Effect of Supplementing Grazing Cattle Calves with Urea-molasses Blocks, with and without *Yucca schidigera* Extract, on Performance and Carcass Traits

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ABSTRACT : Fourteen non-descript zebu cattle calves of about 1 year and 6 months age and 111 kg average body weight were used in this experiment. Grazing (5 h daily) animals were supplemented with urea-molasses blocks with and without Yucca, while the control group was without any supplementation i.e. grazing only. The feeding trial continued for a period of 70 days (November to February). At the end of trial three animals per treatment were slaughtered to compare carcass traits. Group no. 1 was fed block with yucca, group no. 2 was fed block without yucca and group no. 3 was on grazing only. Block intake was found to be 724 g/h/d and 1,239 g/h/d for group no. 1 and group no. 2, respectively (p<0.05). Feed efficiency of blocks was found to be 2.71 kg and 4.86 kg for group no. 1 and group no. 2, respectively (p<0.05). Block intake per kg $BW^{0.75}$ was found to be 14.75 and 26.05 gram for group 1 and group 2, respectively (p<0.05). Average daily body weight gain was found to be 267 g/h/d, 255 g/h/d and 169 g/h/d for group 1, 2 and 3, respectively. Carcass traits among the three treatments were found to be statistically similar. Thus urea-molasses blocks supplementation improved body weight gain and addition of yucca in the blocks further improved body weight gain, feed efficiency and economics. Environment (ambient temperature, rainfall, wind and humidity) had no significant effect on three treatments. ***(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 9 : 1300-1306)***

Key Words : Zebu Cattle, Urea-molasses Blocks, *Yucca Extract*, Carcass, Growth, Grazing

INTRODUCTION

Leng (1993) reported that there are over 10 billion large ruminants in the world of which approximately half are in hot environment of Asia and Africa. These animals exist on tropical feeds which are generally lower in protein and often have extremely low concentrations of mineral nutrients when these are compared with feed resources fed to ruminants in temperate countries. When appropriately supplemented with relatively small amounts of critically deficient nutrients, these "poor quality feeds" can support surprisingly high levels of production. The increases in production are largely a result of increased efficiency of utilization of the available feed.

Low genetic potential, inadequate feed, poor feeding and disease management and inadequate marketing facilities are major causes of poor productivity of Pakistani livestock. For optimal performance of livestock, adequate and balanced feed is essential. Pakistan's estimated annual livestock requirements of digestible protein (DP) and total digestible nutrients (TDN) are 11.29 and 61.29 million tons (mt), respectively. However, only 7.55 mt of DP and 43.32 mt of TDN are available for livestock feeding. Hence, the shortfall in terms of DP and TDN is 33 and 29 percent, respectively (Khan et al., 1993). Rangelands, constitute about two-thirds of the total area of Pakistan, however, provide only about 0.70 mt of DP and 11.2 mt of TDN annually. For grazing ruminants, forages are the major source of essential nutrients. Only rarely, however, tropical forages can completely satisfy all nutrient requirements, especially minerals (McDowell, 1985). Mineral supplementation, if any, is limited to common salt (McDowell et al., 1984). It has been reported that trace element imbalance, along with poor husbandry and inadequate diets, frequently contribute to sub-clinical deficiencies in grazing ruminants (Conrad et al., 1980).

About two million tons of sugarcane molasses is produced per annum in Pakistan. It is the cheapest source of energy. It is, however, low in crude protein (CP) and because of its physical characteristics, its feeding and management in liquid form is difficult. Therefore, if it is solidified and fed in the form of multinutrient urea molasses blocks (UMB) it can prove a good supplement of energy, non-protein nitrogen (NPN), minerals and by-pass protein to the grazing animals (Mirza et al., 1988, 1990). Supplementation of grazing animals with conventional concentrates is possible but is mostly expensive (Mirza et al., 1988).

With diets containing higher levels of urea, rumen ammonia nitrogen (RAN) levels peak rapidly post feeding, with excess RAN being absorbed and excreted as urea. This results in inefficient use of dietary-N and increases energy requirements for hepatic urea synthesis. Abrupt increase in RAN may also cause ammonia toxicity. This problem may also be overcome by the UMB technology.

