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## Economics of Pashmina Based Trans-Humance Production System in Cold Arid Region of Jammu and Kashmir

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I

### INTRODUCTION

India has two recognised pashmina breeds<sup>1</sup> *Changthangi* (*Changra*) and *Chegu* (Mishra *et al.*, 1998). The breeding tract of pashmina goats<sup>2</sup> is restricted to Nyoma and Durbuk blocks of Changthang sub-division of district Leh, in the cold arid region of Ladakh in Jammu and Kashmir; cold desert of Spiti, Todd and Minnar Valley (Lahul and Spiti district); Hangrang Valley of Kinnaur district, Udeen and Sural in Pangri Valley (Chamba district) of Himachal Pradesh and higher belts of Uttar Kashi, Chamoli and Pithorgarh districts of Uttarakhand also produce pashmina. The altitude of pashmina belt ranges from 3000 m to 5000 m metres above sea level. The topography and climate of these areas suits pashmina production (Bhatt, 1992; Wani *et al.*, 1995, Thakur *et al.*, 2005) *Changthangi* with a population of 1,96,383 is native to high altitude areas (3700 to 4500m) in Ladakh region of Jammu and Kashmir reared by a pastoralist nomadic<sup>3</sup> race '*Changpas*' (LAHDC, 2006).

Pashmina occupies a prime position among animal fibres for its firmness, warmth, durability, lightness, softness and ability to absorb dyes and moisture compared to mohair and/or wool for being free from medulation and crimps. Pashmina is highly valued fibre for manufacturing quality apparels. It is recorded in the Guinness Book of World Records is the costliest cloth in the world after trade ban of most precious natural fibre Shahtoosh (King of fibre) of small Tibetan Antelope known as *Chiru*.

Total pashmina production in India during 2005-2006 was 50 tonnes, of which *Changthangi* breed contributed 80 per cent (LAHDC, 2006; Gupta *et al.*, 2006). Goat fibre with less than 19  $\mu$ m diameter is classified as cashmere<sup>4</sup> but the fibre from *Changthangi* breed has average diameter of 10-14  $\mu$ m, which is considered best and warmest in the world. Brilliantly coloured feather weight pashmina shawls prepared from the fibre of *Changthangi* goats have become a fashion sensation, combining today's essential elements of style, comfort and luxury throughout the world (Singher, 1999).

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Besides *Changthangi* goats, *Changluk* sheep used for meat purpose forms essential component of pashmina goat based trans-humance<sup>5</sup> production system. This ruminant during the failure of production system serves as an alternative source of income for sustenance of *Changpa*.

The pastoralist nomads rearing livestock species especially pashmina goats in the Changthang<sup>6</sup> region contribute significantly to the economy of cold arid region<sup>7</sup>, which accounts for 1,07,545 km<sup>2</sup> of the total 3,87,390 km<sup>2</sup> in the arid zone in the country. The rest of the area is hot arid of Indo-Gangetic plains and peninsular India (Daulay, 1987; Government of Jammu & Kashmir, 2005). However, these nomads encounter multiple problems, viz., very poor living conditions, shortage of fodder, poor market accessibility involvement of huge investment in its value addition. These problems render nomads to generate much lower returns than its potential. Despite being an export oriented item, the pashmina production ranges between 40-50 tonnes a year. This study aims to estimate the investment and return structure in rearing these goats and production of pashmina so that concrete policies regarding its development could be formulated.

## II

### METHODOLOGY

The present study is based on both secondary and primary data. While the secondary data on *Changthangi* goats and other livestock species related to population dynamics, geographical distribution, production system was collected from field functionaries of Sheep Husbandry Department and various livestock census reports of Ladakh Autonomous Hill Development Council (LAHDC) Leh, Ladakh, the primary data collected during the year 2004-07 in the ICAR funded research project entitled "Production and Marketing of Pashmina in Cold Arid Region of J&K-Implications Towards Livelihood" was used. Three stage stratified random sampling technique was followed with villages/zones, households and *Changthangi* pashmina goats as the sampling units. The breeding tract of the *Changthangi* goats (Changthang sub-division of Ladakh) comprised three zones, viz., Kurzok (Zone A), Nyoma (Zone B) and Durbuk (Zone C) with 17 villages and 3033 households of which 2282 households reared pashmina goats. The zones represented an aggregation of Changthang sub-division that form extensive territorial zones characterised by the dominance of the common physical, economical and social peculiarities. A sample of 250 households (11 per cent) were randomly selected from the zones and the villages through probability proportional to size. The total pashmina goats in the villages of Changthang were 1,67,363 (of which 50,836, 73,499 and 43,028 were in Zones A, B and C, respectively) and 29,020 pashmina goats producing smaller quantities of fibre with shorter staple length (mainly reared for meat and milk purposes) were in other parts of Leh. To estimate the economic viability of pashmina goat rearing and production of pashmina, 11 per cent of the

