IJAS Iranian Journal of Applied Animal Science

Economic Opportunity Survey of Small Dairy Farms in the Southwest Part of Iran

Research Article

M. Vatankhah[1*], M. Faraji[2], A.A. Gharadaghi[3] and A.R. Aghashahi[3]

[1] Department of Animal Science, Agriculture and Natural Resources Research Center, Shahrekord, Iran
[2] Jahad Agriculture Organization of Chaharmohal and Bakhtiari Province, Shahrekord, Iran
[3] Animal Science Research Institute, Karaj, Iran

Received on: 18 Mar 2012
Revised on: 15 Apr 2012
Accepted on: 2 May 2012
Online Published on: Mar 2013

*Correspondence E-mail: vatankhah_mah@yahoo.com
© 2010 Copyright by Islamic Azad University, Rasht Branch, Rasht, Iran
Online version is available on: www.ijas.ir

ABSTRACT

In this study 495 smallholder dairy farms in 52 villages of different township in southwestern province of Iran (Chaharmohal and Bakhtiari province) included 1321 lactating cows and 2811 total mature cows (lactating and dry) during winter 2009 to summer 2010 were used to estimate economic opportunities in smallholder dairy farms. Questionnaire survey was used to collect data from last year information, recorded information, direct recording during visit the farm and interview with the small holder farmers. The economic opportunity is the amount of additional revenue that could be obtained if farmers could improve various productivity indexes to meet reasonable targets. The total of economic opportunities per farm per year estimated as 2009.68 US $ included 1354.85 US $ (57.94% total) for average daily milk produce per cow, 475.52 US $ (26.07% total) for average lactation length, 75.04 US $ (4.00% total) for average age at first calving, 37.52 US $ (8.98% total) for average calf production interval and 66.75 US $ (3.00% total) for average calf mortality, respectively. The considerable variation observed for economic opportunities, percent of total and total of economic opportunities in different townships, seasons, breeds and size of herds. Thus, increasing the average daily milk production per cow and average lactation length, as well as decreasing average age at first calving and average calf production interval could affect profit and productivity.

KEY WORDS dairy cattle smallholder, economic opportunities, Iran.

INTRODUCTION

Livestock is an important national resource in Iran. On average, 31.8% of the gross value of agricultural production is attributed to livestock production, which provides the main source of income and an important component of the average diet (Kamalzadeh *et al*. 2008). Dairy farming is one of the most important sub-sectors of husbandry in Iran. There are more than 8.2 million cows in Iran, which produce 9.5 million tons milk annually at present (Ministry of Jihad-Agriculture, 2011). A total of 842000 pure-breed Holstein are kept at intensive dairy farms, which are adequately equipped for modern dairy farming. The majority of the cattle population owned by smallholder farmers under traditional management is native, crossbred and pure-breed Holstein (Bakhshoodeh and Shahnushi, 2009). In addition to their economic importance to farm households and complement of agriculture, cattle are linked to the social and cultural life of several million smallholder farmers especially in villages, as well. In spite of this importance of smallholder dairy farms, little information is available regard to the relative importance of factors influencing the income from dairy farming. In a dairy herd, several factors influence economic revenue. These factors might be related to the animal itself, to the management or to the financial inputs. Similarly, some constraints cost the farmer much

more than others. If these main limiting factors could be determined and resolved, the economic returns would be expected to improve significantly. Such components of production are called economic opportunities (Nordlund *et al*. 2007; Bayemi *et al*. 2007). Some researchers estimated economic opportunities for smallholder dairy farms in Cameroon (Bayemi *et al*. 2007), Pakistan (Ghaffar *et al*. 2007) and Paraguay (Ferreira *et al*. 2007). Although, in all of these studies the highest economic opportunity observed for increasing daily milk production per cow and the lowest was estimated for reducing calf mortality rate, the amount of economic opportunities and relative importance of them were different in various countries. Therefore, the objective of this study was to identify the most economic opportunities to increase profit, as well as management factors cause limitations to efficient production of smallholder dairy farms in the southwest part of Iran.

MATERIALS AND METHODS

Location of study

The study was conducted in Chaharmohal and Bakhtiari province located in southwestern of Iran, where is between 31˚ 9' and 32˚ 48' of North longitude and 49˚ 28' to 51˚ 25' of east latitude from Greenwich meridian. This province is located in the central territory of Zagros Mountains. Altitudes in abide area range from 800 to 2100 meters above sea level.

