Annual hair yield attribute in indigenous camel breeds

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In order to obtain optimum profit from camel rearing it is essential to study effective utilization of production of camel hair. The camel hair is being utilized in India since ancient times. It is used in village cottage industry for preparation of common utility items, viz. rope, blankets, floor rugs, bags and mattresses etc. The handicraft articles, made up of camel hair, provide work to rural women in the field of grading of hair, tops preparation, spinning of hair, weaving, embroidery with 100% specialty hair and blending with sheep wool, goat hair, cotton and other products. The camel hair is widely used in rural cottage industry of Rajasthan and Gujarat for preparation of various items (Sahani and Khanna 1993). The hair of dromedary camels are durable, strong and have low conductivity (Mukasa 1981). It has been estimated that a camel hair fabric of 620 g weight will be as warm as a pure wool fabric of 900 g weight (Khanna and Rai 1991). The main body sites of hair coverage in the dromedary camels are shoulders, mid portion of body, neck and hump regions. The preliminary results of camel hair blends with wool, silk waste and polyester have shown encouraging results (Gupta *et al.* 1987, 1989). Blended products may also be prepared with sheep wool, goat hair and cotton. Patni and Dhillon (1988) reported that it is worth while to blend camel hair with polyester, wool or silk waste. The camel hair is stronger and warmer as compared to wool (Khanna and Rai 1990). The total world camel population is estimated to be 19.286 million of which India has third highest camel population of 5.52 million (FAO 1998) after Somalia and Sudan. Therefore, analysis of hair production characteristics of various breeds, sex, age group and year of production etc. are of great importance in exploiting the hair production potential and quality of hair for its future utility as pure camel hair as well as blended with other animal fibres, synthetic waste fibres. It is also important in the rural cottage industry. Thus the present investigation was undertaken as an attempt to evaluate the production potential of different breeds and to suggest suitable improvement strategies.

The hair production from 816 camels (*Camelus*

dromedarius) belonging to the National Research Centre on Camel, Bikaner, were meticulously recorded and analysed. The data on annual hair yield from different breeds, viz. Bikaneri (359), Jaisalmeri (325) and Kachchhi (132) were recorded. The camel belonged to different age group, viz. 1 year (104), 2 year (93), 3 year (106), 4-6 year (152) and above 6 year (361). Annual hair yield data from different year's like 1998 to 1999 (159), 1999 to 2000 (204) and 2000 to 2001 (227) and 2001-2002 (226) were utilized. All the camels were managed under semi-intensive system of management and were daily sent for grazing / browsing for about 6 hr and offered dry fodder (@ 2% of body weight) in the evening time after return from grazing. The hairs were sheared from all over body regions of camel and were clipped by using hand machine during the last week of March of every year. The sheared hair of individual animals were collected in polythene bags after proper skirting (removal of dust and other vegetable matters). The individual camel hair weighted in 5 kg capacity balance with minimum division of 10 g. The recorded data were classified according to various breeds, sex, age and year of production etc. The recorded and classified data were subjected to analysis by applying mixed mode least-squares and maximum likelihood computer programme (Harvey 1987).

Least-square means along with standard error for annual hair production (kg) of Indian camel breeds are presented in Table 1. The Bikaneri breed of camel produced maximum annual hair yield, followed by Jaisalmeri and Kachchhi breed. The mean production in Bikaneri, Jaisalmeri and Kachchhi were 0.967 ± 0.017 kg, 0.733 ± 0.016 kg and 0.624 ± 0.018 kg respectively. Similar trend of observation was also reported by Sahani *et al.* (1996, 1998). Camel of Bikaneri breed produces more quantity of hair probably due to greater body size and the staple length was also higher in this breed as compared to other 2 breeds. The higher staple length is one of the main causes which leads to higher annual hair production in Bikaneri breed. Yadav *et al.* (2000) reported that young Bikaneri camels indicated higher staple length as compared to young Jaisalmeri and Kachchhi camel. The overall annual hair production was 0.778 ± 0.011 kg. The

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Table 1. Least-square mean $\pm$ SE for annual hair yield (kg) of Indian camel breed