Yucca extract (YE) which is the extract of *Yucca schidigera* plant contains steroidal saponins, collectively known as sarsaponins (SAR) and glycocomponents which

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can bind ammonia and other detrimental nitrous gases (Headon, 1991). Goodall and Matsushima (1980) found that YE in feed (40 ppm) can improve nutrient digestibility (6%) and reduce feed intake (7%) in yearling steers. Goetsch and Owens (1985) fed dairy cows with sorghum silage with 44 ppm YE and noted increased digestion coefficients of organic matter, starch and N for the YE diet. Grobner et al. (1982) suggested that YE at 30 and 60 ppm of diet DM increased microbial protein synthesis. With high roughage diets, a slow-release N source might enhance rumen fermentation and ultimately improve production. Objectives of our study, therefore, are to see the effects of supplementation of grazing cattle in winter with urea-molasses blocks and inclusion of YE in blocks on performance, carcass characteristics and economic feasibility and to see the effect of environment on different parameters.

MATERIALS AND METHODS

Animals, grazing, housing and feeding

Fourteen non-descript (not belonging to any specific breed) zebu cattle calves of about one and a half year age and 111 kg liveweight and mixed sex i.e. both male and female, were randomly divided into 3 groups and assigned to three treatment i.e. grazing only (CG), grazing plus supplementation with urea-molasses blocks with yucca extract (YB) or UMB without yucca extract (NYB). All animals were weighed at the start of experiment and then after every fourteen days (after 16 h fasting i.e. without feed and water). Animals were dewormed with Valbazine and were washed with 0.1% solution of Negavon for control of ectoparasites. All animals were grazed together for about 5 h daily. After grazing the supplemented animals were tied individually and each animal had access to UMB which were offered in metal half drums; while the animals in the control group i.e. grazing only, were kept together in one corner of the same shed after making partition. The control group animals were kept untied. Every morning leftover block of each animal was weighed to calculate previous day consumption. We did not calculate the roughage intake of grazing animals because of technical difficulties, therefore feed efficiency or feed conversion ratio was calculated on the basis of intake of blocks only. Because animals in the supplemented group were tied with chains, they had access to water only twice per day i.e. at the time of going out for grazing and at the time of coming back from grazing, while the calves in the control group had access to water for about 18 h per day. The shed was open from sides with Asbestas sheet roofing and concrete floor. Sufficient loafing area with mud floor was available with the shed, with two water troughs in the loafing area, where clean water was always available. Experiment lasted for 70 days from November to January.

Feedstuffs analysis

Representative samples were obtained from urea-molasses blocks and collected in sampling bags. The feed samples were weighed before being placed in the oven at 105°C for 24 h to obtain dry matter (DM) content. The samples were ground using a laboratory hammer mill and were labelled and stored in bags. Crude protein (CP) was obtained by determining the nitrogen (N) using the Kjeldahl method of AOAC (1995) and %N multiplied by 6.25 to get the % CP. Ash content of the feeds was determined according to AOAC (1995) in which the samples were weighed and placed in the muffle furnace at 600°C for 2 h and the remaining ash cooled and weighed.

***Yucca schidigera* extract**

This product was a 100% natural powder made entirely from the stem of the *Yucca schidigera* plant (DK Sarsaponin 30, Desert King International, Chula Vista, CA, USA). It had absolutely no preservatives or carriers and was produced mechanically without any chemical extraction. It was used in the UMB at 0.05%, or at 0.5 gram per kg of block.

Preparation of urea-molasses blocks

Ingredient and chemical composition of UMB is given in Table 1. Blocks were prepared with cool process at the Feed Technology Unit of Animal Sciences Institute of National Agricultural Research Centre, Islamabad, Pakistan. Different feed ingredients were mechanically mixed in the sugarcane molasses in the order mentioned below. Urea, calcium oxide, magnesium oxide, dicalcium phosphate, trace mineral mixture, sodium chloride, cottonseed meal and corn gluten feed. In the yucca extract block, yucca was mixed with molasses before all other ingredients. After mixing, blocks (5 kg each) were made in the hydraulic press. About 24 h after making, blocks were wrapped in plastic bags, for keeping their quality.

Slaughtering and carcass data

At the end of the experiment, three animals per treatment were slaughtered the Muslim way (Halal) to collect data on carcass characteristics. Slaughter weight of animals were obtained by keeping animals without water and feed for about 16 h. After slaughter and flaying the carcasses were split along the vertebral column into left and right halves. Carcass and non carcass components were weighed immediately after slaughter. All the internal organs i.e. liver, spleen, heart, kidneys and lungs were weighed after removing the fat surrounding these organs. Head and

Table 1. Ingredient (%) and chemical composition (on DM basis) of urea-molasses blocks (UMB)

