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# A Model to Analyse and Classify the Level of Farmer's Qualification in Sustainable Dairy Farming

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**Abstract:** This study investigates performance characteristics of dairy farms derived from zootechnical data in a survey. The studied farms were characterised as qualified, average and unqualified by a multiple response test analysing a set of algorithmic rules based on three categories of zootechnical data: farm size, animal housing and milking mechanisation. Other studied data regarding the parameters of animal nutrition, animal husbandry and animal health will be published later. The parameters of farm size included: number of dairy cows, area of cultivated land, milk production per farm, genetic selection for milk yield and artificial insemination. The parameters of animal housing were type of barn, type of barn floor, storage for feed materials, infirmary unit, barn structure for natural ventilation and provision of drinking water. The parameters of milking mechanisation were type of milking device and way of milking, calibration of milking device, sanitation, pre-milking and hygiene before and after milking. The applicability and validity of the results obtained from the multiple response test were made by the comparisons with the results obtained from the average statistics applied to the same data. The mode statistic, but not the mean statistic meets the terms of results obtained from the multiple response test for the characterisation of farms within each of three sets of zootechnical data. The method of multiple response analysis determining the level of farmer's qualification in a sustainable dairy farming was reproducible. The overall results indicated that 27% of farms were qualified, 38% were averaged and 35% were unqualified farms in the activity of sustainable dairy farming. These figures were discussed with previous findings. The way of present classification helps the regional policy makers to efficiently provide the milk services. Important recommendations and possible changes in current dairy policies were underlined in the light of the obtained results for the policy makers as well as the dairy unions and associations.

**Key words:** Questionnaire, multiple response test, regression, farmer's qualification, sustainable dairy farming, performance characteristics

## INTRODUCTION

In last two decades, official figures indicate significant reduction in dairy cattle population associated with a slight increase in total milk production in Turkey (FAO, 2005). Low milk yield per cow per lactation period (1400-1500 versus 5000-7000 kg year$^{-1}$) is reported for Turkey, as compared to developed countries (SPO, 2000). As overall, 71.9% of dairy and beef cattle farms in Turkey have an average of <5 cattle per farm and 67% of farms cultivate an agricultural land of <50 ha$^{-1}$ per farm (SPO, 2000). This was officially declared to be due to the smaller size of animal farms, low production yield per head, insufficient production of feeding materials in house and low rate of artificial insemination. Studying the effect of these factors in the regions, where the dairy farming is heavily intense is considered important in order to determine the type and level of sustainability in animal production and to help the policy makers to reform the policies in the field of dairy farming.

The province of Burdur is known to be one of the largest dairy farming regions in Turkey and considered to have a potentiality to be the Netherlands of Turkey. It has a total geographical area of 7,135,000 ha$^{-1}$ and 29.41% of it is allocated for agricultural production, 1.28% for pasture, 45.63% for forest, 4.16% for water fields and 19.52% for non-usable land (Anonymous, 2009a). There are currently 24,886 farmers actively involved in the agricultural production. Of these farms, 1.05% had no land, 31.38% of extra small sized farms (1-19 ha$^{-1}$ land),

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36.92% small sized farm (20-49 $ha^{-1}$ land), 20.43% middle sized farm (50.99 $ha^{-1}$ land) and 10.22% large sized farm (100.999 $ha^{-1}$ land). The majority of farms are considered as family enterprises. The percentage of farms in animal production in Burdur was 1.04% (260 farms), whereas the percentage of farms in both animal and plant production was 71.23% (17,726 farms). The number of cattle in Burdur was 132,571 in 2008 (Anonymous, 2009a), 98.6% of the cattle population were cross breed or pure breed of European Holstein-Friesian or Simmentals. Total milk produced in Burdur was 210,000 ton in 2003 and 250,000 ton in 2007 (Anonymous, 2009a). In 2008 the state has paid 9,962,361.00 TL (an equivalent of 5 Euro million) for a total sum of 253,958 ton milk as a state milk subsidy (Anonymous, 2009a). The milk subsidy is not restricted by the number of dairy cows per farm (Anonymous, 2009b).

Each farmer in Burdur is at least a member of one of the agricultural cooperatives established and operated by the elected farmers. The number of registered farms in the regional farm cooperatives is over 30,000 (UFC-Burdur, 2005). These cooperatives are not however, specialised in the milk business. The provided services are to collect and market fresh milk as well as to provide seasonal feed materials (silage and concentrated feed) on behalf of their members. Therefore, the milk market is not well regulated and not based on the real market values. The milk producers frequently face to and are not protected against regional and global economic crises. The milk producers are depended on the milk price fixed by the national government and the local farm cooperatives are not fairly represented at fixing the milk price. This is said to be due to insufficient networking activities of farm cooperatives and a restructuring is recommended (SPO, 2000). Thus, the regional milk productivity and management are day to day declining. It is therefore, difficult to establish a sustainable and profitable dairy farming program throughout the region.

