WORLD RABBIT SCIENCE 1995, 3 (2), 69-73.

MOLASSES BLOCKS AS SUPPLEMENTARY FEED FOR GROWING RABBITS

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ABSTRACT : In the present study molasses-blocks, including different amounts of cereal by-products and cement, have been tested in order to verify their effectiveness as supplementary feeds for forage fed rabbits. The four feeding treatments were tested on 180 New Zealand White rabbits of 37, 65, 80 days of age during two trials. Molasses-blocks were formulated with 4 or 10 % of cement on DM (B4 and B10) and provided to the animals in addition to fresh alfalfa. The two control groups were fed fresh alfalfa alone (AA) or an industrial balanced pellet (IP). The higher cement level in block B10 induced the animals to reduce its ingestion (P<0.05) that was compensated by an higher consumption of alfalfa. All the treatments produced higher daily gains in comparison to alfalfa alone (30.4 and 30.5 vs. 17.8 g/d for B4, B10 and AA respectively at 37 days of age ; 32.5 and 25.2 vs. 21.8 g/d at 65 days of age ; 33.5 and 29.9 vs. 21.9 g/d at 80 days of age). The differences were always significant for B4 and IP (P<0.05). The increased performances produced by blocks were lower than the ones produced by IP control, but the results were good enough so that the differences were non significant in the post-weaning period and near to the slaughtering age. The results obtained may encourage the use of molasses-blocks as supplementary feeds to increase the growing performances of meat rabbits in Developing Countries.

***RÉSUMÉ** : Supplémentation de l'aliment par les blocs melassés pour lapins en croissance.*
Dans cette étude, des blocs mélassés comportant différentes quantités de sous produits céréaliers et de ciment, ont été testés afin de vérifier leur efficacité en tant que supplément de l'alimentation de lapins nourrit de fourrages. Au cours de deux traitements, les quatre aliments expérimentaux ont été testés sur 180 lapins Néo-Zélandais Blancs agés de 37, 65 et 80 jours. Les blocs mélassés contenait 4 ou 10 % de la MS de ciment (B4 et B10) et était distribués aux lapins en plus de luzerne fraîche. Les deux groupes témoins n'ont reçu que de la luzerne fraîche (AA) ou un granulé industriel équilibré (IP). Les animaux ont réduit leur ingestion (P<0,05) du bloc B10 qui contenait le taux le plus élévé de ciment et compensés par une consommation élevée de luzerne. Tous les traitements ont donnés des gains moyens journaliers plus élevés comparés à la luzerne seule (30,4 et 30,5 vs 17,8 g/d pour B4 et AA respectivement à 37 jours d'âge ; 32,5 et 25,2 vs 21,8 g/d à 65 jours d'âge ; 33,5 et 29,9 vs 21,9 g/d à 80 jours d'âge). Les différences entre B4 et IP étaient toujours significatives (P<0.05). Les performances améliorées obtenues avec les blocs restaient inférieures à celles obtenues avec la groupe témoin IP, mais les résultats étaient assez satisfaisants puisque les différences n'étaient pas significatives dans la période d'après sevrage ou proche de l'âge de l'abbatage. Les résultats obtenus peuvent encourager l'utilisation de blocs mélassés comme supplément d'alimentation pour augmenter les performances de croissance des lapins de chair dans les pays industrialisés.

INTRODUCTION

The poor and unbalanced quality of forage based diets, usually provided to rabbits in Developing Countries, was frequently underlined (CHEEKE and PATTON, 1982 ; LEBAS, 1983 ; CHEEKE and RAHARJO, 1988 ; VAN EEKEREN *et al.,* 1991 ; DESHMUKH *et al.*, 1993a,b). To integrate forage based diets the use of supplementary molasses–blocks appears to be the easiest technology to be employed in countries where the infrastructure and socio–economic conditions impair preparation and commercialisation of balanced industrial feeds. This technology has the advantage to permit the utilisation *in situ* of local by–products.

Proper integration of cement or lime is needed not to exceed with molasses to obtain more resistant and solid blocks so as to limit their consumption and to attempt a more balanced intake of required nutrients (BINH *et al.*, 1991 ; FILIPPI BALESTRA *et al.*, 1992).

Very frequently the main forage utilised is fresh alfalfa (FEKETE, 1982 ; LEBAS, 1983 ; FINZI, 1987 ; FINZI *et al.*, 1988). To integrate alfalfa based diets, relatively rich in protein, by-products containing blocks have been studied, mainly to provide energy to growing rabbits.