pashmina goats numbering 18,328 were selected randomly. Since the costs and returns bear a direct relationship with age of the animal, as such these were further classified as per the age and sex for estimating the investment and returns from the sampled goats. Averages and percentages were used to analyse data. Compound growth rates were worked by exponential linear regression and economic feasibility tests, viz., benefit cost ratio (BCR), net present value (NPV), internal rate of return (IRR) and pay back period (PBP) was ascertained (Gittinger, 1982). It was observed that medicine charges and minor feed charges during 5 to 10 days of crises period (when pastures get covered under snow) and miscellaneous expenditure were the only important variable cost components due to the fact that animals are reared as migratory flocks under trans-humance production system. Fixed costs included interest charged @ 7 per cent on fixed capital (price of the animal which was calculated at Rs. 50/- per kg live body weight plus the price of pashmina produced during the reference year), depreciation and imputed value of family labour<sup>8</sup>. Returns from fixed farm resources included gross returns excluding total variable cost.

### III

#### RESULTS AND DISCUSSION

##### *Major Economic Indicators of Livestock*

Traditionally Ladakh has had livestock economy contributing 60 per cent to the economy of the region (Government of Jammu and Kashmir, 2006) and it provides livelihood, and fulfills the nutritional requirements for the majority of its population (Ladakh Vision Document, 2004). Thus it is intimately interwoven in the fabric of pastoralist nomadic and agro-pastoralist<sup>9</sup> communities of Changthang. Most of the flocks of livestock are small domesticated ruminants of goat and sheep reared at a very high altitude, hilly tracts and valleys of Changthang. The abundant natural resources congenial for efficient rearing of the small domesticated ruminants in Ladakh account for more than 43 per cent of the total area of the State of Jammu and Kashmir. These ruminants with special attributes like ability to utilise a wide range of poor quality forages and browse<sup>10</sup>; ability to walk long distances on difficult terrains; short generation intervals/high reproductive rates; smaller carcasses conveniently marketed or consumed over a short time period; ability to withstand draught and cold aridity better than cattle; yield high valued fibres and easy flocking instinct (herding by children, younger and even older members of the family) are most suitable for the region. These vast natural resources would, therefore, demand optimal utilisation and exploitation of the domesticated small ruminants for conversion of this harsh and fragile agro-climatic zone into prosperous one.

The major indicators of overall livestock economy in different blocks of Leh and State as a whole are presented in Table 1. A perusal of Table 1 reveals that minimum pressure of livestock per square km area is in Leh block and maximum in

TABLE 1. MAJOR INDICATORS OF LIVESTOCK ECONOMY OF DIFFERENT BLOCKS OF LEH AND STATE (2004-05)

Particulars (1)		Blocks				Leh district total (7)	State (8)
		Leh (3)	Khaltsi (4)	Nubra (5)	Changthang (6)		
Number per square kilometre area of*	Livestock	254.88	1037.02	488.04	7665.24	927.18	409.77
	Cattle	67.41	48.61	52.80	141.75	64.83	127.66
	Buffaloes	-	-	-	-	-	43.03
	Sheep	63.16	384.89	129.52	2080.49	260.12	141.18
	Goats pashmina	23.17	220.10	55.41	4896.52	383.61	8.13
	Non-pashmina	56.26	239.30	208.55	-	129.63	76.93
	Dzo/Dzomo	19.56	46.95	18.06	-	20.95	0.44
	Yak/Demo	4.07	56.73	8.28	379.78	36.93	2.95
	Horses and Donkeys	21.17	40.44	15.42	166.71	31.08	9.77
Pashmina goats: livestock ratio		.09	0.21	0.11	0.64	0.41	0.02
Number of livestock per 1000 persons		856.77	3534.85	5236.67	19493.90	3253.95	975.91
Number of pashmina goats per 1000 persons		77.88	750.25	594.53	12452.60	1346.29	19.36
Number of livestock per 100 ha. of net area sown		1115.92	3417.66	4545.78	26173.63	4690.25	1316.40
Number of pashmina goats per 100 ha. of net area sown		101.44	725.38	516.09	16719.58	1940.54	26.11
Area under fodder crops (ha.)		1283	420	314	3	2020	52410
Grazing and pasture land to total geographical area (per cent)		0.09	-	5.15	-	1.91	5.17
Average pashmina yield (g)	Breeding bucks	130.00	178.00	167.00	350.00	206.00	206.00
	Castrated bucks	175.00	220.18	200.00	519.00	278.00	278.00
	Does	125.00	155.22	146.00	311.00	184.00	184.00

Source: Sample Survey on Livestock/Digest of Statistics, Directorate of Economics and Statistics, J & K Government 2004-05.

\*Number per sq.km reflects area according to village papers excluding area maintained by Forest Department and other mountains/deserts.