On the other hand, Directorate of Agricultural Ministry in Burdur has limited human resources and budget to perform the tasks of animal extension activities as routinely practised in many developed countries (Anonymous, 2009a). In order to draw a road map in the region to improve milk quality and to increase the level of milk production the structure and present statues of these dairy farms must be examined.

The study is lacking to find out information regarding the statues of dairy farms in terms of production, animal health, feeding resources, housing and farm mechanisation to determine the level of sustainability for dairy farming. A few studies have been conducted in the region, to partially deal with the limited aspects of agricultural economy or agricultural mechanization (Boyar and Yumak, 2000; Demircan *et al*., 2006; Akcaoz and Kizilay, 2009). Accurate and complete data generated from zootechnical parameters is needed by the regional farm cooperatives to construct their policies. In this respect, regional farm unions and cooperatives have recently directed their activity towards dairy farming to bring technical and scientific solutions to the problems of dairy farming in collaboration with regional scientific and research institutions. Therefore, the present study was designed to collect, analyze and interpret the zootechnical data for the purpose of providing good quality of services by the local and national authorities.

In the study, a set of algorithmic rules used to determine the level of sustainability as qualified farms, average farms and unqualified farms were applied to ease the understanding of interactions between zootechnical parameters and to provide an easily readable overview of milk producers. The data collected are clustered into various categories:

- Farm size
- Animal housing
- Animal nutrition and husbandry
- Animal health
- Milking mechanization

The information obtained was large and all considered at high level of importance. Therefore, herein only sections regarding farm typology, housing and milking mechanization were presented. The results regarding animal nutrition, animal husbandry and animal health will be combined with an intervention study, which was carried out on the same population and be presented separately.

## MATERIALS AND METHODS

**Survey team:** This study was carried out by Suleyman Demirel University, Department of Animal Science, Isparta Turkey. The team was lead by two coordinators and consisted of 18 new graduates from Animal Science Department and trained as Animal Extension Officer in a 3 months technical and scientific course in the field of animal nutrition and veterinary science.

**Survey:** A preliminary survey consisted of >100 questions was separated into 5 sections:

- Farm size and typology
- Animal housing
- Milking mechanization
- Animal nutrition and husbandry
- Animal health

Approximately, 400 dairy farmers were initially intended to be randomly visited. After the completion of 10 surveys it was foreseen that the size of subjects (400) as well as the number of questions (>100) were large to complete the study. Therefore, the survey was later reduced to contain only 90 questions with 172 subjects. These 172 subjects (farmers) were randomly visited at 18 different locations throughout the region.

The locations were randomly chosen. The average representative farmers per each location was 9.52±2, which was seen to be insignificantly different between the locations ($X^2$ = 20.77; df = 17; p = 0.24). The completed surveys were delivered to the survey coordinators, who checked the information provided and approved for its validity. None of survey was rejected. The documentations were then numbered and archived at Suleyman Demirel University, Department of Animal Science, Isparta Turkey, for further data processing.

**Data processing and statistical analysis:** All data obtained from the survey was entered manually to a spreadsheet using Microsoft office excel application. Data to be selected for statistical treatment was transformed to numerical values. Statistical tests of regression analysis, descriptive statistics, Chi-square and multiple response were applied to the data by using a window based statistical package program (SPSS, 2006). The survey questions were asked under the categories of farm size, animal housing and milking mechanisation.

The questions in each of three categories were considered as zootechnical performance characteristics upon which a set of algorithmic rules were setup. These rules were then subjected to a multiple response analysis in order to establish the level of sustainability of dairy farms under each category. The applicability of multiple response test to evaluate the results of multiple questionnaires was successfully tested by Orhan (2007) in a similar field study.

## RESULTS AND DISCUSSION

### Farm structure

**The membership for cooperatives:** The studied farmers were seen to be regular members of one of the four major regional cooperatives. Eight percent of these farmers were the members of cooperatives, which were established only for milk farmers, 6% of farmers were the members of the Union of Farm Cooperatives (UFC), 33% were the members of agricultural investment cooperatives and 53% were the members of farm irrigation cooperatives.

**The size of farm:** The farmers were asked to provide the area of cultivated land as well as the number of dairy cows, calves, weaned calves, bullocks, heifers, bulls, beef cattle and milk production/day/farm. The descriptive statistics regarding these data were presented in Table 1.

It was obvious that the farm size based on the number of animals kept per farm as well as the area of cultivated land were smaller than expected. The milk production/farm/day was not seen to be at commercially profitable levels. Therefore, these farms could be considered as small sized farms.

