Vol 17 No 1, p 67-72

EFFECT OF STRATEGIC SUPPLEMENT ON MILK YIELD AND ITS COMPOSITION, GROWTH OF CALVES AND ECONOMICS IN DROMEDARY CAMEL - A FARMER DOOR STUDY

N. Saini, B.D. Kiradoo, A.K. Lukha, S.Vyas and K.M.L. Pathak
National Research Centre on Camel, Jorbeer, Bikaner, Rajasthan, India

ABSTRACT

A study of 120 days duration was conducted in Hadala village of Kolayat tehsil of Bikaner district in Rajasthan state to study the effect of the strategic supplementation of deficient nutrients in basal diet of lactating camels at farmer door. Six newly calved lactating camels of 3-6 parity on an average 4-5 lit/d milk yield were selected and distributed equally into 2 groups. Camels were maintained as the practice followed by the farmers routinely with feeding of cluster bean straw *ad lib* (Gp I) and barley grain 1 kg/camel/day with area specific mineral mixture, in addition to straw as a source of energy (Gp II). Significant improvement in serum total protein and globulin were observed due to improved feeding. Similarly milk production and yields of protein, fat and SNF per kg milk was significantly ($P<0.01$) higher in Gp II compared to Gp I. Growth of calves was also significantly ($P<0.05$) higher in Gp II than Gp I in terms of body length, height at withers and heart girth. It was demonstrated that limited amount of supplements in existing practice by scientific intervention i.e., energy through barley grain to basal diet resulted in increased milk yield and income of camel rearers and also had positive effect on health and milk composition of dams. There was good growth of calves.

Key words: Barley grain, calf, camel, camel milk yield, milk composition, farmer door

In villages, camels are still reared exclusively on grazing without supplementary feeding of straw and concentrate. As a result, low productivity and poor nutritional conditions are encountered because of insufficient intake of nutrients from deteriorated grazing lands which further aggravates the economic loss of farmers.

Any improvement achieved by introducing limited amount of locally available supplementary feeds within existing feeding practices may benefit the resource-poor farmers. Limited amount of concentrate, in addition to grazing or straw resulted in substantial improvement in production performance of grazing animals (Shinde *et al*, 1995). Increase in milk production in early lactation beyond sustenance could also be helpful for growth of calves as maximum growth occurs during period of 0-3 months age. At this stage, rumen is not fully developed and calves are dependent totally on mother's milk for their growth. Better growth during this period results in better health, survivability of calves and thus strengthening of herd.

The benefits of limited amount of supplement in existing feeding practice on milk yield and its composition, health, as well as on growth of calves and economics of production was demonstrated at field level.

Materials and Methods

Six multiparous camels (C*amelus dromedarius*) calved in mid February and March 2009 of 3-6 parity, on an average 4-5 lit/d milk yield were selected and equally divided into two groups, i.e. control (Gp I) and experimental (Gp II). Camels were maintained as per the practice followed by the farmers routinely. Gp I was fed cluster bean straw *ad lib* and Gp II offered barley grain 1 kg/camel/day with area specific mineral mixture, in addition to straw. Camels of both groups were allowed access to nearby grazing area. The body weight of the camels was estimated by the linear regression based formula Y=5.071× chest girth (cm) - 451 given by Wilson (1998).

Feed intake and milk yield were recorded daily throughout study period of 120 days. Milk recording was done every morning at 7.00-8.00 am. During each

SEND REPRINT REQUEST TO N. SAINI email: nirmala.saini@rediffmail.com

milking, the 2 left or right side teats were alternatively reserved for calf suckling, while remaining 2 teats were milked by hand after overnight separation of calves from their mothers. In day time, calves were allowed to suckle milk and graze with their mothers. This practice was adopted because camel owners milked their camels 2-3 or more times as per their household need. Total milk yield was calculated by multiplying the recorded morning yield by 2. Milk samples were taken at fortnightly intervals. At the beginning of experiment, the camels were dewormed against endo- parasites using albendazole.

