Turk J Vet Anim Sci
28 (2004) 735-743

Research Article

Dairy Cattle Farming in Kars District, Turkey: I. Characteristics and Production*

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Received: 19.02.2003

Abstract: The objectives of the present study were to determine farm characteristics and production traits on dairy farms in Kars. A 2-stage stratified random sampling strategy was used to select localities (7) and farms (45). The study involved an interview with the farmers and regular visits to the farms. The survey identified important farm characteristics including demography, production and management practices. The results describe (a) farm demographics (number of family members, education of farmers, animal caretakers employed, types of herds, herd sizes, breeds, and age categories), (b) farm management practices; management at feeding (type, source, storage of feedstuffs, feeding, water supply and use of feed supplements during the indoor and outdoor periods, and pasture management), management at calving (use of maternity pens, colostrum feeding, and grouping of calves) and management at housing (period of housing, types of buildings, use of bedding, ventilation systems, and building cleanliness), and (c) production traits (breeding methods, dry period, calving rate, milk yield and processes). Some identified practices (period of housing, dairy breeds, dry period, milk yield and calving rate) differ from those in previous reports and others (use of crumbled dung as bedding, rare use of maternity pens, water from streams during the outdoor period, and common use of pastureland) require serious attention in terms of cattle health. The results may be of use in designing strategies to overcome drawbacks that are detrimental to feasible and profitable farming and also in forming bases for future epidemiological studies in Kars.

Key Words: Farm demography, farm characteristics, management practices, production trait, dairy cattle

Kars Yöresinde Süt Sığırcılığı: I. Karakteristikler ve Üretim

Özet: Bu çalışma, Kars ilindeki süt sığırı çiftliklerinin karakteristiği ve üretim özelliklerinin belirlenmesi amacı ile yapıldı. Lokaliteler (yedi) ve çiftlikler (kırk beş) iki safhalı kota örnekleme tekniği kullanılarak belirlendi. Çalışma kapsamında çiftlikler düzenli bir şekilde ziyaret edilerek, çiftçilerle yüz yüze görüşmeler yapıldı. Çalışmada çiftlik karakteristiklerini oluşturan çiftlik yapısı, üretim ve bakım-besleme uygulamaları belirlendi. Çalışmanın sonuçları; a) çiftlik demografisini (aile üyelerinin sayısı, çiftçilerin eğitimi, istihdam edilen hayvan bakıcıları, sürünün tipi, büyüklüğü, ırk ve yaş kategorileri), (b) çiftlikteki bakım-besleme uygulamalarını; besleme uygulamaları (yemin tipi, kaynağı, depolanması, barınma ve mera döneminde su ve yem temini, kullanılan yem katkı maddeleri, mera kullanımı), buzağılama dönemindeki uygulamaları (doğum bölmelerinin kullanımı, kolostrum, buzağıların gruplandırılması) ve barınma ile ilgili uygulamaları (barınma süresi, ahır tipi, yataklık kullanımı, havalandırma sistemleri, ahırların temizliği) ve c) üretim özelliklerini (tohumlama, kuru dönem, buzağılama oranı, süt verimi ve işlenmesini) ortaya koydu. Belirlenen bazı uygulamalar (barınma süresi, sütçü ırklar, kuru dönem, süt verimi ve buzağılama oranı) önceki çalışmalardan farklı bulunmuştur ve bazı uygulamaların (altlık olarak hayvan gübresi kullanılması, doğum bölmelerinin yaygın kullanılmaması, içme sularının derelerden temin edilmesi ve otlakların ortak kullanımı) hayvan sağlığı açısından ciddiye alınması gerekmektedir. Elde edilen sonuçlar, Kars'ta kârlı bir işletmeciliğe engel olan aksamaların giderilmesine yönelik stratejilerin belirlenmesine ve ileride yapılacak epidemiyolojik çalışmalara temel oluşturabilir.

Anahtar Sözcükler: Çiftlik demografisi, çiftlik karakteristikleri, yönetsel uygulamalar, üretim özellikleri, süt sığırı

Introduction

World farming has grown more intensive in the last 3 decades, making dairy farm management more complicated. This has forced farmers to explore more detailed farm data in order to make appropriate decisions (1). There has also been an increasing awareness of a need for farm data in Turkey, especially in the north-east, in recent years.