MATERIAL AND METHODS

Two trials have been performed with iso–nitrogenous molasses–blocks containing different amount of cement. The first trial was to ascertain the effectiveness of the technology. The second one was to test the performances of growing rabbits in comparison

Table 1 : Chemical composition and nutritive value of foodstuffs (DM)

Feeds		Trial	DM %	CP %	CF %	EE %	Ash % (Ca ; P)	NFE %	NDF %	ADF %	ADL %	DE (1) MJ/Kg
Block 4 (2)	(B4)	I and II	85.0	10.3	7.4	2.9	15.1 (2.3 ; 0.36)	64.3	19.2	11.9	2.7	12.02
Block 10 (2)	(B10)	I and II	86.0	10.0	7.3	2.8	21.4 (5.0 ; 0.35)	58.5	19.1	11.9	2.7	10.52
Ind.pellet	(Ip)	II	91.1	17.2	18.1	2.3	12.1 (1.2 ; 0.52)	50.3	49.2	22.2	4.7	10.49
Alfalfa	(Aa)	I	32.6	21.3	25.4	3.8	12.5 (1.4 ; 0.25)	37.0	37.7	27.4	6.6	9.35
Alfalfa	(Aa)	II	28.9	22.6	25.6	2.7	12.3 (1.4 ; 0.26)	36.8	51.0	34.4	7.1	9.14
Alfalfa waste (3)	(AAW)	II	36.8	14.4	35.7	2.3	13.3 (1.7 ; 0.25)	34.3	57.6	43.8	9.4	5.92

(1) : Calculated: Maertens *et al.*, 1988.
(2) : The percent is referred to cement content (DM).
(3) : Alfalfa wastes were analysed in order to calculate the real feed ingestion

with two controls, which were alfalfa alone and industrial balanced feed respectively.

Two block formulations have been tested. They were characterised by a 4 % and 10 % cement content on dry matter basis (B4 and B10 respectively), and were offered to growing rabbits receiving fresh alfalfa. Both blocks and alfalfa were offered *ad libitum.*

In the second trial two control groups were introduced. One receiving only fresh alfalfa (AA), after one day of open–air drying, and one receiving an industrial pellet (IP). Blocks formulation for B4 and B10 was respectively : cement 3.2 and 8.0 ; molasses 50.8 and 50.1 ; dehydrated alfalfa meal 17.2 for both ; broken rice 11.3 and 7.1 ; wheat bran 17.5 and 17.6 (% on as fed basis). Broken rice and wheat bran were included since they were previously observed as common and relatively cheap in north African countries (FINZI, 1994).

In order to simulate field conditions and to simplify manufacturing, block formulation is expressed on as fed basis. A 5–8 days period of open–air drying was necessary to reduce water content of the blocks to about 15 % before providing them to the animals.

Foodstuffs chemical composition is reported in Table 1. Crude protein and fibre content of the blocks was lower than in the industrial pellet and energy was higher in B4 to permit the animals to balance the overall intake when fresh alfalfa was provided.

To avoid the disturbing effect of different live weight of growing animals at the same age, depending on different feeding treatments, three groups of New Zealand White rabbits animals at different ages were included in the experimental design. In two trials of ten days each animals aged 37, 65 and 80 days were utilised. In the first trial 16 animals in each age group were randomly assigned to the treatments B4 and B10. In the second trial 44 animals for each age group were similarly assigned to the four treatments (B4, B10, AA, IP).

The rabbits were kept in individual cages provided with water *ad libitum*. The rabbits were fed a mix of industrial pellet, blocks, and fresh alfalfa *ad libitum*, and progressively switched to the planned diets within one week before start of the experiment.

Live body weight, feeds offered and alfalfa residuals were individually recorded. Chemical analysis was performed on the feeds offered or block components, and residuals (MARTILLOTTI *et al.*, 1987).

Sugar content of molasses, measured at 20°C (ABBE Refractometer Galileo RG701) was of 81° Brix. Resistance to compression of the molasses blocks was measured with a sclerometer (KRS Mass/NY Dep. 481960).

Data were submitted to analysis of variance with the GLM procedure of SAS (1993).

RESULTS AND DISCUSSION

The mean chemical composition of the diets ingested by rabbits in the first trial (Table 2) was similar to the industrial feed (IP) chosen as control. This one had a crude fibre content relatively high, in order to simulate industrial feeds available in developing countries. Crude protein ingested was between 16.2 % and 17.7 % (DM) and generally higher for group B10 in comparison to B4 (Table 3). This may be attributed to the higher ingestion of alfalfa as B10 was consumed less due to the higher cement content. The content of protein and fibre of the ingested diets in the treatment AA was much higher than in other treatments (protein 23.4 % to 30.9 % ; fibre 20.9 % to 23.5 %).

