Urea Block Manufacturing and Feeding: Middle East Experience

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Introduction
Poor quality roughages comprise the only part of the diet for ruminant animals in most Middle East countries for a considerable part of the year. Animals on such diets are on negative energy balance and supplementary feeding with energy and nitrogen has been used for improving the nutritional status of animals (Capper *et al.*, 1989; Hadjipanayiotou *et al.*, 1975).

Molasses-urea blocks (MUB) have been used as supplements for animals kept under extensive systems of production (Sansoucy 1986). Despite of promising results from MUB feeding their wider application is restricted due to lack of molasses in certain countries and/or areas within countries. As a result, urea block manufacturing without any molasses was promoted by the Food and Agricultural Organization of the United Nations in different parts of the world (Hassoun 1989; Hadjipanayiotou *et al*., 1993a,b). The present paper reviews studies carried out in Cyprus, Iraq, Jordan and Syria aiming at Urea block (UB) manufacturing and feeding with or without molasses and the performance of animals on poor quality basal diet offered along with UB made of a variety of by-products and of binders.

Syria
The work on UB manufacturing and feeding in Syria started in March 1991 with the commencement of the project FAO/UNDP/ SYR/89/003. A large number of UB formulae with or without molasses and using a variety of binders were made (Hadjipanayiotou *et al*., 1993a).

The binders used were cement, plaster of paris ($CaSO_4.1/2H_2O$) and slaked lime ($Ca(OH)_2$). Slaked lime was a better binder than plaster of paris. Although slaked lime was a better binder compared to cement, the choice between the latter two should depend on relative availability and price.

Ingredients used in MUB manufacturing were urea, salt, broiler litter, dried cage layer excreta, wheat bran, solvent extracted olive cake, fresh sugar beet pulp and sugar-beet molasses.

The Syrian studies in line with those of Hassoun (1989) showed that UB can be made without any molasses; the amount of binder required, however, was relatively higher (>10% <15%) especially when poultry excreta was incorporated in the mix. On the other hand, even with a low level (5%) of molasses a 6% slaked lime gave good UB. The amount of water required was increased with decreasing molasses level in the mix; with mixtures without any molasses, up to 50 l of water per 100 kg mix were required.

Aarts *et al.* (1990) reported that when using a concrete mixer, the wheat bran must be introduced in successive small quantities at a time in order to get a homogenous mix. In the Syrian studies, introducing the ingredients in the order water, urea, salt, binder, molasses, poultry excreta and wheat bran showed that the order of mixing is not as critical as has been reported by Aarts *et al.* (1990), and that introduction of wheat bran can be made in large portions. It seems therefore, that mixing procedure can be altered in order to find the easiest and quickest way to produce the blocks.

Details on UB manufacturing, including preparation of ingredients, mixing, moulding, demoulding, UB assessment and curing applied in Syria were reported by Hadjipanayiotou *et al.* (1993a).

Animal Studies

Studies carried on research stations and/or using animals belonging to farmers showed that animals on UB perform better than those on the non-supplemented diets (Tables 1,2 and 3).

Cyprus

Studies in Cyprus followed those in Syria and continued studying further aspects of UB manufacturing. In seven tests carried out from June to November 1993. UB were made using a variety of ingredients (chopped straw, poultry litter, ground barley, fresh brewers grain, fresh tomato pulp, crude olive cake (COLC), urea, salt and wheat bran), binders (cement, slaked lime alone or in combination) and amounts of water.

Table 1. Effect of urea-block feeding on the performance of Awassi ewe lambs offered chopped cereal straw *ad libitum*, Hama Research Centre (Test period: 22/12/90-21/2/91)

	No block	Block	SD
No of animals	35	35	-
Initial weight (kg)	40.1	40.7	5.26
Final weight (kg)	34.9	37.5	1.97***
Weight loss (g/day)	88	53	38.7***
Feed intake (g/day)			
Straw	744	770	-
Block intake	-	90	-

Table 2. Performance of Awassi Sheep grazing stubble (29/9-24/10/90) without (control) or with blocks.

	No block	Block	SD
No. of animals	86	83	-
Daily weight loss (g)	56	6	71.7*
Block intake (g/day)	-	47	-

Table 3. The effect of urea-block feeding on the performance of Awassi sheep grazing cereal stubble in the Salamieh area, Hama (Test period 12/9-24/10/91)

	No block	Block	SD
No. of animals	99	100	
Initial weight (kg)	45.8	44.8	5.52NS
Final weight (kg)	41.5	43.0	0.73***
Weight loss (g/day)	101	41	44.3***
Block intake (g/day)	-	97.3	-

Details on individual formulae and other characteristics have been reported by Hadjipanayiotou (1995). In line with Syrian studies (Hadjipanayiotou *et al.* 1993a), but at variance with tests in other FAO projects (Rene Sansoucy and Michael Allen personal communication) where slaked lime was not very effective binder, slaked lime was an effective binder. Combination of two binders improved hardness (H) and compactness (C) of UB; five percent cement and 5% lime gave better UB than when 10% lime or 10% cement were used. Lime gave harder UB than cement. In the Cyprus studies there was no need for more than 10% binder. Incorporation of olive cake and brewers grain improved UB quality; incorporation of tomato pulp and chopped straw gave UB that could be easily transported but were of low density and spongy. Incorporation of high moisture by-products in UB reduced the amount of water required, but increased storing/curing area required.

Animal studies

In a trial with mature, dry Chios ewes the value of UB as supplement to straw (US) offered ad libitum was compared with other supplements (concentrate-con, lucerne hay- LH and urea-treated straw-UTS offered ad libitum). The present study showed that UB made of by-products can be used for replacing conventional supplements such as top quality roughage and scarce and expensive concentrate feeds. Furthermore, UB feeding gave better results than UTS (Table 4).