* This project was funded by the Scientific and Technical Research Council of Turkey, Project code: VHAG–1777

The Kars district is situated in north-east of Turkey and harbours around 2.7% (300.970/11.185.000) of Turkey's cattle population (2). Agriculture and livestock raising is the largest sector, in which more than 70% of the population are employed (3). Dairy farming is commonly practised as a smallholder enterprise. Milk and milk products constitute a substantial source of income and are marketed in the region and all around Turkey. Although some statistics regarding farm animals such as numbers, breeds, and annual milk yield are available (2,3) there have been no studies describing farm management practices i.e. management at calving, details of feeding and housing on dairy farms in the district.

Determination of farm management practices is of paramount importance when evaluating the epidemiology of livestock diseases (1,4) and farm profitability (5). Studies indicate a strong relationship between farm management practices and infectious or non-infectious livestock diseases such as paratuberculosis, tuberculosis, brucellosis, lameness and ketosis (6-9). It is also well documented that considerable financial losses in the livestock sector are associated with diseases and management faults (5). Therefore, the design and implementation of preventive measures necessitates a detailed knowledge of the environment and conditions in which animals are kept.

An epidemiological study was designed to determine farm characteristics, production traits and health problems on dairy farms in Kars. This part discusses farm characteristics, management practices and production traits on dairy farms.

Materials and Methods

Farm selection

Farms and localities of interest in this study were from a project (supported by the Scientific and Technical Research Council of Turkey, (TÜBİTAK) Project code: VHAG–1777) undertaken to investigate the health status of neonatal calves on dairy farms in central Kars. A 2-stage stratified random sampling strategy was used to first select localities (villages) and then farms (4). Seven localities and 45 farms within central Kars were randomly (simple lottery) selected. Farms were selected from a list of dairy farmers provided by the District Office of the Ministry of Agriculture and Rural Affairs (DOMARA). Although 5 farms per locality were planned at the beginning of the study this varied from 5 to 8 due to the number of animals aborted which led us to include more farms in the study in order to achieve the number of dairy cattle examined for the purpose of the project.

Study Design

This was a longitudinal survey carried out between September 2001 and September 2002. The study involved an interview with the farmers using a pre-tested structured questionnaire, and regular visits to the farms. Visits were made weekly for the calving periods (from October to June) and monthly thereafter for any clinical problems either encountered by or reported to the authors.

The questionnaire consisted of 6 parts: parts 1 and 2 were designed to determine farm demographics (information about farmers, herd sizes, herd types and other animals present on the farm), part 3 included questions on management at calving and milk production, part 4 collected information on the health of dairy cattle and neonatal calves, and parts 5 and 6 were designed to obtain information about housing and feeding. A copy of the questionnaire is available on request.

Data Analyses

Simple frequency distributions were run to determine farm characteristics and production parameters.

Calving rate was calculated for milking cows and dairy heifers using the following formula (10,11):

$$\text{Calving rate} = \frac{\text{Total number of births in 2002}}{\text{Total number of milking cows (dairy heifers) in 2002}} \times 100$$

In calculating annual milk yield, average daily milk yield per cow reported by farmers was multiplied by 305 days of lactation (12).

All data were numerically coded and entered on to a database (Microsoft Access 2000) and analysed using Epi info 6. The Yates corrected chi squared test was used to compare the differences between proportions. The Kruskall-Wallis test was used to compare the differences

between median values. The significance level was set at $P < 0.05$.

Results

Farm characteristics

Farm Demographics: The study enabled us to visit around 10% of the villages (7/67) and to follow up around 2.5% of the dairy cattle (1052/42,000) in central Kars (13).

All selected farms participated in the study. The majority of farmers had primary (62.3%) and high school (33.3%) education. All the farmers were the only day-to-day decision-makers on their farms and only 8 of them (17.7%) were employed off-farm. Animal caretakers were also employed on 75.6% of the farms, 70% of them being family members (Table 1). Farmer's experience in farming varied from 1 to 60 years (mean 31.1), and this figure was between 3 and 50 years (mean 23.8) for animal caretakers. The number of family members varied from 4 to 30 with a mean of 9.1 (Table 2).

Eleven farms (24.4%) had open herds (bought- in milking cows and replacement heifers) and the remaining farms raised their own replacement heifers (Table 1). The median number of dairy cattle was 18 with a range of 6 to 100, and this figure was 14 and 5.5 for milking cows and dairy heifers, respectively (Table 2). Farmers also kept other animals such as sheep, goats, horses, dogs and poultry on their farms (Table 1).

Dairy breeds reported by farmers were Brown Swiss (41.2%), cross breed (28.2%), Simmental (18.3%) and indigenous breeds (12%) (Table 3).