The farms subjected to the present survey were analyzed according to the area of cultivated land or the number of various animal species kept per farm. The number of farms was then regressed against to these parameters. The results of logarithmic regression shown in Fig. 1, indicated that there was a logarithmic relationship between the number of farms and the area of cultivated land; the number of farms decreases with the increased area of cultivated land. In addition, the majority of farms have a cultivated land area <40/ha/farm. The percentage of farms according to the number of various classes of animals was shown in Table 2.

The relationship between the percentage of farmers (y) and the number of animals per farm for dairy cows (x) was: $y = -12.5(x) + 36.3$ $R^2 = 0.91$. Similarly, the corresponding regression equations for other animal species of calves, weaned calves, heifers, bullocks and pregnant heifers were respectively as follows:

Table 1: Descriptive statistics regarding the parameters of farm size

| Parameters studied* | N | Min. | Max. | Mean±SD |
|---|---|---|---|---|
| Area of cultivated land ($ha^{-1}$)** | 96 | 1 | 100 | 22.8±22.7 |
| No. of calves | 131 | 1 | 7 | 2.4±1.5 |
| No. of weaned calves | 109 | 1 | 15 | 3.0±2.4 |
| No. of heifers | 126 | 1 | 15 | 3.2±2.5 |
| No. of bullocks | 80 | 1 | 10 | 2.3±1.8 |
| No. of pregnant heifers | 117 | 1 | 10 | 2.0±1.5 |
| No. of dairy cows | 164 | 1 | 25 | 5.5±3.8 |
| No. of bulls | 11 | 1 | 3 | 1.5±0.8 |
| No. of beef cattle | 10 | 1 | 8 | 2.8±2.5 |
| Milk production per day (litres) | 169 | 6 | 500 | 75.8±72.6 |

N: Number of farmers participated at the survey when answering the related question; *Parameters are expressed as unit per farm; SD: Standard Deviation.**One farmer who declared to have 400 $ha^{-1}$ of cultivated land was identified as outlier and excluded from the analysis

Table 2: Percentage of farms according to the number of animal species per farm

| | Percentage of farmers | | | | | |
|---|---|---|---|---|---|---|
| N | Dairy cows | Calves | Weaned calves | Heifers | Bullocks | Pregnant heifers |
| 1 | 4.9 | 34.4 | 26.6 | 28.6 | 42.5 | 45.3 |
| 2 | 17.1 | 29.0 | 26.6 | 19.0 | 28.8 | 30.8 |
| 3 | 12.2 | 17.6 | 19.3 | 20.6 | 12.5 | 12.8 |
| 4 | 12.8 | 8.4 | 8.3 | 8.7 | 7.5 | 5.1 |
| 5 | 11.6 | 6.1 | 10.1 | 11.1 | 2.5 | 4.3 |
| 6 | 8.5 | 2.3 | 2.8 | 4.0 | 3.8 | - |
| 7 | 9.8 | 2.3 | 1.8 | 1.6 | - | - |
| 8 | 7.3 | - | - | 2.4 | - | - |
| 9 | 5.5 | - | 1.8 | 0.8 | - | 0.9 |
| 10 | 3.7 | - | 0.9 | 0.8 | 2.5 | 0.9 |
| 11 | 0.6 | - | - | - | - | - |
| 12 | 0.6 | - | 0.9 | 0.8 | - | - |
| 13 | 1.2 | - | - | 0.8 | - | - |
| 14 | 1.2 | - | - | - | - | - |
| 15 | 0.6 | - | 0.9 | 0.8 | - | - |
| 16 | 0.6 | - | - | - | - | - |
| 18 | 0.6 | - | - | - | - | - |
| 20 | 0.6 | - | - | - | - | - |
| 25 | 0.6 | - | - | - | - | - |
| n | 164.0 | 131.0 | 109.0 | 126.0 | 80 | 117 |

N: Number of animals per farm; n: Number of farms participated at the survey

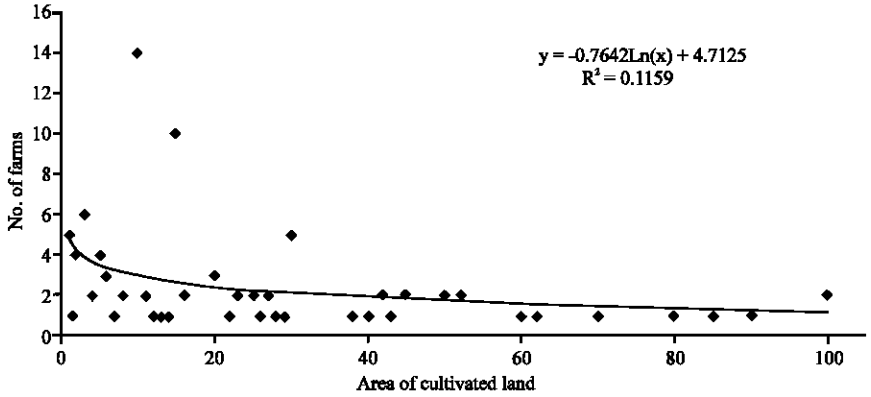


Fig. 1: Logarithmic regression analysis of farm size based on area of cultivated l ha$^{-1}$

