Kafkas Univ Vet Fak Derg
23 (6): 981-988, 2017
DOI: 10.9775/kvfd.2017.18097

Kafkas Universitesi Veteriner Fakultesi Dergisi
Journal Home-Page: http://vetdergi.kafkas.edu.tr
Online Submission: http://submit.vetdergikafkas.org

Research Article

Determining the Priority Selection Emphasis on Characteristics in Terms of Optimized and Non-Optimized Conditions of Production System in Dairy Cows

Reza SEYEDSHARIFI [1] Aysan ESMAILZADEH [1] Nemat HEDAYAT EVRIGH [1]
Sima SAVARSOFLA [2] Jamal SEIFDAVATI [1]

[1] Department of Animal Science, University of Mohaghegh Ardabili, Ardabil, IRAN
[2] Animal Science Research Institute of Iran (ASRI), Agricultural Research, Education and Extension Organization (AREEO), Animal Science, Karaj, IRAN

Article Code: KVFD-2017-18097 Received: 25.05.2017 Accepted: 05.09.2017 Published Online: 08.09.2017

Citation of This Article

Seyedsharifi R, Esmailzadeh A, Hedayat Evrigh N, Savarsofla S, Seifdavati J: Determining the priority selection emphasis on characteristics in terms of optimized and non-optimized conditions of production system in dairy cows. *Kafkas Univ Vet Fak Derg,* 23 (6): 981-988, 2017. DOI: 10.9775/kvfd.2017.18097

Abstract

The aim of this study is assessment of the priority selection emphasis on characteristics in terms of optimized and non-optimized conditions of production system in dairy cows. Optimization is the approach of finding the best accessible value of a predefined objective function within a determined range of effective variables. In optimized conditions for cow future profitability, the decision to cull cattle from herd is based on future predicted profitability of cows. Dynamic planning is an efficient mathematical method which is used to study and optimization of multi-stage decision problems. One of the main challenges in estimating economic value of characteristics is inefficiency of production system. In this study, in order to estimating the economic values and relative importance of characteristics in efficient and inefficient conditions of production system, the average data of six Holstein herds was used which is recorded under supervision of breeding center. After optimizing production system for culling and replacement policies in the herd, a unit is added to the considered characteristic average in order to calculate the economic value of a characteristic after this changes, the production system optimized. The current value of the system calculated in optimized condition before and after changing characteristic and economic value of characteristics obtained from their difference. Relative importance of characteristics such as calving interval, milk production, milk fat, birth weight, mature live weight, increasing daily weight pre-weaning, increasing daily weight after weaning and the first calving age in non-optimized condition of production system are estimated respectively 2.06, 95.62, -4.34, -0.64, 1.90, 1.25, 1.93 and 2.22 percent and In optimized condition of production system are 0.42, 92.55, -0.642, 0.32, 2.00, 1.15, 1.81 and 2.37 percent respectively.

Keywords: *Dairy cows, Economic values, Iran, Non-Optimized, Optimized, Selection emphasis*

Süt İneklerinde Üretim Sisteminin Optimize Edilmiş ve Optimize Edilmemiş Koşulları Açısından Öncelik Seçiminin Belirlenmesi