Duplicate sample of each feed-stuff were analysed for DM, EE, CF and CP according to procedures of AOAC, (2000). Acid detergent fibre (ADF) and Neutral detergent fibre (NDF) were determined by methods of Goering and Van Soest (1970). The table values were used to estimate the Metabolisable energy and TDN contents of the feeds. Four per cent fat was calculated by equation of Gaines (1928). Milk samples were analysed for fat by Gerber method (ISI, 1966). Milk protein was estimated as total N × 6.35 by KELPLUS and per cent total solid (%TS) by gravimetric method. Per cent solid not fat (%SNF) was determined by the difference of %TS and %fat (ISI, 1977). The biometrical parameters were recorded by measuring tape at fortnightly intervals by the procedures given by Higgins and Kock (1984). Data were analysed by SPSS using't' test.

Results and Discussion

Before start of experiment, survey was made in Hadala village to know about the prevailing feeding practices and economic status of camel owners. Camel keepers selected for this study had more than 45 camels with 60 bigha non–irrigated land. The average family size was 7 persons/family. Of these, only 2 were educated. They used only camel milk and have no other milch animal. For this, they kept only 2-3 lactating camels at home on nearby grazing and supplementary feeding of straw, while other lactating camels and calves were left for grazing. Generally, farmers do not feed their livestock as per the productive potential in villages. However, some owners offered good quality roughages to their newly lactating camels for the purpose of increasing milk production for better calf growth.

Feed given and refusal were recorded daily up to 2 weeks to know the intake of nutrients in existing feeding practices. From this, and composition of feed, intake of nutrients were calculated and compared with the requirement given by the ICAR (1985). The feeding schedule and quantity of feed fed to animals suggested that protein (15%) followed by energy (6.90%) were deficient in diet of lactating camels. Chemical analysis of feed offered showed that cluster bean roughage had low CP (6.15%) and high ADF content (42.25%). Low quality roughage could not meet the energy requirement of animals (Nataraja, 1995). In the present study, protein was not taken into consideration because camels were allowed for grazing and during browsing, camels select green parts of plant which are high in CP and relatively low in fibre. The CP content of browsed ranged from 12.4-30.74% with *in vitro* DM digestibility of about 31-65% (Rai *et al,* 2007). Therefore, it appears that camels may obtain enough protein from natural rangeland feeds to sustain reasonable milk yields.

Minimum change in existing feeding practice was done by introducing an energy rich supplement in the diet to meet the energy demand of animals. Hence, as a strategic measure, barley grain was used as an energy source.

The estimated body weight of experimental camels ranged from 593.43 to 654.26 kg. The roughage intake (kg/d) and per cent body weight did not differ significantly between the groups. The daily roughage intake as per cent body weight was slightly lower in Gp II (2.19%) than that of Gp I (2.44%). Likewise, total DM intake recorded was 15.30±0.67 and 14.88±0.20 kg/d, respectively in group I and II. Supplementation resulted in comparatively higher intake of CP (966.87±12.67 vs. 947.48±41.91 g/d), TDN (7.82±0.0.10 vs. 7.74±0.34 kg/d) and ME (118.39±1.56 vs. 116.19±4.24 MJ/d) in Gp II compared to Gp I but difference was non significant. The total DMI in experimental camels ranged from 2.17-2.59%.

In existing feeding schedule, values of TP, globulin, Ca and P were comparatively low (Table 1). Improvement in nutritional status of camels was noticed due to improved feeding. The values of serum TP ($P<0.05$) and globulin ($P<0.01$) were significantly higher in supplemented Gp II than non-supplemented Gp I animals. No significant difference was observed for glucose, urea, calcium and phosphorus between the groups. However, glucose values were higher (64.81 ±1.11) in Gp II than Gp I (54.28± 8.28) unit.

The values of total solids differed significantly ($p<0.05$) at d 60 between the groups. The content of TS ranged from 9.83-13.20% and the mean values for respective groups were 11.73±0.35% and 11.93±0.17% (Table 2 & Fig 1). Milk fat generally increases with increasing intake of energy (Morely, 1970) even

with the high roughage diets (El-Gallard *et al,* 1988) accompanied by increase in milk yield. The per cent fat content of milk increased from the beginning of lactation with increase in milk production, thereafter decreased to reach minimum value of (2.86%) in Gp I and (2.76%) in Gp II at 105 days. The average values of milk fat ranged from 2.3-4.2% in both groups. The mean values of per cent SNF at day 105 differed significantly between the treatment groups being significantly lower in Gp I (6.96%) than Gp II (9.05%) (Figs 2 and 3).

