

The Profitability of Animal Husbandry Activities on Farms in Dry Farming Areas and the Interaction between Crop Production and Animal Husbandry: The Case of Ankara Province in Turkey

H. Tanrıvermiş^{*1} and M. Bülbül²

Abstract

This paper examines the linkages between livestock and crop farming activities and provides a comparative analysis of the profitability of different livestock activities in the highlands of Ankara. The data was collected from 52 sample farms in the Nallıhan, Ayaş, Güdül and Beypazarı districts of Ankara by way of a questionnaire, where the farms have, on average, 20.7 ha of land and are thus regarded as small family farms. Insufficient irrigated land and working capital, weak market relations and the pressure of high population brings about a requirement to strengthen crop-livestock interaction. Production on the farms is generally carried out in extensive conditions, with goat, sheep and cattle husbandry in addition to crop production. Crop production makes up for 20.8% of the total gross production value on the farms. Of this figure, the entire yields of wheat, barley, pulses, straw and fodder crops are used for own consumption by the households, along with 74% of the wheat and 77% of the barley produced. The research results indicate that the current management systems may be defined as mixed farms in terms of crop–livestock linkages. The average total income of the households surveyed is 9,412.0 USD, of which 63.4% comes from farming activities. Every 1 USD invested in animal husbandry provides an income of 1.12 USD from dairy cattle breeding, 1.13 USD from Angora goat breeding, 1.16 USD from sheep breeding and 1.27 USD from ordinary goat breeding. It has been found that ordinary goat breeding, which provides the greatest relative profitability for the farms, offers many advantages, and that the transition from Angora goat breeding to ordinary goat breeding through the breeding of ordinary male goats into the Angora herd has occurred in recent years. The results of the survey indicate that supporting crop production with animal husbandry is considered a requirement in order to maintain economic and social sustainability in the farms and to support rural development.

* corresponding author

¹ Harun Tanrıvermiş, Associate Professor, Department of Agricultural Economics, Agricultural Faculty, Ankara University, Dışkapı, Ankara, Turkey, Tel: +90 312 596 16 05, Fax: +90 312 318 53 60, e-mail: tanrivermis@gmail.com; tanriver@agri.ankara.edu.tr.

² Mehmet Bülbül, Professor, Department of Agricultural Economics, Agricultural Faculty, Ankara University, Dışkapı, Ankara, Turkey, Tel: +90 312 596 16 05, Fax: +90 312 318 53 60, e-mail: bulbulmeh@yahoo.com; bulbul@agri.ankara.edu.tr

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1 Introduction

The insufficient and unbalanced nutrition in rural areas is emerging as an increasingly important problem in developing countries (FAO, 2006; İNAN, 1998). The most obvious solution to these problems in rural areas would seem to be engaging in both livestock and crop production, utilizing the interaction between the two, which has been suggested as a means to raise the income and improve the living standards of those people, and also increasing employment (AÇIL and DEMIRCI, 1984). Livestock provides meat and milk for the households, as well as cash income that can be invested in crop production technologies. In many regions, livestock is also a means of storing capital to buffer food shortages in years of poor crop production (POWELL *et al.*, 2004). The dependence of animal husbandry activities on land in the farms is related to the input demands of the activities and the means of meeting these from within the farm. While some livestock activities are highly dependant on land, others, such as poultry farming, are not. In cases where there are sufficient pastures and meadows, goat and sheep breeding emerge as an important main or complementary income and employment source for rural households. In the farms located in villages distant from the markets, where there is little opportunity to sell produce, dairy cattle breeding is oriented to meeting the needs of the individual households, with any milk over and above that used by the household being refined into milk products. Goat and sheep breeding are activities that are highly dependant on land and require intensive labor. These activities are performed particularly in the highlands of developing countries, where labor is abundant and unemployment is a common problem, enabling people to consume animal products at low cost (DEVENDRA, 1981; PETERS *et al.*, 1981; FAO, 2006).

In Turkey there are 4.2 million households in rural areas, 76.2% of which are engaged in crop and animal production activities. The farms engaged in both animal and crop production activities are generally located in dry farmlands, in the highlands and in mountainous areas, but are generally engaged in animal husbandry on a small scale. On average, farms keep an average of four head of cattle or buffalo, and nine head of sheep or goats. On farms carrying out only animal husbandry activities, the average livestock per farm is five head of cattle or buffalo and 35 head of sheep or goats (SIS, 2004b,a). The low average of livestock population, even on specialized livestock farms, has a substantial negative affect in utilizing economics of scale. The income sources of rural households vary depending on the natural, economic and social conditions of the settlements. On the farms settled on higher ground, the amount of farmland, particularly meadows and pastures, is low; the rate of idle labor is high; the capital is insufficient; income and saving levels are restricted; and living conditions are very arduous.

Dry farmlands integrate crop and livestock activities in the Central Anatolian Region of Turkey, in line with the trend in the rest of the country. Located in the northern part of the Central Anatolian region, Ankara has a dry climate; it receives limited rainfall (average 367-480 mm year⁻¹) and is suitable for small ruminant breeding. The total

number of farms in Ankara is 43,400, 31.0% of which deal with crop production and 6.0% with animal husbandry, while 63.0% are involved in the production of both crop and animal products. The province of Ankara contains a total of 1.3 million ha of farmland, of which 62.9% is allocated for cereal production. Although 15.3% of this is appropriate for irrigation, only 7.4% is actually irrigated. There are 219,792 head of cattle, 535,621 head of sheep, 34,572 head of ordinary goats and 88,308 head of Angora goats in the province. Goat and sheep breeding is one of the major sources of income and employment on the farms located in the mountainous regions of Ankara, and along with cattle breeding provides multiple products, such as milk, mohair, hair, wool, increase in stock (live weight gain), leather and manure. In the Ayaş, Güdül, Nallıhan, and Beypazarı districts of Ankara the farms are involved in sheep, goat and cattle breeding as well as crop production, and in the villages settled in or around forests, where the land resources are sloped, the rearing of goat and sheep is a traditional activity. However, after the 1980s the livestock populations in farms have significantly reduced in parallel to the changing economic conditions. It has been observed that changes in socio-economic factors are rapidly transforming traditional and extensive crop and livestock management practices.

