

Seven

DAP and Farmers' Strategies

Despite their greater suitability and relevance, traditional farming practices are losing their efficacy and feasibility in the face of the changing demography, institutions, and technologies (Jodha and Partap 1993). However, what has not changed, or what has not even been researched, is the DAP system. This is because of the strong, rather inseparable, convergence between attributes of DAP and specific characteristics of mountain agriculture. Despite the great degree of institutional intervention that, in the context of the livestock sector, mainly focusses on the development of specialised breeds to be maintained to yield marketable, edible products, farmers did not allow the DAP system to degenerate.

The tilled terraces provide a diversity of agricultural niches. Thus, wherever farmers take advantage of this diversity, increasing their security, DAP becomes a meaningful tool in the process. In their indigenous land and soil management technologies, the farmers skillfully ration the use of DAP according to the type of land, soil, crop, season, etc.

Low ploughing frequency is practised on fallow lands. DAP input in low amounts in the high Himalayan areas is complementary to the more delicate ecological balance. To take care of the soil moisture content, the ploughing frequency in upland (rainfed) areas is lower than in lowland (irrigated) areas. In upland areas, manure, in most cases, generally in the winter crop season, is applied after sowing because, in addition to increasing soil fertility, it also acts as a mulch to conserve the moisture of the soil.

The emergence of the current DAP management situation has already been discussed in detail and is a vital part of farmers' strategies.

7.1 Livestock Farming

The livestock holding size is according to the requirements of a family and the area specificities. In a cereal and fruit crop farming system, an individual household normally likes to have a buffalo for milk production, a female buffalo calf, a pair of bullocks, and sometimes a cow for the reproduction of bullocks. Male buffaloes are

not kept as they do not fit into the farming system. Male buffalo calves are starved to death a few days after birth. A pair of bullocks is generally kept on 1.5 ha of cropland. Usually marginal and smallholders do not maintain full pairs of bullocks. In this way, they save maintenance costs and use hired bullocks or share. If they keep bullocks, then they hire them out to earn cash income. Some small and marginal landholders raise their income by raising large numbers of goats and sheep. Livestock holding size, in fact, is a functional unit of the livestock population. In a livestock-based farming system, the composition of the livestock herd is different from those in the other systems. The herd consists of a very large number of sheep and goats. Bovine species are given less importance than bovines. Ovines are easier to maintain. Large numbers of livestock can be supported easily on the vast rangeland areas where high quality fodder species grow.

Transhumance in mountain areas is a response to local resource conditions and seasonal scarcity, allowing for the extensive use of natural regenerative processes, the management of risk through movement options, and the exploitation of vertical and horizontal spatial linkages created by the mountain area's diverse landscapes (Jodha and Partap 1993).

The cattle breeds in the mountains are suitable for farming systems with limited resources and are well adapted to a wide range of ecological conditions. The specific traits of the hill and mountain breeds of cattle and their suitability to mountain agriculture will be discussed shortly. Farmers' management of breeds especially suited to diverse local conditions and to specific purposes (e.g., draught power) is the strong potential of traditional strategies. However, no breed is a single-purpose breed. They perform more than one role. For example, goats and sheep, which are conventionally regarded as meat and wool animals, respectively, are also used extensively as pack animals, especially by nomadic mountain communities. In some areas, sheep and goats transport more produce even than conventional pack animals. Pack animals, in addition to performing their usual function, are also used for riding by tourists and thus become an additional source of income. Even bullocks are used as pack animals during transhumance and migration. Occasionally, buffaloes too offer the same service. Among all classes of livestock, except among the transhumant pastoralists, cattle are considered to be the most important, particularly because of their power attribute for mountain agriculture.

7.2 Draught Animal Breeds - Characterisation and Suitability to Terrain

The current conventional development intervention in the livestock sector, which in the mountains is centered around the crossbreeding of local cows with exotic bulls, has been launched to achieve the single target of increased milk production. But this kind of intervention totally ignores the cattle breeds found in the region and their unique role in agro-ecosystems. This programme also ignores the consequences it would have on the DAP system in mountain agriculture. The process of substituting

many local breeds with exotic ones leads to the loss of natural resistance and competitive ability of the animals. It will severely affect the long-term sustainability of the livestock sector.

While some deterioration might have already occurred, local cattle breeds are still thriving and contributing to the system. There is hardly any mention of local mountain breeds in the literature. Of course there are volumes portraying them as 'useless', 'unwanted', 'burden on the hills', 'uneconomic', 'ecological disaster', 'dung-cows' etc. All this is because of ignorance, because no systematic efforts have ever been made to examine the unique traits and characteristics of the poor men's cattle closely.