Özet

Bu çalışmanın amacı, süt ineklerinde üretim sisteminin optimize edilmiş ve optimize edilmemiş koşulları açısından öncelik seçiminin değerlendirilmesidir. Optimizasyon, önceden belirlenmiş bir objektif fonksiyonun erişilebilir en iyi değerini belirlenmiş etkili değişkenler aralığında bulma yaklaşımıdır. Optimize koşullarda ineklerin gelecekteki verimliliği için sürüden bir sığırın çıkarılması kararı ineklerin gelecekteki tahmin edilen verimliliğine bağlıdır. Dinamik planlama, çok aşamalı karar problemlerinin incelenmesi ve optimizasyonu için kullanılan etkili bir matematiksel yöntemdir. Özelliklerin ekonomik değerini tahmin etmede başlıca zorluklardan biri, üretim sisteminin verimsizliğidir. Bu çalışmada, üretim sisteminin uygun ve uygun olmayan koşullarında ekonomik değerlerin ve özelliklerin göreceli öneminin tahmin edilmesi amacıyla, ıslah merkezi gözetiminde kaydedilen altı Holstein sürüsünün ortalama verileri kullanılmıştır. Sürülerde atılma ve değiştirme politikaları için üretim sistemini optimize ettikten sonra, bu özelliklerin ekonomik değerini hesaplamak için dikkate alınan karakteristik ortalamaya bir birim eklenir, bu değişikliklerden sonra üretim sistemi optimize edilir. Sistemin mevcut değeri, karakterler ve bu karakterlerin farklılıklarından elde edilen ekonomik değerleri değiştirmeden önce ve sonra optimize edilmiş koşulda hesaplanmıştır. Buzağılama aralığı, süt üretimi, süt yağı, doğum ağırlığı, ergin canlı ağırlık, sütten kesme öncesi günlük ağırlık kazanımı, sütten kesme sonrası günlük ağırlık kazanımı ve ilk buzağılama yaşı gibi karakterlerin oransal önemi üretim sisteminin optimize olmamış koşulunda sırasıyla 2.06, 95.62, -4.34, -0.64, 1.90, 1.25, 1.93 ve 2.22, optimize koşulda ise 0.42, 92.55, -0.642, 0.32, 2.00, 1.15, 1.81 ve 2.37 olarak belirlendi.

Anahtar sözcükler: *Süt ineği, Ekonomik değerler, İran, Optimize olmayan, Optimize, Seleksiyon vurgusu*

İletişim (Correspondence)
+98 914 3540078
reza_seyedsharifi@yahoo.com

INTRODUCTION

In livestock breeding, making decision in terms of effective characteristics on profitability (correction objectives) and the share of each characteristic in profitability (economic value or relative importance) are the first steps to development of breeding programs [1]. Economic value of a characteristic indicates the share of genetic growth of which to develop economic efficiency of production system [2,3]. Wrong estimation of this value leads to lack of conformity of breeding program with economic conditions of production system [4]. Bio-economic models are one of the important tools for estimating economic value. In this method, the economic value of the characteristic will be assessed by simulating one unit change in one of the elements of characteristic operation (production and operation) while others remain without change so that its impacts on economic output of the production unit can be calculated [5,6]. Simulation is a process of modeling a real system and doing examinations on the model in order to determine system behavior or assessment of different strategies in a way that simulation model introduces the best production condition according to existing facilities and system capacity. Optimization was found the best accessible value of a predefined objective function within a determined domain of effective variables. In optimized condition for future profitability of cow, livestock culling decision is based on future predicted revenue of cow and by this method; the decision of elimination or maintenance of livestock will be carried out [7]. Difference of production models, characteristic definition and assumptions related to impact of management systems on genetic improvement of a particular one, makes direct comparison more difficult among different countries. In order to compare the suggested selection indicator of a country with others, relative emphasize of the characteristics is calculated [7].

One of the main challenges in estimating economic value of characteristics is inefficiency of production system. As the impact of breeding is long-term, it is necessary to perform it for optimized system and not for non-optimized systems. On-optimized systems lead to skewed estimation of economic values and relative importance of characteristics [8]. Optimized replacement decisions, directly affected by milk price fluctuations, replacement expenses and price of additional heifers, is one of the most important factors for dairy farms [9]. In order to determine optimized replacement decision under different production conditions, dynamic planning is used [10]. Dynamic planning includes stage, condition or state and optimized policy. Every planning problem converts into trivial problems which called a stage. Every stage includes decision making and one or more condition or state. Decision in each stage is made based on the determined condition of the system in that stage. Optimized policy in each stage represents the best decision from that stage to final stage. In this method, production system is divided into limited or unlimited periods and stages along time horizon. In each stage the situation of the system is observed and a decision related to the system is made. This decision affects the system situation in the next stage certainly or occasionally [10]. Each stage depends on some states. Based on the state and decision, intermediate revenue is obtained. In probable dynamic planning method, situation occurrence includes uncertainty therefore; the decisions depend on the conditions occurrence possibility and decision which is made in the previous period. In order to consider uncertainty in prediction, Markov chain model will be used [11]. To select several characteristics simultaneously, the relative importance should be considered. In total genetic-economic indicator, economic value determines the amount of selection emphasize in order to obtain optimized genetic progress with the maximum profitability [12]. So, the aim of this study is to determine relative emphasize of different characteristics in optimized and non-optimized production system.

