

CHAPTER 2

The State of Mountain Agriculture in Bhutan

Introduction

Bhutan is a landlocked, mountainous country situated in the eastern part of the HKH region. It has an area of about 46,000 sq. km and a population of 0.6 million. The elevation ranges from 1,500 masl in the southern strip to 5,000 masl in the middle mountains, and up to 7,500 masl in the high mountains. It has a great diversity of agro-climatic conditions favourable for a variety of crops and for raising livestock. Each valley has unique climatic characteristics resulting from differences in altitude, rainfall, and exposure to sun and wind.

The country's economy is essentially based on agriculture. Subsistence farming is the main occupation of the majority of the population, more than 85% of whom live in rural areas; and more than 95% of the population depends directly or indirectly on agriculture for its livelihood. The primary, or renewable natural resources (RNR), sector (agriculture, livestock, and forestry) remains the dominant economic sector in Bhutan, although it is currently declining in importance (see Table 2.1). This sector accounted for 37.5% of GDP in 1995 when it employed about 78% of the economically active adult population. The average annual growth in real terms in this sector between 1980 and 1995 was 3.5%. Hence, although it is growing other sectors are growing faster so it is becoming relatively less important.

Estimates for land cover, based on analysis of satellite data, show that in 1994 forests accounted for 73% of the land area, and cultivated areas for 8%. Given the location of their farms and the primitive transportation network, most Bhutanese farmers integrate their activities so as to become self-sufficient, producing a variety of grains, fruit, vegetables, and dairy products and harvesting both timber and non-timber forest products. Bhutan became a net importer of food in the early 1960s as a result of the growing urban population and the growing work force involved in development activities. The current level of food self-sufficiency is about 65%. Despite significant improvements in yield, the output of food grains has not been able to keep pace with the increasing demand.

Table 2.1 shows the share of the three main components in the primary sector and their contribution to GDP between 1980 and 1995. The contribution of all three components to GDP declined by around one third. One of the main causes has been continued social and economic

Table 2.1
Share of the primary sector in the GDP (%)

Sub-sector	Share of 1980 GDP	Share of 1990 GDP	Share of 1995 GDP
Agriculture	27.8	23.5	20.2
Livestock	12.4	9.4	8.2
Forestry and logging	15.5	11.1	9.1
Total primary sector	55.7	44.0	37.5

Source: UNDP Development Cooperation Report, 1996

improvements, for example, in transportation and communication, which have resulted in a policy shift towards the growth of the secondary (mining, quarrying, construction) and tertiary (trade, transport, finance) sectors. This has led to a significant change in the composition of the GDP.

Of the country's 46,000 sq. km of land, only about eight per cent is considered suitable for arable agriculture and a further four per cent for use as pasture. The largest part is covered by forest. Despite the relatively low population density (15/km²), the average Bhutanese family in the north owns a farm of only about 0.8 ha. Table 2.2 suggests that the majority of households have landholdings of less than one hectare. Households with insufficient land of their own enter into tenancy contracts and share cropping arrangements to get additional land for food production. An estimated seven per cent of all rural households are landless. Most of the land currently under cultivation lies in small and often isolated pockets along the main river valleys and throughout the southern foothills. Farming in Bhutan is not easy, because the steep slopes of most agricultural land make farming labour intensive and farm mechanisation is often not possible.

Table 2.2
Percentage of farm holdings of different sizes (in ha)

Farm size class(ha)	Lhuntshi % of HHs	Mongar % of HHs	Tashigang % of HHs	Pemagatsel % of HHs
<0.5	21	11	16	16
0.5-1.0	20	23	22	36
1.0-1.5	17	28	17	31
1.5-2.0	9	19	16	11
2.0-3.0	19	12	18	5
>3	14	7	12	2

Source: Ministry of Agriculture (1991)

Farming and Cropping Systems

Most farming in Bhutan consists of subsistence crops and animal husbandry. Subsistence farmers practise shifting cultivation, growing mainly maize as a food security measure. Transhumance pastoralism is prevalent throughout the northern range of Bhutan at altitudes of 2,800-4,500 masl. The migratory communities depend mainly on yak and cattle. Depending on the areas, they also include sheep and goats. The communities lead a semi-nomadic life, moving from one permanent habitation to another, depending on the season and the availability of pasture. They trade livestock products for food crops (rice) and other necessary commodities during the winter,

when they live at lower altitudes. During the summer they cultivate their land with barley, millet, and buckwheat.

Shifting cultivation, 'tsheri', is a predominant form of land use in Bhutan that is practised over an extensive area, especially in the eastern region. The total area under shifting cultivation is estimated at 115,000 ha (based on satellite imagery, 1983), or 32% of the total cultivated area of the country. However all areas are not under cultivation at a time. In shifting cultivation 30-40% of the land remains as fallow, regenerating areas—and farmers will back land at 4-to 10-year intervals. In eastern Bhutan, up to 79% of the cultivated land is under *tsheri* (Partap and Watson 1994). The type of shifting cultivation practised in Bhutan is a 'montane' variant—practised predominantly on steep slopes—and differs from that in other parts of the HKH (e.g., in Meghalaya). The intensity of land use is also lower as a result of the very low population density.