Management Practice

Management at feeding: Types of forage fed to animals during the housing period were hay, straw, sugar beet pulp, silage, ground barley, cotton seed meal, wheat bran and others (oat, trefoil etc). The majority of farmers also fed commercial concentrate mix (93.3%) to their animals during housing (Table 4). Of the farmers surveyed, 42 were reported to use feed supplement during the indoor period. The most common supplement used was salt (59.2%) followed by mineral block (22.2%) and both salt and mineral block (16.7%) (Table 4).

Limited numbers of farmers offered hay, straw, barley and commercial mix when animals were on pasture. On 26 of the farms, feed supplements were also used during the outdoor period. The majority of farmers used salt (92.5%), and only 2 farmers used mineral block

Table 1. Farm demographics on 45 dairy farms in Kars.

	No of farms = 45	Percentage (%)
Owner making daily decisions	45	100
Owner employed off-farm	8	17.7
Education		
primary school	28	62.3
high school	15	33.3
university	2	4.4
Animal caretaker	34	75.6
from the family	24	70
not from the family	10	30
Herd type		
open herd	11	24.4
closed herd	34	75.6
Other animals		
sheep	7	15.6
goats	6	13.3
horses	35	77.8
dogs	43	95.6
poultry	39	86.7

Table 2. Farm demographics on 45 dairy farms in Kars.

	%	No.	Mean	Median	IQ range	Range
No. of family members	100	410	9.1	7	6-10	4-30
No. of years in farming						
owner	100	-	31.1	30	25-40	1-60
caretaker	75.6	-	23.8	20	15-30	5-60
Cattle	100	1638	36.4	25	17-40	6-250
Dairy cattle	100	1052	23.4	18	13-27	6-100
Milking cows	100	759	16.9	14	10-20	6-65
Dairy heifers	88.9	293	7.3	5.5	2.5-10	1-35
Calves	84.4	546	14.4	7.5	3-15	1-150
Bulls	46.7	40	1.9	1	1-2	1-7

(%) = percentage, No. = total number of people and animals, IQ = inter quartile

Table 3. Breeds of dairy cattle raised on 45 dairy farms in Kars.

	(%)	No. = 1052 (%)	Mean	Median	IQ range	Range
Brown Swiss	80	433 (41.2)	12	11	1-32	1-32
Simmental	53.3	192 (18.3)	8	5	2.5-11	1-25
Holstein	6.6	4 (0.3)	1.3	1	1-2	1-2
Indigenous	22.2	126 (12)	12.6	11.5	7-20	2-24
Cross breed	62.2	297 (28.2)	10.6	9	5.5-135	1-43

% = percentage, No. (%) = number of animals and percentage, IQ = inter quartile

as a feed supplement when animals were on pasture (Table 4).

The majority of farms produced their own forages (hay, straw, silage, sugar beet pulp), barley and wheat bran while commercial concentrate mixes were purchased on all farms (Table 5).

Concentrate feedstuffs (commercial mix, barley and wheat bran) and straw were stored in a covered barn on the majority of farms, while hay was mostly stored outside and uncovered (Table 5).

Water was provided from mains (68.9%) when animals were housed, whereas animals drank water from streams (91.1%) during the outdoor period (Table 4).

Six of the farmers (13.3%) had private pastureland and the remaining farmers grazed their animals on common pastureland. Dairy cattle grazed the same pasture as sheep, goats, horses and geese on most of the farms (95.6%) (Table 4).

Management at housing: Animals were housed for an average of 7.4 months in a range of 6 to 10 months on all farms. Housing commenced mostly in September (37.8%) and October (53.3%) and ceased in April (15.6%), May (62.2%) and June (22.2%). Animals were housed in 'traditional' type cowsheds (made of stones and mud, 68.9%), 'modern' type cowsheds (well planned and structured, made of concrete, 22.2%) or both types (8.9%). All buildings had a system of ventilation (holes or chimney in the roof and windows) (Table 6).

Bedding was used on 82.2% of the farms when animals were housed. The most common type of bedding

Table 4. Feeding related management practices on 45 dairy farms in Kars.