MATERIAL and METHODS

In this study, in order to estimate relative emphasize of characteristic in optimized and non-optimized condition of production system, the average data of six Holstein herd is used which recorded under consideration of country breeding center. Herd data and economic and bio parameters used for modeling for base scenario has been represented in *Table 1*.

Profit obtained from the difference of revenues and costs.

Table 1. *The data of studied herd and economic and bio parameters used for modeling for base scenario*

Parameters	Amount	Symbol
Birth weight (kg)	43.28	BW
Mature live weight (kg)	680	LW
Preweaning daily gain (kg)	0.65	DG
Postweaning daily gain (kg)	0.506	PDG
Preweaning survival rate (%)	0.95	SR
Postweaning survival rate (%)	0.98	PSR
Survival rate to 24 h of birth (%)	0.98	S24
Age at first calving (days)	720	AFC
Milk price per kg milk (Riyal)	16000	Pm
Natural pasture silage cost per kg DM (Riyal)	2020	Psil
Concentrate cost per kg DM (Riyal)	13200	Pconc
Price per kg LW (Riyal)	70000	PLw
Productive lifetime (days)	1800	PLT
Milk yield per cow per year (kg)	13280	MY
Amount of DM consumed from silage per cow per day (kg)	20	Sil

Revenue and costs of every cow in a year is as follow:

P = R-C

In the above equation, P is annual profit, R is annual revenue and C is annual cost per each cow. Annual revenue per every cow through milk sale (R_{milk}), male calf ($R_{male\ calves}$), eliminated cow ($R_{cows\text{-}age}$), culled heifers ($R_{culled\ heifer}$) and manure (R_{manure}) is calculated as follow:

$R = R_{milk} + R_{male\ calves} + R_{cows\text{-}age} + R_{culled\ heifer} + R_{manure}$

Annual cost for each cow is calculated as follow:

C = CFeed - birth - w + CFeed - w - ma + CFeed - ma - afc + CFeed - cows + CHealth - birth - w + CHealth - w - ma + CHealthh - maafc + CHealth - cows + CLabor - birth - w + CLabor - w - ma + CLabor - ma - afc + CLabor - cows + CReproduction - heifers + CReproduction - cows + CFix

The parameters which are used in above equations are defined as follow:

C Feed-birth-w: nutrition cost of heifer from birth to weaning, CFeed-w-ma: nutrition cost of heifer from weaning to 18 month age, CFeed-ma-afc: nutrition cost of heifer from 18 month age to first calving, CFeed-cows: nutrition cost of dairy cow, CHealth-birth-w: health and hygiene cost of heifer from birth to weaning, CHealth-w-ma: health and hygiene cost of heifer from weaning to 18 months age, CHealthh-ma-afc: health and hygiene cost of heifer from 18 months age to first calving, CHealth-cows: health cost of a cow, CLabor h- birth-w:labor cost from birth to weaning, CLaborh- w-ma: labor cost from weaning to 18 months age, CLaborh- ma-afc: labor cost from 18 months age to first calving, CLabor-cows: labor cost for each cow, CReproduction-heifers: reproduction cost of the heifer, CReproductin-cows: reproductive cost of cow, CFix: fix costs.

The relation between costs and revenues determined by a mathematical method and economic coefficient of characteristics estimated using system analyze method:

$$V_I = \frac{P_{m_{i+\Delta}} - P_{m_i}}{\Delta}$$

In which V_i is economic coefficient, Pmi+Δ is average profit per each cow after adding a genetic unit in I characteristic, P_{mi} is average profit per each cow before genetic progress and Δ is I increase of character which is used to determine economic coefficients. Optimization of dynamic planning depends on replacement decisions in each state and stage which depends on operation in current state and optimized decision in next stage. In order to optimize production system, Markov chain simulation in the probable dynamic planning method is used. A set of Markov processes is considered as follow and every moment is placed in a particular state of $S_1,\ldots, S_n$ and the state of system changes in discrete times and regular intervals according to a set of probabilities. Accordingly, if the state is indicated for times t = 1.2…. by q_t, in order to show the operation of this process in format of Markov processes, the current state should be determined based on previous states which is shown in the following equation:

$$P(q_t = S_j | q_{t-1} = S_i, q_{t-2} = S_k, \ldots) = P(q_t = S_j | q_{t-1} = S_i)$$

