# A comparative economic analysis of sheep production systems: A case study of Jordan

**Article** *in* Journal of Food Agriculture and Environment · April 2012

CITATIONS
10

READS
1,527

**3 authors:**

Tala Qtaishat
University of Jordan
**20** PUBLICATIONS **72** CITATIONS
SEE PROFILE

Ali Jaddo Al-Sharafat
Jerash University
**16** PUBLICATIONS **74** CITATIONS
SEE PROFILE

Mohammad Majdalawi
University of Jordan
**19** PUBLICATIONS **90** CITATIONS
SEE PROFILE

**WFL** Publisher
*Science and Technology*
Meri-Rastilantie 3 B, FI-00980
Helsinki, Finland
e-mail: info@world-food.net

*Journal of Food, Agriculture & Environment Vol.10 (2): 690-694. 2012* *www.world-food.net*

# A comparative economic analysis of sheep production systems: A case study of Jordan

**Tala Qtaishat [1]*, Ali Al-Sharafat [2] and Mohammed I. Majdalawi [1]**
[1] *Department of Agricultural Economics and Agribusiness, Faculty of Agriculture, University of Jordan, Amman, 11942, Jordan.*
[2] *Department of Agricultural Economics and Extension, Faculty of Agriculture, Jerash University, Jerash, 26150, Jordan.*
**e-mail: talaqtaishat@yahoo.com, Bkhitan2@yahoo.com, Mohammadmj@yahoo.com*

*Received 6 December 2011, accepted 2 May 2012.*

**Abstract**

This study was conducted to introduce a comparative economic analysis of sheep production systems in Jordan. A total of 156, 28 and 16 stockowners adopting transhumant, mixed farming and nomadic sheep production systems, respectively, were interviewed. A structured questionnaire was designed to obtain information from respondents about socio-economic profiles, total variable costs, annual revenues, net income, and animal productivity. Three important and traditional discounted financial indicators were used in the study, the Net Present Value (NPV), the Internal Rate of Return (IRR) and the Benefits-Costs ratio (B/C). The results showed that all the indicators used in the study were acceptable in the three investigated sheep production systems. The NPV for the nomadic production system was highest according to the net cash flows estimated in the study. It was positive and acceptable. The IRR for this system was 166 % and the B/C approximately 2. These values indicated that the nomadic sheep production system in Jordan is the most profitable one compared to the other two systems. The transhumant production system is in the second place and the mixed farming system is the last one. Profitability of the nomadic system is affected by the presence of the proper strategies to decrease costs of production and to increase income. Feed expenses for the flock in this system are minimal. Full dependence on natural resources, a minimum amount of supplemental feeding, and the limited demand for inputs are major reasons for this system to be more profitable than the other two sheep production systems.

***Key words:*** Sheep, mixed farming, transhumant, nomadic, net present value, internal rate of return, benefits-costs ratio.

## Introduction

Livestock production has many advantages. It permits the use of labor for some profit during parts of the year, when labor cannot be used to produce crops. It permits the conversion of some marketable crops into other products. It also helps in the conservation of soil fertility and in rounding out a well balanced and profitable farm organization [1]. Among livestock production activities, sheep farming is an important activity for a large population of small and marginal farmers as well as landless agricultural laborers. In the event of a lack of seasonal rains, leading to crop failure, rearing sheep gives a helping hand to the farmers, therefore "sheep" are affectionately labeled as "mortgage lifter" by the rural poor [2]. Sheep, as well as goats, are important for the provision of animal protein and as a source of income for small holders in the less-developed parts of the world [3].

