The Moroccan experience with feed blocks: Research and development

Boulanouar B., Chriyaa A., Tarhzouti O., Sahnoun A.

in

Ben Salem H. (ed.), Nefzaoui A. (ed.), Morand-Fehr P. (ed.).
Nutrition and feeding strategies of sheep and goats under harsh climates

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 59

2004
pages 203-208

The Moroccan experience with feed blocks: Research and development

B. Boulanouar*, A. Chriyaa*, O. Tarhzouti* and A. Sahnoun**
*INRA-Morocco, BP 6570, Rabat Instituts, 10101 Rabat, Morocco
**Livestock Directorate, Ministry of Agriculture, Rabat, Morocco

---

SUMMARY – Moroccan agriculture generates large amounts of agricultural and agro-industrial by-products. When considered separately, some of these by-products present nutritional deficiencies or some physical properties that impede their utilisation. Feed blocks, or the so called multi-nutrient blocks provide a means to alleviate these deficiencies. A few years ago, the Moroccan Ministry of Agriculture promoted the use of a feed block formula based on sugar beet molasses (40%) and wheat bran (30%). The handling difficulties of molasses and the newly emerging and competing uses of molasses for yeast and alcohol production, somewhat hampered the adoption of this formula. The National Institute of Agricultural Research has conducted research for the last five years in order to address these questions. Early research tested the use of feed blocks by sheep as a supplement against other alternatives, particularly during stubble grazing. Later on, research aimed at testing physical properties, cost and animal utilisation of different block formulae. This paper describes the early development phases of block making and use by the Ministry of Agriculture and presents the available results from both on-station and on-farm research. The paper will then conclude with the outcome of a first scaling up experience (joint venture INRA and NGO's) of block production and the perspectives ahead.

Key words: Feed blocks, supplementation, sheep, semi-arid environment.

RESUME – *"L'expérience marocaine avec les blocs alimentaires : Recherche et développement". L'agriculture marocaine génère des quantités importantes de sous-produits agricoles et agro-industriels. Considérés séparément, ces sous-produits présentent des déficiences nutritionnelles ou des caractéristiques physiques qui contrarient leur utilisation. Les blocs alimentaires, communément appelés blocs multi-nutritionnels, restent un moyen pour corriger ces contraintes. Vers la fin des années 80, le Ministère de l'Agriculture voulait promouvoir l'utilisation de blocs alimentaires à base de mélasse (40%) et de son de blé (30%). Les difficultés de manutention de la mélasse et les nouvelles possibilités d'utilisation de la mélasse pour la production de levure et d'alcool, ont freiné davantage l'adoption de cette formule. Des recherches ont été menées par l'INRA pendant les cinq dernières années pour traiter de ces questions. Pour commencer, les recherches se sont intéressées à tester l'utilisation des blocs alimentaires du Ministère comme moyen de supplémentation sur chaumes en comparaison avec d'autres alternatives. Plus tard, la recherche a visé le test des propriétés physiques, le coût et l'utilisation par les ovins de différentes formulations de blocs. Le présent article décrit le début de la phase de fabrication et promotion des blocs par le Ministère et présentera les résultats des recherches en station et hors station concernant leur utilisation. L'article conclut avec une expérience pilote menée en joint-venture entre l'INRA et des ONG sur le "scaling-up" de la production des blocs. Enfin, des perspectives futures seront avancées.*

Mots-clés : *Blocs alimentaires, supplémentation, ovin, milieu semi-aride.*

Introduction

Regardless of the prevailing agro-ecological context, animal production in Morocco is relying more than ever on feed supplementation in the form of concentrates for a considerable part of the production cycle. Considering the growing dependence on foreign sources for livestock products and feedstuff, there is a serious need in optimizing the use of domestic feed resources. The concern is even greater in the ruminant sub-sector where range land feed resources are undergoing heavy degradation and particularly when forage crops make up only little contribution in covering herd requirements (10%).

In addition to rangelands, the ruminant production sub-sector in Morocco depends essentially on fall-cereal crops grains (such as barley) or crop by-products of limited quantity and low quality (such as straw and stubble grazing). With the utilization of some non-conventional feeds generated from agro-industrial activities and the use of basic knowledge in ruminant nutrition, the potential and feasibility of upgrading the quality of available roughage exist.

The use of feed blocks (or the so called multi-nutrients blocks) offers a solid and storable medium for combining several ingredients with different, but complementary physical and nutritional characteristics in order to correct deficiencies in the basic roughage. They can serve also as a means to get the animals to ingest other nutrients and additives (minerals, vitamins, drugs). The inventory, the physical and chemical characteristics, the temporal and spatial availability of different agro-industrial by-products vary among countries and among regions within a country. Likewise, more profitable alternative uses may exist or arise for different agro-industrial products. Therefore, physically, nutritionally and economically feasible block formulations should then be studied carefully according to each context.