The climatic is characterized by four distinct seasons. An annual precipitation varies between 250-1600 mm with a mean of 700 mm. The human population in this province is 856000 persons according to census in 2006. More than half of the populations are settled in cities and the other half are settled in villages and tribal regions. The main occupation of people in this province is agriculture and husbandry.

Economic Opportunity Survey (EOS)

Four hundred-five smallholder dairy farms belonged to 52 villages of different township with a total of 1321 lactating cows and 2811 mature cows (lactating and dry) were used to estimate economic opportunities during winter 2009 to summer 2010.

The criteria for selection of a farmer were that a farmer should have 1 to 19 adult cows in a village system, be easily accessible and to have some records on production, reproduction and finance. The descriptions of chosen farmers are shown in Table 1.

Questionnaire survey was used to collect data from last year information, recorded information, direct recording during visit the farm and interview with the smallholder farmer by training technicians. The economic opportunity survey was conducted using the forms designed for this goal and data were entered in to an Excel database in five sections (Nordlund *et al*. 2007) consisting:

1. Milk production from farm per day (yesterday only).
2. Expenses for cattle health care and feeds (sum of purchased feeds, veterinary services and medicines during the last year).
3. Inventory of herd, culls and deaths (number of cattle sold or dead during the past year, average price per each class of animal).
4. Milk and calf production per cow (this section described current milk production per cow on one day, calving date, age at first calving, calf production interval and day in milk).
5. Summary of herd management (this section was necessary for setting targets used in evaluating farm performance).

Table 1 The description of selected smallholder dairy farms

Title	Number of farm	Relative frequency (%)
Season		
Winter	186	37.58
Spring	201	40.61
Summer	108	21.82
Breed		
Native	11	2.22
Crossbred	327	66.06
Holstein	157	31.72
Herd Size		
Small (1-4)	441	89.09
Medium (5-10)	54	10.91

The economic opportunities for each herd were estimated for the number of potential sources of income or costs by using the procedure of Nordlund *et al*. (2007). Briefly, for each variable, the average value of a given herd was compared to a target value that the farmer could realistically obtain. A realistic target was obtained by ranking all the considered herds and using the 80th percentile of the data collected as the goal for variable that higher value is desirable, e.g. lactation length, milk yield and percentage of milk sold to milk produced; and for variable that lower value is better, e.g. calf mortality, average age at first calving and calf production interval the 20th percentile was used as the available target (Table 2).

For the feed costs as a percentage of milk income index 50th percentile was used for target. The economic opportunity was obtained by calculating the difference between the herd average and the target value and multiplying by the value (US $) of a unit change in the variable of interest for five indices (Nordlund *et al*. 2007). The total economic opportunity was calculated by summation of all estimated economic opportunities for each herd and to obtain relative contribution of each economic opportunity from total, the

value of each economic opportunity divided by total and multiplying by 100 for each herd.

Table 2 The targets and percentile of economic indexes of dairy farm productivity calculated in the EOS

Index	Target	Percentile
Percentage of milk sold to milk produced	87%	80th
Calf mortality rate	3.85%	20th
Age at first calving	29 months	20th
Calf production interval	15 months	20th
Lactation length	376 days	80th
Lactating cows as a % of total cows	84.8%	80th
Lactating cows as % of all cattle	42.66%	80th
Milk production per cow per day	18 kg	80th
Feed costs as a % of milk income	75.76%	50th
Cattle health care expenses (US $)	9.21 US $	20th

Statistical analysis

The GLM procedure of SAS (1996) was employed to identify important fixed effects affecting on economic opportunities, percent of each EO from total EO and management indices. The statistical model using to analyze was follows:

$$Y_{ijklm} = \mu + S_i + C_j + B_k + H_l + e_{ijklm}$$

Where:

Y_{ijklm}: were the observations for EO, percent of EO from total and management index.

μ: the overall mean.

S_i: the effect of i^{th} season of recording (i=winter, spring, summer).

C_j: the effect of j^{th} township location of herd.

B_k: the effect of k^{th} breed of cow (k=native, crossbreed, Holstein).

H_l: the effect of l^{th} herd size (small, medium).

e_{ijklm}: the effect of residual.

The t-test was used to compare least square means of different levels of each effect in the model. To analyze the percent of EO traits, the data was transformed by log and reported the anti-log of values after analyze.