The first animals domesticated, after the dogs were sheep and goats. Sheep are multi-purpose animals, producing meat, milk, skins and wool/hair. Sheep production is a crucial sector of human activity [4]. Sheep farming requires low capital and not much specialized machinery compared with most other agricultural production alternatives [5]. Sheep with their small body size, high productive capacity, and rapid growth rates are ideally suited for production by resource-poor smallholders. Sheep thrive in a wide variety of environments. They require less capital, because they can be completely maintained on pastures and agricultural waste products. A flock of sheep can provide families with food each day in the form of milk, but only in limited parts of the world, sheep are milked for dairy food. Sheep milk is an excellent raw material for the milk-processing industry especially for cheese production. Sheep are gregarious, they prefer to cluster together. The tendency of these animals to cluster facilitates their management and makes it easy to discover any abnormalities in the flock and sick animals often withdraw or lag behind [6].

The sheep industry produces a variety of products. This industry generates business for supply companies, such as feed and sheep health supplies. In addition, sheep-industry generates income supports businesses where goods and services are purchased [7].

A number of sheep production systems have been described. These production systems range from free range (extensive) to tethering in subsistence production to confinement in semi-intensive and intensive systems [8].

As compared with other classes of livestock, sheep are particularly good in the utilization of a more arid type of grazing. They are good at utilizing wasteland and are also excellent scavengers, cleaning fields and destroying weeds. They produce more liberally in proportion to what they consume, their returns come quickly [9].

## Sheep Industry in Jordan

The main breed of sheep in Jordan is Awassi, which has shown great adaptability to the harsh environmental conditions of the area. The Awassi is the most numerous and widespread breed of sheep in southwest Asia. It is the dominant type in Iraq, the most important sheep in the Syrian Arab Republic and the only indigenous breed of sheep in Lebanon and Jordan. The name of the Awassi is attributed to the El Awas tribe between the Tigris and Euphrates Rivers. In literary Arabic, *awas* is the term for the

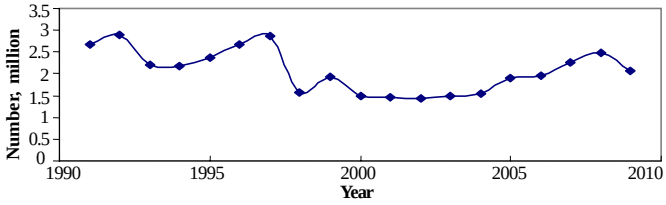
red-and-white camel garb or for a white sheep [10]. The Awassi is used for a range of products: meat, milk and wool. However, this breed is raised primarily for milk. It has unique physiological characteristics, such as resisting many diseases and parasites, walking long distances across pastures for grazing, tolerating extreme temperatures, and enduring adverse feeding conditions [11].

Jordan has recorded a fluctuating number of sheep. The total number of sheep in Jordan, according to the results of the livestock survey on the 1st of November 2009, conducted by the Ministry of Agriculture (MOA) [12] was estimated to be 2,070, 940. The value of physical inputs in thousand Jordan Dinar (JDs) used in livestock production (including sheep) and the value of other expenditures for livestock production in Jordan (including sheep) were estimated to be 608,482 [1 JD = 1.4 USD] in 2009. The value of sheep, goat and uncategorized cattle holdings produced during the same year was estimated to be 270,488 thousand JDs, which is about 35% of a total of 770,660 thousand JDs resembled livestock production in the country for that year [12]. Sheep production amounts to about 68% of the total livestock production, providing the country with about 16,000 tons of red meat and 56,000 tons of liquid sheep milk according to the Department of Statistics (DOS) [13] records for the year 2009. Jordan imported about 278,000 sheep in 2009. The value of these heads was about 11,701,000 JDs. The same year Jordan exported about 93,000 sheep. The value of these heads was about 17,228,040 JDs. The previous numbers show the importance of livestock production (including sheep production) in the country as well as the contribution of this sector to national production. Fig. 1 shows the number of sheep in Jordan (1991-2009).

Jordan imports approximately 150,000 sheep each year from Syria, Sudan, Romania, Ethiopia and some other countries. The country exports some 50,000 sheep to Saudi Arabia every year. According to DOS figures, the Kingdom's need for lamb in 2009 stood at 35,251 tons, while local production reached 16,032 tons. The Kingdoms self-sufficiency regarding lamb increased from 30.3% in 2005 to 45.5% in 2009.