In this equation, *P* (q_t) shows system state and *P* $(q_t = S_j/q_{t-1})$ is a transient probability which defines the movement from one state to another along a determined period. Accordingly, future behavior of the system depends on its current state. In this study, planning horizon is 10 lactation period and each period is a stage to decision making. It should be noted that by considering 10 calving in the model, in fact we do not have the 11th calving. So, system value does not affect decision making after planning horizon and is considered as zero and since in the last lactation period the cow is replaced intentionally, system value in the last stage equals to slaughter or scrap value in management concepts. State variables used in dynamic planning to describe cows situations includes power generated in 3 levels with a production less than 5000 kg, 5000-7000 kg and more than 7000 kg which include 0.02, 0.35 and 0.63 percent of cows respectively and reproduction operation classified in 4 levels by calving intervals of 410, 450, 490 and 530 days. To indicate state parameters, condition vector of the cow at Tth stage is defined as follow:

$$S_T = [S_t^{parity}, S_t^{prod}, S_t^{reprod}]$$

Which S_t^{parity} is the number of lactation period of dairy cow, $S_t^{parity} = 1,2,\ldots,10$, S_t^{prod} is production capacity ($S_t^{prod} = 1,2,3$), 1 for low production dairy cow, 2 for medium and 3 for high production. and S_t^{reprod} is the condition in pregnancy time $S_t^{reprod} = 1,2,3,4$, $S_t^{reprod} = 1$ is is an ideal state (there is no delay in pregnancy), 2 is a state with 40 days delay in pregnancy and calving in next year, and respectively, 3 and 4 are 80 and 120 days delay in pregnancy. A decision made at the end of T stage is (maintenance = 0 and replacement = 1). Decide to maintain means that the cow will remain another calving period in the herd. Replacement decision relates to results of cow sale and replacement with a new cow in the first lactation period.

Function of lactation period efficiency in each stage is as follow:

If we decide to maintain the dairy cow:

$R(s^{parity,prod,reprod}, x = 0) = MR(s^{parity,prod,reprod}) - FC(s^{parity,prod}) - TL(s^{parity,prod,reprod})$

And if decide to replace livestock with heifer:

$R(s^{parity,prod,reprod}, x = 1) = MR(s^{parity,prod,reprod}) - FC(s^{parity,prod}) - TL(s^{parity,prod,reprod}) - HC + SR(s^{parity}) + GP(s^{parity})$

Which $MR(s^{parity,prod,reprod})$ is milk production efficiency and is a function of lactation period, production capacity and pregnancy condition, $FC(s^{parity,prod})$ is nutrition cost which is function of lactation period and production capacity, $TL(s^{parity,prod,reprod})$ is losses value and is a function of lactation, production capacity and pregnancy condition. HC Is the cost of replaced heifer $SR(s^{parity})$ is efficiency of cow sale to slaughterhouse and is a function of lactation and $GP(s^{parity})$ is the value of genetic progress and is a function of lactation. Efficiency and costs which are not dependent on replacement rate, removed from the model. Optimized decision calculated numerically with a continuous repeat using CompEcon toolbox in MATLAB software [13]. Continuous repeat can be used to optimization under an infinitive planning horizon and when some the state are relatively small. Also in this study, annual profit of the cattle designed by the MATLAB programming language to simulate bio-economic system of cattle and then the amount of revenues and costs estimated in the system and finally relative emphasize calculated as follow:

$$\mathrm{RE} = \frac{(\boldsymbol{EV_i} \times \boldsymbol{GSD_i})}{\sum_{\boldsymbol{i=1}}^{\boldsymbol{t}}(\boldsymbol{EV_i} \times \boldsymbol{GSD_i})} \times 100$$

Which RE EV_i, GSD_i are relative emphasize, economic value and genetic standard deviation of the i^{th} characteristic and t is the number of characteristics in the correction objective. It should be noted that different genetic standard deviation must be derived from valid scientific sources [13,14]. By comparing relative emphasize between countries, it is possible to make essential decisions in order to sperm imports and improving progeny test programs. After optimizing production system for replacement and culling decisions for the cattle, one unit is added to average of the considered character and then production system can be optimized again according to this change. Current system value calculated in optimized condition before and after changing the characteristic and economic value and relative emphasize obtained from their difference.