While many research papers and reports in the WANA region suggest the potential of increasing ruminant production in extensive systems by the use of multi-nutrients blocks, the present paper reports on the development and research efforts that were made in the use of multi-nutrients blocks in Morocco and concludes with some recommendations for future perspectives in research and development.

Overview of the Moroccan experience with feed blocks

The early development phase

Concerned with the optimization of the use of agro-industrial by-products on one hand and inspired by research and development work in neighboring countries and other countries around the world on feed blocks utilization on the other hand, Moroccan planners sought a technical assistance in 1987 from FAO to promote the manufacturing and the utilization of feed blocks. Although, the objective was to develop and test several feed block formulations, the underlying assumption was to manufacture feed blocks that incorporate large proportions of molasses (a block that serves as a carrier of cheap energy in the form of molasses) and contains urea as another strategic ingredient. Another overall concern in the process was to insure sound physical structure of the block while aiming at a nutritional complementarity among the different ingredients. Therefore wheat bran along with mineral-vitamin mix came into play. With that in mind, it was then necessary to work out the right proportions of these ingredients in the block. In the 1990-91 season, the Ministry moved into a realization phase of the concept with the set-up of a research contract with the Agronomic and Veterinary Institute-Hassan II and SNDE (a livestock State Farm). The outcome of this research-development contract was the identification, among the many formulae tested, of a block that contains on as its basis: 40% molasses, 30% wheat bran, 10% urea, 15% cement and 5% mineral-vitamin mix. With the prices that prevailed at that time, the cost of production amounted to 1.3 Dh per kg of block. Another achievement during that first year was the establishment of a government-supported manufacturing unit in the state farm which produced 1000 tons of blocks. For the following three seasons, the ministry via its provincial directorates launched an ambitious extension program in several regions. The extension program consisted of distributing blocks for free, organizing field days for producers and training sessions for extension technicians and the production of extension material (videos, slides, bulletins). In the midst of this tremendous development effort, only one experiment was conducted in the eastern part of Morocco that quantitatively documented the utilization of these blocks and their effect on animal performance (Hammoudi, 1995, unpublished).

The idea of maximizing the use of molasses in the block derives its logic from the availability of large quantities of this ingredient in Morocco. Indeed the several sugar manufacturing plants across the country generate approximately 200,000 tons of molasses annually (65% from sugar beet, 20% from sugar cane and 15% from sugar purification). Despite its low price at the time (0.3 Dh/kg), these large quantities were only partially valued through animal production (25% for export, 25% for local yeast and alcohol production, only 27% was directly used by the farms in animal production whereas 23% is indirectly used in animal production). The small proportion (27%) that is directly valued at the farm level is due essentially to the handling difficulties associated with the liquid nature of molasses particularly for remote farms. Therefore, the feed block technology was intended to alleviate such difficulties and, presumably, boost direct utilization of molasses at the farm level.

Strategically, the Ministry targeted this newly made-up technology in Morocco to correct feed gaps during the summer and fall particularly in cereal producing domains and range land areas. Likewise, blocks were realistically considered as a maintenance feed for livestock through difficult times, including periods of feed shortages during drought.

The liberalization of some agro-industrial by-products in late 80s, the recent recurrent years of drought, the new export opportunities that opened up for molasses made its prices go up almost fourfold in 1995. This context made the molasses based formula a luxurious rather than a thrifty one.

Main conclusions of this phase

Despite the tremendous effort during the earlier development phase, feed blocks remained unpopular in many regions. It was relatively easy to manufacture the blocks, but it was hard to convince the producers to use them.

Moreover, given the fact that the whole extension program was conducted in the absence of structured data collection on the cost-benefit of this technology, it became difficult to assess the real benefit and extrapolate the real and potential impact of these blocks when adopted at the farm level. With the very scarce data on block utilization at the end of this phase, it was impossible to conclude if the engaged development effort is worthwhile. Apart from the infrastructure and organizational difficulties of getting the molasses to the spot of block making, a need for a research that will evaluate the block technology was then obvious at the end of this first phase.

The research and development phase

The National Institute of Agricultural Research (INRA) took the initiative to conduct research in order to: (i) study the effect of feeding the blocks promoted by the Ministry of Agriculture on sheep performance grazing stubble on station and on farm; (ii) to identify new feed block formulae that respond to the new pricing context of the ingredients used and that account for the regional variation of ingredients availability; and (iii) conduct a research-development action aiming at the *"scaling-up"* of blocks manufacturing in a self sustained way.