The followings could be considered as the technical constraints for securing a thriving sheep industry in the country [12]: 1) non-availability of high-yielding breeding stock; 2) a low level of nutrition and managerial efficiency; 3) a lack of definition for the production objectives; 4) limited attention to applying modern techniques for improving the reproductive efficiency, e.g. artificial insemination, synchronization of estrous, semen freezing, etc; 5) limited use of outstanding exotic breeds for improvement and 6) limited utilization of organized marketing.

Small ruminant production systems in Jordan developed gradually in the middle of the past century as a result of the increased settlement of the nomadic Bedouin, change to and concentration on sheep and goat raising instead of other large animals such as camels, deterioration of traditional grazing systems




*Source: Prepared by the researchers.*

***Figure 1.*** Number of sheep in Jordan (1991-2009): Million heads.

(eastward and westward trips), more use of vehicles for moving flocks and equipment, and increased dependency on imported feed [14]. Small ruminants' production systems as well as the relative importance and the potential for increased production by species in diverse areas differ markedly due to variations in resource endowment, climate, population and disease incidence, level of economic development, research support and governmental economic policies [15].

Three main systems of sheep production have been described in Jordan: transhumant, mixed farming, and nomadic production systems. These production systems are adopted by almost 78%, 14% and 8% of the stockowners in Jordan for transhumant, mixed farming and nomadic systems, respectively [16]. The production system implies an organized body of production using sciences such as genetics, animal breeding, animal health, economics, animal nutrition and other related sciences. The classification of pastoral societies into nomadic, semi-nomadic, and transhumant depends on the extent of dependence on livestock for subsistence, their mobility and the degree of their reliance on sedentary agricultural communities [17].

Nomadic herding is an extreme example of extensive farming, where herders move their animals to use feed from occasional rainfalls. This system of production is characterized by trekking and exposure to high ambient temperatures. Animals lose body weight while moving. The traditional system of management is characterized by a high incidence of diseases and parasitism, together with the adverse effects of climate. Other characteristics include losses to stealing, motor accidents, poisoning by crop farmers and due to conflicts between livestock owners and crop farmers, losses to predators, and indiscriminate mating [18]. The nomadic production system is distinguished by less supplementary feeding, longer grazing, no fattening operations, and a low dependence on veterinary services [8]. The traditional grazing pattern is that at the end of the dry season the animals are either near permanent villages feeding on dry forage or browse to find range and water.

The transhumant production system involves seasonal movement, but returning to a settled base for at least part of the year. In this system the flock owner has a relatively permanent base, at which he grazes his flock for more than half of the year and then migrates with his flock to another part of the region for the remainder of the year. Flocks move along established migration routes on a fairly fixed schedule of dates [19]. The traveling unit is normally consisted of a common herd owned by close male relatives, a father and son.

Newton [20] defined the mixed-farming production system as that system in which little or no seasonal or annual movement takes place; the animals remain near the village or cultivation areas throughout the year. This system is also called "The Integrated Production System". It is mostly found in high rainfall zones. The main characteristic of this system is that it has a permanent base in the village or in the cultivated areas [21]. Mixed farming exists in many forms depending on external and internal factors. External factors are weather patterns, market prices, political stability, technological developments, etc. Internal factors relate to local soil characteristics, composition of the family and farmers' ingenuity. The objectives of this system are threefold: (i) complementary benefit from an optimum mixture of crops and livestock (ii) spreading income and risks over both

crops and livestock production and (iii) the scope to adjust the crop/ livestock ratio to social and economic needs and opportunities [22].