RESULTS

In this study, revenues and costs are represented separately. The results show that the most of revenues and costs of dairy cows breeding unit is obtained from milk sale (89% of the total revenues) and costs related to health and nutrition (55% of the total costs) respectively. Economic value of a characteristic calculated for production and operation characteristics which is defined as change in profit for each dairy cow in year for one unit genetic merit of considered characteristic when other characteristic remain stable. Economic value of characteristics in non-optimized conditions of the system has been shown in *Table 2*. Results showed that economic value of a characteristic follow different factors such as production, economic and nutrition parameters of production system. In this study, optimizing livestock replacement and culling policies carried out in the format of productive and reproductive characteristics. *Table 3* shows the current expected value using replacement strategies and optimized elimination for three capacitive livestock group. It can be seen as increases of culling rates as the cow get older. By considering 10 calving in the model, we do not have the 11th calving. In 10th calving, there is no future condition assumption for cow and system value in this stage is equivalent to scrap value. Such that, system value after the end of planning horizon do not impact the decision making and would be considered as zero. For 9th calving, since its future condition is 10th calving, the amount of elimination is much greater than other calving. One of the main criteria in estimating current expected value is organizing cows in the cattle based on future revenue and cost and according to this amount, decides to maintain or cull the cow in the herd. Therefore, without considering these values, the cows are culled earlier than optimized time which leads to cattle profitability reduction. Probability of transition from one lactation period to next period using data related to reproductive condition (4 states of calving interval) in every lactation period has been represented using logistic regression in *Table 4*.

Table 2. *Economic value of characteristics in non-optimized conditions of the production system*

Trait	Economic Value (Riyal)
Calving interval	38764.84
Calving rate	41966.26
Survival rate 24 h after calving	31123.38
Milk production	52806.22
Milk fat	-90500.69
Lifetime of production	-1354.72
Mature live weight	44448.54
Birth weight	-9377.8
Preweaning daily gain	14809.23
Postweaning daily gain	23952.72
First calving age	45951.32

Assume that 0.34 indicates the ideal probability of calving interval in the first lactation. Coefficients related to different levels of milk production for low, medium and high productive levels are 0.02, 0.35 and 0.63 respectively. To calculate economic values of characteristics in optimized condition, first, the coefficients related to different productive and reproductive conditions of different lactation periods obtained. After estimating multiplication of current expected values to coefficients related to different productive and reproductive conditions of different lactation periods, the weighted average of total current expected values in frequency of herd composition

Table 3. *Current expected value of different productive and reproductive conditions related to different lactation periods (in million Riyals)*

Lactation	Production Capacity											
	Low Production				Average Production				High Production			
	Pregnancy Status				Pregnancy Status				Pregnancy Status			
	a	b	c	d	a	b	c	d	a	b	c	d
1	9.540371059 (K)	1.537438682 (K)	3.534198504 (K)	5.531073751 (K)	5.505448073 (K)	7.502515695 (K)	0.499275518 (K)	496150765.2 (K)	5.467387450 (K)	7.464455072 (K)	9.461214894 (K)	1.458090142 (K)
2	4.545097240 (K)	6.542164862 (K)	8.538924684 (K)	0.535799932 (K)	8.511106888 (K)	0.508174511 (K)	2.504934333 (K)	501809580.5 (K)	..474346944 (K)	2.471414566 (K)	5.468174388 (K)	7.465049635 (K)
3	6.543259387 (K)	8.540327009 (K)	0.537086832 (K)	2.533962079 (K)	9.510980426 (K)	2.508048049 (K)	4.504807871 (K)	6.501683118 (K)	476448765.8 (K)	0.473516388 (K)	2.470276210 (K)	5.467151457 (K)
4	6.535657786 (K)	9.532725408 (K)	1.529485231 (K)	3.526360478 (K)	5.505855977 (K)	7.502923599 (K)	9.499683421 (K)	1.496558669 (K)	474476134.4 (K)	7.471543756 (K)	9.468303578 (K)	1.465178826 (K)
5	0.523315284 (K)	2.520382906 (K)	4.517142728 (K)	7.514017975 (K)	5.496740729 (K)	7.493808351 (K)	0.490568174 (K)	4.487443421 (K)	469431334.4 (K)	6.466498956 (K)	8.463258778 (K)	1.460134026 (K)
6	1.507869673 (K)	3.504937295 (K)	6.501697117 (K)	8.498572364 (K)	3.485253612 (K)	5.482321234 (K)	8.479081056 (K)	0.475956304 (K)	462927385.6 (K)	9.459995007 (K)	1.456754830 (K)	3.453630077 (K)
7	5.490797701 (K)	7.487865323 (K)	9.484625145 (K)	1.481500393 (K)	3.472848645 (K)	5.469916267 (K)	7.466676089 (K)	0.463551337 (K)	456411188.1 (K)	3.453478810 (K)	5.450238632 (K)	7.447113879 (K)
8	4.473874735 (K)	6.470942357 (K)	8.467702179 (K)	1.464577427 (K)	6.461273811 (K)	8.458341433 (K)	1.455101256 (K)	3.451976503 (K)	451622147.0 (R)	3.448689769 (R)	5.445449591 (R)	7.442324838 (R)
9	7.459805688 (R)	9.456873310 (R)	2.453633133 (R)	4.450508380 (R)	4.453201033 (R)	6.450268655 (R)	8.447028477 (R)	0.443903725 (R)	445770796.1 (R)	3.442838418 (R)	5.439598240 (R)	7.436473487 (R)
10	4.450928367 (R)	6.447995989 (R)	8.444755811 (R)	0.441631059 (R)	4.444981291 (R)	6.442048913 (R)	8.438808735 (R)	0.435683983 (R)	438290830.9 (R)	1.435358453 (R)	3.432118275 (R)	5.428993522 (R)