Changthang sub-division compared to overall average of district Leh and state of Jammu and Kashmir. The figures further indicate that the density of pashmina goat population followed by sheep was highest amongst all livestock species in Changthang. However, non-pashmina goats (Malra goats) appeared to be animal of choice in other blocks of district Leh. Although buffalo is one of the important milch animals of the state but its population is negligible in Leh. The importance of livestock and *Changthangi* goat production can also be judged from the fact that number of livestock and *Changra* goats per thousand persons is highest in Changthang followed by Nubra and Khaltsi blocks. The same trend is observed in the number of livestock and *Changra* goats per 100 ha of net area sown. Difficult topography coupled with harsh climatic conditions has rendered farm mechanisation impossible in cold arid zone. So, dzo/dzomo (a cross-bred of yak and cattle), horses and donkeys in Leh and yak/demo, horse, donkey in Changthang serve as the main source of draught power in agriculture and transport. The area under fodder crops is negligible in the whole Changthang. The average yield of pashmina across the zones ranged between 130–350; 175–519 and 125–311 grams respectively in breeding

bucks, castrated bucks and does revealing thereby that the castrated bucks yielded the highest compared to breeding bucks and does.

#### *Growth Performance of Small Ruminants*

The growth performance of small ruminants in the district Leh is presented in Table 2. Two time periods, i.e., 1995-96 to 2000-01 and from 2000-01 to 2005-06 were considered appropriate to estimate the changes that have taken place in respect of the population and production compared to other small ruminants that form the components of pashmina goat based production system. The analysis revealed that pashmina production increased by 7.91 per cent from 1995-96 to 2000-01 and 15.83 per cent during 2000-01 to 2005-2006, where as its population increased by 7.83 and 24.56 per cent during the same period. The other species in general exhibited decrease during the period 2000-01 through 2005-2006 except Angora cross and Changluk sheep, which showed an increase of 29.48 and 14.40 per cent, respectively, during the period. Growth rates of pooled data on the pashmina production, population and population of other small ruminants was worked out for the time series data from 1995-96 to 2005-06. The overall compound growth rates revealed that pashmina production and population increased by 3.70 per cent and 4.94 per cent, respectively during the period. The non-pashmina goats, Mulluk sheep and Merino cross exhibited a reduction by 2.02, 3.59 and 8.90 per cent, respectively as compared to population of Angora cross and Changluk sheep, which increased by 2.28 and 7.54 per cent respectively. Changuluk sheep used for meat purpose was the essential component of pashmina goat based production system.

#### *Altitude, Population, Flock Size and Demographic Trend*

Information on zone wise population estimates for the *Changthangi* goat was collected in order to assess the village wise concentration viz-a-viz altitude. The same is analysed in Table 3. The altitude in Changthang sub-division varied from 3728 masl in Hemya to 4553 masl in Samad with 4394 to 4553 masl in zone A, 3728 to 4151 masl in zone B and 3788 to 4545 masl in zone C. The pashmina goat population in the sub-division was 1, 67,363 reared by 2282 families as such average flock size was 73. In zone A, B and C 30.37, 43.92 and 25.71 per cent pashmina goats respectively were recorded with 440, 1089 and 753 households rearing pashmina goats with average flock size of 116, 68 and 57 pashmina goats. The highest goat concentration (20.89 per cent) across the villages was found in the pastoralistic nomadic village of Kurzok and lowest (0.95 per cent) in agro-pastoralistic village of Likchey. These figures revealed that goat population and fibre yield varied in direct proportion to the altitude. The highest average yield was recorded in all the villages falling in zone A and village Koyul and Anlay in zone B and village Chusul in zone C.

TABLE 2. GROWTH PERFORMANCE OF SMALL RUMINANTS IN DISTRICT LEH

Sr. No. (1)	Year (2)	Pashmina production (kg) (3)	Pashmina goat population (4)	Non-pashmina goat population (5)	Angora cross/ alpine/Jakhrana (6)	Changluk sheep (7)	Mulluk sheep (8)	Merino cross (9)	Total (10)
1.	1995-96	32000	146216	70604	4498	52987	67840	22540	364685
2.	1996-97	32400	147812	77385	4790	53105	68126	22743	373961
3.	1997-98	31900	145980	84784	5969	54434	70848	21890	383905
4.	1998-99	32500	146890	93389	7148	56981	69340	22412	396160
5.	1999-2000	32656	133288	105891	8704	57385	71415	21130	397813
6.	2000-01	34532	157663	97957	5706	66822	74923	18117	421188
7.	2001-02	34200	156493	80048	5902	85806	59091	11684	399024
8.	2002-03	41900	209821	84042	6798	98968	60147	11385	471161
9.	2003-04	42000	229656	70227	13295	103210	59676	12193	482627
10.	2004-05	48000	227416	67534	6381	113544	52714	11835	479388
11.	2005-06	40000	196383	62339	4024	76443	46038	11248	396475
CGR (per cent)		3.70	4.94	-2.02	2.28	7.54	-3.59	-8.90	2.22
		(0.74)**	(1.15)**	(1.52)	(3.23)	(1.50)**	(0.88)**	(1.33)**	(0.68)**

Figures in parentheses indicate standard errors of respective growth rates.

\*\* denote significance at 5 per cent level.