## Materials and Methods

***The sample:*** A total of 200 sheep farmers from the entire country were randomly selected for this study by using stratified random sample. The selection criterion was based on the relative importance of sheep in each governorate (number of sheep in the governorate divided by the total number of sheep in the country). Table 1 shows the distribution of the sample according to this criterion. The sample was selected according to the production system's relative importance in the country. A total number of 156, 28 and 16 stockowners adopting transhumant, mixed farming and nomadic production systems, respectively, were interviewed. Table 2 shows the distribution of the sample according to the type of production system. Secondary data sources to achieve the study objectives include, mainly, the Department of Statistics and the Ministry of Agriculture. The average size of a flock was 50 heads.

**Table 1.** Distribution of the sample according to the number of sheep in each governorate.

| Governorate | Total No. of Sheep | Relative importance (%) | Interviewed stockowners |
|---|---|---|---|
| Amman | 390970 | 19% | 38 |
| Balqa | 113780 | 5% | 10 |
| Zarqa | 210720 | 10% | 20 |
| Madaba | 142480 | 7% | 14 |
| Irbid | 286190 | 14% | 28 |
| Mafraq | 419290 | 20% | 40 |
| Jarash | 010850 | 1% | 2 |
| Ajlun | 016850 | 1% | 2 |
| Karak | 249080 | 12% | 24 |
| Tafiela | 077340 | 4% | 8 |
| Ma'an | 129250 | 6% | 12 |
| Aqaba | 024140 | 1% | 2 |
| Total | 2070940 | 100% | 200 |

**Table 2.** Distribution of the sample according to production system.

| System | % of Adoption in the Country | No. of Sheep | Interviewed Stockowners |
|---|---|---|---|
| Transhumant | 78% | 1614983 | 156 |
| Mixed Farming | 14% | 289868 | 28 |
| Nomadic | 8% | 165639 | 16 |
| Total | 100% | 2070490 | 200 |

***Data collection:*** A structured questionnaire was designed to obtain information from respondents regarding socio-economic profiles, total variable costs, annual revenues, net income, animal productivity and marketing profiles. These items were broken down to their corresponding subtitles. The questions were posed in the respondents' language. The survey was conducted using personal interviews with communal farmers in the entire country.

***Data analysis:*** Averages for the costs and revenues were calculated to be considered the core of the analysis when determining of the financial feasibility and other economic considerations for the sheep-production systems comparison. The total fixed, variable costs, and annual cash flows as well as the total annual revenues were calculated on a yearly basis. The NPV, IRR and B/C ratio for each of the three production systems were the financial indicators used in the study.

## Results and Discussion

***Production costs:*** Production costs are mainly variable and fixed. Variable costs are those operating costs that vary as the level of production changes. They are items that will be used during one operation year or one production period. Examples include feed, fuel, veterinary services and supplies. These items would not be purchased if production was not undertaken. Fixed costs are not affected by short-term enterprise decisions and do not vary with the level of production. Generally, fixed costs are associated with buildings, machinery, and equipment that are pro-rated over a period of years. Both variable and fixed costs differ according to the production system.

Table 3 shows expenses for a 50-head flock in each of the three investigated production systems for a production period of one year. As shown in Table 3, for a sheep flock consisting of an average of 50 sheep, the mixed-farming production system is the highest one in terms of total production costs (44,000 JDs), the nomadic system is least (20,650 JDs) and the transhumant system is in the middle (26,000 JDs). Housing and feeding are the main production costs in each system. The highest housing requirements are in the mixed-farming system. The reason for this high cost is due to the fact that this system is adopted by households or enterprises, where crop cultivation and livestock rearing are more or less integrated components of a single farming system. Adopting mixed-farming production system implies more housing facilities than other production systems. Pastoralists under the transhumant production system have a permanent homestead and base. Their animals depend on the natural forage legumes and grasses for subsistence, but these items are usually unavailable in the dry season. They move in response to seasonal changes in the quality of grazing. Grain and other basic needs are purchased with the proceeds of selling live animals, so the cost of feed in this system is higher than that for the other two production systems. Due to the long settlement time in both the mixed-farming and transhumant production systems, the health and labor costs are much higher than those in