The mean values of protein ($P<0.05$) and ash ($P<0.01$) as presented in table 2 and Fig 4 differed significantly between the groups. The protein content of both groups at days 75 and 105 differed significantly between the treatments. The Gp II had significantly higher 2.45%protein than that of Gp I (2.27%). Increased milk protein yield due to increased energy intake was also observed by Couvreur *et al* (2007) in dairy cows. Singh *et al* (2009) also observed an increased milk protein and yield while no effect on fat content with increasing level of energy supply. Required quantities of concentrate intake increased the availability of carbohydrate thus sparing the protein from catabolism which improved the animal performance (Lee *et al*, 2001) because of increased efficiency of nitrogen (Arroquy *et al,* 2004).

Initially, at day 30, the ash content was higher; thereafter, values decreased with the advancement of lactation. The ash content in present study ranged from 0.58 – 0.95% and was significantly higher in Gp II (0.75%) than Gp I (0.68%). In both the groups% TS, % fat and % protein contents of milk fall suddenly at week 15, i.e. about 105 d after parturition which corresponded peak summer period. However, El-Hatmi *et al* (2004) observed minimum value of TS content in camel milk after 19 to 27 and fat 21-23 week of parturition in lactation study of 10 month.

Table 1. Blood biochemical status before and during experimental study.

Attributes	TP (g %)	Albumin (g %)	Globulin (g %)	Glucose (mg %)	Urea (mg %)	Calcium (mg %)	Phosphorus (mg %)
In existing feeding	6.71±0.19 [a]	4.00±0.05[b]	2.71±0.17[a]	54.52±5.17	32.96±1.79	7.85±0.07	4.43±0.27
system	(6.37-7.03)	(3.90-4.10)	(2.37-2.97)	(46.50-64.10)	(30.89-36.55)	(30.89-36.55)	(3.89-4.73)
After experimental feeding							
Gp I	7.01±0.06[ab]	3.62±0.16[b]	3.38±0.23[b]	54.28±8.26	35.94±3.45	8.90±1.13	5.20±0.32
	(6.89-7.08)	(3.45-3.96)	(2.98-3.78)	(38.67-66.80)	(30.51-42.36)	(7.03-10.96)	(4.64-5.75)
Gp II	7.47±0.18[b]	2.92±0.12[a]	4.54±0.13[c]	64.81±1.91	32.54±1.76	8.92±0.77	4.49±0.28
	(7.20-7.83)	(2.68-3.04)	(4.33-4.79)	(61.14-67.64)	(29.12-34.97)	(7.90-10.45)	(4.15-5.06)
Sig.	0.04	0.002	0.001	0.39	0.59	0.58	0.19

Table 2. Mean±SE milk constituents values of experimental groups at different time intervals.

Periods	**d 30**	**d 45**	**d 60**	**d 75**	**d 105**	**d 120**	**Mean±SE**
% Total Solid							
Gp I	12.48±0.59	12.28±0.77	13.20±0.30[b]	11.82±0.93	9.83±0.42	10.78±0.80	11.73±0.35
Gp II	11.62±0.52	11.65±0.41	12.35±0.35[a]	12.75±0.37	11..81±0.33	11.41±0.05	11.93±0.17
% Fat							
Gp I	2.53±0.08	2.83±0.27	3.66±0.21	3.93±0.48	2.86±0.56	3.63±0.18	3.24±0.17
Gp II	3.16±0.28	3.26±0.49	3.40±0.45	3.86±0.20	2.76±0.21	3.43±0.20	3.31±0.13
% SNF							
Gp I	9.95±0.50	9.45±0.50	9.53±0.15	7.88±0.50	6.96±0.22[a]	7.15±0.65	8.49±0.33
Gp II	8.46±0.38	8.38±0.27	8.95±0.25	8.89±0.20	9.05±0.53[b]	7.98 ±0.22	8.61 ±0.14
% Protein							
Gp I	2.25±0.05	2.32±0.20	2.26±0.14	2.34±0.13[a]	2.29±0.11[a]	2.20±0.11	2.27±0.04[a]
Gp II	2.27±0.17	2.27 ±0.03	2.41 ±0.12	2.67 ±0.18[b]	2.59±0.04[b]	2.52±0.14	2.45±0.05 [b]
% Ash							
Gp I	0.74±0.02	0.75±0.008	0.68±0.02	0.59 ±0.03	0.66±0.03	0.67±0.02	0.68 ±0.01[a]
Gp II	0.82±0.06	0.84±0.06	0.77±0.03	0.76[a]±0.01	0.64±0.03	0.66±0.02	0.75±0.02[b]

Camel calves of supplemented Gp II showed significantly higher body length (cm) throughout study period compared to Gp I (Table 3). The height at wither (cm) of both groups was also differed significantly at d 30, 90 and 120 days and was higher in Gp II than Gp I. Mean values of heart girth (cm) was higher in Gp II (201.37±2.32) than Gp I (198.50±2.75) thus showing more growth of calves of Gp II which may be possible due to more availability of quality milk.