Table 4: Performance of Dry Chios ewes offered straw *ad libitum* alone (US) or with a supplement of urea block (US+UB), concentrate (US+C) and lucerne hay (US+LH) and/or urea-treated straw (UTS) alone.

	US	UTS	US+UB	US+Con	US+LH	SD
No. of animals	7	7	7	7	7	-
Initial weight,kg	64.1	64.2	63.2	64.5	62.7	10.0
Final weight,kg	57.2	59.7	59.6	60.6	59.9	9.4
Weight loss,kg	6.9b	4.5ab	3.6a	3.9a	2.8a	2.3
Intake, g/kg.75/d						
Straw	35ab	41a	35ab	33ab	29b	6.8
Supplement	-	-	14a	10b	14a	3.7

Iraq

Work in Iraq and Jordan was initiated under the auspices of the Mashreq project RAB/89/026, Increased Productivity of Barley, Pasture and Sheep. The author worked as a consultant for the project and with national scientists in the two countries formulated a work plan that included on state and private farm studies. Ingredients used for UB manufacturing were wheat bran, rice bran, poultry litter, date pulp, beet pulp, corn cobs, reed, urea, salt, CaO, $CaCO_3$ and whey.

Different type of mixer was/is used in Iraq. This type of mixer beats and compresses the material against the walls of the container. This smearing action results in better mixing of the ingredients, blocks of higher density, compactness and hardness. There are now two plants of UB manufacturing in Iraq, a state one (Baghdad area) with an output of 3.5 t daily and a private (Mosul area) with an output of 2.5 t per day. Both plants sell their UB to farmers (Annual Report, 1993/94 Mashreq Project RAB/89/026).

Animal studies

In a number of studies carried out on state and private farms the beneficial effect of UB feeding on the performance of ewes grazing cereal stubble was obvious (Table 5).

Table 5. Effect of feeding UB on the performance of Awassi ewes grazing cereal stubble (Annual Report 1993/94, Mashreq Project)

Experimental site	Mosul, Al-Muside		Mosul, Al-Irbeed	
Treatment	No UB	UB	No UB	UB
No. of ewes	30	30	30	30
Days on test	36	36	36	36
Initial weight,kg	48.4	49.4	46.6	46.0
Final weight,kg	50.8	53.6	48.5	48.8
Weight gain,g/d	50	115	51	75

Jordan

Ingredients used in Jordan for UB manufacturing were urea, salt, sun-dried olive cake, poultry litter, wheat bran, fresh brewers grain, fresh tomato pulp , cement and slaked lime. Most formulae, like in Cyprus, Iraq and Syria were of very good H and C.

Animal studies

In line with other Mashreq countries UB feeding resulted in improved growth rates, and the use of UB gave better results than UTS (Table 6).

Table 6. Effect of feeding supplements of UB and UTS to Awassi sheep grazing cereal stubble (Annual Report, 1993/94, Mashreq Project)

	UB	UTS	Control
No. of ewelambs	12	12	11
Initial weight,kg	28.8	31.8	29.7
Final weight,kg	31.3	33.9	31.5
Days on test	30	30	30
Weight gain,g/d	83	70	61
Extra cost, JD	0.05	0.08	0.0
Net return,JD/head	6.1	5.17	4.6

Conclusions

It is concluded that it is possible to make UB of good hardness and compactness without any molasses. Brewers grain and COLC when available, not only can be used for UB but they can also improve UB qualities. Furthermore, tomato pulp can be used in UB, and incorporation of high moisture by-products in UB will reduce the amount of water, but will increase storage/curing area required. COLC seems to have binding qualities, and at high levels of inclusion ($\geq$15%) may facilitate the use of less quantities of binders. The fact that COLC is available during the rainy season, make its use for UB manufacturing problematic, since dehydration of UB is longer. Surpluses of COLC, however, can be easily preserved by ensiling in heaps next to oil mills (Hadjipanayiotou 1995), and utilized in UB after February.

It seems that when making UB without any molasses/COLC and/or other ingredients having binding qualities, the type of mixer used is of greater significance for making good quality UB. The concrete mixer is just turning and mixing the material, whereas other mixers, beat and compress the material against thewalls of the container. This smearing action produces UB of higher density and results in better contact between the binder(s) and the other ingredients. It is my opinion that mixers that beat and compress the material against the walls of the container might have to be used for making good quality UB without molasses.

Hardening of UB increased with advancing storage period. Sansoucy (1986) reported that resistance of 5-6 kg/cm2 to penetration would seem appropriate to ensure the desirable level of production. Long storage of at least some formulae results in an extremely hard blocks that could reduce block intake seriously. It is preferred that UB are made at a time prior to their use so that they would reach the desired degree of hardness at the time required. However, when long storage period is inevitable, wrapping and/or storing the blocks in polyethylene sheets/bags will maintain the desired hardness.

Slaked lime can replace a great part of cement; the selection of the binder therefore, should depend upon price and availability. For certain UB formulae, combination of the two binders may improve

UB qualities (Hadjipanayiotou, 1995).

Preston and Leng (1987) concluded that UB feeding is a technology that can be applied by small farmer whereas preparation of a urea solution and spraying it onto straw is a demanding and often arduous task making its wider application problematic. Since the present findings showed a greater response to UB than UTS straw feeding lend further support the conclusions of Preston and Leng (1987). Finally, It is concluded that UB made of by-products can be used for replacing conventional supplements such as good quality roughage and concentrate feeds fed to ruminant animals.

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