**Table 3.** Total costs (50 head/ year).

| System | Item | Total cost (JDs) |
|---|---|---|
| Mixed Farming | Housing | 15000 |
| | Feeding | 10000 |
| | Health | 7500 |
| | Labor | 6000 |
| | Sheep | 4500 (90 JDs/head) |
| | Miscellaneous | 1000 |
| | Total | 44000 |
| Transhumant | Housing | 5000 |
| | Feeding | 10000 |
| | Health | 1000 |
| | Labor | 4500 |
| | Sheep | 4500 (90 JDs/head) |
| | Miscellaneous | 1000 |
| | Total | 26000 |
| Nomadic | Housing | 5000 |
| | Feeding | 7500 |
| | Health | 750 |
| | Labor | 2400 |
| | Sheep | 4500 (90 JDs/head) |
| | Miscellaneous | 500 |
| | Total | 20650 |

Source: Calculated by the researchers based on survey results.

the nomadic production system. The results of the survey indicated that, for the nomadic production system, rangelands constituted 55% of feed resources while for the transhumant production system this source constituted 30%, and for the mixed-farming it constituted only 15%. The variations in the dependence of each system on rangelands is the main reason of the difference of feed costs in the three investigated production systems which, in turn, were reflected in the total production costs.

***Income and cash flow:*** The average productivity and the yearly income for a flock consisting of an average of 50 sheep were calculated according to the lowest profit margins for the three investigated production systems. Table 4 shows income resources and total returns for a 50-head flock in each of the three investigated production systems for a period of one year. The calculations were made assuming that the infertility rate was 5% and that the fertilization rate per sheep was 1.2 each year. The price paid per kg of carcass for the lambs with a desired carcass weight of 15-20 kg is 10 JDs. The market price of a lamb, which is 12 months old is 140 JDs and 30 lambs at this age are marketed annually. The calculations related to milk and cheese production were made according to the assumptions that a sheep is milked for 6 months, that 250 g of milk is obtained from each lactating ewe, and 1 kg of cheese is made from 4 kg of milk. Besides the main incomes of lamb meat and cheese, the income obtained from the sales of the culled rams and sheep from the flock was also included into the total income. The twining percentage was 20%, the mortality rate 2% and the culling percentage 5%.

In order to judge the economic status for each of the three investigated sheep-production systems, the NPV, IRR and the B/C ratio for each production system were calculated, assuming 10 years project period. Tables 5-7 show the costs, returns and cash flows of 50 head of sheep for a period of 10 years, assuming that the costs increase by 10% and the returns increase by 15% yearly for each the system. Table 8 shows the values of the three financial indicators used to conduct the economic comparison among the three investigated sheep-production systems.

As shown in Table 8, according to the net cash flows estimated in Table 5, the Net Present Value (NPV) for the mixed-farming system was positive, high, and acceptable. The Internal Rate of Return (IRR) was 25%. The Benefits-Costs ratio (B/C) was approximately 1.2. These values show that the sheep production in Jordan using the mixed-farming is profitable. Adopting this system, under the previously mentioned conditions, will provide returns with about 25% higher than the costs. The B/C ratio is acceptable. A B/C ratio more than 1 means that the project is viable. The B/C value indicates that the benefits of this project

**Table 4.** Total returns (50 head/ year).

| System | Item | Total Returns (JDs) |
|---|---|---|
| Mixed Farmin | Milk | 2,000 (40 ewes [1 kg/ewe/200 days]/2) × 0.5 JD. |
| | Cheese | 5,000 (40 ewes [1 kg/ewe/200 days]/2)/4 × 5 JD. |
| | Wool | 1,500 |
| | Manure | 1,000 |
| | Culling | 2,500 |
| | Lambs | 8,000 |
| | Total | 20,000 |
| Transhumant | Milk | 1,500 (40 ewes [0.75 kg/ewe/200 days]/2) × 0.5 JD. |
| | Cheese | 3,750 (40 ewes [0.75 kg/ewe/200 days]/2)/4 × 5 JD. |
| | Wool | 1,500 |
| | Manure | 00000 |
| | Culling | 2,500 |
| | Lambs | 7,000 |
| | Total | 16,250 |
| Nomadic | Milk | 1,000 (40 ewes [0.50 kg/ewe/200 days]/2) × 0.5 JD. |
| | Cheese | 2,500 (40 ewes [0.50 kg/ewe/200 days]/2)/4 × 5 JD. |
| | Wool | 1,500 |
| | Manure | 00000 |
| | Culling | 2,500 |
| | Lambs | 6,000 |
| | Total | 13,500 |