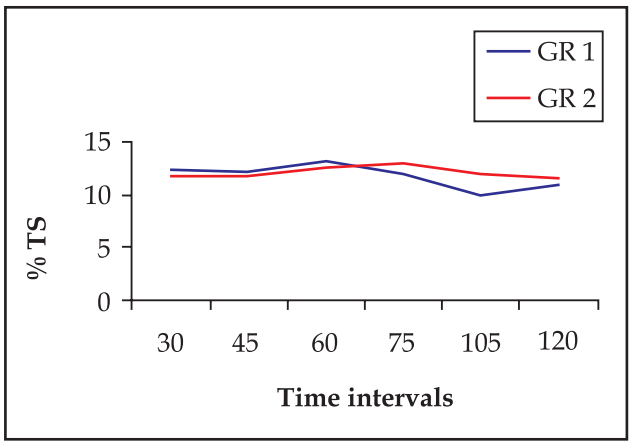

Fig 1. % Total solid at different time intervals.

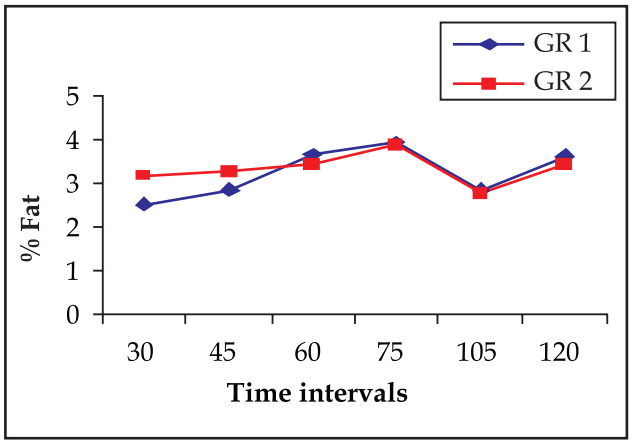

Fig 2. % Fat at different time intervals.

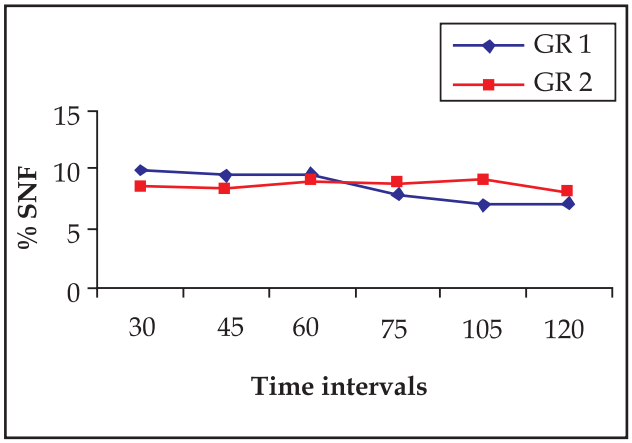

Fig 3. % SNF at different time intervals.

Milk yield among the fortnight intervals within groups also did not show significant variation over a study period of 120 days. Milk production increased progressively up to 15 week of parturition and thereafter started declining. Total milk yield of 5.03 l/d of Gp I and 6.18 l/d of Gp II differ significantly ($P<0.01$) and was higher in Gp II than Gp I (Table 4 and Fig 5). Similar difference was also observed for 4% FCM between the groups. This may possible due to supplementation of barley which had high content of fermentable fibre of which 90% is degraded in rumen and thus provide matching energy requirement to rumen microbes for better digestion of straw. Increased milk yield with supplementation of maize grain and no consistent difference in milk composition was observed due to supplement by Gallardo *et al* (1991 a). Higher feed efficiency in Gp II was due to better quality of nutrients available for utilisation.