The main problems in the crop and livestock management systems include inadequate working capital and feed resources, limited farmland and irrigated land resources, shortages of productive pasture and meadows, lack of access to nutrient inputs, labor shortages during the planting season and inadequate access to markets. A principal challenge facing agriculture in dry farming is how to achieve sustainable increases in crop and livestock production with limited use of fertilizers, pesticides, feed supplements, certified seeds, fuels, water, and so on. Low household incomes and the high cost of fertilizer and feed supplements, among other factors, prevent the widespread use of external nutrient sources, which are generally limited to small farms devoted to cash crops. Diet supplements for livestock are used rarely in livestock activities around the highland and mountain areas due to limited working capital, insufficient farmland and weak market access. As long as fertilizers and feed supplements are unavailable, the fertility of cropland will continue to depend on the nutrients supplied from animal manure (POWELL *et al.*, 2004). On the farms in the highlands at an altitude of over 800 meters in Ankara Province, in order to utilize the products obtained from crop production in animal husbandry and to improve the productivity of crop production and maintain soil productivity, it is necessary to improve the income sources and living standards of households by utilizing manure, and thus strengthen the transfer between activities.

Although there are many scientific researches analyzing the economic results of animal breeding at a farm level in Turkey (ERKUŞ and DEMIRCI, 1983; KIRAL *et al.*, 1996), the issue of livestock-crop interaction in farms remains understudied. It is necessary to develop appropriate policies for the higher regions by evaluating the profitability and competitive strengths of livestock activities, and the impacts of the livestock-crop interaction on the economic performances of the activities. Crops and livestock are enterprises that have been operationally and functionally linked for years (MCCOWN *et al.*, 1979) and the linkages between animal breeding and planting activities are evaluated

from the viewpoint of food, investment, manure, feeds and employment (POWELL and WATERS-BAYER, 1985). In the evaluation of crop–livestock systems, the ratios of input provided from farms (at least 10% of the feed) or share production value obtained from non-livestock farming activities in all farms (SERÉ and STEINFELD, 1996; POWELL *et al.*, 2004) are assessed in general. In this research, the usage of land and labor forces in the farms located in the high regions of Ankara, livestock-crop interaction, the gross production value of the crop and animal production activities, costs, farm and total incomes of the households and their sources, production volume of the animal husbandry activities, production costs, gross and net margin (profit) per herd or large animal unit (LAU) are examined. Based on the research results, improvements of livestock-crop interaction in dry farming areas and opportunities for increasing the income contribution obtained from these interactions have been discussed.

2 Materials and Method

In this study, the economic efficiency of the production activities and livestock-crop interaction taking place in the high regions of Ankara have been evaluated using the questionnaire data obtained from the farms situated in the districts of Ayaş, Güdül, Beypazarı and Nallıhan, where alongside crop production the focus is on the breeding of Angora goat, ordinary goat, sheep and dairy cattle. The data was collected by administering a questionnaire to farms involved in market-oriented production with 20 or more head of goat and sheep and four or more head of dairy cattle in the 16 villages with the highest livestock population and the most breeders in the four districts. The survey was implemented between May and July 2006, and included input-output figures related to the production activities of the 52 farms that agreed to participate in the survey. The monetary results of the study were measured initially with the national currency, and then converted into USD, based on the average exchange rate of the Central Bank of the Republic of Turkey.

Production factors, income from farming and other sources, head of livestock, productivity, production costs, profitability levels, and the tendencies and expectations of the producers were examined in the evaluation of the structural properties of the farms. Production costs were measured by taking the actual inputs and the prices paid by the producers as a basis. The gross production value was calculated by multiplying the average production figures obtained from the farm by the farmers' received prices. Variable (fertilizers, pesticides, feeds, veterinary, shearing, hired labor, shepherding, transportation, sales and working capital interest) and fixed costs in crop production and livestock activities were analyzed. Fixed assets and the economic life of breeding animals were taken as a basis for the amortization calculation, and real interest rates (5%) were used in the identification of the interest of the fixed assets. The interest of working capital was determined through short-term loan interest rates (average 18%). The herd composition in the farms and annual livestock inventory were examined. The change in inventory (real increase in inventory value) was found by subtracting the value of the stock, the sold value and the animals slaughtered in the households at the end of the year from the value of the animal stock at the start of the year and purchase price by using a

livestock inventory chart (AÇIL, 1976; TURNER and TAYLOR, 1998). After determining the annual livestock numbers for each enterprise, animal populations are transformed to a standard figure, known as the large animal unit (LAU), based on species and age (AÇIL and DEMIRCI, 1984; İNAN, 1998).

A partial budget or production activity analysis was implemented for the analysis of contributions of animal husbandry to the welfare of the producers (TURNER and TAYLOR, 1998). During the production activity analysis, net profits from the activity were determined by subtracting the production costs of the activities from the gross production value; and gross profits of the activity were determined by subtracting variable costs of production activities from the gross production values (GITTINGER, 1984; AÇIL and DEMIRCI, 1984; ERKUŞ *et al.*, 1995). In the research area, crop and animal production activities have been operationally and functionally linked for years (MCCOWN *et al.*, 1979) and the evaluation of linkages between these activities can be used to draw up policies to enhance sustainable rural development. The livestock-crop interaction in the farms was evaluated taking into account factors such as usage of lands, capital demand, own consumption rates of the crop and animal produce, usage of manure, distribution of gross production value according to activity and the impact of livestock-crop interaction on living standards of producers. In the evaluation of the crop–livestock systems, farms on which at least 10% of the feed comes from crops and/or crop by-products or on which more than 10% of the total agricultural production value comes from non-livestock farming activities are termed as mixed farms (STEINFELD, 1998; SERÉ and STEINFELD, 1996; POWELL *et al.*, 2004).

3 Research Results and Discussion

3.1 Farmland of Households, Climate Conditions and Land Use

While Ankara's dominant climatic characteristic is the continental climate, the mild and rainy Black Sea climate can also be observed in the northern regions of the province. While the city has an average annual rainfall of 367 mm, in the districts of Beypazarı, Ayaş, Gündül, and Nallıhan this figure increases to 440–480 mm. 78% of the average annual rainfall in Ankara is concentrated between the months of October and April. 80.6% to 88.2% of farmlands are within the 1st – 4th soil classes and the rest of these lands fall in the 6th – 7th classes. Dry lands, constituting 90% to 95% of the total land in the region, fall within the range of 1st – 7th classes. 48.9% to 71.4% of the lands in the districts are located in mountainous areas on a gradient of more than 12%. Since the lands are sloped, the productive soil depth is not sufficient. In the four districts, 73.7% to 81.9% of the lands have very low (less than 50 cm) topsoil cover (KHGM, 1992). In sloped areas, topsoil is generally shallow, high in acidity, low in fertility and vulnerable to erosion. In the districts surveyed, 13.4% to 20.7% of the lands are subject to very severe water erosion and 42.1% to 60.7% are subject to severe water erosion. No serious drainage or barrenness problems, which can negatively impact productivity, are observed (KHGM, 1992). In the districts, the share of the lands not affected by these problems is very low, which has a detrimental affect on the rate of obtainable income.