RESULTS AND DISCUSSION

The overall mean and least square means (±SE) of economic opportunities in smallholder dairy farms for different level of fixed effects (US $) are shown in Table 3. The total EO per herd, considering all indices, is also shown in Table 3 (2009.68 US $). Among five economic indices the average milk production per cow per day offered the highest opportunity (1354.85 $) and with 57.94% of total EO (Table 4), could contribute much to increase income. The average lactation length was also important and with 475.52 US$, accounting for 26.07% of total EO among five different indices evaluated.

Although, the average of calf production interval offers less EO compared to the other considerable indices, table 4 shows that the calf mortality rate have the lowest percent of total EO. The overall mean EO from decreased calf mortality rate, age at first calving and calf production interval were low and accounting for 3%, 4% and 8.98% of the available total EO, respectively (Table 4).

Table 3 shows that the effect of season was significant on EO resulted from reducing calf production interval and increasing in lactation length only (P<0.01). The EO obtained from reduced calf production interval in summer was higher than other seasons and EO from increased lactation length in spring was lower than other seasons. Table 4 shows that the percent of EO as total from reduced age at first calving in spring was higher than other seasons (P<0.05) and for increased lactation length was lower than other seasons (P<0.01).

The effect of township and breed of cattle factors were significant (P<0.05 and 0.01) on EO resulted from all of the indices and total EO, except for calf mortality rate. The effect of township and breed factors were significant on percent of total EO accounted for the lactation length and milk production per cow per day only (P<0.05). The highest least square means of total EO and EO resulted from all indices except lactation length observed in the native breed and the lowest estimated for Holstein breed. However, the highest EO and percent EO as total EO of this index observed in Holstein and the lowest was in native breed, due to the lower lactation length in Holstein cows compared with other breeds, (Tables 3 and 4).

The least squares means of considered traits for different townships were omitted from the results as it was thought to be of less interest and hence excluded from Tables 3 and 4. There was significant (P≤0.01) variation in considered traits between different townships, which might be attributed to variation in the environmental conditions, differences in local finance and market and other managerial factors. Indeed, the least square means of total EO and EO resulted from all of indices except calf mortality rate and calf production interval, were significantly (P<0.05 and 0.01) higher in medium herd size than small herd size (Table 3).

However, the least square means of percent EO from increasing lactation length in medium herd size was higher (P<0.01) than small herd size only (Table 4). The overall mean and least squares means of 5 management indices for different level of some fixed effects are shown in Table 5. No economic opportunities were estimated for these indices. However, the calculated values were compared to benchmark values and serves as an obvious motivational factor for other variables and to emphasize the importance of solving problems related with these factors.

Table 3 Least square means (±SE) of economic opportunities in smallholder dairy farms for different level of fixed effects (US $)

Effect	Calf mortality rate	Age at first calving	Calf production interval	Lactation length	Milk production per cow per day	Total EO
Overall mean	66.75±10.76	75.04±12.66	37.52±3.23	475.52±34.19	1354.85±66.86	2009.68±74.00
Season	NS	NS	*	**	NS	NS
Winter	70.57±33.14^{a}	133.43±37.90^{a}	47.62±9.14^{b}	804.47±92.00^{a}	2140.28±180.28^{a}	3196.47±194.95^{a}
Spring	72.57±33.14^{a}	165.43±38^{a}	59.90±9.14^{ab}	582.76±92.00^{b}	2167.14±180.48^{a}	3047.81±195.05^{a}
Summer	113.05±38^{a}	117.33±43.52^{a}	64.10±10.57^{a}	594.10±105.43^{a}	2372.76±206.66^{a}	3261.43±223.43^{a}
Township	NS	*	**	**	**	**
Breed	NS	**	**	**	**	**
Native	114.66±76.28^{a}	263.62±87.33^{a}	111.24±21.14^{a}	402.86±211.52^{a}	3130.57±414.86^{a}	4022.95±448.48^{a}
Crossbreed	93.24±23.14^{a}	114.67±26.48^{a}	49.05±6.38^{b}	626.67±64.09^{a}	2216.86±125.71^{b}	3100.38±335.90^{b}
Holstein	48.19±27.05^{a}	38.09±30.95^{b}	11.33±7.52^{c}	951.81±75.14^{b}	1332.86±47.24^{c}	2382.38±159.24^{c}
Herd size	NS	*	NS	**	**	**
Small	80.48±27.05^{a}	92.19±30.95^{b}	61.90±7.52^{a}	245.90±75.05^{b}	1507.33±1472.38^{b}	1987.71±159.14^{b}
Medium	90.28±42.48^{a}	185.33±48.67^{a}	52.57±11.81^{a}	1074.95±117.90^{a}	2946.19±231.14^{a}	4349.43±249.81^{a}

* significant at P<0.01; ** significant at P<0.05 and NS: non significant.
The means within the same column with at least one common letter, do not have significant difference (P>0.05).

