SOLID participatory research from Greece: Effect of irrigation of pasture on grazing on milk yield, milk quality and overall animal health

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Summary

The potential use of sown irrigated pasture under Greek conditions for grazing by dairy goats was assessed in filed trial that involved a semi-intensively reared herd. One of the major costs in such systems is feeding which is mainly based on purchased feeds and seasonal grazing in paddocks that are in close proximity with the farms. Pasture availability in Greece is limited to certain periods of the year as a result of climatic conditions. The period in which dairy goats can have access to natural pastures for grazing is restricted to spring and autumn months; all other months availability of the year natural pastures is scarce. Hence, extending the time of pasture availability for semi-intensively reared dairy goats is a challenge. The solution is the use of irrigated sawn pasture, which was adopted as the main objective in the present study that was undertaken in commercial dairy herd of goat in collaboration with the farmer. The trial run in a participatory manner and involved two groups of goats that were offered either high or low supplementary feeding with concentrates indoors and were subsequently allowed to graze in an irrigated sawn pasture. Goat performance, milk yield and quality was assessed as well as the herbage growth and production of the paddock. The results reveled that irrigating pasture can be used as an alternative option in feeding management of semi-intensive dairy goat production systems with beneficial outcomes in term of animal health and productivity as well as farm economics.

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1 Aims and Research question

The primary aim was to assess the potential use of sown irrigated pasture under Greek conditions for grazing by dairy goats. The work was focused on the use of natural resources in an environmentally sound manner. A secondary aim was to use a semi-intensive husbandry system for the production of desirable quality milk at higher yield than is traditional. Because of the potential length of the herbage growth season in Greece it may also be possible to extend the period in which dairy goats can have access to irrigated pasture for grazing into times of the year when the supply of natural pastures is scarce.

Hence, the study had to main objectives:: i) to determine whether the establishment and maintenance of irrigating pasture with suitable sward for grazing by dairy goats was feasible and ii) to monitor the effects of grazing on such irrigated pasture on milk yield, milk quality and overall animal health and reproductive efficiency.

2 Background

2.1 Research Background

The evidence in the literature suggests that grazing is an important component in different rearing systems of goat herds (Ruiz et al. 2009, Escareño et al., 2012). Grazing natural or irrigated pasture is used either as a complementary feeding option in high yielding goats (Lefrileux et al. 2008) or as the basic feeding resource in organic systems (Miotello et al. 2009). In any case there is a plethora of studies regarding the benefits of grazing in goat production systems (Napoléone et al. 2011; Pajor et al. 2014), particularly in the Mediterranean region (Mancilla-Leytón et al. 2013; Escareño et al. 2012; Ruiz et al. 2009).

The sheep and goat farming in Greece is based on milk production from relatively small farms and flocks (Zygoyiannis et al. 1997). The provision of sown pasture for grazing by either sheep or goats is rare in Greece and there has been a remarkable scarcity in relevant studies. An exception is an earlier study by Zygoyiannis et. al. (1999), which explored the use of irrigated pasture for fattening lambs from indigenous Greek dairy breeds of sheep. In that study it was recognized that if grazing will be used as a feeding option for fattening lambs then irrigation would be necessary considering the climatic conditions during summer (mean maximum and minimum day temperature around 34^{o}C and 17^{o}C, respectively, and mean precipitation 0.6 mm). Similar studies where grazing was used for meat production of goats are also available in the literature (Ortega-Jimenez et al. 2005; Alexandre et al. 2007; Alexandre et al. 2009).

2.2 Farmer Background

A dairy goat farmer with personal interest in enhancing forage production of grazing pastures was approached and he committed to participate in the study. The farm has been one of the key farms used in WP2 of the SOLID project. The herd consisted of 400 adult Damascus goats. For the purposes of the study a group of 96 goats was selected and monitored for milk yield and quality on a monthly basis. The farm has very recently started to market its milk from dairy goats to the local market as pasteurized or ultra-pasteurized. The farmer Dimitris Minopoulos had plans to extend its market in large cities and also to produce a variety of dairy products. One of the key issues however, has been the cost of feeding. Hence, the idea was that by introducing grazing in the existing feeding program

of dairy goats would help reducing feeding costs. Moreover, the use of grazing would help the farm marketing a more environmental friendly method of milk production. At farm level, grazing would reduce the costs of purchasing forages and more importantly would contribute to better animal welfare, and prolong the productive life of the dairy goats.

3 Methodology and data collection

3.1 Location of the farm

"Amalthia Farm" with registration EL63300433, located in Ano Kaliniki Florina, Greece (http://www.agroamalthia.gr,). The owner, Mr Dimitris Minopoulos, tel: +306973435539, +302385092815.