Study the effect of feeding the blocks promoted by the Ministry of Agriculture on sheep performance on station and on farm

All the research conducted at INRA to evaluate the Ministry's feed blocks, was conducted with sheep grazing stubble. Typically, sheep breeding and early- to mid-gestation occur on stubble. When stocking density is low and/or when high aftermath biomass is available, grazing can go on until late gestation. The dynamic of nutrients availability on stubble has been sufficiently described (Guessous *et al.*, 1987; Outmani *et al.*, 1991; Fares, 1992; Boulanouar, 1994). While, all these authors recognize the importance of initial stubble biomass and the applied stocking rate in shaping the dynamic of nutrients availability, they all agree that, chronologically, protein becomes first limiting, followed by protein and later on both energy and protein decline sharply as grazing goes on. These authors also established that early stubble grazing allows reasonable animal performance without resorting to supplementation, whereas energy and protein supply becomes subsequently necessary.

With this background in mind, and with reference to the livestock producers feeding practices during stubble grazing, the overall objective of this research was to comparatively evaluate (first in a steady model and then in a dynamic one) the value of feed blocks as a supplement against other supplementation alternatives such as barley grain, sunflower cake, *Atriplex* leaves and twigs.

Main conclusions of this research

Since, the research work was done with sheep during mating or in early- to mid-gestation and therefore considered to be at maintenance level. The production objective with the use of blocks was then modest and consisted of maintaining live weight or at least minimizing weight loss. Although the time frame depends on initial stubble biomass and the stocking density, a general model for moderate to low performance of sheep on stubble is summarized in Table 1.

During early-grazing (0-4 weeks), reasonable animal performance were achieved without resorting to supplementation (30 to 60 g of weight gain). During mid-grazing (4-8 weeks), it was necessary to provide energy in order to maintain weight. During late-grazing (8-12 weeks), it was necessary to provide both energy and protein supplementation in order to avoid weight loss.

Table 1. Supplementing stubble-grazing sheep with feed blocks.

	Time frame		
	0-4 weeks	4-8 weeks	8-12 weeks
Availability on stubble	+ +	+	-
Energy	+	-	-
Protein	+	+	-
Opportunity for supplementation			
Energy	0	+	+
Protein	0	0	+
Opportunity for UM[†] feed block utilization	0	+	?

[†]Urea-molasses block.

The results of five extracted from five research works indicated that:

(i) It was hard to beat barley grain as a supplement in early- to mid-grazing of stubble.

(ii) Urea-molasses feed blocks combined with an energy source concentrate such as barley grain may not be a cost effective supplementation for stubble.

(iii) At an advanced stage of grazing (8-12 weeks), supplementing with feed blocks alone prove ineffective. Indeed as DM intake becomes limiting it was hard to make a case for catalytic effect of a urea-molasses based block. It could be useful to offer some straw at that time.

(iv) A combination of feed blocks and *Atriplex* leaves and twigs offers a supplementation option particularly for late grazing on stubble.

(v) At an advanced stage of grazing, the supply of true protein may also become necessary in order to reduce weight loss.

Based on the above results highlights, the opportunity for utilizing a urea-molasses feed block to supplement sheep grazing stubble is great to good respectively during the early- to mid-grazing periods and questionable during late-grazing due to low dry matter availability.

Identify new feed block formulae that respond to the new pricing context of the ingredients and that account for the regional variation of ingredients availability

The objective of this research was to investigate ways to modify the formulation without jeopardizing the physical characteristics and the rate of consumption of the block by sheep. The cost of production was another assessment factor of these modifications. The physical characteristics of the block were examined subjectively using a scoring system to determine cohesion and hardness. Moreover rate of consumption was determined with sheep over a period of at least 20 days.

In order to lower the cost of production feed blocks, Sibaoueih (1997) incorporated increasing proportions (10, 20 and 30%) of raw olive oil cake at the expense of wheat bran while keeping other constituents constant. The 30% olive cake formulae was not a success as the mixture could not hold as a block. In that case, the proportion of molasses should be lowered to allow the mixture to solidify. It was also indicated that the uses of another binder such as lime or clay should be considered. Both the energy content and cost of production was lowest at 20% olive oil incorporation level. The recorded rate of consumption of the blocks with olive oil cake was very low. This finding remained unexplained by the author who recommended sieving the olive oil cake in the future.