Table 2 : Chemical composition and nutritive value of total feed intake (DM), (average consumption during the trial)

Age DE (1)	Treatment (2)		Trial %	CP %	CF %	EE %	NFE %	Ash %	NDF %	ADF %	ADL MJ/Kg
37-47 days											
	AA & B4	I	16.5	17.5	3.5	49.0	13.6	19.3	12.2	3.5	12.29
	AA & B10	I	17.4	19.2	3.5	44.4	15.6	20.6	13.3	3.7	11.56
	AA & B4	II	19.6	17.4	3.4	47.3	12.4	35.9	20.9	4.2	12.07
	AA & B10	II	23.2	18.0	3.5	41.8	13.5	36.4	19.5	4.2	12.65
	AA	II	23.8	23.5	3.5	38.3	10.8	45.7	26.8	5.3	11.73
	IP	II	17.2	18.1	2.3	50.3	12.1	49.2	22.2	4.7	10.49
65-75 days											
	AA & B4	I	16.4	16.5	3.3	50.0	13.8	22.1	14.4	3.7	11.78
	AA & B10	I	17.7	18.7	3.4	44.4	15.8	25.9	17.6	4.5	10.61
	AA & B4	II	19.1	14.1	3.3	50.4	13.0	30.2	16.3	3.2	12.90
	AA & B10	II	18.6	16.2	3.3	46.8	15.1	34.5	20.1	4.1	11.47
	AA	II	23.4	23.4	3.5	39.1	10.7	45.9	27.2	5.3	11.61
	IP	II	17.2	18.1	2.3	50.3	12.1	49.2	22.2	4.7	10.49
80-90 days											
	AA & B										
	AA & B10	I	17.2	18.5	3.4	45.0	16.0	24.8	16.7	4.3	10.81
	AA & B4	II	21.2	12.0	2.8	48.4	15.7	30.5	18.6	3.9	11.74
	AA & B10	II	25.2	15.5	2.9	35.7	20.7	36.9	23.1	4.8	10.61
	AA	II	30.9	18.79	2.2	31.2	14.8	49.1	31.8	6.5	10.04
	IP	II	17.2	18.1	2.3	50.3	12.1	49.2	22.2	4.7	10.49

(1): Calculated: Maertens *et al.*, 1988.
(2): AA: Fresh alfalfa ; B4 and B10: Blocks containing 4 or 10 % cement respectively ; IP: Industrial pellet.

Both diets containing blocks provided a lower content of NDF and ADF in comparison with the controls AA and IP. This was due to block composition characterised by a low cell-wall content and high soluble carbohydrates, as a consequence of molasses inclusion. Further, B10 being harder than B4 (26.8 *vs.* 22.4 Kg/cm2), was less utilised and was compensated by an higher amount of alfalfa ingested, resulting in lower consumption of NDF and ADF in B4 group.

All the treatments produced higher daily gains in comparison to alfalfa alone. The differences were always significant for B4 and IP ($P<0.05$). The increased performances produced by blocks were lower than the ones produced by the IP control, but the results were good enough so that the differences were non significant in the post–weaning period and near to the slaughtering age. Only in the intermediate period (live weight 1.6 kg) the block supplementation gave significantly different results in comparison to IP ($P<0.05$). These results show that supplementation of alfalfa based diets with molasses blocks can be a practical proposal for better performances. The local availability of molasses and other by–products at a low cost is the necessary condition to advise the proposed technology in Developing Countries.

The block supplementation of alfalfa was sufficient to obtain acceptable feed conversion rate values. These were similar to the IP control within the group 37–47 days of age.

Blocks had practically no waste, showing a better utilisation in comparison to granulated feed. Rabbits preferred leaves to stems when eating alfalfa, this caused a waste influencing the final composition of total ingesta. Comparing the offered alfalfa to its waste crude protein decreased from 22.6 to 14.4 % and crude fibre increased from 25.6 to 35.7 %.

Alfalfa palatability influenced the total feed intake which was different in the two trials when the same treatments are considered. Due to continuous variations of fresh alfalfa bromatological characteristics it is theoretically impossible to formulate blocks for an optimum integration of all kinds of alfalfa. For these reasons, and also to obtain more simple formulations, additives, mineral micro nutrients and vitamins balance have not been considered in the present study.

As reported in Table 3, in the first trial the higher cement rate (B10) reduced block intake ($P<0.05$ when rabbits were 65 and 80 days old). This lower consumption was compensated by an higher consumption of alfalfa and, as a result, live weight daily gain was not significantly different in the two treatments.