Age (year)	Bikaneri			Jaisalmeri			Kachchhi			Overall
	M	F	P	M	F	P	M	F	P	
1	0.804 ± 0.061 (20)	0.711 ± 0.057 (23)	0.758 ± 0.043 (43)	0.639 ± 0.048 (25)	0.575 ± 0.056 (18)	0.607 ± 0.037 (43)	0.634 ± 0.069 (8)	0.505 ± 0.063 (10)	0.569 ± 0.047 (18)	0.630 ± 0.021 (10)
2	1.318 ± 0.063 (19)	1.003 ± 0.065 (18)	1.161 ± 0.045 (37)	0.884 ± 0.049 (23)	0.754 ± 0.059 (16)	0.819 ± 0.039 (39)	0.674 ± 0.069 (8)	0.644 ± 0.066 (9)	0.659 ± 0.048 (17)	0.902 ± 0.027 (9)
3	1.548 ± 0.063 (19)	1.238 ± 0.055 (25)	1.394 ± 0.042 (44)	1.053 ± 0.048 (24)	0.905 ± 0.063 (14)	0.979 ± 0.039 (38)	0.811 ± 0.059 (11)	0.714 ± 0.055 (13)	0.763 ± 0.040 (24)	1.076 ± 0.025 (106)
4 - 6	0.896 ± 0.056 (24)	0.816 ± 0.041 (45)	0.856 ± 0.035 (69)	0.765 ± 0.044 (29)	0.703 ± 0.046 (26)	0.734 ± 0.032 (55)	0.675 ± 0.062 (10)	0.581 ± 0.046 (18)	0.628 ± 0.039 (28)	0.735 ± 0.021 (152)
> 6	0.718 ± 0.043 (41)	0.616 ± 0.025 (125)	0.667 ± 0.025 (166)	0.567 ± 0.036 (42)	0.484 ± 0.023 (108)	0.525 ± 0.217 (150)	0.549 ± 0.055 (13)	0.462 ± 0.035 (32)	0.506 ± 0.032 (45)	0.547 ± 0.015 (361)
Overall	1.057* ± 0.026 (123)	0.877* ± 0.022 (236)	0.967* ± 0.017 (359)	0.781* ± 0.020 (143)	0.684* ± 0.023 (182)	0.733* ± 0.016 (325)	0.669* ± 0.028 (50)	0.581* ± 0.024 (82)	0.624* ± 0.018 (132)	0.778 ± 0.011 (816)

* - Significant at 1% level. (M - male, F - female, P - pooled).

male Bikaneri camels (1.057 ± 0.026 kg) produced higher hair yield than female (0.877 ± 0.022 kg). Similar trend of observation was found in all other breeds. In all age group cases male camel produces heavier yield than female.

The 3 year (1.076 ± 0.025 kg) age group produced higher quantity of hair, followed by 2 years (0.902 ± 0.027 kg), 4 to 6 (0.735 ± 0.021 kg) and 1 year (0.630 ± 0.026 kg) age group. Above 6 year age group produced lowest quantity of hair yield i.e. 0.547 ± 0.015 kg. The present results are consistent with the observation reported by Bhakat *et al.* (2001). The main reason behind this appears to be the protection provided by nature to the young animals. Table 2 reveals the year-wise least-squares mean along with standard error for annual hair production (kg) in indigenous camels. In all over the 4 year Bikaneri breed (0.939 ± 0.015 kg) produced highest yield. On the contrary the Kachchhi breed (0.648 ± 0.023 kg) produced lowest yield. There was not much variation in annual

hair production in different year. Almost similar trend of production was observed all over the years. It ranged from 0.732 ± 0.021 kg to 0.810 ± 0.019 kg. The ANOVA to study the effect of breed, sex, age, year and interaction between genetic group and sex on annual hair production was carried out. The breed significantly ($P < 0.01$) affected the annual hair production. Bikaneri breed of camel significantly ($P < 0.01$) produced higher annual hair yield as compared to the other genetic groups. As expected the sex of camel had a significant ($P < 0.01$) influence on annual hair yield. The male camels of all breeds produced significantly higher annual hair yield as compared to the female camels. Age of camel also significantly ($P < 0.01$) affected the annual hair yield. On the other hand year of production did not affect the annual hair yields significantly. The interaction between genetic group and sex was also found to have significant ($P < 0.05$) effect. The skin coat of younger camels (1 to 3 years age) was

Table 2. Year-wise least-square mean $\pm$ SE for hair production (kg) in indigenous camel

