

Chapter 4

Landuse Efficiency, Cropping Pattern & Agricultural Productivity in Sikkim

4.1 Land use efficiency – Productivity Measures (Agricultural):

Efficient Resource Allocation is a situation in which it is not possible to reallocate available resources so as to achieve more of one objective without accepting less of another. This applies whether the resources are those available to an individual, a firm, or a govt. If an individual could gain by shifting expenditure from one good or service to another, the existing allocation is not efficient. If a firm could shift resources so as to achieve more of one objective, profit for example, without accepting less of another, say growth, the existing allocation is inefficient.¹

The main resource in the earth is land. The land is degraded for many reasons. Sometimes it is caused by the interference of human beings. There may be technical problems but the main reason of land degradation is economic as opined by Edward. According to him, the marginal agricultural lands in the developing countries are less productive and thus generate low income to the poor. The poorer people try to increase their agricultural lands by converting the forests in to cropping lands. As a matter of fact, the use of such land is easier and cheaper. As a consequence, the land degradation further expands for such use of frontier and marginal lands

A study in 1990 shows that the annual deforestation rate in tropical countries was 0.8% (5.4 million ha per annum) during 1981-90, among them the highest rate of deforestation occurs in Asia (1.2%). Another interesting survey was conducted in 1997 [Barbier & Burgess, 1997] in 53 tropical countries to explain the determinants of deforestation. The results showed that the increase in population density increases forest clearance; rising per capita income and agricultural yields reduced the demand for forest conversion. So, it was concluded that as countries develop economically and as the productivity improves, deforestation should be low.

The poorest 20% of the rural population in developing countries was mainly concentrated in low potential lands as opined by Leonard et al. (1989). Low potential is defined as resource poor or marginal agricultural lands, where inadequate rainfall, adverse soil conditions, fertility and topography limits agricultural productivity and increased the risk of soil degradation. Out of 75% of the poorest 57% in Asia, 20% in Latin America and 51% in Africa can be found in low potential lands.²

Generally, the mountain area has many constraints for cultivation. The mountain soil is not very fertile because of limited soil components and chances of further deterioration by landslides or other natural calamities. The high altitude area naturally has low temperature and cold weather throughout the year that renders diversification of agriculture difficult. The low irrigational facility has compelled the people for low yield from agriculture. Normally, the high altitude area has very few flat pieces of lands. They practiced terrace cultivation, but it is very costly and labour intensive. The poor communication leads to less usability of fertilizer for the enhancement of production as well as productivity.

Sikkim is a tiny hill state with common mountain features. The people of Sikkim are practicing terrace cultivation and struggling for more agricultural production. But, due to geographical constraints, production and productivity are not enough to feed the increased population. If we see the production figure of agricultural crops in different time periods at equal intervals, the tendency can be traced automatically. The data of agricultural production from 1975-76, 1985-86, 1995-96 and 2000-01 have been given to show the changes.

The agricultural income has been divided into two broad aspects: a) Income from non-commercial crops and b) Income from commercial crops. So, the discussion will be made keeping in mind the above aspects.

The traditional or non-commercial crops of Sikkim are Rice, Maize, Millet and Buckwheat. These crops are grown traditionally for domestic consumption. Since late 1970s to early 1980s, the wheat cultivation got popularity and its production increased manifold. The commercial crops are Ginger, Potato, Mandarin, off-season vegetables and the indigenous large Cardamom etc.