Source: Calculated by the researchers based on survey results.

**Table 5.** Costs, returns, and cash flows under the mixed-farming system (50 head).

| Year | Total Fixed Costs (JDs) | Total Variable Cost (JDs) | Total Costs (JDs) | Returns (JDs) | Cash Flow (JDs) |
|---|---|---|---|---|---|
| 1 | 24,500 | 19,500.00 | 44,000.00 | 20,000.00 | -24,000.0 |
| 2 | | 21,450.00 | 21,450.00 | 23,000.00 | 1,550.000 |
| 3 | | 23,595.00 | 23,595.00 | 26,450.00 | 2,855.000 |
| 4 | | 25,954.50 | 30,417.50 | 25,954.50 | 4,463.000 |
| 5 | | 28,549.95 | 28,549.95 | 34,980.12 | 6,430.170 |
| 6 | | 31,404.95 | 31,404.95 | 40,227.12 | 8,822.170 |
| 7 | | 34,545.45 | 34,545.45 | 46,261.19 | 11,715.74 |
| 8 | | 37,999.99 | 37,999.99 | 53,200.37 | 15,200.38 |
| 9 | | 41,799.99 | 41,799.99 | 61,180.43 | 19,380.44 |
| 10 | | 45,979.99 | 45,979.99 | 70,357.49 | 24,377.50 |

Source: Calculated by the researchers based on market prices.

**Table 6.** Costs, returns and cash flows under transhumant system (50 head).

| Year | Total Fixed Costs (JDs) | Total Variable Cost (JDs) | Total Costs (JDs) | Returns (JDs) | Cash Flow (JDs) |
|---|---|---|---|---|---|
| | 14,500 | 11,500.00 | 26,000.00 | 15,250.00 | -10,750.00 |
| 2 | | 12,500.00 | 12,500.00 | 17,357.50 | 4,857.50 |
| 3 | | 13,765.50 | 13,765.50 | 19,988.13 | 6,222.63 |
| 4 | | 15,141.50 | 15,141.50 | 22,986.35 | 7,844.85 |
| 5 | | 16,655.65 | 16,655.65 | 26,434.30 | 9,778.65 |
| 6 | | 18,321.22 | 18,321.22 | 30,399.49 | 12,078.27 |
| 7 | | 20,153.34 | 20,153.34 | 34,959.41 | 14,806.07 |
| 8 | | 22,168.67 | 22,168.67 | 40,203.32 | 18,034.65 |
| 9 | | 24,403.54 | 24,403.54 | 46,233.82 | 21,830.28 |
| 10 | | 26,843.89 | 26,843.89 | 53,168.89 | 26,325.00 |

Source: Calculated by the researchers based on market prices.