Breed	1998 - 1999	1999 - 2000	2000 - 2001	2001 - 2002	Overall
Bikaneri	0.976 $\pm$ 0.031 (70)	0.898 $\pm$ 0.027 (94)	0.929 $\pm$ 0.026 (101)	0.952 $\pm$ 0.027 (94)	0.939** $\pm$ 0.015 (359)
Jaisalmeri	0.727 $\pm$ 0.034 (58)	0.716 $\pm$ 0.029 (80)	0.769 $\pm$ 0.028 (89)	0.769 $\pm$ 0.026 (98)	0.746** $\pm$ 0.015 (325)
Kachchhi	0.587 $\pm$ 0.046 (31)	0.581 $\pm$ 0.047 (30)	0.717 $\pm$ 0.042 (37)	0.707 $\pm$ 0.044 (34)	0.648** $\pm$ 0.023 (132)
Overall	0.763 $\pm$ 0.022 (159)	0.732 $\pm$ 0.021 (204)	0.805 $\pm$ 0.019 (227)	0.810 $\pm$ 0.019 (226)	0.778 $\pm$ 0.011 (816)

**Significant at 1% level.

camel breed

A	Bhhi		Overall
	F	P	
34	0.505	0.569	0.630*
069	± 0.063	± 0.047	± 0.026
3)	(10)	(18)	(104)
74	0.644	0.659	0.902
069	± 0.066	± 0.048	± 0.027
3)	(9)	(17)	(93)
111	0.714	0.763	1.076
059	± 0.055	± 0.040	± 0.025
1)	(13)	(24)	(106)
75	0.581	0.628	0.735
062	± 0.046	± 0.039	± 0.027
0)	(18)	(28)	(152)
49	0.462	0.506	0.547
055	± 0.035	± 0.032	± 0.015
3)	(32)	(45)	(361)
9**	0.581**	0.624**	0.775
028	± 0.024	± 0.018	± 0.011
0)	(82)	(132)	(816)

observed to be more soft and finer as compared to adult age group. The Indian dromedary camel breeds showed a wide colour variation ranging from light brown in Jaisalmeri breed to brown, dark brown and blackish colour in Bikaneri and Kachchhi breeds of camel.

The study can be concluded that male camels of Bikaneri breed of 3 years of age produces higher annual hair yield as compared to other age groups, other sex and breeds. It shows enough variation in the annual hair production and hence there exists scope for future improvement in production. The potentiality of camel hair production indicated scope for preparation of blends of camel hair with other natural and synthetic fibres in addition to its traditional use under village conditions. For improving the hair productivity efforts should be made to select superior males within Bikaneri breed of dromedary camel.

SUMMARY

The camel hair and its products can be an important source of additional income for camel keepers. Yearly hair production data from 816 Indian dromedary camels belonging to 3 elite breeds that belong to 5 different age groups were recorded for 4 different years. The mean annual hair production varied from 0.547 ± 0.015 kg (above 6 year age group) to 1.076 ± 0.025 kg (3 year age group). The Bikaneri breed of camel produced maximum annual hair yield followed by Jaisalmeri and Kachchhi breed. The least square analysis indicated significant ($P < 0.01$) effect of breed factors on annual hair production. The male camel produced significantly ($P < 0.01$) heavier annual hair clip than female in all breeds and all age group cases. Annual hair yield was significantly ($P < 0.01$) influenced by sex factor. The highest annual hair production was observed in 3 year age group followed by 2, 4-6, 1 year and 6 years age group. Age of camel had a significant ($P < 0.01$) effect on annual hair production. The interaction between genetic group and sex was significant ($P < 0.05$) on

annual hair production.

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erent year. Almost similar trend was observed in all the years. It ranged from 1.0 ± 0.01 kg. The ANOVA to study age, year and interaction between annual hair production was carried out. Sex ($P < 0.01$) affected the annual hair yield of camel significantly ($P < 0.01$). The male camel produced significantly higher annual hair yield as compared to the other sex. The sex of camel had a significant effect on annual hair yield. The male camels produced significantly higher annual hair yield as compared to female camels. Age of camel also affected the annual hair yield. On the whole, the interaction between genetic group and sex was significant ($P < 0.05$) effect on annual hair yield of camels (1 to 3 years age) was

indigenous camel

2001 - 2002	Overall
0.952 ± 0.027	0.939 ± 0.015
(94)	(359)
0.769 ± 0.026	0.746 ± 0.015
(98)	(325)
0.707 ± 0.044	0.648 ± 0.023
(34)	(132)
0.810 ± 0.019	0.778 ± 0.011
(226)	(816)