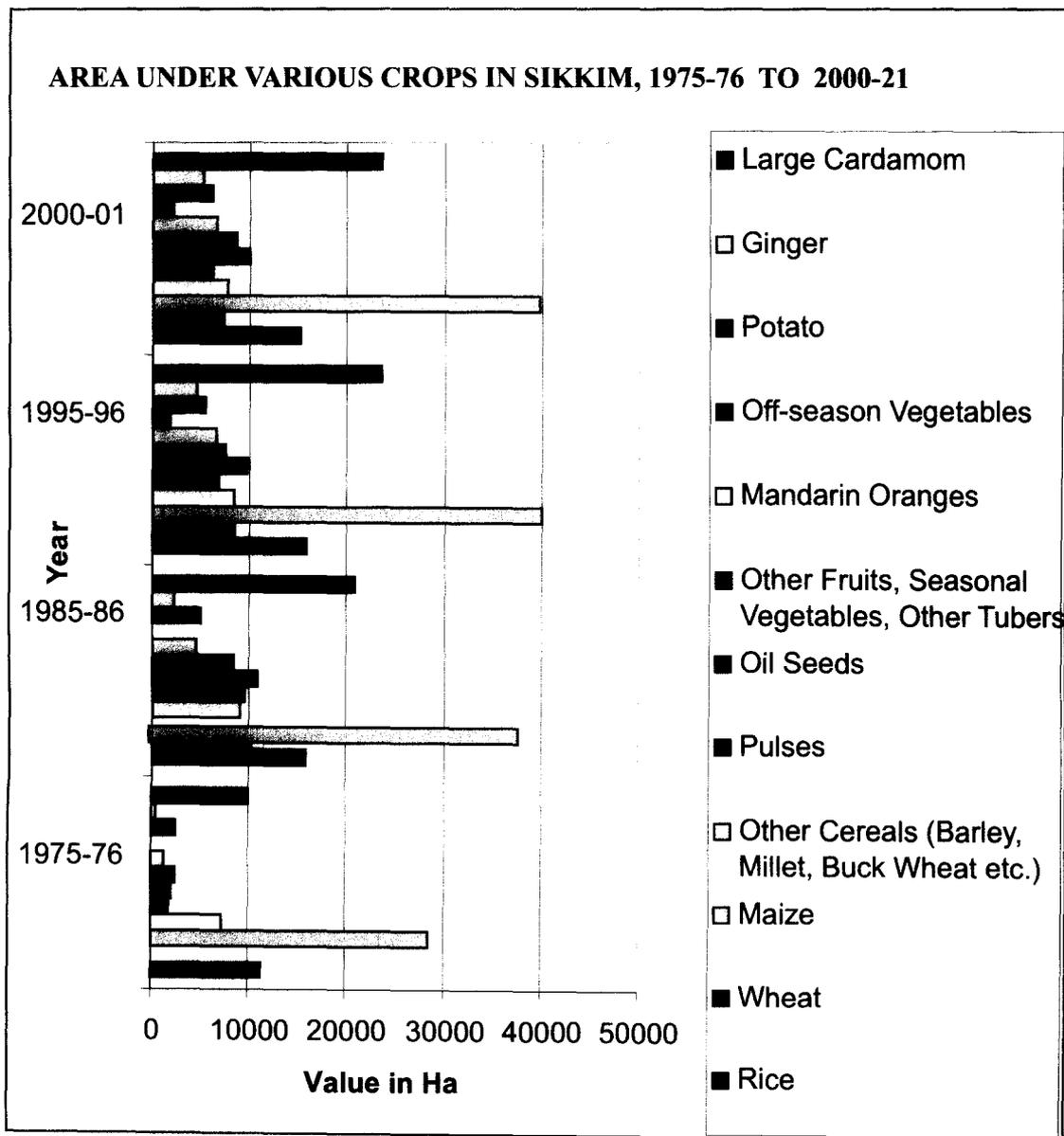
Table 4.1: Area (Ha) under various Crops in Sikkim from 1975-76 to 2000-01

CROP NAME	1975-76	1985-86	1995-96	2000-01	Gain/loss in 25 years(%)
Rice	11400	15900	15940	15210	33.4
Wheat	150	10100	8420	7210	4706.7
Maize	28500	38100	39940	39900	40.0
Other Cereals (Barley, Millet, Buck Wheat etc.)	7200	9000	8270	7690	6.8
<i>Total Cereals</i>	<i>47250</i>	<i>73100</i>	<i>72570</i>	<i>70010</i>	<i>48.2</i>
Pulses	1700	9500	6730	6030	254.7
Oil Seeds	2000	10750	9730	9990	399.5
Other Fruits, seasonal vegetables, other tubers	2600	8450	7400	8650	232.7
Total Common Crops	53550	101760	96430	94680	76.8
Mandarin Oranges	1400	4600	6600	6650	375.0
Off-season vegetables	0	20	1700	2020	0
Potato	2400	5000	5500	6200	158.3
Ginger	500	2300	4500	5100	920.0
Large Cardamom	10000	20900	23550	23480	134.8
Total Cash Crops	14300	32820	41850	43450	203.8
Total Cropped Area	67850	134580	138280	138130	103.6