a: ideal pregnancy status, b: 40 days delay in pregnancy, c: 80 days delay in pregnancy, d: 120 days delay in pregnancy

Table 4. *Results related to probability of reproductive conditions in different lactation periods with logistic regression*									
Calving Interval	**Lactation**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
410 Days (ideal pregnancy status)	0.34	0.33	0.31	0.30	0.29	0.28	0.26	0.23	0.22
450 Days	0.23	0.22	0.21	0.20	0.20	0.19	0.18	0.18	0.17
490 Days	0.15	0.15	0.14	0.13	0.13	0.12	0.14	0.15	0.15
530 Days	0.28	0.30	0.34	0.37	0.38	0.41	0.42	0.44	0.44

Table 5. *Economic value of characteristics in optimized and non-optimized conditions of production system*		
Trait	**Economic Value in Non-optimized Conditions (Riyal)**	**Economic Value in Optimized Conditions (Riyal)**
Calving interval	38764.84	16772.5
Calving rate	41966.26	90808.8
Survival rate 24 h after calving	31123.38	67311.3
Milk production	52806.22	108721
Milk fat	-90500.69	-28462
Lifetime of production	-1354.79	4433.5
Mature live weight	44448.54	98778.1
Birth weight	-9377.8	10019.2
Pre-weaning daily gain (kg)	14809.23	28849.4
Post-weaning daily gain (kg)	23952.72	47863.9
First calving age	45951.32	104447

Table 6. *Relative importance of characteristics in optimized and non-optimized condition of production system*				
Trait		**Genetic Standard Deviation**	**Relative Importance (%) in Optimized Condition**	**Relative Importance (%) in Non-optimized Condition**
Productive	Milk production	561.7	92.55	95.62
	Milk fat	14.9	-0.642	-4.34
Reproductive	Age at first calving	15	2.37	2.22
	Calving interval	16.52	0.42	2.06
Growth	Postweaning daily gain	24.95	1.81	1.93
	Preweaning daily gain	26.15	1.15	1.25
	Mature live weight	13.32	2.00	1.9
Survival	Productive Life Time	0.29	0.0195	-0.001
	Birth weight	21.44	0.32	-0.64

extracted to determining the amount of optimized state profit in base scenario. After optimizing production system for replacement and culling policies within the cattle to calculate economic value of a characteristic, one unit added to the average of the considered characteristic and based on this change, production system optimized again. Current value of the system calculated in optimized conditions before and after characteristic change and economic value obtained from their difference. In this study, absolute economic coefficients in optimized condition of production system and economic value of characteristics in optimized and non-optimized conditions of production system are represented in the *Table 5*. According to this table, economic value of milk production, age of the first calving and calving intervals in non-optimized condition of production system are 52805.22, 45951.32 and 38764.84 Riyals per kg respectively and after optimizing economic value system these values obtained as 108721.4, 104447 and 16772.5 Riyals per kg for a cow per year. According to *Table 6* relative importance of characteristics in optimized and non-optimized condition of production system milk production in Optimized Condition and non-optimized condition were 92.55, 95.62 percent respectively.