In another trial (Tarhzouti and Boulanouar, unpublished), the aim was to study the effect of increasing the proportion of raw olive oil cake at the expense of molasses, the substitution of cement for slaked lime and the replacement mineral-vitamin mix for NaCl on the physical characteristics and the cost of the block. Out of the ten formulae tested, only three were selected. These formulae were tested out in a supplementation trial and showed promising results. It was concluded from this work that it is possible to reduce the proportion of molasses in the block without jeopardizing its structure. However, a moderate (10-15%) proportion might be necessary to stimulate appetite and increase the efficiency of urea utilization. This research also showed that slaked lime could be a better binder than cement as the latter may reduce intake due to excessive hardness of the block. Compared to the original formula, the energy content and the cost of production was lower. Interestingly, the increasing incorporation of olive oil cake did not hinder block voluntary intake.

Conduct a research-development action aiming at the "scaling-up" of blocks manufacturing in a self-sustained way

With the cease of government subsidy, and the lack of interest from the private enterprise, large scale block manufacturing becomes a difficult task. Researchers at INRA hypothesized that large scale block manufacturing can be done by a cooperative of farmers in a self sustained manner provided some technical guidance and a start-up operating money. The specific objective was then, putting together the know how of INRA (a public research institute), the operating budget brought by a Research and Development NGO and the infrastructure and skills of a crop producers cooperative in order to: (i) develop skills at the producers level in feed rationing in general and block manufacturing in particular; (ii) to scale up the manufacturing process of feed blocks in a cost effective way with a capacity of 3000 kg per day during summer time; and (iii) use the proceeds generated by the farmers co-operative from block sales to secure operating budget and establish a revolving fund.

INRA researchers provided the technical assistance during production, utilization and evaluation of the blocks and also in producing didactic material. The R/D NGO provided financial support to tart a production of 50,000 kg of blocks, to fund the training workshops for the farmers and their sons, to launch a marketing campaign. While the producers co-operative provided infrastructure and labor, other public institutions such as the Commune and the Provincial Directorate of the Ministry of Agriculture played merely a facilitator role.

Main conclusions of this pilot experience

Within the cooperative, the experience was a positive pedagogic experience, as it helped participants to acquire technical and managerial skills in a new field of intervention. Likewise, neighboring farmers who visited the unit expressed interest in the organizational concept. Moreover, early sales showed that the operation can be profitable.

Unfortunately some unknown background conflicts among the members of the cooperative surfaced and disturbed the functioning of the unit. Therefore some serious preliminary reconnaissance of the context of the cooperative could have helped to avoid the stalemate. Luckily, an Italian NGO expressed interest in picking up the experience and moving it forward.

Conclusion

The available information from the Moroccan experience with feed blocks indicates that:

(i) Urea-molasses blocks can play a positive role in extensive animal production systems and that quantitative and qualitative assessments of the block on farm showed producers enthusiasm towards this technology.

(ii) It is also obvious that organizational and infrastructural problems hindered the adoption of the molasses containing feed blocks. Encouraging with guidance and some seed money producers cooperative can offer a solution to scaling up self sustained manufacturing units.

(iii) Modified block formulations can provide "maintenance" type of blocks at a cheaper cost while alleviating the problems associated with the liquid nature of the molasses and its accessibility.

(iv) Research on feed blocks manufacturing should be pursued while diversifying the ingredients to include other agro-industrial by-products and to design blocks for higher performance levels with the inclusion of good quality protein sources.

References

Boulanouar, B. (1994). *Meeting the nutritional requirements of sheep in semi-arid Morocco*. PhD Dissertation, University of Nebraska, Lincoln, 246 pp.

Farès, A. (1992). *Les chaumes de céréales: Caractérisation et utilisation par les ovins dans la région du Tadla*. Mémoire 3ème cycle, Option Productions Animales, IAV Hassan II, Rabat.

Guessous, F., Outmani, A., Dahbi, E., Garrette, J.E. and Johnson, W.L. (1987). Utilization of wheat stubble by sheep: Effect of protein supplementation on intake, diet composition and animal weight. In: *38th EAAP Annual Meeting*, Lisbon (Portugal).

Hammoudi, A. (1995). Résultats de l'essai de suivi de l'utilisation des blocs de mélasse. Direction Provincial de l'Agriculture d'Oujda, Service de la Production Agricole (Note interne), 4 pp.

Outmani, A., Lingbuhl, J.M., Guessous, F. and Johnson, W.L. (1991). Utilization of wheat stubble pastures by gestating ewes. *Small Ruminant Res.*, 4: 257-267.

Sibaoueih, M. (1997). Mise au point d'une formulation de blocs alimentaires à base de grignons d'olives. In: *Rapport Annuel du Programme Viandes Rouges 1996*, Boulanouar, B., Matthess Guerrero, A. and Morkramer, G. (eds). INRA, 167 pp.