Source: Sikkim: A Statistical Profile 2002, DESME, Government of Sikkim

The above table shows the area under different crops. The total cropped area has increased more than 100% (103.6%). This increase in area made it possible to cultivate by converting land from other cultivable wasteland or land converted from forest. It can be followed from the table that the traditional crop (rice and cereals) area increased till mid-eighties, but after that the area decreased gradually. The area under wheat production increased remarkably (4706.7%). Wheat was introduced in Sikkim in the late '70s. So, in early eighties and early nineties the area under wheat production increased substantially. People also started growing cash-crops like mandarin oranges, potato, ginger etc, and the area under horticultural crops increased remarkably. The production of off-season vegetables was not a common practice earlier. The farmers started to cultivate these after the merger of the state with India and subsequently the area under such crops increased substantially. The area under pulses, oil-seeds, potato, mandarin oranges etc too increased during this period. The area under cereal crops increased by 48.2%, whereas, the total area under common crops reached 76.8%. This difference is caused by an increase in area for production of pulses, oil-seeds and horticultural crops. All the cash/commercial crop areas increased significantly. Actually, Sikkim started to switch from traditional crop to commercial/cash crop since its merger with India. It is evident from the figure (203.8%) of area under total cash crops. The area under traditional crops declined during late eighties to mid-nineties. But during this period the area under cash crops or horticultural crops increased. Thus, it can be concluded on the basis of the secondary data that the land use practice of the people of Sikkim was changing from traditional practices. More and more people were shifting from their age-old traditional cereal based agriculture to cash-crop based agriculture to maintain their livelihood with limited resources and increasing population pressure.

Figure 4.1: AREA UNDER VARIOUS CROPS IN SIKKIM, 1975-76 TO 2000-21



Source: Sikkim: A Statistical Profile 2002, DESME, Government of Sikkim

Table 4.2: Change in Crop Production (in Tonnes) in Sikkim:

CROP NAME	1975-76	1985-86	1995-96	2000-01	Gain/loss in 25 years(%)
Rice	10000	16500	21870	21350	113.5
Wheat	150	16200	15300	10100	6633.3
Maize	16500	47600	56560	59610	261.3
Other Cereals (Barley, Millet, Buck Wheat etc.)	4500	7700	8060	6970	54.9
Total Cereals	31150	88000	101790	98030	214.7
Pulses	700	8450	5910	5160	637.1
Oil Seeds	700	10250	7640	7380	954.3
Other Fruits, seasonal vegetables, other tubers	3200	17800	23300	27750	767.2
Total Common Crops	35750	124500	138640	138320	286.9
Mandarin Oranges	3600	5000	7000	7500	108.3
Off-season vegetables	0	40	7600	9550	0.0
Potato	5000	16400	24000	25500	410.0
Ginger	2000	10900	2400	2400	20.0
Large Cardamom	2300	3900	3600	4670	103.0
Total Cash Crops	12900	36240	66200	71220	452.1
Total Crop Production	48650	160740	204840	209540	330.7

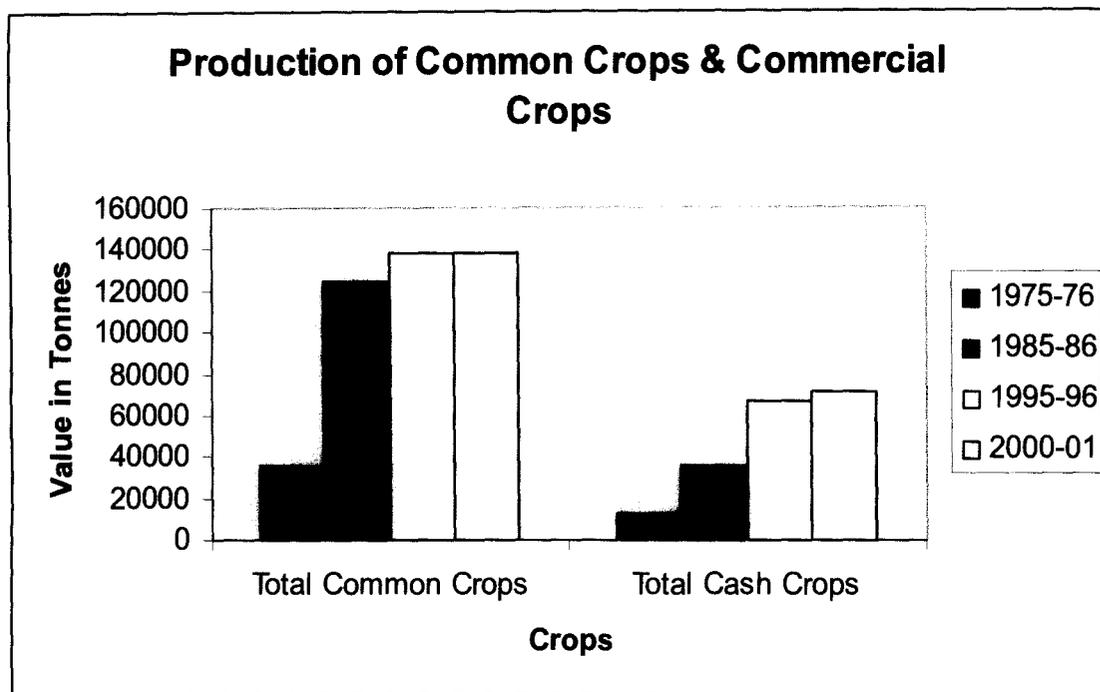
Source: Sikkim: A Statistical Profile 2002, DESME, Government of Sikkim