Ingredients	Yucca blocks (YB)	Without Yucca blocks (NYB)
Sugarcane molasses	45	45
Urea (Fertilizer grade)	8	8
Calcium oxide	7	7
Magnesium oxide	1	1
Dicalcium phosphate	1	1
Trace-mineral mixture*	1	1
Common salt	1	1
Corn gluten feed (20%)	18	18
Cotton seed meal	18	18
Yucca schidigera extract	0.05	-
Chemical composition (%)		
Dry matter (DM)	90.37	89.75
Crude protein (CP)	28.85	28.63
Ether extract (EE)	1.72	1.51
Crude fiber (CF)	3.92	3.89
Crude ash	28.75	28.55

* Composition of trace mineral mixture (%):
Dicalcium phosphate=81; Common salt=6; Magnesium sulphate=5; Zinic sulphate=1.5; Sulfur=0.5; Ferrous sulphate=1.5; Manganese sulphate=1; Potassium iodide=0.09; Copper sulphate=0.45; Cobalt chloride=0.03; Sodium bicarbonate=2.03.

trotters were weighed without flaying and without removing horns or hooves. Stomach and intestines were first weighed with feed and water contents and then again weighed after removing the contents. Weight of gut fill was computed as the difference between a full and empty alimentary tract. Empty body weight (EBW) was computed as the difference between slaughter weight and weight of gut fill. Four ribs viz 11th to 14th were cut for determination of chemical analysis of meat. All meat was scraped from the four ribs and chemical analysis was done using AOAC (1995) methods. Dressing percentage was calculated by the formula:(Hot carcass weight/slaughter weight×100). Both halves were then cut into 6 parts i.e. legs, loin, ribs, shoulder, neck and tail. Dressing percentage on empty live-weight (ELW) basis (slaughter weight-gut fill) was also calculated by the method of Mahgoub et al. (1995).

Statistical analysis

Experimental data were analysed utilizing Statistical Analysis Systems (SAS, 1990) General Linear Models Procedure. Least square means were computed and tested for significance using Duncan's Multiple Range Test (Duncan, 1955).

Economic analysis

Economic analysis of liveweight gain by the cattle calves was done by using the technique of Perrin et al. (1979). In this analysis cost of supplemental block was deducted from the price/benefit of the liveweight gain. Price of liveweight gain was fixed to be Rs. 60 per kg liveweight. In the calculation of economics we did not include the price of roughage eaten because we could not record roughage intake of grazing animals.

Environmental data

This data which included maximum and minimum daily ambient temperature, morning and afternoon humidity, wind speed and rainfall was obtained from Soil and Water Resources Program of NARC. Morning humidity was recorded at 8:30 am and afternoon humidity at 2:00 pm.

RESULTS

Multinutrient blocks of same ingredient composition with and without *Yucca schidigera* extract were prepared and fed to experimental animals (Table 1), while the animals in the control group were only on grazing without any supplementation. The mean empty body weight of cattle calves at the start of this experiment was 111.0 kg. Table 2 gives details of growth and block intake. Average daily gain was found to be 267 g/h/d in animals fed urea molasses blocks with yucca (YB), 255 g/h/d in animals fed block without yucca (NYB), and 169 g/h/d in animals in

Table 2. Block intake and performance of cattle calves during the experimental period

Parameters	Treatments			
	YB[1]	NYB[2]	CG[3]	SEM[4]
No. of cattle	5	5	4	-
Live-weight gain ($g \cdot hd^{-1}$ day^{-1})	267^a	255^a	169^b	48
Blocks consumption ($g \cdot hd^{-1}$ day^{-1})	724^a	$1,239^b$	-	40
Feed conversion ratio of UMB	2.71^a	4.86^b	-	0.76
Blocks intake ($g \cdot kg\ BW^{-0.75}$ day^{-1},	14.75^a	26.05^b	-	1.43

[1] Urea-molasses block with Yucca extract+grazing.
[2] Urea-molasss block without Yucca extract+grazing.
[3] Control group i.e. grazing only.
[4] Standard error of the treatment means (n=68).
[a,b] Means in rows with different superscripts differ significantly $p<0.05$.

control group (CG). Therefore, significantly higher weight gain was found in supplemented groups compared to control group ($p<0.05$). Average daily blocks consumption (g/h/d) was higher ($p<0.05$) in NYB group (1,239), compared to YB (724) group. Feed conversion (amount of blocks eaten per body weight gain) was found to be significantly lower in YB compared to NYB group. Block intake (g/d) per kg $BW^{0.75}$ was found to be 14.75 and 26.05 for YB and NYB groups respectively ($p<0.05$). A linear increase in block consumption was noted with the passage of time in both groups. Interaction between weather data and animal performance was found to be non-significant among treatments. The economic analysis of the data showed that addition of *Yucca schidigara* extract in the block was economically feasible and maximum net benefit of supplementation was obtained in the yucca supplemented group (Table 3).