$y = -24.4Ln(x) + 48.4 R^2 = 0.96$
$y = -12.9Ln(x) + 31.3 R^2 = 0.88$
$y = -14.2Ln(x) + 34.7 R^2 = 0.91$
$y = -15.4Ln(x) + 31.0 R^2 = 0.88$
$y = -23.2Ln(x) + 47.5 R^2 = 0.88$

Figure 2 shows, the model for estimation of relationship between the percentages of farms and the number of dairy cows. The best model was found to be logarithmic regression. The regression equation obtained from these raw data was validated for the present case (Fig. 2). These results suggested that the number of farms significantly decreases when the number of animals per farm increases.

**Type of animal production:** Out of 172 farms, 79% of farms were dairy cow producers and 2% of farms were beef cattle producers, while 19% of farms were both dairy cow and beef cattle producers.

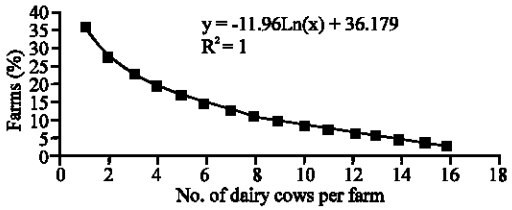


Fig. 2: Validation of logarithmic regression indicating the best relationship between the number of dairy cows the percentage of farmers

**Type of animal breed:** Out of 172 farms, 88% of farms have a livestock of cross breed of Holstein-Friesian, whereas 12% of farms have a mixed livestock of crossbreed of both Holstein-Friesian and Simmentals. Most of animals (99%) kept in 172 farms were labelled with ear tags.

Table 3: The results of survey for the section of farm size

| Attributes | Multiple-levels | Frequency (%) | Codification* |
|---|---|---|---|
| Membership to relevant | Milk co-operatives | 8.0 | 1 |
| and appropriate Co-operatives | Agricultural irrigation | 53.0 | 3 |
| | Agricultural development | 33.0 | 2 |
| | Union of farm co-op. | 6.0 | 1 |
| Size of cultivated land | 1-25 $ha^{-1}$ per farm | 69.0 | 3 |
| | 26-50 $ha^{-1}$ per farm | 20.0 | 2 |
| | 51-75 $ha^{-1}$ per farm | 6.0 | 2 |
| | 76-100 $ha^{-1}$ per farm | 5.0 | 1 |
| Size of dairy cows | 1-5 cows per farm | 58.3 | 3 |
| | 6-15 cows per farm | 39.2 | 2 |
| | 16-25 cows per farm | 2.5 | 1 |
| Milk production day per farm | A-6-100 kg per farm | 78.6 | 3 |
| | 101-250 kg per farm | 18.4 | 2 |
| | 251-500 kg per farm | 3.0 | 1 |
| Milk yield per cow per day | <15 kg per cow per day | 65.6 | 3 |
| | 16-25 kg per cow per day | 26.3 | 2 |
| | > 25 kg per cow per day | 8.1 | 1 |
| Age at 1st insemination | <15 month-old | 13.0 | 2 |
| | 15-17 month-old | 34.0 | 2 |
| | at 18 month-old | 48.0 | 1 |
| | >20 month-old | 5.0 | 3 |
| Selection for milk yield | Regular selection | 50.6 | 1 |
| | Irregular selection | 16.9 | 2 |
| | No selection | 32.5 | 3 |
| Animal labelling | Ear tags | 99.0 | NA |
| | other | 1.0 | NA |
| Animal breed | Holstein-friesen | 98.0 | NA |
| | Simmentals | 2.0 | NA |

*The codes of 1, 2 3 were used to test for frequency of farmer's qualification in dairy farming as qualified indicated by 1: Averaged by 2: Unqualified farmers by 3: Respectively; NA: Not Applied for codification

**Average milk production per cow per day:** About 65.6% of farms have a daily milk production of <15 L $cow^{-1}$, while the percentage of farms with a milk production between 16-25 and >25 L $cow^{-1}$ were 26.3 and 8.1%, respectively.