It has already been stated that the area under production has increased in case of cash-crops from the time of Sikkim's merger with India, and the traditional cash crops' production area decreased since late-eighties. The production of all the crops has increased manifold from 1975 to 2001. But it is interesting to see that during late eighties to mid-nineties the production of cereals have started to decline except for maize and fruits or seasonal vegetables. The production of total cereals has increased by 214.7%. But the production of the total common crops has increased by 286.9%. The difference is caused by production of pulses, oil seeds and various fruits or tubers. The production of all the cash crops like mandarin oranges, potato, ginger etc have increased substantially with uniformity. The production of ginger has decreased remarkably. The production of off-season vegetable has been introduced since mid-eighties and increased thereafter to a large extent. The production areas of commercial crops have been increased manifold but the production did not. It happened due to fall in productivity. The production of total cash-crops has increased substantially to 452.1%. This increase is contributed by potato and off-season vegetables which helped the farmers to get more profits.

Sikkim produces many crops and maize is the most important one. The production of maize has decreased from 1997-98 to 1999-2000. The rice production was in second position, followed by wheat. The production of almost all crops has decreased in 1999-2000. In 1998-99, there was a very long spell of dryness in Sikkim. According to the Agricultural department of Sikkim, the total rainfall was 93.34mm, which was lowest over last 25 years. It had visible adverse affect on the economy, especially, on rabi and cash crops and obviously on drinking water in mountains. It also had adverse impact on the main cash crop, cardamom. It is estimated that sixty percent of the state's large cardamom was lost during that spell.

The South district ranked first in horticultural production except potato and fruits. The North district was first in the production of cardamom, while the West district was first in the production for potato. East district was first amongst the four for the production of fruits.

Figure 4.2: Production of Common and Commercial Crops from 1975-76 to 2000-01



Source: Sikkim: A Statistical Profile 2002, DESME, Government of Sikkim

The productivity is defined as production of per unit land. Generally, in India, agricultural productivity is measured in kg. per Hectare. The productivity of land depends on various factors. The character of soil, weather of the particular area, precipitation, availability of water, topography, irrigational facility, fertilizer availability etc. are important factors that can change the productivity of a particular produce.