Carcass data which included dressing percentage (Table 4); weight of non-carcass offals (Table 5) and chemical analysis (Table 6) showed non-significant differences among treatments ($p>0.05$).

DISCUSSION

In our study the highest body weight gain (BWG) was found in group supplemented with UMB having YE (YB); followed by group fed blocks without Yucca (NYB) and minimum BWG was found in non-supplemented group (CG). Results of our study are in agreement with Pate et al. (1985) who found that cows fed molasses were significantly heavier than the non-supplemented ones. Jayal et al. (1982) also reported similar results in Haryana cattle. Another thing worth noting is that animals in the control group were not individually tied with chains on their return from grazing, while the two groups supplemented with UMB were individually tied for the sake of recording block intake of individual animal. Therefore, animals in the control group were more comfortable in the way that they have continuous access to water, they could loaf around and sit where ever they like i.e. on cemented floor or non cemented floor, under the roof or under the sky and this could have positive impact on their BWG. Rehman and Tahir (1988) when fed similar feed to weaned Sahiwal female cattle

Table 3. Economics of liveweight gain in cattle calves fed UMB vs control group

Parameters	YB	NYB	CG
Supplemental feed intake (g/hd/day)	724	1,239	Nil
LWG (g/hd/day)	267	255	169
Block's ingredient price (Rs./kg)	5.19	3.89	Nil
Cost of supplemental feed (Rs.)	3.76	4.82	Nil
Total benefit of LWG at Rs. 60/kg	16.02	15.3	10.14
Net benefit of supplementation (Rs.)	12.26	10.48	10.14
Days needed for 50 kg LWG	187	196	296

1 US$=62 Pakistani Rupees (Rs.).

Table 4. Carcass traits of cattle calves

Items	Treatments			
	YB	NYB	CG	SEM
Slaughter weight (kg)	130.23	128.50	123.83	4.34
Hot carcass weight (kg)	69.60	68.32	65.54	2.64
Dressing* percentage (%)	53.44	53.17	52.91	0.61
GIT contents (kg)	23.29	20.93	21.89	1.10
Empty body weight (kg)	106.60	107.57	101.94	4.13
Hot carcass weight (kg)	69.60	68.32	65.54	2.64
Dressing** percentage (%)	65.08	63.51	64.29	0.67

* Dressing percentage on the basis of slaughter weight (SW).
** Dressing percentage on the basis of empty body weight (EBW).
Empty body weight=Slaughter weight-Gastro intestinal tract (GIT) contents.
n=3.

Table 5. Weight of non-carcass offals (kgs) of cattle calves

Items	Treatments			
	YB	NYB	CG	SEM
Slaughter weight (SW)	130.23	128.50	123.83	4.34
Head	7.11	7.15	6.84	0.21
Hide	8.38	9.77	8.43	0.59
Trotters	2.63	2.90	2.64	0.1
Full stomach	25.87	23.62	23.47	1.13
Empty stomach	6.45	6.63	5.90	0.28
Full intestines	5.95	6.08	6.61	0.29
Empty intestines	2.08	2.14	2.29	0.21
GIT contents	23.29	20.93	21.89	1.10
Liver	1.85	1.80	1.78	0.05
Spleen	0.29	0.30	0.31	0.03
Heart	0.43	0.42	0.41	0.02
Kidneys	0.27	0.30	0.31	0.01
Lungs	1.31	1.47	1.30	0.06
Total offals	30.80	32.88	30.21	
Offals as percent of SW	23.65	25.59	24.40	
Gut fill as % of SW	17.88	16.29	17.68	
Hide as % of SW	6.43	7.60	6.81	
Eatable offals* as % of SW	3.19	3.34	3.32	

* Eatable offals include liver, spleen, heart, kidneys and lungs.
n=3.