The average operating and of the farms is 20.71 ha, almost all of which is owned land (91%), and self-entrepreneurship is dominant. Entrepreneurs state that the lands cannot provide a satisfactory level of income and it has been found that the amount of the lands cultivated through rental and partnering is at low levels. Other factors, such as the lack of labor in the farms (due to the aged and unhealthy population), the location of some parcels remote from the villages, and land cultivation not being economically advantageous have led some households to open some parcels of their own lands for utilization under rental or crop-sharing. The households are generally regarded as small family farms in terms of land, although operating farmland is 3.4 times greater than the national average (6.1 ha).

Table 1: Land assets and land tenure in the farms.

<i>Land Tenure Forms</i>	<i>Types of Land (ha)</i>			<i>Total Land (ha)</i>
	<i>Irrigated Land</i>	<i>Dry Land</i>	<i>Orchards & Vineyards</i>	
Owned Land	0.55	17.65	0.55	18.75
Land Used Under Rental and/or Crop-sharing	1.81	1.34	–	3.15
Land Allocated to Rent and/or Crop-sharing	–	1.19	–	1.19
Total Operating Land	2.36	17.80	0.55	20.71

On the farms, 85.9% of the lands are comprised of dry lands, generally allocated to cereal, pulses, and fodder crop production. 11.4% of the farmlands are irrigated and 2.7% of fruit plantations and vineyards. 14.1% of the lands cultivated by the farms are irrigated, and are used for the cultivation of sugar beet, alfalfa and tomatoes, as well as for vines and fruit orchards. 34.8% of the operating land is cultivated for wheat, 28.1% for barley, 3.2% for common vetch, 1.1% for alfalfa, 1.2% for chickpeas, 2.2% for sugar beet, 1.1% for vegetables and 2.7% for vines and fruit orchards, whereas 25.6% is left fallow. Since rainfall is scarce in the summer, the farms continue to rotate fallow dry lands. The approach of cultivating pulses and beans every year instead of allowing the land to remain fallow is observed only in one village. 4.3% of the farmlands are reserved for fodder crops, which falls short of the requirements for the animal husbandry activities. Under these conditions, pasture and forest lands are used for dry grass production and a significant amount of cereals are used as fodder.

3.2 Population and Labor Forces and their Use on Farms

The average household contains 5.11 persons, divided between sexes as 2.66 male and 2.45 female, resulting to 3.84 man work units. On average, 9.8% of the household residents are between the ages of 0 and 6, 14.7% between 7 to 14, 70.6% between 15 and 65, and 4.9% 66 and above. The 15 to 65 age group constitutes the economically active (productive) population in the households, and at 70.6% is higher than the national average.³ Due to the migration of the younger population to urban areas the average age in the villages has increased, leading to lower tendencies to invest in the

businesses. While the population in the province and districts of the region is on the rise, the population in the rural areas is becoming lower. The decrease in the number of households in rural areas causes the barren lands with low productivity to be left idle as grassland.

It has been found that 100% of the male and female population in the households above the age of 7 is literate. The average schooling period of the population is 6 years, comprising primary (primary and secondary school) education. 40% of the family labor in farms cannot be utilized effectively throughout the year, however, as the production activities are not planned according to the labor requirement, these households employ permanent or temporary hired labor. While utilization of the idle labor force is expected with the improvement of animal husbandry activities on the farms, 48 of the surveyed households employ permanent shepherds, and all of the shepherding jobs are carried out by hired labor. In addition, the farms generally employ hired labor during maintenance and harvesting seasons. Since non-agricultural job opportunities of the household population are limited, crop and animal production are the main economic activities. 60% of the household heads are covered by social security, and most of this amount comprises of those who had worked in non-agricultural jobs in the cities before turning back to rural areas after retirement.

3.3 Capital Structure and Distribution in Farms

54.6% of the total assets of the farms are fixed capital (land, land improvements, building and crop assets) whereas 45.4% is working capital (livestock, tools and machinery, and other working capital items). The value of livestock, at 34.7%, has the highest share in total assets, followed by land (30.4%), buildings (22.3%) and tools and machinery (7.2%). On the farms, the share of crops and trees in the total assets is 1.1%, that of the land improvement investments 0.8%, and other working capital (input and output in stocks, cash, and so on) 3.5%. The average head of animals on the farms is 137.98 LAU, 35.1% of which is Angora goat, 33.9% ordinary goat, 27.4% sheep, 3.1% dairy cattle and 0.5% poultry and work animals. Considering the limited availability of cash on the farms, problems are experienced in meeting the requirements of animal husbandry in the winter season, which leads to the untimely slaughter of lambs and young goats.

Diversification into animal husbandry reduces risk by providing insurance in case of crop failure. In these systems, livestock is also a source of liquidity and investment capital in the absence of savings and credit institutions. Income obtained from the sale of livestock can provide the cash needed to finance crop farming and improve crop production by providing the investment capital needed to enhance productivity (HOPKINS and REARDON, 1993). Crop farming meets the working capital requirements of animal husbandry activities, while the income obtained from sales of livestock meets the working capital demands of crop production (financing a product with another product within the farm). In the households, harvesting and marketing jobs of such crops as wheat and barley, for which 62.9% of the total lands are reserved, are carried out in the summer season, and the income obtained from sales of these products is used to meet the working capital demands of animal husbandry activities. Cash on the farms is limited, and the income

obtained from the sales of crop products within the year is not sufficient to meet the demands of working capital and family requirements, leading to untimely lamb and goat sales.

3.4 Livestock-Crop Interactions on the Farms, Breeding Objectives and Gross Production Value

The historical development process of the farms of Ankara has witnessed three different periods with regard to livestock-crop interaction. In the first period, prior to 1950, animal power was used for land cultivation, processing and the transportation of products, and manure was the only fertilizer available. The second was the 1950-1880 period, when tractors and mechanical power replaced work animals, even in mountain villages; the usage of off-farm inputs such as chemical fertilizers, pesticides, certified seeds and concentrated feeds increased; and subsistence farming was replaced with market oriented production. However, serious population pressure on the farmlands and a significant decrease in the livestock population was observed within this period. The third period is post-1980, when the relatively more educated population migrated to urban regions, the elderly and retired individuals began participating in farming, and input transfers between crop production and animal husbandry became common in the mountainous regions. Since there are literally no producers with agricultural insurance, crop-livestock interaction significantly reduces risks and uncertainties in production and income, and also creates employment opportunities.