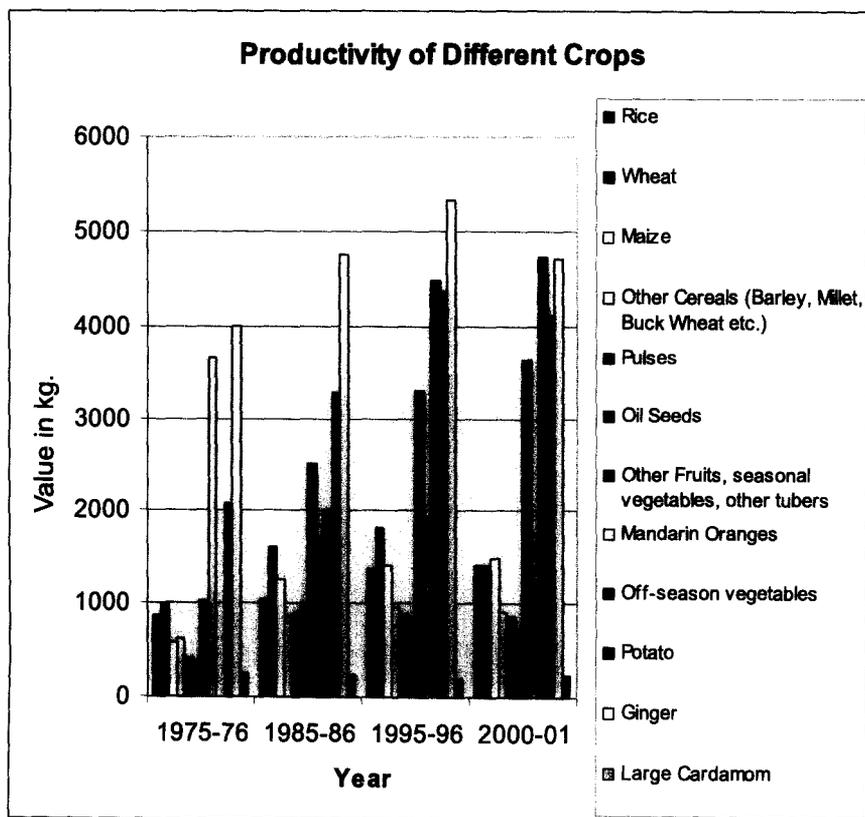
Table 4.3: Change in Productivity (in Kg) of Various Crops:

CROP NAME	1975-76	1985-86	1995-96	2000-01	Gain/loss in 25years
Rice	877	1038	1372	1403	59.97
Wheat	1000	1604	1817	1400	40
Maize	579	1249	1416	1494	158.03
Other Cereals (Barley, Millet, Buck Wheat etc.)	625	855	974	906	44.96
Total Cereals	659	1203	1402	1400	112.44
Pulses	412	889	878	857	108
Oil Seeds	350	953	785	739	111.14
Other Fruits, seasonal vegetables, other tubers	1015	2514	3290	3651	259.7
Total Common Crops	667	1223	2067	1460	118.89
Mandarin Oranges	3675	1672	1928	1764	-52
Off-season vegetables	0	2000	4470	4728	
Potato	2083	3280	4363	4112	97.4
Ginger	4000	4739	5333	4705	1762
Large Cardamom	255	233	191	233	-8.62
Total Cash Crops	1001	1340	1937	1894	89.21
Total Crop Productivity	732	1248	1568	1584	116.39

Source: Sikkim: A Statistical Profile 2002, Government of Sikkim

It is found from the table as well as from the diagram below that the productivity of rice has increased (59.97% in 25 years) day by day since Sikkim's merger with India. In case of wheat the productivity increased up to 1995-96 but decreased again since 2000-01. The productivity of maize has increased consistently since 1975-76. In case of other cereals and total cereals, the productivity has increased up to 1995-96 and again decreased since 2000-01. In case of pulses and oil seeds, the productivity increased sharply in 1985-86 but again decreased slowly since then. The productivity of other fruits, seasonal vegetables, and other tubers has increased sharply since 1975-76 and it is as high as 259.7%. In case of total common crops, the productivity has increased since 1975-76 to 1995-96 and again decreased in 2000-01. As productivity is concerned with the soil quality, irrigational facility etc, the productivity could increase only up to certain limit. The scope for further increase is very limited.

Figure 4.3: **Productivity of Various Crops from 1975-76 to 2000-01**



Source: *Sikkim: A Statistical Profile 2002, DESME, Government of Sikkim*

Table 4.4: **Area , Production and Productivity of Horticultural Crops:**

Year	Crops	Area('000ha)	Production('000ton)	Productivity(kg/hact)
1998-99	Fruits	5.83	8.337	1453
	Vegetables	5.22	24.17	4704
	Spices	7.11	33.04	4725
	Roots & Tuber Crops	15.53	1.28	81
2002-03	Fruits	7.13	11.2	1570
	Vegetables	7.78	37.18	4781
	Spices	26.97	35.41	1313
	Roots & Tuber Crops	7.26	30.83	4246
2003-04	Fruits	7.65	11.52	1510
	Vegetables	8.52	41.89	4919
	Spices	31.7	38.71	1222
	Roots & Tuber Crops	7.91	35.19	4449

Source: Adapted from Sikkim: A Statistical Profile 2004-05, DESME, Govt. of Sikkim, Gangtok