Table 4 Least square means (±SE) of economic opportunities percent in smallholder dairy farms for different level of fixed effects

Effect	Calf mortality rate	Age at first calving	Calf production interval	Lactation length	Milk production per cow per day
Overall mean	3.00±0.47	4.00±0.52	8.98±1.09	26.07±1.57	57.94±1.72
Season	NS	*	NS	**	**
Winter	2.76±1.43^{a}	3.11±1.59^{b}	2.67±3.30^{a}	31.42±4.31^{a}	56.47±4.65^{b}
Spring	2.92±1.44^{a}	5.90±1.60^{a}	6.19±3.30^{a}	14.58±4.31^{b}	67.13±4.65^{a}
Summer	3.87±1.65^{a}	4.05±1.83^{ab}	5.66±3.78^{a}	15.07±4.94^{b}	70.78±5.33^{a}
Township	NS	NS	NS	**	**
Breed	NS	NS	NS	**	**
Native	4.29±3.30^{a}	8.00±3.67^{a}	45±7.60^{a}	31.42±9.91^{b}	84.34±10.69^{a}
Crossbreed	3.56±1.00^{a}	4.72±1.11^{a}	5.41±2.30^{a}	18.63±3.00^{b}	68.33±3.24^{a}
Holstein	1.71±1.17^{a}	1.33±1.30^{a}	8.67±2.70^{a}	39.03±3.52^{a}	41.71±3.80^{b}
Herd size	NS	NS	NS	**	ns
Small	3.61±1.17^{a}	4.72±1.30^{a}	7.39±2.70^{a}	15.63±3.52^{b}	66.33±3.79^{a}
Medium	2.76±1.84^{a}	3.97±2.04^{a}	2.30±4.23^{a}	25.08±5.52^{a}	63.26±5.96^{a}

* significant at P<0.01; ** significant at P<0.05 and NS: non significant.
The means within the same column with at least one common letter, do not have significant difference (P>0.05).

Table 5 Least square means (±SE) of management indices in smallholder dairy farms for different level of fixed effects

Effect	Percentage of milk sold to milk produced	Lactating cows as a % of total cows	Lactating cows as % of all cattle	Feed costs as a % of milk income	Cattle health care expenses (US $)
Overall mean	62.75±1.39	84.83±1.12	42.66±0.81	75.76±1.80	37.43±1.90
Season	NS	NS	NS	NS	NS
Winter	51.59±3.63^{a}	79.86±3.37^{a}	42.29±2.45^{a}	88.59±6.07^{a}	40.86±5.71^{a}
Spring	48.41±3.62^{a}	80.74±3.37^{a}	43.46±2.45^{a}	89.20±6.00^{a}	42.09±5.71^{a}
Summer	49.88±4.14^{a}	87.08±3.86^{a}	43.25±2.81^{a}	97.63±6.47^{a}	36.38±6.57^{a}
Township	**	NS	*	**	NS
Breed	**	NS	NS	**	NS
Native	21.63±8.38^{c}	76.66±7.75^{a}	42.00±5.63^{a}	136.17±15.41^{a}	53.24±13.14^{a}
Crossbreed	57.91±2.46^{b}	83.43±2.35^{a}	43.71±1.71^{a}	86.85±3.26^{b}	28.57±4.00^{a}
Holstein	70.34±2.91^{a}	87.58±2.75^{a}	44.29±2.00^{a}	65.24±3.77^{c}	37.52±4.67^{a}
Herd size	*	*	NS	NS	*
Small	46.07±2.95^{b}	86.16±1.40^{a}	44.28±1.00^{a}	91.35±5.31^{a}	46.19±4.67^{a}
Medium	53.85±4.64^{a}	78.27±3.56^{b}	40.26±2.55^{a}	92.08±7.07^{a}	33.43±7.33^{b}

* significant at P<0.01; ** significant at P<0.05 and NS: non significant.
The means within the same column with at least one common letter, do not have significant difference (P>0.05).