Animal production has been relatively common in the farms of the upland areas for several centuries. The decision to engage in crop-livestock farming on sloped land is closely related to the characteristics of land and water resources. Small-scale farmers used a wide range of produce, such as wheat, barley, vegetables, fruits, grapes and pulses, to meet the demand of the household and to feed their livestock. In recent decades, with the rapid economic growth, the number of animals per farm has increased or animal production has become localized in specific villages or farms. This has caused weak linkages between crop and livestock activities, which are vital for the intensive use of local resources and for the economic, social and environmental sustainability of small scale farming.

The crop-livestock farming systems for highlands are focused on dairy cattle, sheep and goat farming in particular. Farmers are still continuing to breed cross-bred dairy cattle that graze in pasture for 3 to 5 months a year and are fed in the barn for the rest of the year. Sheep and goats usually graze on natural pastures, meadows and forestlands for 7 to 9 months per year and stay in the pen during the December-April period. During the grazing season, in the months of April and May supplementary feeding is carried out. Agricultural by-products, such as straw, dried grass, grain and fodder crops, are used for feed, and thus it is possible to reduce production costs. Angora and ordinary goats are usually kept on the highlands, steep mountains or on forestland. Feed from common property resources provides a low-cost raising system, but not an efficient one. It destroys the plant cover, which, coupled with rainfall and sloped terrain, can cause

serious soil erosion. However, higher economic benefits can be obtained when animals are able to graze, and their manure returned to the soil to enrich fertility.

The dry and low-precipitation climate of Ankara is suitable for goat and sheep breeding. As sheep and goat breeding is a meadow-based (extensive) activity, it is generally preferred to draw benefit from the meadowland, as long as the climate conditions are appropriate, in order to reduce costs, to ensure easy herd management and reduce the demand for working capital. Not all the examined villages have the opportunity to utilize meadows and plateau under common ownership of the village, an important factor considering the costs associated with renting meadows and plateau. Nine of the villages use common land owned jointly by the village, three use pasture rented from neighboring villages, and four use in-forest grazing areas, although this practice is illegal.

Farms are forced to graze their goat and sheep flocks inside the forests, as the amount of meadows, fallow land, pastures and tablelands in their villages is insufficient. In addition, grazing is performed on cereal stubble in the July to October period and on fallow land until September each year. Factors such as the barrenness, low fertility and insufficiency of the lands owned by the households, as well as the fact that some do not possess any land at all, makes goat and sheep breeding a very low cost per animal, and therefore advantageous, activity.

One of the most problematic issues in terms of crop production-animal husbandry interaction is encountered in animal-forest relations (CHANG, 1989; CHEN *et al.*, 1992; GÖKÇE and ENGİNDENİZ, 1994). Ordinary goats consume the leaves and young sprouts of the trees and damage the forests, which have the ideal plant coverage for low-cost feeds. However, it is thought that Angora goats and sheep cause no harm to the forests. The government has followed a policy of discouraging farmers from goat production in an attempt to conserve forestland. While the forestry authority seeks to ban goats and sheep from the forests as per the legal stipulations, the producers defend that Angora goats and sheep do not damage the forests to the same extent as ordinary goats.

Farmers select animal husbandry as a source of income and employment depending on factors such as land resources and topography (particularly the gradient of the land), soil fertility, availability of meadow and pasture, household labor force, price of feeds, value of produce, livestock accommodation, machinery assets of the farms, and in particular consumer demand, trends and traditions. Since a significant amount of the lands of the farms is barren, steep and of moderate or low fertility, the amount of meadows and pastures are limited, settlements are far away from markets, transportation is problematic especially in high lands, and the winter season and the time spend in shelters is relatively long, it would be advisable for these farms to focus on sheep and goat breeding.

Producers have animal husbandry experience that varies from between 5 to 72 years, with an average experience of 34.7 years. The 52 producers who participated in survey were queried about their reasons for engaging in animal husbandry. The reasons why farms prefer Angora goat, ordinary goat and sheep breeding include the high adaptation capabilities of these animals to barren lands, rapid increase in herd populations due to high birth rates, the ability to perform breeding activities even in primitive shelters

and low maintenance costs as compare to intensive livestock activities, alongside other factors such as the traditional nature of the activity (especially for Yörüks) and it being the most convenient activity for increasing household income. On the other hand, farms engage in the breeding of dairy cattle for own produce consumption, low labor demand when compared to other activities, convenient opportunities the activity offers for utilizing the family labor force and to meet the cash requirement of the farm (Table 2).

Table 2: The reasons animal husbandry activities are preferred*.

<i>Reasons (Objectives) of Breeders</i>	<i>Mohair Goat</i>		<i>Ordinary Goat</i>		<i>Sheep Breeding</i>		<i>Milk Cattle Breeding</i>	
	<i>No.</i>	<i>Rate (%)</i>	<i>No.</i>	<i>Rate (%)</i>	<i>No.</i>	<i>Rate (%)</i>	<i>No.</i>	<i>Rate (%)</i>
Adaptation to barren land and ease of feeding	36	17.82	41	19.34	43	18.07	6	4.20
High fertility rates and ease of expanding the herd	32	15.84	38	17.92	40	16.81	3	2.10
Breeding possible even with primitive shelter	29	14.36	20	9.43	34	14.29	2	1.40
Low maintenance costs and a traditionalized activity	27	13.37	23	10.85	31	13.03	4	2.80
Increasing the household income	23	11.39	27	12.74	27	11.34	17	11.89
Herd management tasks are at a low level and easy	21	10.40	25	11.79	25	10.50	13	9.09
Labor force requirements are lower than other activities and the high potential to use family labor	17	8.42	20	9.43	19	7.98	32	22.38
Meeting cash requirements of the farm	13	6.44	11	5.19	14	5.88	22	15.38
Meat, milk, manure, wool, hair, and mohair to meet family requirements	4	1.98	7	3.30	5	2.10	44	30.77
Total	202	100.00	212	100.00	238	100.00	143	100.00

(*) Survey participants were allowed to give more than one reason.