	Indoor period		Outdoor period	
	NF	%	NF	%
Forage				
Hay	45	100	3	6.7
Straw	41	91.1	3	6.7
Sugar beet pulp	11	24.4	0	0
Silage	5	11.1	0	0
Others (oat, trefoil)	2	4.4	0	0
Concentrate				
Commercial mix	42	93.3	1	2.2
Ground barley	41	91.1	1	2.2
Wheat bran	8	17.8	0	0
Cotton seed meal	2	4.4	0	0
Feed Supplement	42	93.3	26	57.8
Salt	25	59.5	24	92.3
Mineral lick block	10	23.8	2	7.7
Both	7	16.7	0	0
Water Supply				
Mains	31	68.9	3	6.7
Stream	8	17.8	41	91.1
Well	6	13.3	1	2.2
Pastureland				
Private			6	13.3
Common			39	86.7
Other animals sharing the same pasture as dairy cattle (Sheep, goats, horses and geese)			43	95.6

NF = number of farms, % = percentage

Table 5. Source and storage of feedstuff fed to dairy cattle on 45 farms in Kars.

	source of feedstuff n = 45 (%)			storage of feedstuff n = 45 (%)		
Forage	HM	P	B	CB	OC	OU
Hay	91.1	6.7	2.2	6.7	6.7	86.7
Straw	87.8	4.9	2.4	87.8	4.9	2.4
Sugar beet pulp	100	0	0	100	0	0
Silage	100	0	0	100	0	0
Other (oat, trefoil)	100	0	0	100	0	0
Concentrate						
Commercial mix	0	100	0	0	100	0
Ground barley	65.9	29.3	4.9	65.9	29.3	4.9
Wheat bran	100	0	0	100	0	0
Cotton seed meal	0	100	0	0	100	0

HM = home made, P = purchased, B = both home made and purchased,
CB = in a covered barn, OC = outside and covered, OU = outside and uncovered

Table 6. Housing related management practices on 45 dairy farms in Kars.

	Number of farms (n = 45)	Percentage (%)
Housing animals	45	100
traditional	31	68.9
modern	10	22.2
both	4	8.9
Use of ventilation system	45	100
Use of bedding	37	82.2
dung	33	89.2
straw	4	10.8
Daily cleaning of dirt	45	100
Yearly cleaning out	41	91.1
Use of disinfectant	41	91.1
limestone	38	92.7
chemicals	3	7.3
	Mean	Range
Housing period (month)	7.4	6-10
Daily cleaning of dirt (times/day)	4.3	1-10

used was crumbled cattle dung (89.2%). This was used to keep the floor dry (Table 6). Buildings were cleaned an average of 4.3 times a day (range 1 to 10) and buildings were cleaned up yearly on 91.1% of the farms using limestone (92.7%) or chemicals (7.3%) as disinfectants (Table 6).

Production

The most common method of breeding was natural service (77.8%), and 22.2% of the farms used both natural service and artificial insemination (Table 7). Birth rates for milking cows and dairy heifers in 2002 were 73.8% (560/759) and 46.1% (135/293), respectively (Table 8). This difference was statistically significant ($P < 0.001$).

The dry period varied from 1 to 4 months with an average of 2.5 months on the farms studied. The calving period varied from 3 to 9 months with an average of 6 months. Calving took place from September to July with the majority of calves being born in winter (Table 7). Four farms (8.9%) had a maternity pen, and on the remaining farms calving took place in the shed where cows were normally tied up. Calves spent an average of 5 days (range 1 to 60 days) with their mothers after birth (Table 7). Colostrum was fed to calves on all farms by means of either bottle (4.4%) or suckling (95.6%). Mean time from calving to colostrum feeding was 1.9 h within a range of 1 to 6 h. Calves were grouped in a calf pen within the same shed as cows on all farms (Table 7).

Cows were milked twice a day, either manually (80%), by milking machine (6.6%) or both (13.4%) in the shed where animals were tied up (Table 7). Daily milk yield per cow varied from 3 to 40 l with a mean of 9.2 l/cow per day. When daily milk yield was compared according to breed there was no significant difference between the breeds ($P = 0.4$) (Table 9). Fourteen farmers (31.1%) processed milk on their own farms for the production of cheese and butter, and the remaining farmers (68.9%) sold it to factories (Table 7).

Discussion

The present study was intended to provide a comprehensive picture of farming practices and production traits on 45 dairy farms in Kars. Some practices differ from previous reports and some require serious attention in terms of cattle health.

Table 7. Production related management practices on 45 dairy farms in Kars.

	Number of farms (n= 45)	Percentage (%)
Breeding		
natural service	35	77.8
NS and AI	10	22.2
Maternity pen	4	8.9
Drying cows	45	100
Colostrum feeding	45	100
suckle	43	95.6
bottle fed	2	4.4
Milking		
manually	36	80
milking machine	3	6.6
both	6	13.4
Milk process		
on farm	14	31.1
sold	31	68.9
	Mean	Range
Calving period (month)	6	3-9
Time spent with mother after birth (day)	5	1-60
Dry period (month)	2.5	1-4
Time from birth to colostrum feeding (hour)	1.9	1-6

Table 8. Dairy cattle calved in 2002.