There cannot be one best breed of cattle or any other livestock species. But there might be a best breed for the farmer, for a farming community, and for a geographical region. Farmer's individual choice, type, and quality of breeding stock available in the community, type of farming system, physiological and regional adaptability of breeds, and a community's sociocultural set-up are some factors determining the population of any breed in a particular farming system or region. Local breeds, thus, are a result of natural selection and the deliberate selection of farmers in a particular area or community. By selecting an ideal breed or breeds in a particular farming system, farmers increase their ability to convert inputs into useful products.

In the central Himalayan areas, including the adjoining plains, there are three important types of cattle breed dominating the area. What is known as the hill or *pahari* breed is the most popular among mountain farmers. It is this breed that contributes the maximum to the farming system in the context of draught power supply and other ecosystem services. But this local breed has not so far been classified scientifically. In the following paragraphs, we have described in brief the basic qualities of the prominent breeds. An effort to characterise the so far non-descript breed has also been made.

i. *Ponwar Breed*

This is a well-defined breed of Indian cattle. It is considered to be a draught breed. Bullocks of this breed are found in the Sitarganj, Nanakmatta, Khatima, and Tanakpur areas of the *Terai* region in the Kumaon Himalayas. The bullocks of this breed are very active and very useful for draught purposes. The cows are poor milkers. These animals have coarse heads; narrow faces; concave foreheads; long, pointed horns; tight sheaths; and long, tapering tails. Black and white are the prevailing colours among these animals. Animals of this breed prefer free grazing on *Terai* grasses. They are well adapted to the hot and humid climate of the *Terai* area and quite resistant to the insects and worms of this region. This breed is generally accepted as the most suitable cattle breed for the *Terai*.

ii. Jwalapuri Breed

This breed has not yet been documented as a cattle breed of India, but it is found in large numbers in the areas of outer Garhwal, namely, Jwalapur, Hardwar, Rishikesh, Bhaguwala, etc.

The body size is small to medium and the colour is white, black, and red and sometimes a mixture of white with black or red colours. The animals are sluggish, with loose skin and short, strong and straight legs. The body is low set and the animals are well adapted to *Terai* conditions and docile in nature. The muzzle, knee, pastern, and switch of the tail are black. The tail is very long, sometimes touching the ground.

Cows of this breed are poor yielders but the bullocks are good draught animals. They are used to performing all agricultural operations but are especially liked for puddling rice fields.

iii. Other Breeds of Cattle

In the *Terai* area of the Indian Central Himalayas, particularly in Kashipur, Rudrapur, Pantnagar, and Kichha, crossbred cattle constitute a major proportion of the livestock population. Crossbred females are reared primarily for their milk. The majority of these animals are crosses of Jersey and Holstein/Friesian with local cattle.

Crossbred females are of very large in size and heavy in weight and are good milk producers, but the males are not ideally suited to field operations. In the *Terai* area they are used for carting heavy loads. Due to their sluggish nature, bulky bodies, and humplessness, they are not used for ploughing and other agricultural operations.

In the hills and mountains, however, non-descript cattle make up the core of the livestock sector. The body size and weight of cattle decrease gradually as we proceed from the Shivalik hills to the Middle Himalayan mountains. The prevalent breeds of cattle are of the draught varieties; they produce good working bullocks highly suitable to mountain conditions, while their progeny give small quantities of milk.

On the basis of body colour, female cattle generally fall into three groups : the white cows called *Dhauri*, the blacks called *Kali* and the reds called *Gauri*. Their male counterparts are locally called *Dhauri*, *Kala*, and *Gauri*, respectively. The body is small, short, and set low with small, strong and straight legs. The hooves are small but compact and most suitable for walking and grazing on steep slopes. The tail is long with a black switch. Small body size, light weight, hardiness, activeness and tolerance of severe cold are the other traits inherent in the local cattle, enabling them to adapt to and perform well in specific geographical conditions. The animals can climb a few stairs and walk easily for grazing, even on steep mountain slopes. The bullocks are well

trained to cross narrow footpaths and rivulets with gravelled bases and to work in small, terraced fields at various altitudes.

Since the mountain cattle breed is non-descript, and hence the animal's body measurements are not available in the literature, we have attempted to describe the breed by way of recording measurements of important body parts indicative of the breed's characteristics. This exercise has been carried out only in relation to male cattle, i.e., bullocks, on which our whole discussion is based. A reconnaissance survey was carried out in which five villages in Tehri district in the Garhwal Himalayas, namely, Sawali, Jagdhar, Dharkote, Dikholgaon, and Pali, were selected. In each village, five pairs of bullocks, in total 50 working bullocks of different ages, were selected for examination. The different measurements are given in Table 7.1.