All but 11 of the 52 producers surveyed stated that they were inclined to continue goat and sheep breeding in the future. The reasons given by the 11 that were inclined to abandon livestock breeding included the unsatisfactory prices for mohair, wool, goat hair and goat and sheep meat. In the examined villages and farms covered in the survey, the livestock populations have decreased by as much as 80%, while farms engaged in animal husbandry have decreased by two-thirds since the 1980s. The reasons for this include insufficient and/or unstable prices of animal products, the wish to transform the land from pasture to cultivation, the ban on grazing in forests, high feed costs, high wages of shepherds and insemination facilitators, the high cost of leasing pasture in villages with no common grazing areas and the decreasing demand for sheep and goat meat in parallel to increasing levels of social welfare. Goats and sheep can bring income that is double or treble their value annually thanks to mohair, wool, hair, milk, and lamb and

kid sales; however, the breeding activity necessitates regular cash throughout a year and the working capital demands of the breeding activity is met only by cash assets obtained from other activities and funds. Most of the farms tend to continue their livestock breeding activities as it is the only source of income and is a traditionalized activity, and because they do not have sufficient land or capital for crop farming.

For the households that breed sheep and goats which do not have any privately owned lands it is very difficult for the crop and livestock activities to finance each other, and since animals can not be properly maintained and fed the mohair, hair, wool, milk, and live weight productivity remains low. The households commonly slaughter lambs and kids prematurely after 3 to 5 months, when the optimum live weight is not reach until 5 to 8 months, causing a decrease in profitability levels of the animal husbandry activities within the farm. The premature slaughter of lambs and kids is on one hand, an economic loss, an, on the other hand, a problem concerning animal welfare, as particularly defined by CULLEN (1991) and BARTUSSEK (1999).

Most part of dry land farming in Anatolia region of Turkey integrates crop and livestock production, in line with the rest of the country. In these systems, the productivities of livestock and croplands are inextricably linked. In the examination of the crop-livestock interaction, the own consumption of the crops in the farms and the marketing ratios of these produces and transfers between crop production and animal husbandry activities are primarily evaluated. Wheat and barley are the principal cereals, alfalfa and wild vetch are the main fodder crops, chickpeas are important in some areas, and sugar beet, vegetables, and fruits are cultivated along rivers and streams. Legumes and vegetables are used for subsistence, cereals are used both for subsistence and as cash crops. The straws from wheat, barley and pulses, as well as all of the fodder produced in the households, are used in animal husbandry and are not offered to the market. Similarly, 74.2% of the wheat and 76.7% of barley produced is utilized as feed in animal husbandry, and a certain amount of these crops is kept as seeds to be used in crop production. The remainder is consumed by the household. The farms produce vegetables, fruit and grapes at a low level for household consumption, while nearly all of the industrial plants, such as sugar beet, are produced in a particularly low number of farms and are offered to the market (Table 3).

Crop residues are vital livestock feeds during the 3 to 5-month winter season, and manure enhances soil fertility for crop production. Feed from pasture, meadows, forestland and fallow lands provide important livestock feeds, and manure is used for increasing cropland productivity. The households use 70.5% of milk produce, 3.2% of meat or live animals, 97.1% of eggs, 1.1% of wool produce, 13.7% of hair produce and 95.4% of manure is utilized on the farm, with the remaining offered to the market. A significant part of the animal products is used to meet the product requirements of the household members, shepherds and other agriculture workers. Since most of the animal products produced in the households is also consumed in the households, in cases when the households abandon animal production activities, sufficient and balanced nutrition of families and meeting the animal product requirements will become a significant problem. As noted by MINASYAN and MKRCHYAN (2005), farming still helps to provide the minimum

Table 3: The utilization of products produced by farms in households and marketing ratios.

Crop Products	Arable Land (ha)	Average Per Household			
		Production Amount (kg)		Marketing Rates (%)	
		Grains	Straw	Grains	Straw
Wheat	7.21	14,650	8,445	25.81	0.00
Barley	5.81	14,319	6,625	23.33	0.00
Common Vetch	0.67	678	940	0.00	0.00
Alfalfa	0.23	3,450	–	0.00	–
Chickpeas	0.25	255	320	60.00	0.00
Sugar Beet	0.45	29,255	–	99.65	0.00
Vineyards	0.35	3,650	–	43.22	–
Vegetables	0.23	11,560	–	65.35	–
Fruit Plantation	0.20	5,550	–	45.51	–
Fallow Land	5.31	–	–	–	–

of food for consumption, keeping extreme poverty in rural areas lower as compared to urban areas. On the other hand, manure is used entirely for the fertilization of croplands and is generally obtained from either one's own livestock or from the livestock of other farmers on rare occasions. When intensive vegetable and fruit farming is uncommon in the region, the marketing ratio of manure is very low. Animal power was used for the production, harvesting, processing and marketing of crops before the 1950s, after which tractors replaced animal power. It is observed that there are no longer any farmers using animal power.

The average gross production value in farms is 65,626.02 USD, 20.8% of which comes from crop production and 78.2% from animal production. Since 20.9% of the gross production value is obtained from non-animal husbandry activities in the farms, in line with the general principles put forth by SERÉ and STEINFELD (1996); POWELL *et al.* (2004) (stating more than 10%), these business can be defined as mixed farms. In the crop farming, wheat production has the largest share (7.6%) in gross production value of the households, followed by barley production (5.7%). Dairy cattle breeding have very limited share in the households and is generally oriented to meet the milk and milk product demands of the households; none of the households engage in cattle fattening. Since farms are generally located in the villages situated around the forests, only producers living in four villages were found to supply the milk in excess of household requirements to the market. In mohair goat breeding, the income obtained from mohair production and the sale of goats has an important share, and milking is performed only to meet the requirements of own consumption, as Angora goat milk has no commercial value. In ordinary goat and sheep breeding, milking is performed for an average of 40

to 50 days annually, and the milk is generally used for household consumption and for refining into milk products, whereas kid, lamb, goat hair, mohair and wool is generally produced for the market. In animal production, the Angora goat has the largest share (30.1%) in the gross production value of the farms, followed by ordinary goats, sheep, dairy cattle, and other animal husbandry, which are 23.0%, 19.8%, 6.0% and 0.3% respectively (Table 4). Angora goats, ordinary goats, sheep and cattle skins can be sold for high prices, and thus the leather from the animals slaughtered for household consumption or that have died of natural causes are supplied to the market. There is a linear relation between the volume of the livestock activities or herd size and the gross production value of these activities and the gross production value of the activities increases parallel to the increase in herd sizes. However, an increase in the herd size may also yield an increase in costs, as well as dispatch and management problems.

Table 4: Gross production value and distribution in farms.