TABLE 3. DISTRIBUTION OF GOAT HERDS BY PROPORTION IN VARIOUS VILLAGES CATEGORISED ON THE BASIS OF ALTITUDE AND QUALITY OF PASHMINA (2005-06)

Name of the village (1)	Altitude (m masl) (2)	No. of households (3)	Population of pashmina goats (4)	Average size of pashmina goats per household (5)	Average fibre yield of sampled animals (g) (6)	Fibre diameter range (µm) (7)	Grade (8)
Zone A							
Kurzok	4394	52	34964 (20.89)	114	433.96	8-12	A
Samad	4553	306	9046 (5.40)	110	434.97	8-12	A
Kharnak	4242	82	6826 (4.08)	132	423.76	8-12	A
Average/total	4396	440	50836 (30.37)	116	432.76	8-12	A
Zone B							
Nyoma	4090	195	13967 (8.34)	72	342.49	13-14	C
Nidder	4090	33	1982 (1.18)	60	333.37	13-14	C
Anlay	4151	332	26166 (15.63)	79	409.24	9-13	B
Koyul	4151	180	17403 (10.40)	97	404.74	9-13	B
Chumathang	4115	199	9824 (5.87)	49	229.76	14-15	D
Hemya	3728	70	2566 (1.53)	37	219.06	14-15	D
Likhey	3788	80	1591 (0.95)	20	176.29	14-15	D
Average/total	4016	1089	73499 (43.92)	68	354.77	9-15	B-D
Zone C							
Kargaim	4394	96	8345 (4.98)	87	356.81	13-14	C
Chusul	4545	142	13863 (8.28)	98	371.74	9-13	B
Durbuk	3788	122	3132 (1.87)	26	246.55	14-15	D
Shuchakul	3878	159	3323 (1.98)	21	282.83	13-14	C
Tharuk	3810	64	1973 (1.18)	31	253.37	14-15	D
Meerak	4298	80	4684 (2.81)	58	323.25	9-13	B
Phobrang	4298	90	7708 (4.61)	86	350.22	13-14	C
Average/total	4144	753	43028 (25.71)	57	338.11	9-15	B-D
Overall average/total	4136	2282	167363 (100.00)	73	375.21	8-15	A-B

Figures in parentheses indicate percentage to total.



### *Quality of Pashmina*

Fibre diameter is the single most important feature of pashmina. Smaller the diameter, the finer the fibre (Ryder, 1987). The next important feature of pashmina is fibre length, colour and yield. The villages of Changthang were categorised into four grades/groups, viz., A, B, C and D keeping in consideration the fibre diameter, length, colour and yield of pashmina.

Table 3 shows that the quality of fine pashmina production is directly related to altitude. The best pashmina (grade A) with average fibre diameter of 8-12  $\mu\text{m}$  comes from Kurzok zone that lies at an altitude range of 4242 to 4553 m masl. The next best (grade B) comes from the villages/areas of Anlay, Koyul (zone B), Chusul and Meerak (Zone C) with average fibre diameter of 9-13  $\mu\text{m}$ . The third best quality is from Nyoma/Nidder villages along Indus River (zone B) and Karigaim, Schuchakul, Phobrang villages near Pangong Lake (zone C) where average diameter of pashmina fibre was 13-14  $\mu\text{m}$ . Grade D pashmina with fibre diameter 14 to 15  $\mu\text{m}$  comes from the agro-pastoralist villages of Rong valley (Chumathang, Himya and Likchey) and Durbuk, and Tharuk of zone C rearing pashmina goats mostly under semi-intensive system of production. However, fibre diameter of individual goats/sexes may be more or less than the range for village. Generally altitudes, cold aridity and availability of quality pasture were the important parameters for lower fibre diameter.

### *Economics of Changthangi Goat Rearing*

Income and investment pattern in any enterprise is one of the most sensitive and crucial factors determining the economics of that enterprise. A detailed analysis regarding different components of income and net returns over costs on the basis of methodology adopted by various researchers (Rath, 1992; Kumar and Deoghare, 2002; Kumar and Deoghare, 2003; Kumar and Pant, 2003; Shinde *et al.*, 2003; Kumar *et al.*, 2006) from time to time has been documented in Table 4.

### *Cost of Rearing*

The total input cost of *Changthangi* goat rearing was estimated to be Rs. 593.86, Rs. 536.93 and Rs. 514.17 per animal and Rs. 68787, Rs. 36511 and Rs. 29307 per flock in zone A, B and C, respectively. Imputed value of family labour was found to be the major component of the total expenditure because animals are reared as migratory flocks and accounted for 38.90, 44.13 and 47.06 per cent of total cost in zone A, B and C, respectively. Hired labour for rearing goats was not prevalent in the study area so could not find place in cost structure. The imputed value of family labour followed by the cost of animals constituted the major portion of fixed investment in goat rearing. *Changthangi* goat rearers usually build up the flocks from their own animals over the period of productive life of animal and cull

TABLE 4. COST AND RETURNS IN CHANGTHANGI GOAT REARING (2005-06)

