Irrigated fodder as the pillar of cattle products' supply chains in the South Mediterranean area: present situation and future prospects

Sraïri G.M.T.

in

Acar Z. (ed.), López-Francos A. (ed.), Porqueddu C. (ed.).
New approaches for grassland research in a context of climate and socio-economic changes

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 102

2012
pages 483-487

Irrigated fodder as the pillar of cattle products' supply chains in the South Mediterranean area: present situation and future prospects

M.T. Sraïri

Department of Animal Production and Biotechnology, Hassan II Agronomy and Veterinary Medicine Institute, Allal Fassi Road, P.O. Box 6202, Rabat (Morocco)
E-mail: mt.srairi@iav.ac.ma

Abstract. Recent evolutions of livestock systems in the South Mediterranean area converge towards an intensification of production. Rangeland systems located in rain fed areas may not be sufficient to ensure the supply of animal proteins. As a consequence, increased efforts are needed to get more milk and meat from irrigated areas, which imply a steady output of high quality forage. The study of water uses by livestock in irrigation schemes requires a complex methodology, which has to take into account various functions of production: (i) from water volumes of different sources to fodder (quantity of biomass and its distribution throughout the seasons) and then (ii) from forage to cattle products (both milk and meat at the same time as farms are often not specialised). Moreover, climate change affects water availability and intense pressure on groundwater may put at risk many livestock systems. In this study, we take the example of the Tadla large scale irrigated scheme (105,000 ha) to present the issue of water productivity through cattle. Then, we discuss the future prospects of this topic, given the possibilities of on-farm intervention to achieve a "Livestock Revolution": improving farms' income with a sustainable use of the available water resources.

Keywords. Cattle systems – Forage – Groundwater – On-farm intervention – Water productivity.

Les fourrages irrigués en tant que pilier des chaînes d'approvisionnement en produits bovins dans le Sud de la Méditerranée : situation actuelle et perspectives

Résumé. *Les évolutions récentes des systèmes d'élevage dans le Sud de la Méditerranée montrent une intensification de la production. En effet, les systèmes pastoraux situés dans les zones pluviales ne peuvent plus assurer l'approvisionnement en produits animaux. Par conséquent, davantage d'efforts seront nécessaires pour obtenir plus de lait et de viande à partir des zones irriguées, ce qui induit une production stable de fourrage de bonne qualité. L'étude des usages d'eau par l'élevage dans les zones de grande hydraulique requiert une méthodologie complexe, qui doit intégrer différentes fonctions de production : (i) des volumes d'eau aux fourrages (quantité de biomasse et sa distribution au cours des saisons) et (ii) des fourrages au lait et à la viande, car les exploitations d'élevage bovin ne sont pas spécialisées. En outre, les changements climatiques affectent la disponibilité en eau et la pression sur les nappes peut compromettre la durabilité de nombreux systèmes d'élevage. Dans cette étude, le périmètre de grande hydraulique du Tadla (105 000 ha au centre du Maroc) est pris en exemple pour présenter la problématique de la valorisation de l'eau par l'élevage. Puis, nous discutons des conséquences de cette thématique, sous l'angle de l'intervention dans les exploitations agricoles afin de réaliser une « Révolution de l'Elevage » : améliorer les revenus avec un usage durable des ressources.*

Mots-clés. *Eau souterraine – Fourrage – Intervention – Systèmes bovins – Valorisation de l'eau.*

I – Introduction

Since the early 1950s, the South Mediterranean area has been experiencing important shifts in its food supply. For instance, the Maghreb (Algeria, Morocco and Tunisia) countries used to be net exporters of agricultural goods, mainly cereal grains and livestock products (Miège, 1961).

However, they have become importers of food, due to a rapid demographic growth. In fact, the case of Morocco clearly illustrates this food dependency, even though ambitious agricultural policies have been implemented. In the specific field of livestock products, there has been a marginalisation of range land systems and a trend of intensification, through two complementary directions: (i) the emergence of modern poultry facilities, based on totally imported inputs, and (ii) the settlement of dual purpose (milk and meat simultaneously) cattle smallholder farms, using imported breeds (Sraïri, 2011). In less than 40 years, a dairy chain has been entirely set-up, based on a fragmented offer (almost 700,000 farms which often have less than 5 cows), with more than 60% of milk originating from large scale irrigated schemes. Therefore, the supply of cattle products is largely dependent on irrigated fodder. In the near future, such a phenomenon is expected to develop, due to climate changes and the increase in milk and meat demand, which might put pressure on groundwater resources (Wada *et al*., 2012). As a consequence, there is a need to assess more precisely the intervention possibilities to improve water productivity through cattle (Le Gal *et al*., 2009). This might also assist farmers and the operators in the supply chains to think to sustainable ways to use water and to increase their incomes.