DISCUSSION

According to the results, milk production has the highest economic value. Positive economic value for milk production indicates that genetic improvement of milk production has positive effect on the system. It should be noted that any factor which leads to reduce costs of milk production or increase the revenue obtained from milk sale, leads to increase economic value of milk production. The differences between economic values of characteristics in optimized and non-optimized conditions are due to using optimized livestock replacement method which was used as farmer policy in replacement and impacts the profit. In optimized condition in order to improve future profitability of cow, elimination decisions are based on predicted future revenues. In non-optimized condition, cows are removed earlier or later than optimized time and therefore profitability is reduced. The role of optimization in total profitability has been reported in different studies. Accordingly, in order to maximize cattle profit, elimination decisions should be optimized. Mir Mahdavi et al.[15]; Sadeghi et al.[16] and Sahragard et al.[17] estimated economic value of milk production 232, -353.6 and 983.3 Riyals respectively. Also, in this study, economic values of milk fat, production lifetime and birth weight in non-optimized conditions are -90500.69, -1354.72 and -9377.8 Riyals respectively and in optimized condition are -28461.8, 4433.5 and 10019.2 respectively. Sayed Sharifi et al.[14] reported economic values of milk production, age of the first calving and calving intervals in non-optimized condition of production system -7297.84, -80752.14 and -197416.81 respectively and economic values of these characteristics in optimized condition of production system 20833.51, -34277.73 and -6450.21 Riyals respectively.

Negative coefficients indicate profit reduction after increasing one genetic unit because of higher cost than revenue [18]. According to the various economic values in different reports, it seems that the reason is significant variety of production systems, management, production level and market conditions and local economy which means input price change and increasing price of milk sale. Studying reported sources indicate that in most of the studies economic coefficients of production characteristics and one or two characteristics of durability and reproduction has been estimated and relative importance of different characteristic in reported studies for the country and other provinces are differ from each other. Accordingly, the comparison of relative importance of characteristics obtained from this study has been represented in *Table 6*. Using dynamic planning as one of the optimization methods to realize future condition from the point of management variables of production system such as elimination and replacement policies, leads to unbiased estimation of economic values and relative importance. From *Table 6* it can be seen that in optimized condition of production system, the characteristics of milk production, age of first calving and mature live weight have the highest relative importance therefore, in order to increase production system efficiency, these characteristics should be selected in priority. According to using strategies of optimized replacement and culling dairy cows with ages higher than optimized age, observed that there is difference in estimating relative importance in comparison to non-optimized condition of production system in terms of characteristics ranking. Non-optimized production system leads to skewed estimation of economic values and relative importance and selection improper orientation in selection indicator [19]. Therefore, it is better to perform economic values and relative importance of characteristics for optimized systems and not for non-optimized systems.

The simultaneous change in the price of inputs and outputs in the system balances the effects of each other in determining the economic values of the traits, but a large increase in output prices than inputs, and vice versa causes a lot of changes in the economic value of the traits. Therefore, in these cases, it is suggested that the economic values of the traits should be recalculated again.With regard to the process of changes in economic values, increases in food prices have high influence on the profitability of breeding systems. Therefore, the pricing policy should be more precise and more sensitive. Using dynamic planning as one of the optimization methods for identifying future conditions in terms of management variables of the manufacturing system, such as culling and replacement policies, will result in an unbiased estimation of the economic values of the traits. The non-optimal production system is a fundamental challenge in estimating the economic value of the traits. Due to the long-term effects of breeding, it is necessary to determine the economic values for optimal systems. The reason for the differences between the economic values of the traits in optimal conditions and non-optimal conditions is the use of an optimal replacement strategy of the livestock so that it influences the stockbreeder's policy in the replacement of the profit. In order to improve the future profitability of cows, deciding to remove livestock should be based on the anticipated future incomes of the cows.