Particulars (1)	(Rs./annum)					
	Per animal			Per flock		
	Zone A (2)	Zone B (3)	Zone C (4)	Zone A (5)	Zone B (6)	Zone C (7)
Average flock size per household	-	-	-	116	68	57
I. Variable cost						
Feed cost	40.00	42.50	42.20	4640	2890	2405
Veterinary expenditure	8.50	7.25	7.00	986	493	399
Misc. expenditure	2.91	2.88	2.74	237	196	156
Total variable cost	51.41 (8.66)	52.63 (9.80)	51.94 (10.10)	5863	3579	2960
II. Fixed cost						
Imputed value of family labour	231.00 (38.90)	237.00 (44.13)	242.00 (47.06)	26796	16116	13794
Depreciation	160.71	117.31	98.52	18642	7977	5616
Interest on fixed capital	150.74	129.99	121.71	17486	8839	6937
Total fixed cost	542.45 (91.34)	484.30 (90.20)	462.23 (89.90)	62924	32932	26347
Total cost(I+II)	593.86	536.93	514.17	68787	36511	29307
Returns						
Milk (ltrs)	23.09	15.77	12.65	2678.44	1072.56	721.05
Value of milk	207.81 (13.28)	141.93 (11.11)	113.85 (9.19)	24106	9651	6489
Pashmina yield (kg)	0.432	0.357	0.338	50.19	24.28	19.27
Value of pashmina	692.42 (44.25)	553.44 (43.3)	507.16 (40.94)	80321	37634	28908
Value of animals sold	350.40 (22.39)	338.91 (26.51)	332.50 (26.84)	40646	23046	18952
Value of added stock	271.19 (17.33)	200.88 (15.72)	242.33 (19.56)	31458	13660	13813
Value of dung	43.00 (2.75)	43.00 (3.36)	43.00 (3.47)	4988	2924	2451
Gross returns	1564.82	1278.16	1238.84	181519	86915	70614
Net returns	970.96	741.23	724.67	112732	50404	41307
Family labour income	231.00	237.00	242.00	26796	16116	13794
Returns to fixed farm resources	1513.41	1225.53	1186.90	175656	83336	67654

Figures in parentheses indicate percentage to total.

old/unproductive and dispose surplus animals. *Changthangi* goats are reared under harsh climatic conditions, therefore, suffer heavy losses on account of diseases, cold aridity and malnutrition. The magnitude of loss due to mortality was accounted for under the depreciation.

#### *Income for Livelihood*

The most important benefits from *Changthangi* goat rearing were in the form of pashmina, animal sales, changes in flock inventory, milk and manure. The *Changthangi* goat rearers earned a net profit of Rs 970.96, 741.23 and 724.67 per animal and Rs. 112732, Rs. 50,404 and Rs. 41,307 per family in zone A, B and C,

respectively and was the highest compared to any other goat species in India. The magnitude of net annual income generated from goat in zone A was 30.99 and 33.98 per cent higher compared to zone B and C, respectively. The return from pashmina formed the major component of gross returns in *Changthangi goats* (>40 per cent) followed by sale and value addition in kids. Goat rearing not only generated income for livelihood under harsh climatic conditions, but also provided nutritional security to nomads (*Changpa*) in the form of milk and meat.

### *Employment Potential*

It is evident from Table 4 that *Changthangi goat* rearing on an average generated an income to the tune of Rs. 26,796, Rs. 16,116 and Rs.13,794 per household per year in zone A, B and C, respectively, by utilising family labour like adult male, women, old persons and children. It may be concluded from the above findings that pashmina enterprise is profitable, possesses self-employment potential and if proper attention and care is taken, it will prove helpful in increasing the family welfare of downtrodden nomads rearing the breed under miserable conditions.

### *Economics of Changluk Sheep Rearing*

Besides *Changthangi goat*, Changthang is equally famous for *Changluk* breed of sheep. The breed, besides cash income from sale of animals provides multiple products like meat, famous for tenderness and aroma; fine wool used in garment making; castrated rams used as pack animals to carry load upto 12 kgs in cold desert. The predominant colours of the breed are white, black, brown and grey.

The data regarding total input cost and return from the *Changluk* sheep rearing of Changthang are presented in Table 5. The average flock size of *Changluk* sheep worked out to 55.41, 32.80 and 14.61 animals per household in zone A, B and C respectively. The total cost was worked out to Rs. 500.00, Rs. 473.24, Rs. 460.39 per animal and Rs. 27,705, Rs. 15,522, Rs. 6,726 per flock per year in zone A, B and C, respectively. The cost of imputed value of labour constituted the highest share in total cost, followed by depreciation and interest on fixed capital. The success of any production system depends on the returns generated from it. The amount realised from sale of animals followed by value of added stock was the main component of gross income. The magnitude of income from wool was lower due to poor yield. The gross and net income per animal was higher in zone A (Kurzok zone) compared to zone B and C. The average net income per animal worked out to Rs. 214.52, Rs. 160.74 and Rs. 161.61 in zone A, B and C respectively. It could be concluded that *Changluk* sheep rearing is generating a reasonably good flock business and family labour income and serves as a good source, as an alternative to pashmina based production system in distress climate and production.