**Artificial insemination, the age of fist insemination and the number of insemination for successful fertilization:** The farmers were asked to provide the information on the above mentioned parameters and they were classified as follows: 92% of farmers were found to keep appropriate records of their dairy cows, 86% of farmers routinely practice artificial insemination, while the rest still use traditional insemination technique. The percentage of farms where the heifers were inseminated at an age younger than 15 months old were 13%, whereas the percentages of farms, where the heifers were inseminated at an age of between 15-17 months old, at 18 month old and after 20 months old were 34, 48 and 5%, respectively. The percentage of farm with the number of successful insemination of 1, 1-2 and 2-3 or >3 were 19, 23, 45 or 13%, respectively. The statistical test indicated that there was no significant relationship between the age of insemination and number of successful insemination in the present investigations ($X^2 = 13$; df = 16; p = 0.67).

**Selection for genetic improvement in milk production:** Regular and irregular selection in the flock for genetic improvement of milk production were mostly preferred by 50.6 and 16.9% of farmers, respectively and those not practicing at all is about 32.6%.

**Analysis and classification of the studied farms to determine the level of sustainability by the criteria of farm size:** The results of studied parameters can be better overviewed in the Table 3. Of the studied parameters the most influencing 7 attributes were selected to define and classify the type of milk business in the region. These attributes and their multiple levels were illustrated in Table 3. Three algorithmic rules were extracted to classify the level of milk profession into three main groups: qualified farmers indicated by 1; averaged farmers by 2 and unqualified farmers by 3. The algorithmic rules were reorganized in the form of multiple response questionnaires and statistically analyzed by a multiple response test using SPSS. Therefore, in order to estimate the percentage of farmers falling into these three categories (1, 2 or 3), the numbers of farmers from each of subcategories of seven parameters (or questions) were coded with the same numerical number and then the percentages of each of these codes were calculated from

Table 4: Summary pooled frequencies (percentages) of Qualified (Q), Averaged (A) and Unqualified (U) farmers established for the criteria of farm size, animal housing milking mechanization by the multiple-response test average statistics

| | Multiple-response test | | | Mean statistic | | | Mode statistic | | |
|---|---|---|---|---|---|---|---|---|---|
| Percentage | Q | A | U | Q | A | U | Q | A | U |
| Farm size | 18.6 | 30.6 | 50.7 | 0.6 | 64.0 | 34.5 | 13.0 | 33.5 | 53.5 |
| Housing | 38.1 | 31.5 | 30.4 | 8.1 | 85.5 | 6.4 | 37.8 | 30.0 | 32.2 |
| Milking | 23.1 | 53.6 | 23.3 | 3.5 | 82.0 | 14.5 | 14.0 | 74.4 | 11.6 |
| Pooled | 27.0 | 38.0 | 35.0 | 4.0 | 77.0 | 19.0 | 21.6 | 46.0 | 32.4 |

their respective frequencies. These percentages are then considered to reveal the overall statues in the region. The outcomes were as follows: the percentage of qualified milk producers, 18.6%; the percentage of average milk producers, 30.6%; the percentage of unqualified milk producers, 50.7%. Another alternative of such estimation was to determine the average statistics, Central tendency measures in order to validate the results obtained from the multiple response test. Within each of seven questions, each farmer from 1-172 was coded as qualified, average or unqualified, farmer. Then the percentages of a-c were calculated from the frequencies, either from the mean or from the mode. The outcomes were as follows: The percentage of a-c estimated by the mean average was 0.6, 64 and 35.5%, respectively, whereas, the percentage of a-c estimated by the mode average was 13, 33.5 and 53.5%, respectively (Table 4). Of these estimates, the multiple response and mode average were closely comparable while mean average failed to reveal the present statues of farmers. In fact, the mean statistic does not provide meaningful information for such discrete data (count, binary or proportional).

**Animal housing**

**Housing:** In the region, three types of animal housing were observed, completely confined housing, semiconfined housing and openhousing, 51.2% of animal barns were completely confined housing type (a typical traditional barn), 36.6% were semiconfined housing and 12.2% were openhousing.

**Feed storage unit:** About 43.0% of farms have no feed storage unit, whereas 36% of farms have a feed storage unit and 21% of farms have either a forage storage unit, concentrate feed storage unit or silage storage unit.

**Infirmary unit:** About 40.7% of farms had no infirmary unit at the farm building. About 27.3% had only a unit for keeping new born calves separately, 1.7% had only a unit for labouring cows, 4.7% had a unit for labouring cow, sick animals and calves and the remaining (25.6%) had a different room for non-infirmary purposes.

**The structure of barn floor:** The concrete floor structure is dominant in these farms (80.8%), while the soil floor structure is rare (11%). The remaining (8.1%) had both concrete floor and soil floor structure.

**Barn structure and natural ventilation:** About 14% of these barns had no windows and roof openings, therefore these barns are ventilated through the doors, 31.4% of barns were ventilated through the opened windows and 22.6% of barns were ventilated through the roof openings. The remaining (32%) had natural ventilation through a combination of windows, doors and roof openings.