Camel owners therefore, would be benefited through income resulting from additional milk and higher growth rate. The average milk yield in group II was 22.8% more compared to control (Table 4). At

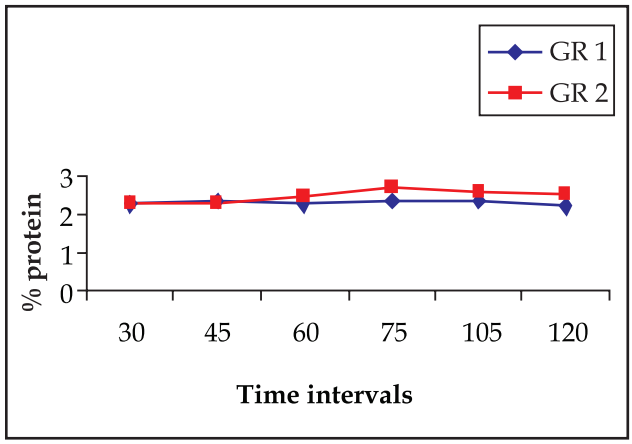

Fig 4. % Protein at different time intervals.

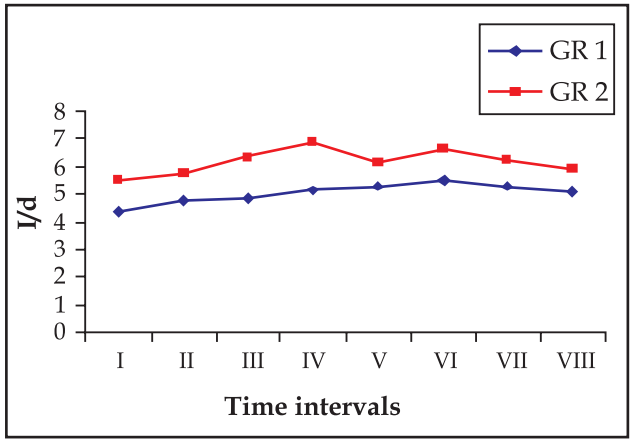

Fig 5. Average milk yield (1/day) at different intervals.

Table 3. Biometry of camel calves of treatment groups at different time intervals.

Attributes	At start	d 30	d 60	d 90	d 120
Body Length (cm)					
Gp I	80.00±2.12	85.25±2.05^{A}	90.25±1.65^{A}	99.12±3.82^{a}	155.75±2.17^{A}
Gp II	82.50±2.32	87.75±2.17^{B}	94.25±1.43^{B}	103.90±2.77^{b}	160.00±2.16^{B}
Height at Wither (cm)					
Gp I	131.50±2.50	134.50±2.21^{a}	143.25±3.32	147.25±2.95^{a}	198.50±2.75^{a}
Gp II	131.50±2.63	137.25±2.28^{b}	144.25±2.75	150.00±3.18^{b}	201.37±2.32^{b}
Heart Girth (cm)					
Gp I	113.50±2.59	117.75±0.85^{A}	124.50±6.11	134.25±5.54	212.75±2.37^{a}
Gp II	114.25±2.59	121.50±1.19^{B}	126.25±1.51	138.50±5.37	216.25±2.39^{b}

Superscript A, B. differ at $p<0.01$, a, b. differ at $p<0.05$

Table 4. Milk yield, efficiency of nutrient utilisation in experimental animals.

Parameters	GP I	GP II
Milk yield (l/d)**	5.03±0.12	6.18±0.15
4% FCM **	4.00±0.09	5.46±0.20
Total Fat (kg/d) **	0.160±.09	0.238±0.013
Total Protein (Kg/d) **	0.122±.000	0.150±0.00
Total SNF (Kg/d) **	0.39±0.01	0.51±0.02
Efficiency of nutrient utilisation		
CP intake/ kg milk (g/d)	190.49±5.91	160.50±9.54
TDN intake/ kg milk(kg/d)	1.55±0.04	1.29±0.07
DM intake / kg milk (kg/d)	3.07±0.09	2.48±0.14
Economics of milk production		
Feed cost/day (Rs)	53.25	62.90
Milk cost/day (Rs)	80.48	98.88
Extra income (Rs /month)	-	552

Cost of milk @Rs 16/d, straw cost Rs 3.50/kg, barley cost Rs/ 14.5 kg.

the yield of 150.9 l/month for control camels, the extra milk released from supplements was 34.5 l/month. By taking milk price as Rs 16/l, the extra income would be Rs 552 per month.