TABLE 5. COST AND RETURNS IN CHANGLUK SHEEP REARING (2005-06)

Particulars (1)	(Rs./annum)					
	Per animal			Per flock		
	Zone A (2)	Zone B (3)	Zone C (4)	Zone A (5)	Zone B (6)	Zone C (7)
Average flock size per household	-	-	-	55.41	32.80	14.61
I. Variable cost						
Feed cost	35.00	38.00	38.00	1939	1246	555
Veterinary expenditure	6.50	6.00	6.00	360	197	88
Miscellaneous expenditure	2.30	2.40	2.40	128	78	35
Total variable cost	43.80	46.40	46.40	2427	1521	678
II. Fixed cost						
Imputed value of family labour	231.00	237.00	242.00	12800	7774	3536
Interest on fixed capital	98.65	87.50	84.35	5466	2870	1232
Depreciation	126.55	102.34	87.64	7012	3357	1280
Total fixed cost	456.20	426.84	413.99	25278	14001	6048
Total cost (I+II)	500.00	473.24	460.39	27705	15522	6726
Returns						
Wool yield (kg)	0.60	0.55	0.55	33.25	18.04	8.03
Value of wool	30.00	27.50	27.50	16620	902	402
Value of animals sold	356.12	325.88	322.00	19733	10689	4704
Value of dung	43.00	43.00	43.00	2383	1410	628
Value of added stock	285.40	237.60	229.50	15814	7793	3353
Gross returns	714.52	633.98	622.00	39592	20794	9087
Net returns	214.52	160.74	161.61	11887	5272	2361
Family labour income	231.00	237.00	242.00	12800	7774	3536
Returns to fixed farm resources	670.72	587.58	575.60	37165	19273	8409

### *Sources of Livelihood in Changthang*

Two important economic indicators important in study of any enterprise are income and employment generation potential. These two indicators are mutually dependent. The estimation of these indicators becomes imperative in a production system which is livestock based system located at very difficult, inaccessible and poor mobile terrain. In this context while small ruminants contribute significantly to the production system, the agricultural crops too makes a meagre contribution. The survey on pashmina production revealed that wheat and barley were two crops which supported the particular small ruminants based production system.

The data collected during the course of survey was analysed and is presented in Table 6. The table documents the average gross and net income which was the highest across the zones in *Changthangi goats* compared to *Changluk sheep*. Similar trend was observed in family labour income, however the overall average revealed that goats yielded more income per annum per household in their respective zones. The goat rearing yielded highest employment of 267.96, 161.16 and 137.94 days per household per annum in zones A, B and C respectively followed by sheep.

TABLE 6. INCOME AND EMPLOYMENT GENERATION FROM VARIOUS PRODUCTION SYSTEMS IN CHANGTHANG (2005-06)

Particulars (1)	Per animal/ hectare			Per household		
	Zone A (2)	Zone B (3)	Zone C (4)	Zone A (5)	Zone B (6)	Zone C (7)
Changthang goat	Gross income Rs.)	1564.82	1278.16	1238.84	181519	86915
	Net income (Rs.)	970.96	741.23	724.67	112632	50404
	Family labour (Rs.)	231	237	242	26796	16116
	Employment (man-days)	2.31	2.37	2.42	267.96	161.16
	Average flock size (No.)	-	-	-	116	68
Changluk sheep	Gross income (Rs.)	714.52	633.98	622.00	39592	20794
	Net income (Rs.)	214.52	160.74	16161	11887	5272
	Family labour (Rs.)	231	237	242	12800	7774
	Employment (man-days)	2.31	2.37	2.42	128.00	77.74
	Average flock size (No.)	-	-	-	55.41	32.80
Wheat	Gross income (Rs.)	Neg.	18312	18312	-	1281
	Net income (Rs.)	Neg.	344	344	-	24
	Family labour (Rs.)	Neg.	5237	5237	-	366
	Employment (man-days)	Neg.	52.37	52.37	-	3.66
	Average holding (ha.)	-	-	-	-	0.07
Barley/ gram	Gross income (Rs.)	Neg.	10237	10237	-	2661
	Net income (Rs.)	Neg.	-563	-563	-	-146
	Family labour (Rs.)	Neg.	3437	3437	-	893
	Employment (man-days)	Neg.	34.37	34.37	-	8.93
	Average holding (ha.)	-	-	-	-	0.26
Total	Gross income (Rs.)	-	-	-	221111	111651
	Net income (Rs.)	-	-	-	124519	55554
	Family labour (Rs.)	-	-	-	39596	25149
	Employment (man-days)	-	-	-	395.96	251.49

The income and employment pattern for most important crops are also presented here. The figures revealed that gross income was highest in wheat and net income was negative in barley across the zones, thus emphasising the importance of wheat in the production system compared to barley. The results conclude that in terms of net income, family labour income and employment generation of pashmina goat rearing proved the most promising source of livelihood in Changthang followed by sheep.