**Provision of drinking water:** Three types of watering were seen in the region: individual automated drinkers (8.7%), through a bucket by hand for each cow (14%) and through a large drinker tanks for a group of cows (76.2%).

**Analysis and classification of the studied farms to determine the level of sustainability by the criteria of animal housing:** The distribution of farms into the studied parameters was discribed in Table 5. Three sets of algorithmic rules were again made to classify the statues of animal housing. The analysis and classification of farmers according to the studied criteria were carried out by the multiple response test as well as the average statistics, which were described previously. The outcomes of analysis were presented in Table 4. The best classification was obtained by the multiple response analysis, which was supported by the estimated percentages according to the mode statistic (Table 4).

**Milking mechanization**

**Milking equipment:** Milking is carried out either by hand (11%), by a portable (mobile) milking device (78.5%), by a fixed milking device at the barn (4.1%), or by a milking device fixed at a special milking unit (5.2%). About 1.2% of the subjects provided no answer.

**Calibration of milking device:** The farmers were asked, whether they can calibrate the milking device for vacuum adjustment, pulse adjustment and any other adjustments. About 27.3% of farmers were considered to be expert for the calibration their milking device, whereas 30.8% of farmers did not know how to calibrate, but received help of other farmers, 20.3% of farmers know how to calibrate the vacuum of device and the remaining (21.5%) knows pulse and other adjustments.

Table 5: The results of survey for the section of animal housing

| Attributes | Multiple-levels | Frequency (%) | Codification* |
|---|---|---|---|
| Type of barn | Fully confined | 51.2 | 3 |
| | Semi-confined | 36.6 | 2 |
| | Open | 12.2 | 1 |
| Structure of | Concrete floor | 80.8 | 1 |
| barn floor | Soil floor | 110.0 | 3 |
| | Both | 8.2 | 2 |
| Feed storage | No feed unit | 43.0 | 3 |
| unit | Yes feed unit | 57.0 | 1 |
| Infirmary unit | No | 43.0 | 3 |
| | Yes-newborn unit | 27.3 | 1 |
| | Yes-labour unit | 1.7 | 1 |
| | Yes-sick animal unit | 4.7 | 1 |
| | Yes-other unit | 25.6 | 2 |
| Barn structure | No opening except doors | 14.0 | 3 |
| and ventilation | Window openings | 31.4 | 2 |
| | Roof openings | 22.6 | 2 |
| | Both window roof openings | 32.0 | 1 |
| Provision of | Automated drinker | 8.7 | 1 |
| drinking water | Bucket watering for individual | 14.0 | 2 |
| | Through a water line for group watering | 76.2 | 3 |

*The codes of 1, 2, 3 were used to test for frequency of farmer's qualification in dairy farming as qualified indicated by 1: Averaged by 2: Unqualified farmers by 3: Respectively

Table 6: The results of survey for the section of milking mechanization

| Attributes | Multiple-levels | Frequency (%) | Codification* |
|---|---|---|---|
| Milking | By hand | 11.0 | 3 |
| | Mobile milking device | 78.5 | 2 |
| | Fixed milking device | 4.1 | 1 |
| | Milking unit | 1.2 | 1 |
| | No answers | 1.2 | NA |
| Calibration skills | Can calibrate device | 27.3 | 1 |
| | Not calibrate device | 30.8 | 3 |
| | Can adjust vacuum | 20.3 | 2 |
| | Can adjust pulse | 21.5 | 1 |
| Chancing hoses | Every 6 month | 21.5 | 1 |
| | Every year | 23.3 | 2 |
| | When it is old | 33.1 | 3 |
| | No answer | 11.6 | NA |
| Cleaning milking | Water | 57.0 | 3 |
| device | Water + liquid | 5.8 | 2 |
| | Rinsing + water + liquid | 25.0 | 1 |
| | No answer | 12.2 | NA |
| Pre-milking | Yes | 8.7 | 1 |
| | No | 8.7 | 3 |
| | No answer | 4.1 | NA |
| Breast cleaning | Yes | 7.0 | 1 |
| | No | 88.8 | 3 |
| | Sometimes | 0.6 | 2 |
| | No answer | 4.1 | NA |

*The codes of 1, 2, 3 were used to test for frequency of farmer's qualification in dairy farming as qualified indicated by 1: Averaged by 2: Unqualified farmers by 3: Respectively. NA: Not Applied for codification

**Changing hoses:** The farmers who change the hoses of milking device in every 6 months were 32%, whereas those changing the hose once a year were 23.3% and those changing the hose, whenever is necessary was 33.1%, respectively. About 11.6% of the subjects provided no answer.

**Clean-up the milking device after milking:** Those cleaned the milking devices with only using hot water were 57%, those applied a cleaning liquid together with water were 5.8%, those applied a proper cleaning combined with rinsing before and after milking in addition of using hot water plus cleaning liquid were 25%. About 12.2% of the subjects provided no answer.