The study concluded that deficiencies of nutrients exist at farmer level and owners did not feed supplement to their animals. As practically feasible and economical measures, supplementation of limited amount of energy rich barley grain and ASSM improved the yields of milk and nutritional status of camels, as well as growth of calves at village condition.

Acknowledgement

The work was carried out under project AICRP on "Improvement of feed resources and nutrient utilisation in raising animal production." We are thankful for financial assistance provided by ICAR.

References

AOAC (2000). Official Methods of Analysis. 17th Ed. Association of Official Analytical Chemists, Gaithersburg, Md., USA.

Arroquy JI, Cochran RC, Villarreal M, Wickersham TA, Llelwellyn DA, Titgemeyer EC, Nagaraja TG, Johnoson DE and Gnad D (2004). Effect of level of rumen degradable protein and type of supplemental non fibre carbohydrate on intake and digestion of low quality hay by beef cattle. Animal Feed Science and Technology 115:83-99.

Couvreur S, Hurtaud C, Marnet PG, Faverdin P and Peyraud JL (2007). Composition of milk fat from cows selected for milk fat globule size and offered either fresh pasture or corn silage based diet. Journal of Dairy Science 90:392-403.

EI-Gallard TT, Gihad, EA, Allam SM and EI-Bedawy TM (1988). Effect of energy intake and roughage ratio on the lactation of Egyptian Nubian (Zaraibi) goats. Small Ruminants Research 1(4):327-41.

EI-Hatmi H, Khorchani T, Abdennebi M, Hammandi M and Attia H (2004). Effect of diet supplementation on camel milk during the whole lactation under Tunisia arid range condition. Journal of Camel Practice and Research 11(2)147-152.

Gaines WL (1928). Cited from Maynard *et al* (1984). In: Animal Nutrition. 7th. Ed. pp 4-5.

Gallardo M, Cangiano C, Gagliostro G and Gordon H (1991). a. Intake of grazing dairy cows 2. Effect of energy supplementation on forage substitution rate and milk production. Revista Argentina de production Animal 11(4)381-89.

Goering HK and Van Soest PJ (1970). Forage fibre analysis. Hand book No. 379.ARS USDA, Washington DC.

Higgins AJ and Kock RA (1984). A guide to the clinical examination chemical restraint and medication of the camel. British Veterinary Journal 60(3)485503.

ICAR (1985). Nutrient requirements of livestock and poultry. Indian Council of Agricultural Research, New Delhi.

ISI (1966). IS:1479. Methods of test for Dairy industry. Part II. Chemical analysis of milk. Indian Standards Institute, New Delhi.

ISI (1977). IS:1224 PartI. Determination of fat by Gerber method. Indian Standards Institute, New Delhi.

Lee MRF, Jones EL,Moorby JM, Humphrey MO, Thedorou M, K Macrae JC and Scollan ND (2001). Production responses for lamb grazed on *Lolium perenne* selected from elevated water–soluble carbohydrate concentration. Animal Research 50:441-49

Morely GML (1970). Studies on the effect of different feeds on quality and quantity of dairy cattle. Ph.D. Thesis, Punjab University, Chandigarh.

Nataraja MB (1995). Evaluation of Ruminants feed stuffs for energy content by digestion trial, Rumen *in vitro* incubation (gas production) and chemical analysis. MVSc thesis University of Agricultural Science Bangalore, India.

Rai P Ajit and Samanta AK (2007). Tree leaves, their production and nutritive value for ruminanats. Animal Nutrition and Feed Technology 7:135-159.

Shinde AK, Karim SA, Singh NP and Patnayak BC (1995). Growth performance of weaner lambs and kids under intensive and semi intensive feeding management. Indian Journal of Animal Science 65:830-833.

Singh C, Bhaskaran and Krishnamoorty (2009). Effect of varying level of metabolisable energy intake on yield and SNF constitutes of milk in lactating dairy cows. In: Proceeding of Animal Nutrition Association World Conference 14-17 Feb. 225.

Wilson RT (1998) Camels. The Tropical Agriculturist Series, Macmillan Education Ltd (London) and CTA (Wageningen).