#### *Economic Feasibility of Pashmina*

Economic viability of pashmina goats was estimated by applying economic feasibility tests, viz., benefit cost ratio (BCR), net present value (NPV), internal rate of return (IRR) discounted @ 12 per cent and pay back period (PBP). The figures 1.72, 1843.17, 72.14; 1.42, 1037.92, 42.90 and 1.36, 877.65, 60.63 in respect of BCR, NPV (Rs.) and IRR (Table 7) respectively in zone A, B and C reveal that these indicators were higher to the tune of 26.47, 110, 42.48 per cent in zone A compared to zone C and 21.12, 77.58 and 68.15 per cent higher compared to zone B. The pay back period (yrs.) was estimated at 0.58, 0.70 and 0.73 in zone A, B and C

respectively. Again zone A was observed to pay back in lesser period by 17 and 21 per cent compared to zone B and C respectively. The results therefore indicate that Zone A is most profitable compared to other pashmina producing zones in the study area. The higher productivity of the enterprise in zone-A could be attributed to its being at higher elevation which is directly proportional to the yield. The general observation was that the enterprises in all zones pay back the investment in less than a year which is indicative of the fact that the pashmina rearing is profitable and economically viable.

TABLE 7. ECONOMIC FEASIBILITY ANALYSIS OF PASHMINA PRODUCTION

Particulars (1)	Zone		
	A (2)	B (3)	C (4)
B.C.R @ 12 per cent discount rate	1.72	1.42	1.36
Net present value (Rs.)	1843.17	1037.92	877.65
Internal rate of return	72.14	42.90	60.63
Pay back period (Yrs.)	0.58	0.70	0.73

## IV

## CONCLUSION

The livestock density was more in Changthang compared to overall district Leh, due to sole dependence of the population on livestock sector in general and domesticated small ruminants in particular. Pashmina production and population increased by 7.91 and 7.83 per cent during 1995-96 to 2000-01 and by 15.83 and 24.56 per cent during 2001 to 2005-06 respectively. However, other species registered a decline during the same period. The altitude was directly related to pashmina population, fibre yield and quality of pashmina. The rearing of pashmina goats was economically viable in terms of gross, net, family labour income and employment generation. However, there existed a wide and marked gap in productivity of pashmina flocks in various zones of Changthang owing to severity of constraints. The Changluk sheep was a better alternative for sustenance during the failure of Changthangi goat based production system.

## V

## POLICY IMPLICATIONS

There is an urgent need for pragmatic planning ensuring proper development of the breed through proper breeding strategy for enhancement of the pashmina yield/livelihood/nutritional security/employment generation and export earnings of the country. The mortality rate need to be reduced by strengthening the feed, fodder to Changthangi rearers on subsidised rates during crisis period, besides providing shelter/lambing shed facilities. Potential pasture areas need to be identified and

protected through integrated rural development programmes jointly with stakeholders. Liberal credit schemes need to be introduced so as to make the rearers able to purchase timely inputs which is the most impeding factor in realising productivity potential of the breed.

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#### NOTES

1. There is no specific breed of cashmere/pashmina goat. The term *Cashmere goat* refers to any goat from which commercial quantities of cashmere (the fibre that has a mean diameter  $< 19 \mu\text{m}$ ) can be harvested (Lupton, 1992; Pattie and Restall, 1992). The breeds which produce cashmere/pashmina fibres in different countries are listed below (Masoni, 1981).

	Name of the country	Pashmina/cashmere producing breed
1.	Afghanistan	Asmari, Vatani
2.	China	Chungwei, Liaoning
3.	India	Changthangi, Chegu, Gaddi
4.	Iran & Iraq	Kurdi, Morghose, Rani
5.	Mongolia	Mongolian
6.	Pakistan	Kaghani, Kel
7.	Nepal	Northern Hill goat, Bhotia, Sinhal
8.	Tibet	Tibetan
9.	USSR (former)	Altai Mountain, Charihissar, Down, Don, Kirgis, Orenburg
10.	Australia, New-Zealand, Scotland and U.S.A	Feral goats

2. The goat (*Capra hircus*) is the earliest domesticated ruminant, descended from the wild species, but there is much confusion to its lineage. The origin of *cashmere goat* has been traced to *Capra falconeri* markhor (Harris, 1962; Misharev, 1963; Epstein, 1969; Roberts, 1969) to *Capra hircus* blythi, Sindhi ibex and to *C. aegagrus*, *C. falconeri* and *C. ibex* Siberica (Kiyatkin, 1968). The geographical location (breeding tract) of these wild species exist in the mountains extended between  $27^{\circ} 30'$  to  $65^{\circ} 45'$  N;  $33^{\circ}$  to  $98^{\circ}$  E, at an altitude of 500 to 5000 m masl (Parker, 1990). The habit and habitat, food and enemies of these species are almost common, though distinguished from each other on the basis of type, shape, size of horns, reproduction and life cycle (Bhat, 1992).

All the important breeds yielding cashmere are grouped in a group called central Asiatic pashmina goats (Masoni, 1969). However, this main group has been divided into three sub-groups (Miller, 1986).