II – Materials and methods

A close monitoring of six smallholder farms' cropping and rearing practices has been implemented to assess water productivity through cattle (Table 1). The study sample was representative of the farms located in the Tadla (105,000 ha centre east of Morocco) irrigation scheme, with none of them having access to groundwater. The protocol consisted in an analysis of a chain of production functions: (i) from water volumes (rainfall and irrigation network) to forage biomass, and (ii) from forage and other feed complements to cattle products (milk and live weight gain).

Table 1. Characteristics of the sample study farms in the Tadla irrigated scheme

Farms	1	2	3	4	5	6
Arable land (ha)	5.0	6.3	6.5	1.4	1.6	1.8
Total fodder crops area (ha)	2.7	3.4	2.6	0.8	0.8	1.0
Alfalfa (ha)	2.0	2.0	2.2	0.8	0.8	1.0
Herd characteristics (Unit)						
Lactating cows	6.5	7.0	6.4	2.0	2.0	3.0
Growing cattle	5	7	6	2	2	3

A further reflection on the intervention possibilities to enhance water productivity through cattle farming in irrigated schemes was initiated. It consisted in testing balanced dietary rations to feed lactating cows. Its effects on milk yield were assessed. A final discussion on the means to achieve a "Livestock Revolution" was elaborated: getting more milk and meat and improving farms' incomes in semi arid irrigated areas, with a sustainable use of water resources.

III – Results and discussion

Results show that the overall performances of cattle farms are widely variable (Table 2). For example, the mean annual output of alfalfa dry matter was only 9.09 ± 0.75 tons/ha, far from its potential. Similarly, the mean annual milk yield per cow did not exceed 2,170 kg. Indeed, from irrigated fodder to cattle products, evident losses appear, due to inappropriate farming practices, like insufficient water availability, imbalanced cattle feeding and poor hygiene. As a consequence, the average profitability per cow is weak (less than 230 € per year including the value of calves' sales), because the price cost of milk is often higher than farm gate milk price. In fact, only the calf crop allows a majority of farms to reach an economic equilibrium. Therefore, live animals' sales represent a strategic income for farms, whereas milk enables them to get a steady cash flow to face daily expenses. These trends result on a highly perfectible water productivity through cattle: 1.8 m^3 per kg of raw milk and 10.6 m^3 per kg of live weight cattle. All together, these results imply that measures are needed to ensure the competitiveness of dairying with irrigated fodder in irrigated schemes, with regard to other agricultural (fruits, vegetables, etc.) or non agricultural (tourism or industry) activities. This happens at a time where water scarcity is becoming a priority item for Morocco, as rhythms of water consumption are not sustainable, having resulted in the depletion of many aquifers.

Table 2. Technical performances of irrigated cattle farms: from water productivity to profitability

Farms	1	2	3	4	5	6
Alfalfa yield (tons of dry matter/ha)	7.97	9.17	9.58	9.82	9.62	8.40
Milk						
Milk output (kg)	14,820	11,900	13,310	6,800	3,800	4,950
Total water used (m^3)	31,170	25,950	22,200	7,750	5,740	8,970
Water productivity through milk (m^3/kg of milk)	2.1	2.2	1.7	1.1	1.5	1.8
Meat						
Total live weight gain (kg)	2,100	1,740	1,770	430	710	1,290
Total water used (m^3)	19,710	22,500	9,980	3,820	6,720	10,800
Water productivity through meat (m^3/kg of milk)	9.4	12.9	5.6	8.9	9.4	8.4

As the diagnosis of water productivity through cattle revealed wide margins of intervention, a protocol was planned to promote lactating cows' milk yield, by the adoption of balanced dietary rations. It consisted in comparing the cows' true dietary rations with their total optimal requirements, in five farms with cows of different genetic (purebred Holstein or crossbred cows). The potential energy and protein requirements for milk production were determined using models describing variations in daily milk yield during lactation (Wilmink, 1987). These were related to the herds' genetic merit and their average monthly lactation stage.

At each farm visit, the correspondence between cows' nutritional requirements and the true ration was evaluated. A supplementation was suggested to the farmer when a gap was detected. The acceptance of the suggested dietary rations was tested by monitoring cows' average milk yield and noting the farmers' opinion about the changes that were made.

The effects of the continuous correction of the dietary rations according to potential milk yield in a farm with Holstein cows are shown in Fig. 1.

In this farm, characterised by a lactation potential of 23 kg of milk daily at the beginning of the monitoring period, the strategy was adopted in less than two months. In other farms, mainly with crossbred cows (Holstein x local), it took more time to bridge the gap. All together, the results demonstrate the possibility to promote cows' milk yield by a close follow-up of their dietary rations. This requires a relationship of confidence and proximity with the farmers.