3.1 Monitoring of farm records and Data collection

A draft protocol was established in late 2012 when the farm decided to use irrigated pasture for grazing. Soil data were initially obtained by analyzing soil samples before the establishment of irrigated pasture. A mix of seeds specifically recommended for pastures suitable for goat grazing was sown in November 2012 and it was well established in April 2013. The goats were turned out grazing in groups in May 2013. The initial plan was to make measurements for one year to cover one full lactation period (Table 1). Due to some problems with irrigation over the summer of 2013 it was decided to continue the study for another year. During the period of the study the work carried out is described below:

Table 1. Timetable and proposed methodology for data collection

Parameter	Method	Data collection
Milk yield and assessment of individual goats	Recorded in parlour by hand milking and weighting the milk	monthly
Herbage measurements	Adapted methodology	monthly
Soil moisture measurements	Adapted methodology	weekly
Overall farm financial data	Farm records	monthly

For the purposes of the study a group of 96 goats was selected from a dairy herd comprised approximately 400 goats. After turn out to pasture the first week at each year the goats were initially trained on grazing irrigated pasture. The animals grazed as a single flock (*96*) but with different level of supplementary feeding indoors, in order to test for the efficiency of the different feeding strategies (**Group A**: high level of supplementary feeding indoors and **Group B**: low level of supplementary feeding indoors). Quantities of the feedstuff provided were adjusted to meet the nutritional demands of each one of the two groups depending on their average milk yield. Body condition score was estimated at monthly intervals. The available pasture consisted of two Paddocks (A and B) which covered a total area of 32 acres (20 and 12 respectively), located very close (about 20 meters distance from the shed) to the farm buildings. Mean sward surface height (SSH) was assessed at regular intervals from individual measurements at 39 random points in Paddock A and 35 random points in Paddock B (Figure 1, Picture 3), using a designated sward measuring stick. Chemical analyses of pasture grass and of concentrates and forages fed indoors were performed. These analyses included the estimation of crude protein, crude fiber, ether extract, inorganic matter, and dry matter content. Milk samples were collected at monthly intervals and they were subjected

to further analyses in order to assess Somatic Cell Count (SCC, Fossomatic technology was used), Solids Non Fat (SNF), Colony – forming units (CFU), as well as fat, protein, and lactose content (Milkoscan technology was used). Test – day milk yields were also recorded monthly.

Picture 1. Goat grazing in irrigated pasture

Picture 2. Goat grazing in irrigated pasture supervised by the farmer Mr Dimitris Minopoulos