The crops grown under shifting cultivation depend on the altitude (Table 2.3). The dominant cropping systems are based on potatoes, rice, or maize with wheat, barley, and buckwheat as the predominant winter crops. Maize is the major crop produced (67% of the output). Farming practices are characterised by a minimum application of external inputs and, typically, a five-year fallow. Shifting cultivation is practised to reduce the risk of crop failure and to compensate for food deficits. Almost all shifting cultivators are subsistence farmers.

Farming systems based on food grain crops are found in the valleys and on valley terraces with slopes of less than 30 degrees. The valley terraces are normally irrigated. This type of land accounts for 18% of the cultivated land and is normally used to grow rice in summer and wheat in winter. Potato, buckwheat, mustard, maize, and vegetables are also grown, depending on altitude.

Rainfed farming is quite common on terraces with slopes greater than 30 degrees. Maize is the major summer crop on these terraces. Wheat, barley, mustard, pulses, buckwheat, and potatoes are major winter crops. At present, potatoes are becoming popular as a cash crop.

Table 2.3
Crops grown under shifting cultivation at different altitudes

System	Cycle	Altitude (masl)
Upper temperate regions (rainfed) (Bumthang, Wangdiphodrang, Tongsa)	Fallow 5-15 years Bitter buckwheat (year 1) Sweet buckwheat (year 2) Wheat (years 2/3)	2500-3400
Potato based (rainfed)	Potato/sweet buckwheat (year 1) Wheat or same as above (year 2)	2500-2900
Wheat, barley, buckwheat	Various combinations such as: Year 1: buckwheat /wheat Year 2: wheat Year 3: buckwheat/wheat, wheat, or barley followed by buckwheat	2000-3000
Rice based	Rice, fallow Rice, wheat/barley/buckwheat Rice, maize/mustard	1000-2600
Maize based	Maize/buckwheat (same year)	900-2400

Compiled from Roder and Gurung (1990)

Food Grain Crops and Potatoes

Table 2.4 shows the productivity of the major crops in 1981, 1984, and 1995. The reported yields for most of the major staple crops remained more or less constant from 1981 to 1995, apart from a slight increase in rice after 1984 and an increase in the average potato yield between 1981 and 1984.

Table 2.4
Yield of principal crops over time

Crop	Yield (MT/ha)		
	1981	1984	1995
Maize	1.4	1.5	1.4
Paddy	2.1	2.1	2.4
Wheat/Barley	1.1	1.1	1.1
Buckwheat/millet	0.8	0.8	0.9
Potatoes	6.7	8.0	7.7

Sources: CSO (1989A); LUPP (1995)

Table 2.5 shows the latest available data on the area used for cultivation of different food grain crops, the yield per ha, and the total production. Rice and maize are the principal crops and together account for more than half the total weight of the country's annual crop production. While the country is virtually self-sufficient in maize, barley, millet, and buckwheat, it is only 65% self-sufficient in wheat and 64% in rice. To meet the food shortage, rice and wheat are imported from India by the Food Corporation of Bhutan (FCB) and private traders.

Maize is the most important single cereal grown. In 1984, maize occupied 37% of the cultivated land and contributed 46% to the total food grain production of the country; in 1995 it occupied the greatest area of land of any of the staple crops and contributed 35% of the total weight of food grain (without potatoes). Maize is found growing up to altitudes of 2,900 m, although yields are moderate. Maize rather than rice occupies the largest area of land in the east where it forms the staple in the diet. Rice and maize are grown in all zones except the western cool, temperate zone where wheat, buckwheat, potatoes, mustard, and barley are produced instead. Where irrigation is available, wet land crops in winter include wheat, mustard, and potatoes. The only new basic food crop is the potato, which is now cultivated in the temperate zone and is suitable for export, as it has a high yield (Table 2.4).

Table 2.5
Area, production and yields of staple crops in Bhutan, 1995

Crop	Area(ha)	Production (MT)	Yield(kg/ha)
Barley	4,406	4,849	1,100
Buckwheat	7,290	6,443	883
Maize	55,473	75,380	1,358
Millet	10,319	9,159	887
Mustard	4,782	3,686	770
Potato	5,631	43,325	7,694
Rice	45,086	107,877	2,392
Wheat	9,568	10,747	1,123
Total	142,555	261,466	

Source: LUPP (1995)

Horticultural and Cash Crops

The area planted under different cash crops in 1995, the production in tonnes, and the yields are shown in Table 2.6. Apples, oranges, and areca nuts are the main fruit crops with cardamom being another important cash crop. Orchards and plantations are mainly concentrated in the warm temperate zone (apples at higher altitudes) and the humid and wet subtropical zones (oranges and cardamom at lower altitudes). These commodities are exported to Bangladesh and India in substantial quantities. The attractive markets for these cash crops have encouraged farmers to grow more. An estimated 16,250 households now supplement their incomes from them. The area under this production system is increasing by as much as 15% annually, according to some estimates. Fruit trees are mostly grown on gently sloping, rainfed terraces.