Group	Breeds
Kirgis goat	Altai Mountain, Anatolian Black, Charhissar, Down, Don, Kazakh, Kirgis, Kurdi, Markhor, Orenburg, Uzbekh and Vatani
Mongolian goat	Chegtu, Chungwei, Jinning, Liaoning, Mongolian, Wuan and Xingjiang
Kashmir goat	Changthangi, Chegu, Gaddi, Kaghani, and Tibetan

3. Nomadic pastoralists known as *Changpa* rearing livestock in the cold arid region of Ladakh. These nomadic pastoralists rear livestock under extensive and completely migratory production system as their prime occupation for livelihood and are concentrated in the areas with an elevation range from 3940-4550 m masl. The livestock in the areas mainly consist of *Changthangi goats*, Changluk sheep, Yaks and horse. *Changpa* visit their villages during summers where they grow barley and wheat.

4. The term 'Cashmere' (pashmina as it is generally referred to) is used for the undercoat produced by the *Changra* goats from regions of Tibet and Ladakh which was made into fine fabric in

Kashmir in past (Masoni, 1981). In Oxford Dictionary, Cashmere has been defined as “the under fur of hairy quadrupeds in the elevated land North of Himalayas especially that of the goat which is the material of Cashmere shawls”.

5. Transhumance is the seasonal movement of people with their livestock over relatively short distances, typically to higher pastures in summer and to lower valleys in winter.

6. Changthang refers to a much wider area than that contained within Ladakh region of Jammu and Kashmir. It spans 1600 km from the Chinese province of Qinghai in the East, across Central and North Tibet to Ladakh in the West (Anon, 1890; Goldstein and Beall, 1990). Changthang or northern Plateau is situated in north – east Ladakh and extends from Durbuk to Mannmeerak in the North, Demjok in the east, Rong valley in the west and Rupshu Valley in South (Wani *et al.*, 1995). It is bounded by Chinese occupied Kashmir in North – West, Tibet in East, Lahul and Spiti district (Himachal Pradesh) in South and Kharu and Leh blocks of district Leh in west. It is one of the subdivisions of District Leh. The geographical location of the area extends between 32° 30' to 34° N and 77° 50' to 79° 10' E. There are three road approaches into Changthang from Leh, the main town of Ladakh: one from the south-east via Tanglangla pass at an elevation slightly over 5600 m masl which leads to Kurzok zone and also connects it with the state of Himachal Pradesh via Rohtang pass, Manali. The second from east via Upshi, Rong Valley (Likchey to Chumathang) which leads to Nyoma zone and the third from the north-east via Changla pass at an elevation slightly over 5,183 m masl which leads to Durbuk zone of Changthang.

7. The cold arid region of Western Himalaya mainly comprises Ladakh area of Jammu and Kashmir State and some parts of Lahul-Spiti sub-division in Himachal Pradesh account for 27.80 per cent of the total area under arid zone in India. The region in Jammu and Kashmir lies in the northern most tip of Asian sub-continent between Karakoram and greater Himalayan ranges and is interwoven with nude and rugged mountains, extending from 32°-15' to 36°-0' N latitude and 75°-15' to 79°-10' E longitude. The region has two districts namely Leh and Kargil (includes Gilgit and adjacent areas) and is bounded in North-east by China (Tibet), in south-west by Jammu division, in west by Kashmir valley and in south by Chamba and Lahul-Spiti. It covers an area of 96,701 km<sup>2</sup> accounting 43 per cent of the total geographic area of Jammu and Kashmir State. It experiences severe cold and dry winter and moderately hot and dry summer. The zone receives about 80-90 mm rainfall in Leh to about 300 mm in Kargil. The zone is characterised by formidable aridity with very cold thermal index. Soils of this zone are mountain meadow soils with appreciable spread of skeletal and Tarai soils. Usually soils are derived from weathered debris of rocks, with high permeability and low water holding capacity. This is the zone of highest average elevation. The elevation range from more than 2400 m to peaks ranging from 7200 to 8400 m (Wani, *et al.*: 2004).

8. The amount of labour used to maintain animals was estimated by recording the amount of time spent on different operations, which was suitably distributed among individual animals based on standard animal units (SAU's). SAU's were worked as. A cow/heifer or bullock/Bull or Yak/Demo or Dzo/Dzomo or stallion/mare is equal to one SAU; young stock between 1-3 years is equal to ½ SAU; young stock below 1 year = ¼ SAU; sheep and goats as 1/5<sup>th</sup> of SAU. The imputed value of family Labour was estimated on the basis of average wage paid to a permanent labour in the area. All the types of labour viz., male, female and child used in the different operations were converted in to man-equivalent days. A man-day of eight hours was taken equivalent to 1.5 women work day and 2 work days of child.

9. Farmers rearing livestock as an important subsidiary activity to agriculture and also owe their dependence to agriculture and livestock rearing for their subsistence are termed as agro-pastoralists. These agro-pastoralists are concentrated in those areas of district Leh that fall within an elevation of 3940 m masl.

10. Browse means selective grazing on bushes.



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