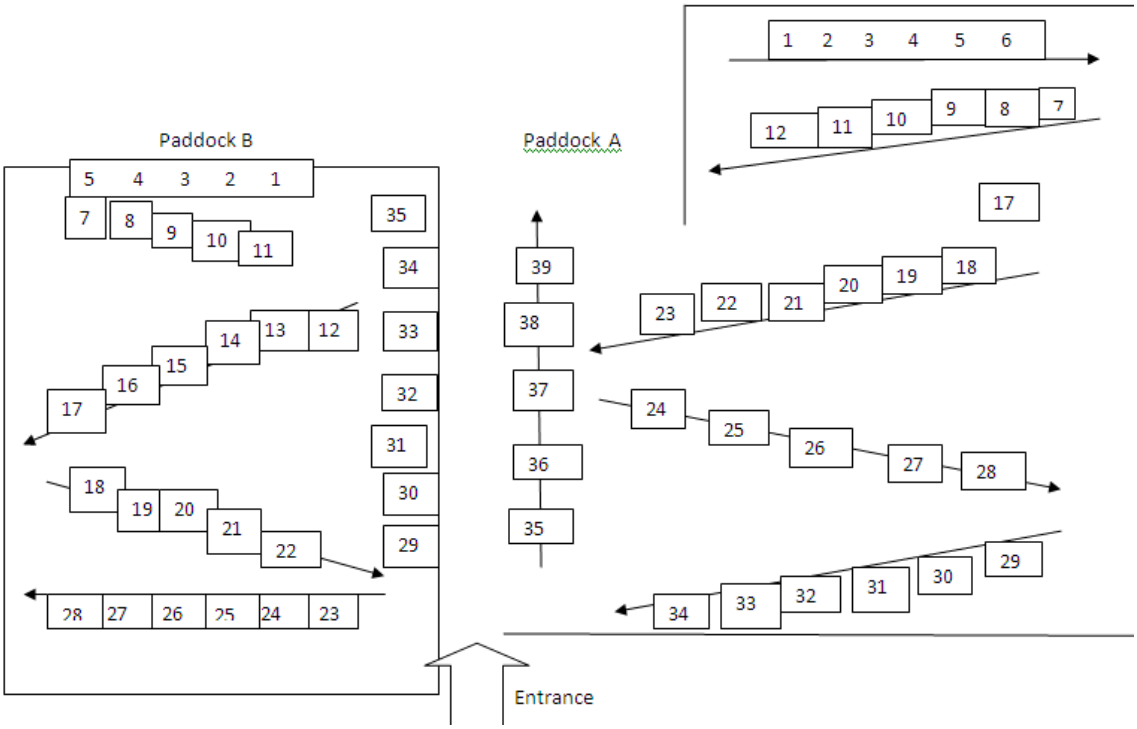

Figure 1. Schematic presentation of swards measurement points in the paddocks

Picture 3. Designated stick for sward height measurements

Picture 4. Irrigation and the condition of the pasture in late August 2013

Considering the problems with irrigation in late summer of 2013 and the variation in sward quality in the two paddocks it was decided to continue the measurements of sward surface height (SSH) at monthly intervals for another year in order to obtain detailed information of sward measurements. Also herbage mass and herbage growth rate (kg DM/ha/d) will be measured by the exclusion cage method (n=4). Soil moisture content (SMC) will be estimated weekly by the farmer.

4 Results

Table 2 shows the average values regarding the physical and the chemical composition of the feedstuffs that were offered to the dairy goats. The data are based on different samples obtained in four different times during the second year.

Table 2. Physical and chemical composition of diets offered to dairy goats

Feedstuffs	Water (%)	Ash (%)	total fat (%)	crude protein (%)	crude fiber (%)
Ration fed indoors					
Commercial concentrate	9,8	8,5	2,5	21,3	7,1
Alfalfa hay	9,3	6,5	2,3	22,8	32,2
Barley Straw	6,6	8,5	0,9	7,8	36,7
Silage	65,3	4	4,8	3,6	18,3
Grazing					
Meadow hay	82,1	2,5	3,9	6,3	8,6

Figure 2 shows the average sward height in the two paddocks that were used for grazing by dairy goats. There were some differences in the sward height in different parts of the paddocks, mainly as a result of the soil quality that maintained different levels of moisture during the summer.

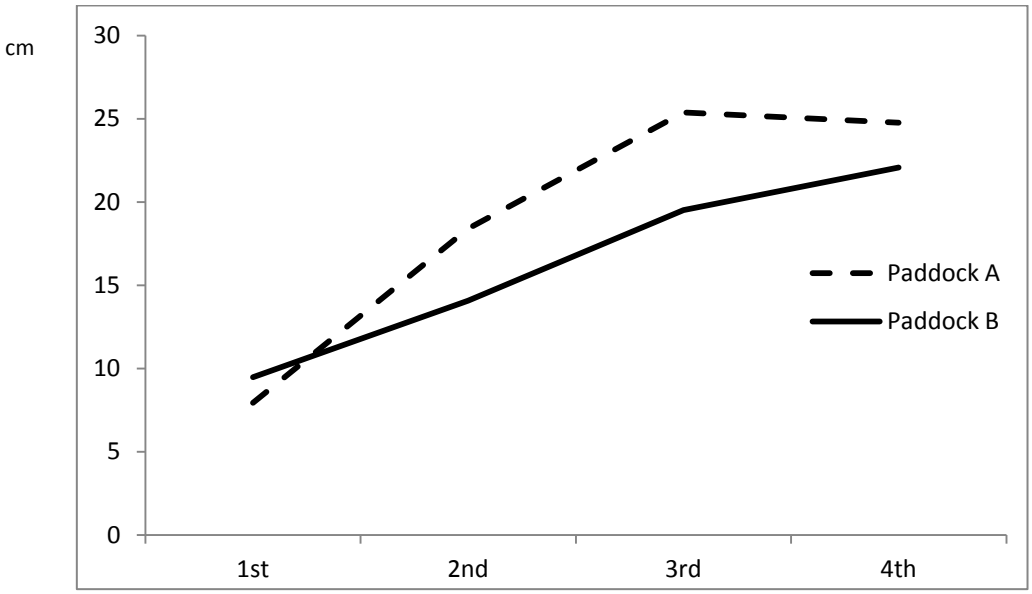

Figure 2. Average sward height in the two paddocks used for grazing by dairy goats, during the four measurements during the second year of the study.

Considering the time that the pasture was available for grazing for the first time (May 2013) as well as the lactation period of the two groups of dairy goats that were selected for the purposes of the study, two measurement of individual milk yield were performed. The first measurement took place on 01-07-2013. Average milk yield of Group A (high level of supplementary feeding indoors) was 2.23 kg per doe. In terms of milk quality the average values of fat, protein, lactose and SNF were 5.05%, 3.48%, 4.25% and 8.64%, respectively. In Group B (low level of supplementary feeding indoors) the

average milk yield was 1.78 kg per doe whereas the average values of fat, protein, lactose and SNF were 2.47%, 3.08%, 4.45% and 8.22% respectively.