	Number (%)	Mean	Median	IQ range	Range
Dairy cattle	695/1052 (66.1)	15.4	14	10-19	4-44
Milking cows*	560/759 (73.8)	12.4	11	8-16	3-37
Dairy heifers*	135/293 (46.1)	3.7	3	2-5	1-11

(%) Calving rate as percentage, * $P < 0.001$, IQ = inter quartile

Table 9. Breed influence on daily milk yield on 45 farms.

	Mean	Median	IQ range	Range	Annual yield*
Dairy cattle	9.2	8	7-10	3-40	2806
Simmental	10.2	10	8-10	3-40	3111
Brown Swiss	9.7	10	7-10	3-40	2959
Cross breed	8.9	9	5-10	3-40	2715
Local breed	7.4	8	5-10	3-10	2257

* calculated for a 305-day period of lactation, IQ = inter quartile

This study identified the housing period, dairy breeds, dry period, milk yield and calving rates differently from other reports (3,12,14,15). The housing period was longer than the 4-month period reported for the eastern cities of Muş and Bingöl by Thompson and Hart (15). The longer housing period in Kars may be explained by differences in altitude and climate, as the winter is longer and more severe in Kars, where the altitude is around 1800 m.

The proportion of breeds recorded in this study is in contrast to that reported by the State Statistics Institute (3) and that by Thompson and Hart (15), in which the dominant breeds were indigenous and cross breeds, while in this study the dominant breeds were Brown Swiss and Simmental. The nature of the farms surveyed may explain this difference. The farms in this study were registered with DOMARA and production of milk and milk products was the main activity and source of income. Therefore, the farmers might have been more careful in selecting breeds.

Milking cows were dried off an average of 2.5 months before calving in this study, slightly longer than the 2 months normally expected for a cow. The longer dry period undoubtedly results in lower annual and lifetime milk production (12,16).

Adjusted annual milk yield calculated for Simmental and Brown Swiss in this study is comparable to that reported by Aksoy (14), who found the annual milk yield for Simmental and Brown Swiss to be 2680 kg and 3000 kg, respectively, but lower than the production level reported for these breeds (12). On the other hand, the annual milk yield of cross and local breeds was higher in this study compared to that reported by İlaslan (17). One possible reason may be that the farms in this survey were dairy farms, and therefore high producing animals were more likely to be kept in the herd but low producing ones removed. Another explanation may be the differences in nutritional management of the herds studied, as milk yield is strictly dependent on nutrition and management (18).

The calving rate obtained in this study failed to reach the minimum production level of 90-94% (10). It is well documented that cows calved during the autumn and winter become in calf again later than those calved in spring and summer (19). This may be a contributing factor in the present study as calving mostly took place in autumn and winter. However, other factors such as feeding and disease occurrence might have played a role, and the possible reasons for this failure require further investigation.

Farm management practices revealed that crumbled cattle dung was used as bedding when animals were housed in order to keep the floor dry. This practice poses a great risk of harbouring infectious agents such as Leptospira spp. and *Bacillus anthracis*, on these farms (20,21).

Maternity pen use was not common and animals gave birth in the shed where they were normally tied up. This practice also has drawbacks in relation to the health of calves, such as trauma and the spread of infections.

Provision of water from streams during the outdoor period also requires attention as many settlements are located close to streams, and human and animal wastes are deposited in to them in Kars. This practice increases the risk of transmission of diseases like leptospirosis, anthrax and clostridial infections (20,21).

Pastureland is common and sheep, horses, goats and geese graze the same pastures as dairy cattle in Kars. This practice also poses serious problems, such as the transmission of infectious diseases between and within species (i.e. malignant catarrhal fever, leptospirosis and anthrax) and inefficient use of pasture by dairy cattle. This implies that alternatives in pasture management should be considered.

Longer housing and dry periods, and lower milk production and birth rates are without doubt major constraints on profitable farming, due either to increased costs associated with longer housing periods or to decreased income due to low milk and offspring production. Additionally, use of dung as bedding, rare use of maternity pens, water supply from streams and poor pasture management are practices posing possible risks to the health and welfare of dairy cattle (22,23).

The present study identified important features and possible failures of dairy farming in Kars. The results are of great help in designing strategies to overcome drawbacks that are detrimental to feasible and profitable farming and also in forming bases for future epidemiological studies in which the effect of farm management practices on disease occurrence is measured in Kars, where many diseases are endemic (24,25).

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