<i>Production Activities</i>	<i>Value (US \$)</i>	<i>Rate (%)</i>	<i>Rate (%)</i>
<i>Crop Production Activities</i>			
Wheat	4,978.83	36.38	7.59
Barley	3,765.52	27.52	5.74
Alfalfa	1,189.54	8.69	1.81
Common Vetch and Sainfoin	1,076.47	7.87	1.64
Sugar Beet	1,762.93	12.88	2.69
Other Crop Products	911.98	6.66	1.39
Total Crop Production	13,685.27	100.00	20.85
<i>Animal Husbandry Production Activities</i>			
Cattle Breeding	3,948.80	7.60	6.02
Sheep Breeding	12,969.13	24.97	19.76
Ordinary Goat	15,058.66	28.99	22.95
Angora Goat	19,747.87	38.02	30.09
Poultry Farming	216.29	0.42	0.33
Total Animal Husbandry Production	51,940.75	100.00	79.15
Grand Total	65,626.02	–	100.00

3.5 Farm and Total Incomes of Households and Incomes Sources

The net return of the farms is 16,957.8 USD, of which the proportion to gross income is 25.8%. The farms earn positive interest revenue for the total assets they invest in agriculture. The farm income of the households is obtained in provisions of labor force of the entrepreneur and of his/her family who work in the enterprise without

pay, the income of the equity capital and the entrepreneurship income. Farm income is an important indicator of the success of the entrepreneur. The average income of households from farming is 5,963.1 USD, and off-farm income is 3,448.9 USD equating to a total household income of 9,412.0 USD. The farm income of families is close to the sufficient farm income (5,543.31 USD) defined by Law, no. 3083 dated 1983. The per capita income is 1,841.9 USD, which is almost on the same level as the rural average, but below the national average.

The opinions of the producers concerning the income sources of the households and their priority were also evaluated. According to the 76.2% of the households, the primary income source comes from animal husbandry, 15.4% said crop production while 8.4% said pension salary, small business and trade incomes and direct income support payments. In order to check the declarations of the producers, the distribution of household incomes according to sources was examined. The share of farm income in total family income is 63.4%, whereas that of pensions, wages and fees is 17.7%, that of direct income support is 15.4%, and that of trade and other activities is 3.5%. It has been determined that the households saved 15.2% of their annual average income and that their average saving trend is below the average for rural areas. 67.1% of the households stated that they obtained sufficient income to meet the annual expenditures of the families, with the remaining 32.9% claimed that the average annual income was not sufficient, and that they have needed to borrow from their neighbors, relatives and organizations.

3.6 Comparative Analysis of Livestock Activities and Competitive Opportunities in Farms

The impact of production activities on the welfare of producers can be measured in terms of gross margin. This approach assumes that fixed costs are not affected by the production activities or the size of farm (GITTINGER, 1984; WEBSTER and BOWLES, 1996; BÜLBÜL and TANRIVERMIŞ, 2002). The contribution of livestock activity to the standard of living of the producer can be measured with the increase in the profit obtained from the activity. The gross production value of animal husbandry activities comprises mohair, wool, hair, change in the inventory value, milk, leather from the dead and slaughtered animals and manure.

The average herd size in the farms and the production costs, gross production value, as well as gross and net profits per household and per LAU are calculated. The distribution of production costs in animal husbandry provides an insight into the production intensity level. Although the share of feed costs in total production costs varies from 22.2% to 24.2% in Angora goat, ordinary goat and sheep breeding, this ratio is around 60% in dairy cattle breeding, which are housed in barns for two-thirds of the year. The share of labor costs in total production costs varies between 45.8% to 48.2% in goat and sheep breeding, whereas this ratio is around 23.0% in dairy cattle breeding (Table 5). As goat and sheep breeding are mainly dependent on natural conditions and pastures, contrary to extensive livestock activities, the biggest share in the annual production costs is taken by temporary and permanent labor costs rather than the costs of feeds.

Table 5: The distribution of production cost items in animal husbandry activities.

<i>Livestock Activities</i>	<i>Feed Costs</i>	<i>Labor Costs (%)</i>		<i>Other Costs (%)</i>
		<i>Temporary Labor</i>	<i>Permanent Labor</i>	
Angora Goat	23.94	12.64	33.16	30.26
Ordinary Goat	22.17	13.11	35.13	29.59
Sheep Breeding	24.23	13.17	34.17	28.43
Dairy Cattle Breeding	59.77	10.42	12.61	17.20

As the breeds, numbers, and ages of the livestock in the farms are variable, gross and net profits per LAU are compared. The gross production value per LAU in the farms is highest in dairy cattle breeding (937.9 USD) followed by Angora goat, sheep and ordinary goat breeding. The gross profit per LAU is highest in dairy cattle breeding, 360.9 USD and lowest in sheep breeding, 183.5 USD. However, an investigation of the net profits per LAU shows that the highest net profit is obtained from dairy cattle breeding at 101.4 USD and the lowest from Angora goat breeding at 46.0 USD. For every 1 USD invested in animal husbandry in the farms the minimum income of 1.12 USD is obtained from dairy cattle breeding, which is followed by 1.13 USD from Angora goat breeding, by 1.16 USD from sheep breeding, and 1.27 USD from ordinary goat breeding (Table 6). As capital is a scarce factor in the farms, utilizing the capital in the areas where relative profitability is highest would be preferable.

One of the most significant indicators in examining goat, sheep and cattle breeding in the farms is net profit and an evaluation of its sufficiency. An advantageous result emerges in terms of gross and net profit based on the realized product yields, production costs and price relations. While the ratio of gross margin to gross production value is 58.0% in ordinary goat breeding, it is 53.5% in sheep breeding, 51.2% in Angora goat breeding and 38.5% in milk cattle breeding. On the other hand, the ratio of net profit to gross production value varies between 10.8% and 21.1% among animal husbandry activities, which is quite high. The average gross profits that the farms obtain from animal husbandry activities are at a rate that ranges between 38.5% and 58.0% of their gross income, and the ratio of the calculated net profit to the gross production value declines to the 10.8% to 21.1% range (Table 6). When the provisions of the capital invested in livestock activities in the farms are subtracted, it is seen that the producer obtains a positive net profit that is comparatively higher than the profitability indicators of agricultural activities in general, allowing utilization of the capital in alternative investment areas.