REFERENCES

1. Harris DL: Breeding for efficiency in livestock production, defining the economic objectives. *J Anim Sci,* 30 (6): 860-865, 1970. DOI: 10.2527/jas1970.306860x

2. Groen AF: Economic values in cattle breeding. I. Influence of production circumstances in situation without output limitations. *Lives Prod Sci*, 22 (1): 1-16, 1989. DOI: 10.1016/0301-6226(89)90121-8

3. Kahi AK, Nitter G: Developing breeding schemes for pasture based dairy production systems in Kenya. I. Derivation of economic values using profit functions. *Lives Prod Sci,* 88 (1-2): 161-177, 2004. DOI: 10.1016/j.livprodsci.2004.10.008

4. Hazel LN: The genetic basis for constructing selection indexes. Genetics, 28 (6): 476-490, 1943.

5. Ponzoni RW: Genetic Improvement of Hair Sheep in the Tropics. FAO *Anim Prod Health Paper 101*, *Rome*, 1992.

6. Rewe TO, Indetie D, Ojango J, Kahi AK: Economic value for production and functional traits and assessment of their influence on genetic improvement in the Boran cattle in Kenya. *J Anim Breed Genet,* 123 (1): 23-36.2006. DOI: 10.1111/j.1439-0388.2006.00558.x

7. De Vries A: Economics of delayed replacement when cow performance is seasonal. *J Dairy Sci*, 87 (9): 2947-2958, 2004. DOI: 10.3168/jds.S0022-0302(04)73426-8

8. Shadparvar A: A review on estimation of economic values in Iran. *Fifth Congress of Livestock Science in Iran*. Sep, 2012. Esfahan Industrial Univ, p.8, 2012.

9. Kalantari AS, Mehrabani-Yeganeh H, Moradi M, Sanders AH, De Vries A: Determining the optimum replacement policy for Holstein dairy herds in Iran. *J Dairy Sci*, 93 (5): 2262-2270, 2010. DOI: 10.3168/jds.2009-2765

10. Heikkila AM, Nousiainen JI, Jauhiainen L: Optimal replacement policy and economic value of dairy cows with diverse health status and production capacity. *J Dairy Sci*, 91 (6): 2342-2352, 2008. DOI: 10.3168/jds.2007-0736

11. Khodaverdi H, Zibaei M, Tahor A: Determine the best time of replacement Komnain Jander in the condition of uncertainty using probable dynamic planning method. 955, *Agri Econom,* 7 (3): 59-84, 2013.

12. Sadeghi-Sefidmazgi A, Moradi-Shahrbabak M, Nejati-Javaremi A, Miraei-Ashtiani SR, Amer PR: Breeding objectives for Holstein dairy cattle in Iran. *J Dairy Sci*, 95 (6): 3406-3418, 2012. DOI: 10.3168/jds.2011-4573

13. Miranda MJ, Fackler PL: Applied Computational Economics and Finances. Cambridge. Mass: MIT Press, 169-170, 2002. Print.

14. Sayed Sharifi R, Shadparvar AA, Hossein-Zadeh NG: Estimating economic values of some of the production and reproduction characteristics in the dairy cows cattle in north west of the country in optimized and non-optimized production system. *J Anim Sci Res,* 24 (1): 159-161, 2014.

15. Mirmahdavi SA, Eskandari P, Shadparvar A, Ghorbani A: Estimating economic coefficients of milk production and lifetime in minimum cost trends in three Holstein farm. *J Agr Sci Tech*, 2, 172, 2006.

16. Sadeghi A: Estimation of production economic conditions and lifetime in Holstein cows. *Master of Art Thesis,* Tehran Univ, 2005.

17. Sahragard S, Shadparvar A, Asadollahi S: Estimation of economic coefficients of milk production and body weight in cows of Lorestan province. *4th Congress of Livestock Sciences in Iran*. Nov, 2010, Ferdosi Mashhad. Univ. p.309, 2010.

18. Bekman H, Van Arendonk JAM: Derivation of economic values for veal, beef and milk production traits using profit equations. *Livest Prod Sci*, 34 (1-2): 35-56, 1993. DOI: 10.1016/0301-6226(93)90034-F

19. Cassandro M, Pretto D, De Marchi M, Penasa M, Lopez-Villalobos N: Economic values of milk production and milk coagulation properties in Italian Holstein-Friesian dairy cattle. *10th World Congress on Genetics Applied to Livest Prod Sci,* Aug, 2014 Vancouver - Canada, 2014.