Oranges rank first among the fruit tree crops in terms of land use, total production, and yield per ha. Most of the orange plantations are confined to the foothills at altitudes ranging from 200 to 1,500m and the bulk of the produce is exported to India. In 1984, the total area planted with orange trees was about 7,800 ha with an annual production of 38,700 mt (Roder and Gurung 1990), by 1995 this had increased to 8,040 ha and 77,000 mt (Table 2.6). Orange orchards vary from small plots with a few trees to plantations of up to 5 ha.

Apples were introduced to Bhutan about 30 years ago, but it is mainly in the last 10 years that the production has risen to commercial importance. Estimates based on an average yield of 50 kg per tree after eight years indicate that apple production will rise to three times the current level without any further increase in planting. The main variety planted is red delicious, followed by golden delicious and royal delicious. These three varieties account for over 90% of the area of apples. More recently, a greater range of varieties has been made available to cater to more diverse markets.

Cardamom is both profitable and not highly labour intensive and is thus suitable for smallholder production. It contributes to export earnings from India and other countries. However, a substantial amount of firewood is needed when the pods are cured and this has led to controls on the expansion of the area under cardamoms. Unless an appropriate alternative system of drying is found, this limit will remain.

Table 2.6
Area, production and yields of major cash crops in Bhutan in 1995

Crop	Area (ha)	Production (mt*)	Yield (kg/ha)
Apple	1,966	9,266	4,712
Areca nut	112	1,073	9,563
Cardamom	6,973	3,980	570
Chilli	683	887	1,298
Ginger	1,140	4,503	3,950
Legumes	1,647	2,098	1,273
Orange	8,040	77,031	9,581
Vegetables	5,990	22,257	3,715
Total	26,551	121,095	

Note: *mt = tonnes

Source: LUPP (1995)

The yields of fresh vegetables and ginger are relatively better than those of legumes and chilli (Table 2.6). Orange and areca nut also show good yields but the yields of apple seem low.

Table 2.7 shows the area planted with various fruit, vegetable, and other cash crops in 1986 and 1995. The area of orange plantations barely changed, whereas that of apple orchards increased by a third. The largest change was seen in the area used for vegetable production—an increase of more than seven times to nearly 6,000 ha. The area under cultivation for ginger and potatoes also increased by two to three times, whereas that used for chillies and cardamom actually went down.

Table 2.7
Area planted with various fruit, vegetable and other cash crops in 1986 and 1995 (hectares)

	1986	1995	Change %
Apple	1,480	1,966	32.87
Orange	7,849	8,040	2.42
Vegetables	737	5,990	723.29
Ginger	464	1,140	145.59
Chilli	975	683	-29.9
Potatoes	2,064	5,631	172.82
Cardamom	8,782	6,973	-20.59

Source: Wangchuk (1993); LUPP (1995)

Livestock

The most important livestock in Bhutan are cattle, mithun, yak, horses, sheep, poultry, and pigs. The livestock census of 1994 counted about 246,000 head of cattle (including 13% cross breeds), 53,000 mithun (including hybrids), 37,000 yak (including yak hybrids), 32,000 sheep, 16,030 goats, 22,071 horses, 158,000 poultry, and 46,000 pigs. Livestock production makes a considerable contribution to GDP, but concerns have been raised about productivity and the impact of growing livestock populations on the sustainability of agriculture and the environment. Livestock provide many essential items like meat, milk, cheese, and wool, which are also used to generate cash income to purchase other household commodities, and animals like yak and mithun are used extensively for the transportation of goods across the steep mountains. In all the agroecological zones in Bhutan, large livestock are an integral part of the farming system, providing draught power; a source of manure, which is used extensively to maintain soil fertility; and a source of livestock products for home consumption. Individual households may own an average of five to six head of large livestock, but most of the animals are assembled in large groups that move between the forests in the winter and alpine pastures in the summer.

Table 2.8 shows the population of various types of livestock in 1986 and 1995. The cattle population declined by 23% and buffalo by 42% over the ten-year period, whereas the goat population increased by 16.4%. The numbers of sheep and yak remained almost constant.

Table 2.8
Changes in the livestock population and composition in Bhutan

	1986		1996		Change in population between 1986- 1996	Change in % share in the total population bet.1986-1996
	Population	% share in the total population	Population	% share in the total population		
Cattle	340262	74.5%	261970	64.9	-23.0	-9.6
Buffalo	5037	1.1%	2889	0.7	-42.6	-0.4
Sheep	43771	9.6%	34465	8.5	-21.3	-1.0
Goat	31757	7.0%	66320	16.4	108.8	9.5
Yak	35694	7.8%	37871	9.4	6.1	1.6
Total	456521	100.0%	403515	100.0		

Source: Statistical Yearbook of Bhutan 1996, Central Statistical Organisation, Ministry of Planning, Royal Govt. of Bhutan