- Do you carry out a pre-milking before milking?
- About 87.2% answered no, whereas 8.7% answered yes and 4.1% with no answer
- After milking do you clean up the cow breast?
- About 7.0% answered yes, 89% answered no and 4.0% with no answer

**Analysis and classification of the studied farms to determine the level of sustainability by the criteria of milking mechanization:** The distribution of farms into the studied parameters was illustrated in Table 6. Three sets of algorithmic rules were also made to classify the statues of milking mechanization. The analysis and classification of farmers according to the studied criteria were carried out by the multiple response test as well as the average statistics, which were described previously. The outcomes of analysis were presented in Table 6. The best classification was obtained by the multiple response analysis, which was supported by the estimated percentages according to the mode statistic (Table 4).

**Pooled results on the level of sustainability in dairy farming in Burdur:** The results of multiple response test for all performance characteristics were validated by the average statistics. Highly comparable and reproducible results were obtained from these two ways of testing, supporting the reliability of multiple response test.

These three groups of performance characteristics had significant effect ($X = 47.6$; $df = 4$; $p = 0.000$) on the determination of farmer's qualifications in dairy farming, indicating that the characterisation of dairy farms could not only be based on the overall evaluation in general terms. In order to get an overview, the results from the multiple response tests for the farm size, animal housing and milking mechanisation were pooled and presented in Table 4. About 27% of farmers in Burdur region were qualified to sustain a productive and profitable dairy farming, whereas 38% of farmers were determined to act as average farms and the percentage of those unqualified farms, which were considered to be non-profitable were 35%.

## DISCUSSION

In the present study, the estimation of the level of sustainability was based on zootechnical performance characteristics of dairy farms in the province of Burdur. The dairy farms were evaluated on the basis of three categories of performance characteristics: farm size, animal

housing and milking mechanisation. This type of highly reproducible evaluation is found to be reliable by the service providers to identify and keep regular records for the progress in time as well as to take subsequent actions for any improvements in the related categories.

The result of farm size indicated that only 18% of dairy farmers in the region were qualified to sustain for dairy farming due to the studied performance characteristics. Of 172 farms, 38.1% are qualified to sustain by the criteria of animal housing and 24% are qualified to sustain by the criteria of milking mechanisation. When these figures are pooled the percentage of qualified farms was 27% in the province of Burdur. These findings were meaningful for the regional policy makers.

The results of a few studies conducted in the same region agreed with the findings. Similar results on the farm size were reported by Demircan *et al.* (2006) for Burdur and by Akcaoz *et al.* (2009) for Antalya, similar to Burdur in terms of studied characteristics. These regional figures were found to be similar to the overall figures reported for Turkey. About 72% of farms had <5 cattle/farm and 67% had <50 $ha^{-1}$ cultivated land (SPO, 2000). Demircan *et al.* (2006) found that only larger farmers with >11 dairy cows were found to be profitable in dairy farming in the province of Burdur. Furthermore, an average income of a dairy farmer irrespective to the size of farm was not found to sustain a farm household. In addition, the half of farmers participated in a sustainability survey in Antalya wanted to close down the milk business due to the economical instability in dairy business (Akcaoz *et al.*, 2009).

Amongst the most influencing risk factors (i.e., variable milk price and health statues of family members) in dairy farming for the province of Antalya, the lack of production hygiene was reported to be the first (Akcaoz *et al.*, 2009) and this result confirmed the findings, indicating that the majority of farmers did not apply appropriate sanitation and proper hygiene before and after milking. This result clearly indicates that modern techniques for animal husbandry is lacking in the region.

On the other hand, the structure of animal housing is not only important for the improved animal welfare, but also for improved production. The study results indicated that only 38% of the animal houses were qualified for the criteria of modern animal housing. A dairy farm without feed storage unit as well as the units for milking and infirmary could not be considered as dairy farm. The percentage of such farms in the region was however, over 30%. It is the duty and responsibility of the policy maker to decide whether under qualified farms are to be stopped and directed to other branches of agricultural enterprises.

In contrary these farmers are registered dairy farmers in the local and national livestock databases for the reception of state subsidy for dairy cows and milk produced All the above results clearly implied that the farm size appeared to be most influencing factor to sustain dairy farming.

The state subsidy for dairy farmers including the aid per litre of milk as well as the aid per animal head has been practised since year 2000 and could not even help to create a sustainable dairy farming in the region. This was proved by the study results, indicating that at least 30% of regional dairy farmers receiving state subsidy did not have proper and at least acceptable animal housing and milking practise. Such financial aids were not restricted with the number of dairy cows per farm as well as the amount of milk produced per farm (Anonymous, 2009b).

