	6 months animals	12 months animals	Donor ram	Donor ewe	Total
Sheep/ewe ratio	1.62	1.60	1.59	0.02	1.00	
			Costs			
Nutritional	874089	1491438	1184663	63506	2069042	5682738

Breeding	76702	56432	223917	5925	249367	612343
Fixed expenses						57619
Total	950791	1547870	1408580	69431	2318409	6352700
			Incomes			
Meat	0	0	6370441	26430	775000	7171871
Dung	70973	124115	131944	4635	143160	474827
Wool	0	0	57711	2937	63408	124056
Total	70973	124115	6560096	34002	981568	7770754
Profit	-879817	-1423755	5151516	-35430	-1336840	1418054

Table 1. Analysis Bio-economic system in rural breeding system in Kabudeh Fars and Zel Mazandran Sheep in Iran

	3 months animals	**6 months animals**	**12 months animals**	**18 months animals**	**Donor ram**	**Donor ewe**	**Total**
Sheep/ewe ratio	1.04	1.03	0.19		0.05	1.00	
			Costs				
Nutritional	271839	910342	199664	41394	24090	535107	1982436
Breeding	133136	99532	56897	47756	25294	541478	904092
Fixed expenses	0						144848
Total	404974	1009874	256561	89150	49384	1076585	3031376
			Incomes				
Meat	0	3076716	0	0	52495	775000	3904211
Dung	38701	45585	2909	2885	1668	30666	122414
Wool	0	0	6875	0	5833	63674	76382
Total	38701	3122302	9784	2885	59995	869340	4103007
Profit	-366273	2112428	-246778	-86265	10611	-207245	1071631

There are significant differences on nutritional and breeding factors in industrial and rural systems which cover 89 and 9 percent of total costs and 65 and 29 percent, respectively. In industrial system, breeding costs decreased while nutritional costs increased which seems a logical strategy [1-4]. Also, in profit section, in industrial system dung price caused an increase 3 percent (from 3 in rural systems to 6 in industrial breeding systems) in total profit. Additionally, there was no significant improvement in meat and wool profit in both breeding systems. In the breeding program of the Italian Piemontese breed a selection criterion has been established based on predicted breeding values for beef traits and calving ease [5]. Economic values for genetic traits in a breeding goal must be derived under optimised management. Applied to persistency, this implies that the economic value of persistency must be derived under optimised insemination, culling, and feeding strategies [9]. Animal breeding generally aims to obtain a successive generation of animals that will produce desired products more efficiently under future farm economic and social circumstances than the present generation of animals [15]. Definition of the breeding objective is generally regarded as the primary step in the development of structured breeding programs [16]. Prior researches indicated that product prices influence relative contributions of improvement of animal traits to (economic) efficiency of production [6-7]. In conclusion, Sheep breed improvement programs in the United Kingdom focus on combining several goal traits into an index of overall merit, as an aid to selecting parental and replacement stock. Goal traits are characteristics of an animal's performance [7, 16-18] so if management decisions are not optimal, the observed covariance between profit and other traits may be affected [11-15].

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