The average circumference of the mouth just above the muzzle is 39cm with a maximum of 40cm and a minimum of 36cm in different sample bullocks. The average distance between eye and muzzle is 20cm, ranging from 18 to 21 cm. The average values for from ear base to muzzle, poll to muzzle, eye to eye, and horn to horn recorded are 32, 40, 15, and 14 cm, respectively. These figures are indicative of the short face of the bullock breed.

Average length of the horn, ear, and width of the ear are found to be 17, 22, and 11cm, respectively. The average length of the neck is 40 and that of the back 73cm. Average distance between hook and hook, hook and pin, hook and hip bones is the same in each, i.e., 29cm, while the distance between hip to pin is 20cm. These values appear to indicate sloping rumps. The average length between shoulder and pin bone is 113 cm (ranging from 96 to 132 cm) and the average heart girth registered is 151 cm (ranging from 122 to 165 cm). These two values are very important for estimating the live weight of an animal. The heights at hump, shoulder, elbow, and knee are 113, 72, 56 and 36cm, respectively, indicative of the short legs and low set body of the animals. The dewlap of the majority of the bullocks, as observed, is thick, wrinkled, fleshy, and heavy with an average width of 75cm. The average body weight based on the measurements from shoulder to pin bone distance and heart girth (circumference just behind the fore legs) registers 250kg and ranges between 140 and 340kg (Table 7.1).

Farmers in many parts of the mountains identify cattle breeds that appear to be different from the aforementioned ones. For example, farmers in Banali village identify two distinctive breeds of bullocks — Malkoti and Rathi. Malkoti has been named because, they say, their ancestors had brought these bullocks from the Malkot area. The Rathi seems to be a mixture of a local breed and one from Rath.

The latter is a non-descript breed classed among dual-purpose breeds. This is a medium-sized breed found in Rajasthan. The bullocks are compact and active, and the cows are fairly good milkers. However, in general, farmers, almost everywhere,

Table 7.1: Important Body Measurements of Work Bullocks

| Particulars | Average(cm) | Minimum - Maximum(cm) |
|--------------------------|-------------|-----------------------|
| Mouth Circumference | 39 | 36-44 |
| Eye to Muzzle | 20 | 18-21 |
| Ear to Muzzle | 32 | 30-36 |
| Poll to Muzzle | 40 | 36-48 |
| Eye to Eye | 15 | 12-20 |
| Horn to Horn | 14 | 12-16 |
| Horn Length | 17 | 10-29 |
| Ear Length | 22 | 15-30 |
| Ear Width | 11 | 10-14 |
| Neck Length | 40 | 30-55 |
| Back Length | 73 | 66-80 |
| Height at Hump | 113 | 96-129 |
| Height at Shoulder | 72 | 65-81 |
| Height at Elbow | 56 | 33-73 |
| Height at Knee | 36 | - |
| Hook Bone to Hook Bone | 29 | 22-38 |
| Hook Bone to Pin Bone | 29 | 21-37 |
| Hook Bone to Hip Bone | 29 | 23-38 |
| Hip Bone to Pin Bone | 20 | 10-35 |
| Shoulder to Pin Bone (L) | 113 | 96-132 |
| Heart Girth (G) | 151 | 122-165 |
| Belly Circumference | 167 | 150-190 |
| Hoof Length | 6 | 5-9 |
| Hoof Circumference | 27 | 24-32 |
| Dewlap Width | 75 | - |
| Tail Length | 82 | 70-90 |
| Body Weight *, kg | 250 | 140-340 |

* The weights of animals were calculated from body measurements by using the following formula (G.B.Pant University 1982, Singh 1985) :

$$\text{Weight, kg} = L \times G^2 / 10317$$

where, L = Length from point of shoulder to pin bone in cm and

G = Heart girth, i.e., circumference of ani immediately behind the front legs, in c

identify their bullocks by skin colour. While interviewed, most of the farmers referred to only two types of bullocks : *Pahari buld* (the hill bullock) or *Ghariya Bail* (the ox produced at home) and *Desi Bail* or *Malya buld* (the ox from the plains). The third category is that of the *Jersey Bail*, which is how people refer to any crossbred bullock. Since the latter breed is only rarely used for field preparations, it hardly comes into group discussion.

A bullock that does not perform well and sits down in the field while ploughing is locally called *Galya Buld* (the useless ox) and such an animal is sold to traders from outside. Animals that are diseased and weak are also sold. Those with a proven high degree of

draught power are retained for longer periods. Transhumant pastoralists keep the animals that are amenable to herding and capable of walking long distances.