The second measurement of milk yield of goats took place on 04-08-2013. The average milk yield of Group A was 1.97 kg per doe. Average values of fat, protein, lactose and SNF were 4.16%, 3.61%, 4.17%, and 8.68% respectively. Average milk yield for Group B was 1.57 kg per doe. Average values of fat, protein, lactose and SNF were 3.1%, 3.33%, 4.21% and 8.22% respectively.

5 Conclusions/Recommendations

Those results helped the farmer to assess objectively the potential use of irrigated sown pasture in his herd. Regarding the two main objectives the results can be summarized as follows:

- the establishment and maintenance of irrigating pasture with suitable sward for grazing by dairy goats is feasible and
- grazing goats on such irrigated pasture has on milk yield, milk quality and overall animal health and reproductive efficiency.

Also the results provide a basis for alternative options in feeding management of semi-intensive dairy goat production systems in Greece considering the cost of feeding indoors mainly purchased feedstuffs. Considering that such practice was beneficial for the studied farm the view is that it could be adopted by many other dairy goat farms that currently rely mainly in grazing communal areas that are located at significant distances from the farm and become unsuitable for grazing at the beginning of the summer. In practice the summer and early autumn months the availability of grazing in Greece is scarce. Given that considerable data regarding pasture management are available together with data regarding milk yield and quality the next step is to disseminate that information in seminars, farmer meetings, publications in farmer magazines etc. Overall, with this study as well the whole work done in the SOLID project at Amalthia farm we have established a close collaboration with the farmer who is now convinced that effective management will be the key of success in his business.

6 References

Alexandre, G., Aumont, G., Coppry, O., Fleury, J., Archimède, H.. 2007. Age of regrowth of irrigated Digitaria decumbens pastures, season of kidding, milk production and growth rate of Creole goats in Guadeloupe (FWI). Journal of Agriculture of the University of Puerto Rico, 91: 169-182.

Alexandre, G., Liméa, L., Fanchonne, A., Coppry, O., Mandonnet, N., Boval, M. 2009. Effect of Forage feeding on goat meat production: Carcass characteristics and composition of Creole kids reared either at pasture or indoors in the humid tropics. Asian-Australasian Journal of Animal Sciences, 22:1140-1150.

Escareño, L., Salinas-Gonzalez, H., Wurzinger, M., Iñiguez, L., Sölkner, J., Meza-Herrera, C. 2012. Dairy goat production systems: status quo, perspectives and challenges. Tropical animal health and production, 45: 17-34.

Lefrileux, Y., Morand-Fehr, P., Pommaret, A. 2008. Capacity of high milk yielding goats for utilizing cultivated pasture. Small Ruminant Research, 77: 113-126.

Mancilla-Leytón, J.M., Martín Vicente, A. Delgado-Pertíñez M. 2013. Summer diet selection of dairy goats grazing in a Mediterranean shrubland and the quality of secreted fat. Small Ruminant Research, 113:437–445.

Miotello, S., Bondesan, V., Bailoni, L. 2009. Organic farming of dairy goats in the Veneto region: Feeding management and milk quality. Italian Journal of Animal Science, 8 (SUPPL. 2):420-422.

Napoléone, M., Hoste, H., Lefrileux, Y. 2011. The use of grazing pastures in goat production: Development of an approach to combine optimized use of the forage resource and the control of related risks. EAAP Scientific Series, 129: 307-316.

Ortega-Jimenez, E., Alexandre, G., Boval, M., Archimède, H., Mahieu, M., Morand-Fehr, P. 2005. Intake and milk production of suckling Creole goats reared at pasture in humid tropics according to the post-grazing residue management. Small Ruminant Research, 59: 2-3 SPEC. ISS., 217-227.

Pajor, F., Kerti, A., Penksza, K., Kuchtik, J., Harkányiné, Z.S., Béres, A., Czinkota, I., Szentes, S.Z., Póti, P. 2014. Improving nutritional quality of the goat milk by grazing. Applied Ecology and Environmental Research, 12 (1), pp. 301-307.

Ruiz, F.A., Mena, Y., Castel, J.M., Guinamard, C., Bossis, N., Caramelle-Holtz, E., Contu, M., Sitzia, M., Fois, N. 2009. Dairy goat grazing systems in Mediterranean regions: A comparative analysis in Spain, France and Italy. Small Ruminant Research, 85: 42-49.

Zygoyiannis, D., Katsaounis, N., Stamataris, C., Arsenos, G. Tsaras, L., Doney, J. 1999. The use of nutritional management after weaning for the production of heavier lamb carcasses from Greek dairy breedsLivestock Production Science 57:279–289.

Zygoyiannis, D., Kyriazakis, I., Stamataris, C., Friggens, N.C., Katsaounis, N., 1997. The growth and development of nine European sheep breeds. 2. Greek breeds: Boutsko, Serres and Karagouniko. Anim. Sci. 65: 427–440.