It allowed all the farmers even with one dairy cow receiving these aids. Therefore, we recommend reinforcing a policy, which foresees to increase the number of cattle per farm and to support a sustainable and profitable dairy farming in a framework program supported with scientific and technical training in the region. This was in general underlined by the EU's report on Turkey in 2008:

> The government's announcement of the intention to scrap decoupled area payments and replace them by coupled payments remains a cause for concern. This would lead to Turkey's agricultural policy drifting away from the reformed CAP and from the principles of competitiveness and market orientation (Anonymous, 2008).

A policy, similar to the one mentioned above was applied in different perspective by the 8th Turkish State Development Plan to develop a sustainable animal production all over the country (SPO, 2000). From 1987-1999 over 300,000 European pure breeds of dairy cattle were imported and provided to the farmers, together with the means of artificial insemination program to increase the animal population and thereby the milk production. The study results showed that even regional farmers were not highly sustainable for the criteria established for good practice of artificial insemination, genetic selection for milk yield and improved milk production (Table 3). The 9th Turkish State Development Plan (SPO, 2006) has admitted that the policy established by the 8th State Plan produced little achievement (clause 186). Surprisingly the 9th State Plan underpins completely different problems of animal sector and foresees the measures to increase the contribution part of animal production in total agricultural production from 28% in 2007 to 37% in 2013 by increasing the percentage of cross or pure cattle breeds in total cattle population from 67% in

2007 to 77% in 2013. Somewhere, in the 9th State Plan a policy, similar to that in the previous plan is again foreseen: the import of European pure cattle breeds and subsequent implementation of an artificial insemination program throughout the country. There is no room in the 9th Plan mentioning the importance of scientific and technical support as animal extension activities by non-governmental organisation such as farm unions or associations. One can question the reason of re-implementation of unsuccessful cattle breeding program established since 1987. Such repetitive action plan would only waste presently eaten up resources. The state must subsidy the farms through independently established non-governmental organisations, whose tasks to create and to keep accurate the database and to establish the local policies based on case sensitive issues. This is also considered as an acceptable approach in the light of alignment with EU's dairy farming policies. The present progress of Turkey in agriculture in this respect is recently announced to be unsatisfactory (Anonymous, 2008). The finding showed that the number of qualified farms for a productive and sustainable milk business in the province was significantly low and the majority of milk producers were evaluated as average producers. The fact was that approximately 90% of farmers were the members of the cooperatives whose tasks are not defined to underpin the milk services. Furthermore, the participation rate of these members at the regular meetings was seen to be 80%. In contrary, one could speculate that the regional problems related to the milk business remained unsolved. The farm cooperatives were not efficient to define or characterise the most influencing factors for sustainable dairy farming. Furthermore, these results implied that a restructuring within these civil organizations is necessary.

The percentage of farms reduces as the number of dairy cows per farm increases. This significantly supports the above hypothesis that the milk business is not demanding and considered as secondary farm activity. This hypothesis became remarkably evident when examining other contributing parameters studied in this survey. A farm with more or less 25 dairy cows is known as a typical dairy farm to be managed at profitable and sustainable manner (Soysal *et al*., 2008). A productive and sustainable dairy farm is the one, which has long established for a high level of milk production, improved milk quality, genetic selection for milk improvement, good housing and husbandry practices and modern milking techniques (Soysal *et al*., 2008). Similar criteria were applied to identify and classify these regional farmers in the present study. In short, the results were found not convincing. In general, when evaluating the parameters of farm size 50% of the farms were unqualified and 30.6% were average farms. Other influencing factors such as animal nutrition, animal husbandry and animal health were already studied for the province of Burdur and will be published later.

This study characterised the type and level of dairy farming in the province of Burdur, which was found similar to the rest of country. Furthermore, a reliable and reproducible tool is used to determine the level of sustainability in these dairy farms. The results were kindly appreciated and taken on the board by the regional unions and associations in order to reinforce new measures in the regions.

## CONCLUSION

A reformist strategy must be followed to change the present statues. A strategy must be based on the following criteria: a modern construction plan must be developed under the climate condition of the region. An open barn construction was previously suggested for the region by Toker *et al.* (1999), a long-term financial support plan for these small sized farmers is inevitable.

In particular, the capacity of dairy farms must at least, be increased to over 20 dairy cows/farm or the farms with very small number of dairy cows, with improper housing and worse management skills should no longer be considered as dairy farm, the level of milk production/farm is recommended to be increased per animal, not by increasing the number of unproductive dairy cows, a plan of genetic improvement of the dairy cow flocks together with the farm management plan must be established for these farm, the farm cooperatives and associations must hire the experts with a scientific and technical background in animal and veterinary science to overcome the problems associated with the declined production levels due to the present problems.

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