The previous results, though achieved with a limited sample of farms, could be of a significant interest if applied to the whole population of herds (almost 55,000 cows) in the irrigated scheme. They would increase the milk output as they would contribute to improve the water productivity through cattle, enhancing its overall competitiveness. Questions remain on the organisation of such an intervention at this scale, due to the withdrawal of State agricultural extension services.

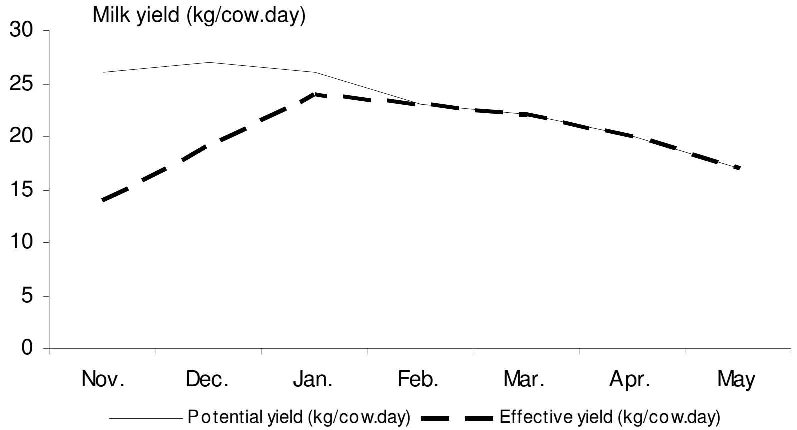

Fig. 1. Effects of the support programme on the average milk yield for Holstein cows.

Another way to improve the water productivity of the dairy chain may be achieved by an enhanced raw milk quality. This topic represents a collective challenge for all the operators of the chain due to the fragmented offer of milk. As a consequence, milk deliveries can only be organised in a two stages process (from farms to collection centres, then to milk plants) which constitutes a significant constraint to assess the quality of each single batch. The set-up of models linking milk quality parameters (fat and protein contents and microbial contamination) in relation to herds' management practices could be useful to avoid costly analyses. Such models would allow designing a grid of milk quality payment, just by the assessment of cattle rearing (feeding, hygiene, etc.) practices. This process has however to be collectively validated by the stakeholders within the dairy chain to improve the quality of milk deliveries (Sraïri *et al.,* 2009).

IV – Conclusions

Recent evolutions in food prices have implied major difficulties to secure the supply. In the Maghreb (Algeria, Morocco and Tunisia) area, which is currently facing a severe water stress, this has led to the increase of food imports, with marked consequences on the balance of trade. Therefore, these countries have to concentrate their efforts on the improvement of their food security, particularly by promoting the domestic output. In the specific field of animal products, the only way to achieve that goal is to promote a "Livestock Revolution": more products with a rationale use of resources. This article deals with that topic, and explores ways to get more milk in semi arid irrigated schemes, with the same amount of water, through a regular production of high quality forage. It shows that the adoption of an on-farm good management practices, like cattle balanced feeding may provide a solution. Another way of intervention consists in improving raw milk quality by the design of grids of payment linking on-farm practices with expected indicators. As the contribution of range land systems is in a steep decrease, the improvement of the supply of milk and meat necessarily requires a better water productivity through herds. Given the numerous roles of forage within agricultural systems (providing cheap nutrients to herds, contributing to the management of soil fertility, etc.), their production and utilization deserve to get more attention from all the stakeholders in the cattle products' chains.

References

Le Gal P.Y., Kuper M., Moulin C.H., Sraïri M. and Rhouma A., 2009. Linking water saving and productivity to agro-food supply chains: a synthesis from two North African cases. In: *Irrigation and Drainage*, 58, S320-S333.

Miège J.L., 1961. *Le Maroc et l'Europe, 1830-1894. Tome II : L'Ouverture*. PUF, Paris, 588 p.

Sraïri M.T., 2011. Le développement de l'élevage au Maroc : Succès relatifs et dépendance alimentaire. In: *Courrier de l'Environnement de l'INRA*, 60, p. 91-101.

Sraïri M.T., Benhouda H., Kuper M. and Le Gal, P.Y., 2009. Effect of cattle management practices on raw milk quality on farms operating in a two stage dairy chain. In: *Tropical Animal Health and Production*, 41, p. 259-272.

Wada Y., van Beek L.P.H. and Bierkens M.F.P., 2012. Nonsustainable groundwater sustaining irrigation: A global assessment. In: *Water Resources Research*, 48, 18 p.

Wilmink J.B.M., 1987. Adjustment of test-day milk, fat and protein yield for age, season and stage of lactation. In: *Livestock Production Science*, 16, p. 335-348.