Table 5 shows that the management indices over different seasons were relatively constant and differences in least squares means between various seasons were not significant (P>0.05) for each of these indices. The effect of township was significant for percentage of milk sold to milk production (P<0.01), lactating cows as percent of all cattle (P<0.05) and feed cost as a percent of milk income (P<0.01). The least squares means of percentage of milk sold to milk produced increased significantly (P<0.01) from native breed to Holstein cattle, while, feed costs as a per-

cent of milk income decreased from native breed to Holstein (P<0.01). The least squares means of percentage of milk sold to milk produced in small herd size was lower than medium herd size, but lactating cow as a percent of total cows and cattle health care expenses in small herd size were higher than medium herd size (P<0.05).

The economic opportunity survey determines the additional profit available if the targets are achieved. Results of the EOS were valuable in identifying management issues that could affect profit and productivity. Milk production per cow per day offered the greatest EO and was 2.85 times larger than increasing lactation length, the index with the second greatest EO, followed by age at first calving, calf mortality rate and calf production interval. The order of different indices observed in this study is in agreement with Bayemi *et al*. (2007), Ghaffar *et al*. (2007) and Ferreira *et al*. (2007), however, the amount of economic opportunities and relative importance were different from their results, due to differences in management factors and local finance. For example, the relative importance of increasing milk production per cow per day in this study (57.94%) was lower than reported value (85%) by Ghaffar *et al*. (2007) and Ferreira *et al*. (2007). The economic opportunity from increased milk yield per cow per day is the extra gross revenue resulted from milk sales if the herd produced at the level of the target (18 kg per cow per day).

The milk yield in a dairy farm might be improving by increasing number of lactating cows and production per cow per day. Nordlund *et al*. (2007) reported that low production were related with many factors such as low genetic potential of the animal, inadequacy of diet, existence parasitism and disease, poor reproduction resulting in disproportionate numbers of cows in late stages of lactation, as well as, other factors. Increasing average lactation length as a second greatest EO is a primary determinant of overall milk production. Longer lactation lengths result in fewer dry days, which consequently less feed are necessary to maintain dry cows through non-lactating periods, therefore cows with longer lactations usually will have greater average annual production (Nordlund *et al*. 2007). Short lactation lengths might be related to breed of cow, milk production level, nutrition status, availability of feed, availability of labor to milk cows, and lots of other factors. Decreasing the age at first calving offered less EO compared to the several of the other factors influencing revenue, which was in accordance with Ghaffar *et al*. (2007). This result could be attributed to the relatively small number of cows with the first calving in selected herds. The age at first calving within each breed of cattle was highly influenced by the way heifers were fed prior to puberty (Bayemi *et al*. 2007). The overall average EO and percent as total EO from decreased calf mortality was low because of the low mortality rate and target value for this index in considered herds, due to the difference between overall mean of mortality rate (6.99%) and target value (3.85%) was low and decreasing mortality rate to achieved target value, increased income slightly. The EO and percent as total EO from decreasing calf production interval such as Ghaffar *et al*. (2007) and Bayemi *et al*. (2007) was comparatively poor, because the calculation did not take into account any additional milk produced per annum from a shorter interval. Ghaffar *et al*. (2007) reported that instead economic opportunities were evaluated separately; interventions were likely to improve a number of indices simultaneously. Such an outcome could be based on combining effects of nutrition, reproduction, environment and genetics. For example, improving nutrition, especially during the pre and post partum periods should help increase milk yield and allow animals to return to estrus sooner. Providing feed for short periods at a strategic time, such as late pregnancy, is one approach which may work to reduce calving to first service intervals. Indeed, better nutrition during lactation might increase lactation length, a contributor to milk produced per cow on one day.

Although, a change of genetic in milk producing animals, either through crossbreeding or selection, can also increase income; in the short term, emphasis on improved feeding and management of existing animals is likely to be the most economically efficient strategy, to allow these animals to produce at a level closer to their existing genetic potential.

Percentage of milk sold to milk produced in this study was in the range reported by Ghaffar *et al*. (2007), Bayemi *et al*. (2007) and Ferreira *et al*. (2007). Increased this index would usually be associated with increased revenue to the smallholder. Increases in herd size and in production per cow would increase the percentage of milk sold to milk produced, provided family and other uses remain constant. Relatively modest increases in either cow numbers or productivity per cow could yield a dramatic increase in milk sales (Nordlund *et al*. 2007). The lactating cows as a percentage of total cows index was an indirect measure of both reproductive performance of the herd and of the length of lactations. Nordlund *et al*. (2007) reported that in herds with calving intervals of 13 months and dry periods of 60 days with annual turnover rates of about 35%, lactating cows as a percentage of all cows was expected to be approximately 85%-90%, which was more than overall mean calculated in this study (84.83%). The lactating cows as a percentage of all cattle index was an indirect measure of the efficiency of the replacement growing program, the reproductive plan and the focus on dairy production as opposed to raising males for meat production. The value of this index calculated in present study (42.66%) was in reported range (22.2% to 49%) for smallholder farms in the other

countries (Nordlund *et al*. 2007; Ghaffar *et al*. 2007; Ferreira *et al*. 2007).