The gross production values obtained from animal husbandry activities, as well as gross and net profit levels, are fundamental factors that may influence the competitive edge of the animal husbandry activities within the farms. In all the animal husbandry activities in the farms, the positive gross and net profits are obtained per herd and LAU. Just as farms have surpassed the production threshold, they are surpassing the profit threshold and are meeting both the variable and fixed costs of production activities. As balances

Table 6: Profitability analysis of animal husbandry activities (Results per household and LAU)

Results of Activities	Mohair Goat		Ordinary Goat		Sheep Breeding		Milk Cattle Breeding	
	HH	LAU	HH	LAU	HH	LAU	HH	LAU
Variable Costs	9,637.35	199.16	6,330.99	138.99	6,026,70	159.31	2,429.34	577.04
Fixed Costs	7,886.12	162.97	5,553.00	121.91	5,158,50	136.36	1,092.41	259.48
Total Production Costs	17,523.47	362.13	11,884.00	260.90	11,185,20	295.67	3,521.75	836.52
Gross Production Value	19,747.96	408.10	15,058.83	330.60	12,969,26	342.83	3,948.81	937.96
Gross Profit	10,110.61	208.94	8,727.84	191.61	6,942,56	183.52	1,519.47	360.92
Net Profit	2,224.49	45.97	3,174.84	69.70	1,784,06	47.16	427.06	101.44
Gross Profit/ Gross Production Value		51.20		57.96		53.53		38.48
Net Profit/ Gross Production Value		11.26		21.08		13.76		10.81
Relative Profit (GPV/Production Costs)		1.13		1.27		1.16		1.12
Livestock Population (LAU)		48.39		45.55		37.83		4.21

HH: Hpusehold, LAU: large animal unit, GPV: Gross Production Value

are calculated and taken into consideration in cost analysis for the lands and buildings (such as domiciles, stables, pens and barns) owned by the manufacturers in the analysis of the production costs, it emerges that the producers gain other advantages in addition to the net profits. Under these circumstances, the maintenance of animal husbandry by the producers will be consistent in terms of management principles. However, it has been found that ordinary goat breeding, which provides the greatest relative profitability for the farms, offers many advantages, and that the transition from Angora goat breeding to ordinary goat breeding by breeding ordinary mail goats into the Angora herds in recent years bases on economic reasons. This finding of the study is quite a useful indicator, in that it shows the possible effects of agricultural policies on individual farms. Particularly in the villages of the district of Nallihan, the tendency to replace Angora goat breeding with ordinary goat and sheep breeding is observed to be high. Although satisfactory margins are obtained from the ordinary goat production activities of the farms, it would be useful to support the producers with incentives within the framework of direct support income – as is the case with Angora goat breeding – in an effort to increase the net profit per animal or per average herd and to increase the productivity of breeder animals.

4 Conclusion

Crop and livestock activities on the farms in the higher lands of Ankara in the Central Anatolian region have existed side-by-side throughout their historical evolution. In the farms, along with crop production, Angora goat, ordinary goat, sheep and cattle breeding have been performed by households living in dry farming areas, around forest settlements, and in the mountains in the Central Anatolian region for a long time, and particularly Angora goat, ordinary goat and sheep breeding are all highly traditionalized activities.

Animal husbandry activities are an important source of income and employment for the farms, and contribute to the improvement of the productivity of soil resources and provide healthy and balanced nutrition for the population. However, it has been found that the farms in which the survey has been conducted, and the villages where these farms are located, have experienced a drop of 80%, particularly in their goat and sheep populations, over the last two to three decades. Factors such as unfavorable relations between production costs and prices for animal products, inadequate state incentives, transformation of pastures and meadows into farmlands, prohibition of grazing for goats and sheep in the forest villages, and the high costs of qualified shepherds has led to a drop in the goat and sheep population in the farms. In order to develop Angora goat, ordinary goat and sheep husbandry there is a need to increase the mohair, wool, hair and meat productivity of the current population, improve the maintenance and feeding conditions, and decrease production costs, as well as increase the profitability of the activity. The Central Anatolian region, and particularly Ankara, is characterized by Angora goat, ordinary goat and sheep breeding, and the study results prove that these activities are nearly traditionalized in farms. The farms perform production generally under extensive conditions and bear the characteristics of small family farms. An average of 40% of the labor forces in the households remains idle, however, the households employ imported labor for animal husbandry and for the maintenance and harvesting of crops. Elderly individuals living in rural areas work in agriculture, and it has been observed that their tendency to invest in agriculture and technology is very low. Of the total assets of farms, 54.6% is constituted by fixed assets and 41.34% by working capital. The general insufficiency of working capital poses significant problems, particularly in winter, when cash incomes are nearly zero. Of the total gross production value in the farms, 20.8% comes from crop production and 79.2% from animal husbandry related production. The average total income is 9,411.9 USD, 63.4% of which comes from farming activities. The savings tendency of the households is low, leading to slow and insufficient capital formation, low investment and slow technological change. The animal populations in the farms are raised under conditions appropriate for animal welfare, sufficient health measures are taken, and the animals are raised in shelters that match the natural settings to the highest extent possible. The producers raise kids and lambs for about 3 to 5 months before selling them; and although premature slaughter may contribute to meeting immediate cash demands of the farms, this process has serious drawbacks in terms of farm economics and animal welfare. However, it is not possible to halt this activity in the short term, as it is something that has continued for centuries.

The straws of wheat, barley and pulses, as well as the fodder produced in the households, are used in animal husbandry. The farms produce vegetables, fruit and grapes at a low level for household consumption and nearly all of the industrial crops, such as sugar beets, are offered to the market. The households use 70.5% of milk produce, 97.1% of eggs and 95.4% of manure within the farms, the remaining being offered to the market. The study results show that farms in the highlands may be defined as "mixed farms". As the majority of animal products produced in households are for own consumption, animal husbandry activities contribute to the balanced nutrition of households. Several natural,

economic and social factors play parts in the selection of animal breeds to be raised by the farms. Income from the activities, costs and profitability are the main indicators among the economic factors. It has been found that ordinary goat breeding, which provides the greatest relative profit rates to the farms, offers great advantages, and that the transformation of Angora goats to ordinary goats through breeding with ordinary male goats is based on economic reasons. The implementation of policies targeted at improving the relative profitability of the sheep and Angora goat populations in the farms would enable the sustainability and competitive edge of these activities with ordinary goat breeding. The government must adjust its agricultural policies to help farmers reduce their costs and improve the quality of their produce, particularly in the highlands. Improvements in feed and grain crop production will help empower the linkages between crops and livestock in highlands. The integrated crop-livestock systems have been resilient, flexible and responsive to economic fluctuations and technical innovations, but should be evolved further to meet the certainty of further change and the challenges of sustainable agriculture.