The horticultural department has laid emphasis on horticultural crops like Mandarin, Large Cardamom, Ginger, Turmeric, Potato and other fruits. The quantity of Ginger production was highest in 1998-99. But the most important commercial crop is Large Cardamom. Sikkim is the chief producer of Large Cardamom in the country. It is very surprising that the productivity of spices has decreased suddenly in 2002-03 and deteriorated further in 2003-04 though the area of cultivation has increased sharply by more than four times from 1998-99 to 2003-04. The production of Roots & Tuber

Crops has increased substantially high but the area under production became almost half than 1998-99. The production, productivity as well as area under production for vegetables have tended to increase every year.

4.2 Cropping Patterns:

The Cropping systems of a region are decided by a number of soil and climatic parameters which determine overall agro-ecological setting for nourishment and appropriateness of a crop or set of crops for cultivation. But at farmers' level, potential productivity and monetary benefits act as guiding principles while opting for a particular crop/cropping system. These micro level decisions with respect to choice of crops and cropping systems are further narrowed down under influence of several other factors related to infrastructure facilities, socio-economic factors and technological developments, which are operating interactively at micro-level. These are: a) *Infrastructure facilities*: Irrigation, transport, storage, trade and marketing, post-harvest handling and processing etc. b) *Socio-economic factors*: Financial resource base, land ownership, size and type of land holding, household needs of food, fodder, fuel, fibre and finance, labour availability etc. and c) *Technological factors*: Improved varieties, cultural requirements, mechanization, plant protection, access to information, etc.³

In Sikkim, there is a visible lack in the development of infrastructure. The irrigation facility is very much limited. The transportation is also very inadequate due to steep terrain. The storage facility is limited. The lack of communication also leads to lack of marketing, because, the produce can not be transported from the remote villages to market places. The provision of post harvest handling and processing of agricultural produces are also very much lacking.

The socioeconomic factors have direct impacts on the cultivators to make a decision for changing cropping patterns. The financial resource bases of the cultivators have increased after the merger of Sikkim with India. The financial institutions (banks, co-operatives etc) made various options for the financial assistance to the farmers.

The average size of operational land-holdings by all social groups has been shown in the following table since the merger of Sikkim with Indian Union. The average size for marginal holding decreased from 0.50ha to 0.40 ha since 1976-77 to 1991-92. The same picture can be seen in large landholdings. Interestingly, the small, semi-medium and medium holdings have increased marginally. This might have happen due to further marginalization of land-holdings due to population pressure and increasing proletarianisation in the state.

Table 4.5 : Average Size of Operational Land-holdings in Sikkim

Category	1976-77	1980-81	1985-86	1991-92
Marginal(below 1ha)	0.50	0.47	0.50	0.40
Small(1-2 ha)	1.45	1.44	1.40	1.70
Semi-medium(2-4 ha)	2.84	2.80	2.80	3.00
Medium(4-10ha)	5.86	5.78	6.00	6.10
Large(10 and above	18.44	15.89	2.20	18.00

Source: Compiled from the data of Agricultural Situation in India, Vol.40 & 50, No.2 & 4, GoI.

The technological development for getting high production is lacking. The use of HYV seeds, fertilizer, technical know-how for the betterment of the agricultural process - all these factors have very limited usability.

Like other mountain states, in Sikkim, the areas with low elevation grow paddy and fruits like mandarin. The high altitude areas grow maize and potato, besides large cardamom. So, the farming system in Sikkim is mainly divided into two broad categories: Maize-Potato dominated system and Cardamom dominated system. The cropping sequence varies in different farming systems. In Maize-potato farming system, potato is harvested in January and Maize in the middle of February. Ginger is harvested in middle of April and pulses in middle of July followed by Peas. The

cropping intensity is comparatively higher in this system. Cardamom plantation is practiced throughout the year.

In the cardamom dominated farming system, maize is harvested in March, finger millet in April and paddy in July. Wheat is produced during the month of December. Cardamom plantation is practiced throughout the year.