**Table 7.** Costs, returns and cash flows under Nomadic system (50 heads).

| Year | Total Fixed Costs (JDs) | Total Variable Cost (JDs) | Total Costs (JDs) | Returns (JDs) | Cash Flow (JDs) |
|---|---|---|---|---|---|
| 1 | 11150 | 9,500.000 | 20,650.00 | 13,500.00 | -5,125.000 |
| 2 | | 10,450.00 | 10,450.00 | 15,525.00 | 7,403.000 |
| 3 | | 11,495.00 | 11,495.00 | 17,853.75 | 9,036.813 |
| 4 | | 12,644.50 | 12,644.50 | 20,531.81 | 10,967.08 |
| 5 | | 13,908.95 | 13,908.95 | 23,611.58 | 13,244.37 |
| 6 | | 15,299.85 | 15,299.85 | 27,153.32 | 15,926.48 |
| 7 | | 16,829.83 | 16,829.83 | 31,226.32 | 19,080.44 |
| 8 | | 18,512.81 | 18,512.81 | 35,910.27 | 22,784.00 |
| 9 | | 20,364.09 | 20,364.09 | 41,296.81 | 27,127.24 |
| 10 | | 22,400.50 | 22,400.50 | 47,491.33 | 32,214.53 |

Source: Calculated by the researcher based on market prices.

**Table 8.** The financial indicators.

| System | Indicator | Value of the Indicator |
|---|---|---|
| Mixed Farming | NPV (JDs) | 30624.07 |
| | IRR (%) | 25 % |
| | B/C Ratio | 1.156 |
| Transhumant | NPV (JDs) | 60680.19 |
| | IRR (%) | 67 % |
| | B/C Ratio | 1.596 |
| Nomadic | NPV (JDs) | 87821.95 |
| | IRR (%) | 166 % |
| | B/C Ratio | 1.83 |

Source: Calculated by the researchers based on market prices.

will outweigh the actual costs that go into the project. Payback is 1.2 times the cost meaning that for every unit of cost, we get 1.2 units of benefit. Again this finding is encouraging.

The NPV for the transhumant production system, according to the net cash flows estimated in Table 6, was also positive and high and, hence, acceptable. The IRR value was 67%. The B/C ratio was more than one (approximately 1.6). These values indicated that the transhumant sheep-production system in Jordan is also a profitable system. The B/C value indicated that the benefits of this project will outweigh the actual cost that go into the creation of the project.

The NPV for the nomadic production system, according to the net cash flows estimated in Table 7, was highest. It was positive, high, and acceptable. The IRR was 166% and the B/C ratio approximately 2. These values indicated that this sheep-production system is the most profitable one. The system will provide returns with about 166% higher than the costs. The Benefits-Costs ratio was high and accepted.

High profitability of the nomadic sheep-production system in Jordan compared to the mixed-farming and transhumant production systems could be attributed to the following reasons:

1. The nomadic system requires less labor per unit area to farm large areas. Lower labor requirement ends in more efficient labor use. A greater efficiency of labor generally means lower production costs.

2. Mechanization in the nomadic production system can be used more effectively over large, flat areas.

3. Animal health is generally improved; fewer health expenses are required because animals are not kept in stifling conditions.

4. There are lower input requirements, such as fertilizers.

5. If animals are grazed on pastures native to the locality, there is less likelihood for problems with exotic species.

6. The local environment and soil are not damaged by the overuse of chemicals.

7. There are no difficulties in managing disease and shortages of labor.

## Conclusions

Despite the fact that only 8% of sheep producers in Jordan adopted the nomadic sheep-production system, it could be deduced that this system is the most viable and profitable sheep-production system in Jordan. The transhumant production system is in the second place and the mixed-farming is the last one. Profitability for the nomadic system is affected by the presence of the proper strategies to decrease production costs and to increase income. Feed expenses for the flock in this system are minimal. Full dependence on natural resources, a minimum amount of supplemental feeding, and the limited demand for inputs are major reasons for this system to be more profitable than the other two sheep-production systems. The key for creating a profitable and competitive sheep production system is not necessarily producing more lambs per ewe or using management-intensive grazing as in the mixed farming or transhumant systems. The viable sheep-production system does not require elaborate facilities and equipment; it is one which can provide a quick return on investment.


## Acknowledgements

The authors wish to express their deep sense of gratitude to the Jordanian Ministry of Agriculture, the Department of Statistics staff, and the Agricultural Directorates in the whole country. The authors would also like to convey thanks to the Faculty of Agriculture in Jerash University for providing the analysis means and related facilities.