References

- AÇIL, A.; Tarımsal Ürün Maliyetlerinin Hesaplanması ve Memleketimizde Tarımsal Ürün Maliyetlerindeki Gelişmeler; Ankara Üniversitesi Ziraat Fakültesi Yayınları: 665, Ankara; 1976.
- AÇIL, A. F. and DEMIRCI, R.; Tarım Ekonomisi Dersleri; Ankara Üniversitesi Ziraat Fakültesi Yayınları: 880, Ankara; 1984.
- BARTUSSEK, H.; A Review of the Animal Needs Index (ANI) for the Assessment of Animals' Well-Being in the Housing Systems for Austrian Proprietary Products and Legislation; *Livestock Production Science*; 6:179–192; 1999.
- BÜLBÜL, M. and TANRIVERMİŞ, H.; Vergleichende wirtschaftliche Analyse des konventionellen und ökologischen Haselnussanbaus in der Türkei; *Berichte über Landwirtschaft*; 80(2):304–320; 2002.
- CHANG, T. W.; Effects of Goats Grazing Pangola Grass Slope Land Pasture on Soil Erosion; *Journal of Taiwan Livestock Research*; 22(2):67–75; 1989.
- CHEN, K. J., LIAO, T. S., LEE, J. S., FAN, Y. K. and CHEN, Y. S.; Effect of Cattle Grazing in Forest on Young Stands; *Journal of Taiwan Livestock Research*; 25(2):189–197; 1992.
- CULLEN, P. T.; *Farm Animal Health: A Practical Guide*; Pergamon Press, Headington Hill Hall, UK; 1991.
- DEVENDRA, C.; Potential of Sheep and Goats in Less Developed Countries; *Journal of Animal Science*; 51(2):461–473; 1981.
- ERKUŞ, A., BÜLBÜL, M., KIRAL, T., ACIL, A. F. and DEMIRCI, R.; Tarım Ekonomisi; Ankara Üniversitesi Ziraat Fakültesi Eğitim Araştırma ve Geliştirme Vakfı Yayın No: 5, Ankara; 1995.
- ERKUŞ, A. and DEMIRCI, R.; Ülkemizin Değişik Bölgelerindeki Tarım İşletmelerinde Hayvancılık Faaliyetleri ve Bu Faaliyetlerin İşletme Bünyesindeki Yeri; Ankara Üniversitesi Ziraat Fakültesi Yayınları: 887, Ankara; 1983.

- FAO; FAOSTAT Citation Database Results; 2006; URL <http://faostat.fao.org/faostat>.
- GITTINGER, J. P.; *Economic Analysis of Agricultural Projects*; John Hopkins University Press, USA; 1984.
- GÖKÇE, O. and ENGİNDENİZ, S.; Türkiye Keçiciliğinin Geleceği Konusunda Bir Değerlendirme; Türkiye 1. Tarım Ekonomisi Kongresi, Tarım Ekonomisi Derneği ve Ziraat Fakülteleri Tarım Ekonomisi Bölümleri, 2. Cilt, İzmir, pp. 35-39; 1994.
- HOPKINS, J. and REARDON, T.; *Agricultural Price Policy Reform Impacts and Food Aid Targeting in Niger*; International Food Policy Research Institute, Washington DC, USA; 1993.
- İNAN, I. H.; *Tarım Ekonomisi ve İşletmeciliği*; Genişletilmiş Dördüncü Baskı, Tekirdağ; 1998.
- KHGM; *Ankara İli Arazi Varlığı*; Rapor No:06, KHGM (TC Başbakanlık Köy Hizmetleri Genel Müdürlüğü), Ankara; 1992.
- KIRAL, T., ÖZÇELİK, A., FIDAN, H. and YILMAZ, D.; *Ankara İli Tarım İşletmelerinde Tiftik Üretiminin Ekonomik Analizi*; Ankara; 1996.
- MCCOWN, R. L., HAALAND, G. and DE HAAN, C.; The Interaction Between Cultivation and Livestock Production in Semi-arid Africa; in: *Agriculture In Semi-arid Environments*, edited by HALL, A. E., CANNELL, G. H. and LAWTON, H. W.; 297-332; Springer-Verlag, Berlin, Germany; 1979.
- MINASYAN, G. and MKRTCHYAN, A.; Factors Behind Persistent Rural Poverty in Armenia; Armenian International Policy Research Group, Working Paper No. 05/08; 2005.
- PETERS, K., DREWES, D. G., FICHTNER, G. and MOLL, S.; Goat Production in Low Income Economic Units of Selected Areas in West Malaysia; in: *Animal Research and Development*; vol. 13; 88-113; Institute for Scientific Co-operation, Tübingen, Germany; 1981.
- POWELL, J. M., PEARSON, R. A. and HIERNAUX, P. H.; Crop-Livestock Interactions in the West African Drylands; *Agronomy Journal*; 96:469-483; 2004.
- POWELL, J. M. and WATERS-BAYER, A.; Interactions Between Livestock Husbandry and Cropping in a West African Savanna; in: *Ecology and Management of the World's Savannas*, edited by TOTHILL, J. C. and MOTT, J. J.; 252-255; Australian Academy of Science, Canberra; 1985.
- SERÉ, C. and STEINFELD, H.; World Livestock Production Systems-Current Status, Issues and Trends; Animal Production and Health Paper: 127, Food and Agriculture Organization, Rome, Italy; 1996.
- SIS; 1997 Village Inventories (1997 Köy Envanterleri); SIS (State Institute of Statistics), Publication No: 2888, Ankara, Turkey; 2004a.
- SIS; Census of Agriculture Agricultural Holdings (Households); SIS (State Institute of Statistics), Publication No: 2924, Ankara, Turkey; 2004b.
- STEINFELD, H.; Livestock and their Interaction with the Environment: An Overview; in: *Foods, Lands and Livelihoods-Setting the Research Agendas for Animal Science*, edited by GILL, M., SMITH, T., POLLOTT, G. E., OWEN, E. and LAWRENCE, T. L. J.; 67-76; British Society of Animal Science Occ. Publ. No. 21; 1998.

- TURNER, J. and TAYLOR, M.; *Applied Farm Management, 2nd Edition*; Blackwell Science, UK; 1998.
- WEBSTER, J. P. G. and BOWLES, R. G.; Estimating The Economic Costs and Benefits of Pesticides Use in Apples; Brighton Crop Protection Conference 1996 Pests & Diseases, British Crop Protection Council, Brighton, UK, pp. 325-330; 1996.