The feed cost as a percentage of milk income in this study was higher (75.76%) than values reported for smallholder farms in Paraguay (Ferreira *et al*. 2007), due to differences in economical situations. If feed cost as a percentage of milk income was high on a farm compared to local averages, there might be problems of low production per cow or high feed costs relative to other local smallholders (Nordlund *et al*. 2007). However, the overall mean of this index calculated in present study (75.76%) provided a local benchmark to comparing other farms. Cattle health care expenses index enables each smallholder to compare costs of health care to other smallholder farms. The amount of this index was in range reported by Bayemi *et al*. (2007) in Cameroon, however it was higher than value reported by Ghaffar *et al*. (2007) in Pakistan. The significant differences of some EO, percent of EO and management indices in various season and township observed in this study could be due to variation in climatic condition and management factors. The amount of EO resulted from various indices could be related to differences in performance of indices and respective target values. If the performance of index be closer to respective target value, the improving of the index to achieved target value will lead to increasing income slightly and vice versa. For this reason, the performance of some indices such as calf mortality rate, age at first calving, calf production interval and milk yield in native breed were lower than crossbreed and Holstein cattle, and improving these indices to achieving respective target values, resulted higher EO in native breed comparing to crossbreed and Holstein cattle. While, EO resulted from lactation length index in native breed was lower than crossbreed and Holstein cattle due to longer length of lactation in native breed than other breeds especially Holstein cattle.

Results showed increasing milk production per cow per day offers the highest EO in all considered breeds, while the second greatest EO in native breed resulted from reducing age at first calving and in crossbreed and Holstein cattle obtained by increasing the length of lactation. The higher performance of some economic and management indices in medium herd size rather than the small herd size could be attributable to the higher cows in medium herd size comparing to small herd size. Indeed, cattle health care expenses index were higher due to prorate of some veterinary services among more cattle in medium herd size was lower than small herd size.

CONCLUSION

The EOS allows smallholder dairy farmers in southwestern of Iran to compare their index levels with those of their peers who are exceeding the average production or management indices in different seasons, townships, breeds and herds size separately, thus highlighting lost income from their shortfalls. This survey demonstrated abundant opportunity for increasing income of smallholder dairy farmers. Improving the performance of economic and management indices to achieved respective targets estimated in this study should allow benefits to be realized.

REFERENCES

Bakhshoodeh M. and N. Shahnushi N. (2009). Economic efficiency of smallholder intensive dairy farms in Iran: Adjusted for market distortion. Pp. 111 in Proc. EAAE-IAAE Seminar 'Small Farms: decline or persistence' University of Kent, Canterbury.

Bayemi P.H., Webb E.C., Naoussi P. and Manjeli Y. (2007). Economic opportunity survey of small scale dairy farms of the North West Province of Cameroon. *Trop. Anim. Health. Prod*. **39,** 583-592.

Ferreira N., Cattoni C.J., Caceres S.C. and Frutos J. (2007). An economic opportunity survey of small dairy farms in Paraguay. *Trop. Anim. Health. Prod*. **39,** 603-610.

Ghaffar A., Qasim Khan M. and Ullah N. (2007). Integrated approach for improving small scale market oriented dairy systems in Pakistan: participatory rural appraisal and economic opportunity survey. *Trop. Anim. Health. Prod*. **39,** 593-601.

Kamalzadeh A., Rajabbaigy M. and Kiasat A. (2008). Livestock production systems and trends in livestock industry in Iran. *J. Agric. Soc. Sci*. **4,** 183-188.

Ministry of Jihad-Agriculture. (2011). Statistics of Agriculture. http://www.maj.ir. Accessed Feb. 2011

Nordlund K.V., Goodger W.J., Bennett T.B., Shamsuddin M. and Klos R.F. (2007). Methods for conducting an economic survey in small-olding dairy farms. *Trop. Anim. Health. Prod*. **39,** 557-566.

SAS Institute. (1996). SAS®/STAT Software, Release 6.11. SAS Institute, Inc. Cary, NC. USA.