Whereas the characteristics of the majority of cattle breeds found in the plains of India have been described properly, no systematic work has ever been carried out on breeds contributing appreciably to the economy of marginal areas. The breeding management system, based on generations of natural selection and deliberate selection by farmers, that has resulted in the existing local breeds with unique traits for surviving and working efficiently in the mountain environment, deserves appreciation and extensive investigation. This would help to conserve local breeds and ameliorate the whole DAP system.

7.3 Harnesses, Implements and Tools

Harnesses, implements, and tools have not only a marked influence on the amount of DAP generated, but the use of DAP would be impossible without the help of these implements.

The use of poorly-designed harnesses and yokes causes inefficient transfer of power from the animal to the implement. Improper hitching requires the animal to exert greater tractive efforts than actually needed to overcome the implement draught (Goe 1983). Farmers generally use light wood (such as that of the ash tree in the upper region of Garhwal, for example) to make yokes. Such yokes are adjustable and comfortable, allowing for increased tractive effort on the part of the animals. The leveller farmers use is also light, and sometimes when it does not work, especially when preparing fields after rice harvest, the levelling process is assisted by manual operations (breaking of clods). In many parts of the Himalayas, where wood from the desired species is not available, the yokes are somewhat heavier (for example, those made of pine wood).

Ploughshares are constructed almost always from oak wood. This is the most important part of a plough. Every family keeps two ploughshares in the case of emergency. Two ploughshares a year are needed. The iron part of the plough is usually pointed like a javelin, rather than being flat as found in the plains, because it has to take care of the gravels and stones found in mountain soils. Puddlers and weeders are made of wood only. No iron is used in them. The weeder (locally known as a *danala*) is consumed very rapidly. In many cases, one *danala* is hardly usable by the next cropping season.

Materials used in harness construction are sometime treated with a preservative, e.g., mustard oil, to increase its lifespan.

All families have hand tools. Even families that hire in bullocks for land preparation will have agricultural implements at home. In our survey, Bagauri village is the exception. The entire village depends on hiring bullocks and ploughs for land preparation.

The agricultural implements and tools, as well as the harnesses, are all made from locally available materials (except for iron ploughshares and the iron parts of hand hoes) and by local persons specialised in the field. These tools and implements are designed by the farmers in such a way that they not only fulfill their needs but also fit into local conditions. The harnesses, tools, and implements, indeed, reflect local traditional art, science, and technology.

A list of district-wise agricultural tools and implements, based on the latest figures available at the district statistical offices, is presented in Table 7.2. Traditional wooden ploughs are maximum in number, reflecting their suitability for mountain agriculture. The 'improved' tools and implements, being popularised by the public system and distributed under various development schemes free of cost, as well as being sold at subsidised rates, cannot replace the traditional ones. Threshing machines, sprayers, sowing machines, and tractors could be introduced, mostly in the plains of the Nainital and Dehradun districts. Certain 'improved' designs fail to show a marked advantage over traditional types in mountainous areas. They are usually heavier than the traditional types, costs (if not available at subsidised rates) are higher, materials for construction are not always readily available, and they may require special tools and components for repair. If the agricultural implements were suitable to the area-specific conditions and are more effective than the traditional types, the farmers would readily accept them.

Table 7.2: Agricultural Implements in the Districts of the Central Himalayas, India

| Districts | Wooden Plough | Iron Plough | Improved Harrow & Cultivator | Threshing Machine | Sprayer | Improved Sowing Machine | Tractor |
|-------------|---------------|-------------|------------------------------|-------------------|---------|-------------------------|---------|
| Pithoragarh | 92194 | 3419 | 667 | - | 344 | 212 | 1 |
| Almora | 128488 | 3543 | 14427 | 707 | 23 | 1032 | 3 |
| Nainital | 39039 | 48333 | 13231 | 6642 | 3320 | 3662 | 7292 |
| Uttarkashi | 37416 | 657 | 336 | 22 | 98 | 3 | - |
| Chamoli | 63243 | 39 | 6 | 1 | 1 | 683 | - |
| Pauri | 67166 | 2595 | 353 | 42 | 42 | 5 | 16 |
| Tehri | 81321 | 85 | 202 | 1 | 1 | 2 | 2 |
| Dehradun | 28313 | 15620 | 1079 | 566 | 566 | 425 | 673 |
| Total | 537180 | 74291 | 30301 | 7981 | 4395 | 6024 | 7987 |

Compiled from the statistical books published by the respective district statistics' offices.

The figures are according to the 1988 Animal Census.