## References


[1]Hopkins J. and Heady, E. A. 1955. Farm Records and Accounting. 4th edn. The Iowa State College Press, Ames, Iowa, U.S.A., 346 p.

[2]Kumaravelu, N., Murallidharanl, R., Kumararaj, R., Sivakumar, T. and Selvakumar, K. N. 2008. Sheep production system in southern and northeastern zones of Tamil Nadu, 2008. Tamilnadu J. Veterinary & Animal Sciences **4**(6)205-207.

[3]Mahgoub, O., 1997. Meat production from the Omani Dhfari goat. Int. J. Animal Sci. **12**:25-30.

[4]Zygoyiannis, D. 2006. Sheep production in the world and in Greece. Small Rumin. Res. 62:143-147.

[5]Nix, J. 1988. The economics of sheep production. British Veterinary Journal **144**(5):426-33.

[6]Ensminger, M. E. and Parker, R. O. 1986. Sheep and Goat Science. 5th edn. The Interstate Printers and Publishers Inc., Danville, Illinois, USA, pp. 153-166.

[7]Smith, B., Aseltine, M. and Kennedy, G. 1997. Beginning Shepherd's Manual. 2nd edn. Iowa State University Press, Ames, Iowa, pp. 3-13.

[8]Food and Agricultural Organization (FAO) 1995. Sustainable Range-dependent Small Ruminant Production Systems in the Near East Region. FAO Regional Office for the Near East, Cairo, Egypt, pp.54-141.

[9]Weaver, S. 2005. Sheep: Small-scale Sheep Keeping for Pleasure and Profit. Hobby Farm Press, Burroughs Irvine, CA, USA, pp.1-6.

[10]Sharafeldin, M. A., 1965. Wool characteristics of Iraqi Awassi sheep. J. Agric. Sci. **65**:223-225.

[11]Mason, I. L. 1988. World Dictionary of Livestock Breeds. 3rd edn. CAB International, 348 p.

[12]Ministry of Agriculture (MOA) 2009. Annual Report. Animal Production Directorate, Amman, Jordan, pp. 69-80.

[13]Department of Statistics (DOS) 2009. Agricultural Statistics. Annual Statistical Bulletin, Amman, Jordan, pp. 78-83.

[14]Abu-Zanat, M. 1995. Production systems of small ruminants within the different agro-ecological zones of Jordan. Working paper submitted to Livestock Research Priorities Workshop, 9-10/11/1995, Amman, Jordan.

[15]Beets, W. C. 1994. Raising and sustaining productivity of smallholder farming systems in the tropics. Agricultural Systems **44**(1):121-124.

[16]Al-Sharafat, A. 1996. Sheep Production Systems in the Northern Badia of Jordan, MSc. thesis, University of Jordan, Amman, Jordan, pp.19-22.

[17]Sharafeldin, E. 1982. Nomadic systems. In Coop, E. (ed.). Sheep and Goat Production. Elsevier, Amsterdam, Holland, pp. 441-458.

[18]Wadham, S., Wilson, R. and Wood, J. 1957. Land Utilization in Australia. 3rd edn. Melbourne University Press, Melbourne, Australia, pp.120-121.

[19]Demiruren, A. S. 1976. The improvement of nomadic and transhumant animal production systems. FAO, ACA/ MISC/74/3, Rome.

[20]Newton, E. 1982. Intensive arable systems. In Coop, E. (ed.). Sheep and Goat Production. Elsevier, Amsterdam, Holland, pp. 483-492.

[21]Juneidi, M.J. and Abu-Zanat, M. 1993. Jordan Agricultural Sector Review: Low Rainfall Zone. APAP II Technical Report, No. 132, Vol. I. APAP II and USAID.

[22]Strobel, H. 1991, Case studies on economics of small ruminant production systems in Jordan. GTZ Veterinary Epidemiology Project, Amman, Jordan, pp. 68-74.