Table 6. Chemical analysis (%) of beef (DM basis)

Items	Treatments			
	YB	NYB	CG	SEM
Dry matter	29.46	31.73	31.43	1.33
Crude protein	62.66	60.62	59.77	0.91
Ether extract	29.06	30.57	31.11	2.65
Ash	3.40	2.88	2.54	0.24

calves in individually tied position, they gained 188 grams daily, while similar animals when fed similar feed in same amount but in untied position, the animals gained 461 grams daily. Feed efficiency was reported to be 17 and 7 kg for tied and untied animals, respectively. However, in our this study although the block fed groups were tied up, they gained significantly better than control group who were not tied up; which indicates the importance of UMB supplementation. Hussain et al. (1996) reported improved growth in steers supplemented with YE. Mader and Brumm (1987) reported improved BWG in steers fed urea plus YE diet compared to only urea diet. The improved performance may be due to increased digestion of organic matter, starch and nitrogen (N) as a result of Yucca supplementation of sorghum silage fed to dairy cows (Goetsch and Owens, 1985). Improved performance of calves *(Bos indicus)* in the present study may be due to increased microbial protein synthesis (Grobner et al., 1982). Doyle et al. (1986) stated that readily fermentable carbohydrates should be fed frequently i.e. two or more meals a day rather than once to avoid depression of cell wall digestibility and intake of straw. Thus UMB are the best way of doing this because animal eats them in small bites, more frequently, and in longer time. Ellenberger et al. (1985) noted decreased ruminal urease activity with YE. Thus a reduction in urea hydrolysis and associated ruminal ammonia-N levels would be beneficial by allowing greater quantities of urea to be utilized in high roughage ruminant diet (Glimp and Tillman, 1965). Hussain and Cheeke (1993) reported better BWG and FE in steers supplemented with YE; and especially with high roughage plus urea supplemented diets. Sadil et al. (1992) reported beneficial effects on ruminal ammonia levels, DM digestibility and rumen pH in lactating cows fed 1% urea supplements to which YE had been added.

The zebu calves *(Bos indicus)* of our study showed good carcass characteristics in the form of high dressing percentage and weights of offals. Dressing percentages in the present study are quite comparable to those reported by (Mahgoub et al., 1995; Muller, 1978; Pasha, 1986, 1987, 1988 and Waddad and Gaili, 1988). Proportions of internal organs of the body of these cattle calves were generally similar to the previous reports (Jabbar and Iqbal, 1994; Mahgoub et al., 1995; Pasha, 1986, 1987, 1988). Naz and Kazmi (1980) and Tahir and Rehman (1990) reported little lower dressing percentages in water buffalo and Sahiwal cattle calves; but probably this was because these observations were made on full body weight basis; and calves were little heavier than those of our study. Waddad and Gaili (1988) also reported almost similar dressing percentages for tropical breeds as found in our study. Owen et al. (1978) found that body fat levels are highly variable and depend upon species, breed, weight, age, plane of nutrition and sex. Abouheif et al. (1991) reported increase in carcass fat from 17 to 27% with increase in camel age. Johnson et al. (1972) and Kempster (1981) reported variation in fat from different cuts. In our study weights of edible offals (i.e. heart, lungs, liver, spleen and kidneys) are in close agreement with Pasha (1986, 1987). Weight of total offals in our study is also in close agreement with Mahgoub et al. (1995).

YE was added in the block at 0.05%. If we take the retail market price of YE in Pakistan it comes to about US$ 42/kg; therefore, the extra price of block with YE was about US$ 0.02 per kilogram of block. Animals in the YB group consumed 515 grams less UMB per head per day, however, they showed an extra BWG of 12 grams per head per day. If we put a price of US$ 0.97 per kilogram of liveweight gain; the net benefit of UMB supplementation vs control comes to US$ 0.20, 0.17 and 0.16 for YB, NYB and CG groups, respectively. Therefore, group fed UMB with YE showed best economic performance followed by UMB without YE and least economic benefit in the control group. These results are in line with the findings of Mirza et al. (1988) and Jadoon et al. (1990). Because YE reduces rate of hydrolysis of urea to ammonia, the level of ammonia in the rumen is stabalized, which might result in reduced intake of block having YE compared to block without YE. Because of the sustained level of ammonia in the rumen, and thus better environment for rumen microbes might have also increased roughage intake in animals supplemented with UMB having YE, and resultantly might have reduced block intake. In future, we shall try to measure roughage intake also to accept or reject this hypothesis.

In conclusion, supplementation of grazing cattle under the prevailing conditions during winter with UMB vs non-supplemented proved their nutritional as well as economic feasibility; and within UMB groups, addition of YE at 0.05% level in block showed its superiority in terms of weight gain, block efficiency and economic viability. However, interaction of treatments with environment and effect of treatments on carcass characteristics were found to be non-significant. We can thus say that under prevailing conditions supplementation with UMB and addition of YE in UMB is feasible.

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