In the first trial B4 ingestion rate (on total intake) increased from 46 % in the younger group to 51 % in the oldest one ; B10 increased from 36 % to 38 %. In the second trial B4 increased from 35 % to 59 % and B10 from 25 % to 39 %. This indicates that blocks are more fitted to supplement diets of aged growing rabbits, and that their consumption can be easily planned varying the cement content (FILIPPI BALESTRA *et al.*, 1992).

The presence of cement in the block formulation induced an high ash content in all the treatments where blocks were included (from 13.6 to 18.7 %). An increase in potassium content was due to molasses. Blocks were characterised by an unbalanced Ca/P rate (6.5:1, B4 ; 14.3:1, B10). No peculiar negative effects on growing performances were registered as a consequence of all these potentially negative factors. Only a moderate softness of faeces was observed on about 1/3 of the animals fed blocks. This effect was attributed to molasses soluble carbohydrates.

CONCLUSIONS

The hardness of the blocks and the small amount gnawed each time resulted in negligible wastage which is advantageous over granulated feed. Another advantage is that the use of blocks should permit the elimination of expensive feeders.

The results obtained in the two trials indicate that supplementary blocks formulated with by–

Table 3 : Productive performances and daily feed intake of growing rabbits at different ages

Age / Treatment (1)	Trial	Alfalfa g DM	Block g DM	Feed intake (2) g DM	Block / ingestion rate	BODY WEIGHT initial	BODY WEIGHT final	LWDG (3)	Feed conversion rate (4)
37-47 days									
AA & B4	I	57.4	48.4	105.8	46	856	1213	35.7	3.3
AA & B10	I	65.6	36.7	102.3	36	872	1206	33.4	3.1
se		3.4	5.6	7.8	–	52	49	4.2	0.4
AA & B4	II	63.5 b	34.6 a	98.1 b	35	910	1248 a	30.4 a	3.1 b
AA & B10	II	57.5 b	19.1 b	76.5 c	25	930	1235 a	30.5 a	2.6 b
AA	II	72.1 a	–	72.1 c	–	871	1049 b	17.8 b	4.5 a
IP	II	–	–	113.0 a	–	890	1265 a	37.5 a	3.1 b
se		–	–	4.5	–	26	35	2.4	0.3
67-75 days									
AA & B4	I	79.3 b	77.2 a	156.6	49	1695	2007	31.2	5.3
AA & B10	I	101.4 a	58.3 b	159.8	36	1672	1978	30.5	5.4
se		5.5	5.0	8.2	–	76	70	3.2	0.6
AA & B4	II	62.0 b	62.3 a	124.2 a	51	1607	1931 ab	32.5 b	3.9 bc
AA & B10	II	73.2 ab	49.3 b	122.5 a	41	1614	1866 bc	25.2 c	5.2 a
AA	II	88.7 a	–	88.7 b	–	1587	1805 c	21.8 c	4.2 b
IP	II	–	–	135.1 a	–	1581	2017 a	43.6 a	3.1 c
se		–	–	4.9	–	29	33	1.7	0.3
80-90 days									
AA & B4	I	79.4 b	82.2 a	161.6	51	2150	2460	31.0	5.9
AA & B10	I	101.5 a	61.7 b	163.3	38	2146	2456	30.9	6.2
se		3.8	4.6	5.1	–	37	30	2.8	0.6
AA & B4	II	73.7 c	104.3 a	178.0 a	59	2033	2368	33.5 a	5.4
AA & B10	II	88.9 b	56.4 b	143.5 b	39	2076	2374	29.9 ab	5.2
AA	II	118.0 a	–	118.0 c	–	2082	2301	21.9 b	5.6
IP	II	–	–	150.1 b	–	2018	2362	34.3 a	4.7
se		–	–	7.0	–	29	36	2.9	0.4

Different letters in the same column, inside the trial and age, indicate significant differences P<0.05.
(1): AA: Fresh alfalfa ; B4 and B10: Blocks containing 4 or 10 % cement respectively ; IP: Industrial pellet. (2): Industrial pellet ingestion is only reported as daily intake. (3): Live weight daily gain. (4): Intake g DM / weight gain g.

products, molasses and different rates of cement are able to integrate alfalfa based diets for rabbits inducing good growth performances without digestive troubles.

The amount of block ingested by rabbits depends on the rate of cement included in the formulation and on the consequent hardness. Thus the cement rate in the blocks can be varied according with alfalfa availability and availability and cost of block components.

Acknowledgements : Research supported by the Italian Ministry of University, Scientific and Technological Research (40 %, 1994)
The authors wish to thank Dr. R. Sansoucy of F.A.O. Rome, for the useful information and suggestions.

Received : September 27, 1994
Accepted : March 29, 1995.

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