The cropping pattern in Sikkim has changed over the years. The cropping pattern of a region is determined by a variety of factors, most notably, elevation, topography, precipitation and so on. The cropping patterns of the state have undergone metamorphic changes since the merger with India in 1975. In the pre-merger period, the agricultural dependency of the people was much higher. Later, this livelihood activity changed but with slower pace. Earlier, there were traditional crops like maize, paddy, millet, pulse etc, but as time passed the farmers tried orange, apple, tea etc. Wheat was introduced in late seventies in Sikkim. The shift of farmers from traditional cereal based low-income crops to high-income cash-crops can be seen clearly in the figures given in the tables. As land is not adequate in the hill area, cultivators have to cultivate many crops throughout the year. So, the cropping intensity is comparatively higher in the hills.⁴

In the pre-merger period, Sikkim's agriculture was very much backwards because of skewed distribution of land-holding, practice of mono-cropping, non-existence of agricultural technology, lower investment, lack of marketing etc. But, the post-merger agricultural policy was oriented towards peasant economy, which covers land reforms, agricultural credit and marketing, provision of inputs like HYV seeds, fertilizers, minor irrigation and encouragement to cash-crops and horticultural products. Some new crops like wheat, rajmah, rape and mustard oil-seeds were introduced after the merger of Sikkim.⁵

The maize cultivation belt is located in the humid tropical zone foothills of Southern Sikkim. As it requires high temperatures and good amount of rainfall, maize is sown in early summer and harvested in September-October. Cultivation of maize requires a good amount of human labour for thinning and weeding process. Longitudinal ditches are prepared in maize fields to save land from erosion. It is a staple food of this belt and is also used for preparation of poultry feed and beer.

Paddy is another important crop of Sikkim. Paddy is a crop mainly of river valleys. Along river beds the crop is raised with the help of irrigation. Small channels taken out of the rivers irrigate the surrounding land. On higher areas where temperature and rainfall conditions permit the cultivation of paddy, the crop is grown on terraced fields. In the river bottoms usually transplantation method is followed but on the higher terraced fields broadcasting method is followed. Now with the assistance of Agriculture Department new high yielding varieties of paddy are grown on the terraced farms with Japanese method. Paddy is a summer crop and it is grown everywhere in the state except very higher areas and most of the paddy is raised on unirrigated fields. Because of copious rainfall during its growth period it is possible to raise paddy on unirrigated fields.

Wheat and barley are winter crops. Wheat is raised in Southern and Central Sikkim where temperature and growing period during winter permit the cultivation of this crop. In areas with short growing period and insufficient moisture during winter barley and buck wheat are raised. On the soils which are not fit for paddy or wheat cultivation or where short growing period does not permit the cultivation of superior cereals, millets are raised.

Cardamom, oranges and apples constitute an important part of Sikkim's trade with other parts of the country. Luscious oranges are grown in the southern warmer area of the state whereas apples are grown in elevated areas of Central and Northern Sikkim. Cardamom is a foreign exchange earner crop also. Therefore special steps are being taken to augment the production of cardamom.⁶

The caste-wise average size of land-holdings in Sikkim have been shown in the following table. Though, the data used in this table are of 1985-86 and 1991-92, the trend of holdings can be seen as a consequence of the measures taken by the govt. several times regarding the land transfer. Govt. took measures to protect the ST people, who were the indigenous tribes of the state. So, the size of average holdings not declined even marginally, rather, increased in all categories except marginal holdings. Though, the percentage of SC population is very small in Sikkim, the average land-holdings declined in all categories, except, the large holding. Therefore,

it can be concluded that the landholdings of SC people have marginalized since the merger of Sikkim with India more drastically than among any other castes.

Table 4.6 : Average size of operational Land-holdings of SC & ST in Sikkim

Category	SC		ST	
	1985-86	1991-92	1985-86	1991-92
Marginal(below 1ha)	0.5	0.4	0.5	0.5
Small(1-2 ha)	1.1	1.5	1.3	1.5
Semi-medium(2-4 ha)	2.7	2.9	2.9	3.1
Medium(4-10ha)	5.8	5.7	6.1	6.4
Large(10 and above	11.7	27.3	16.5	16.2

Source: Compiled from the data of Agricultural Situation in India, Vol. 50, No.4, GoI.

The following table shows the ethnic community-wise land-holdings since the merger of Sikkim with India. The highest percentage of paddy-field holding was with Nepali community, followed by Bhutias. Nepali community holds highest percentage of dry-lands and wastelands. But, Lepchas, hold maximum cardamom fields. The Bhutia community had 2nd highest cardamom fields, paddy-fields and wastelands.

Table 4.7: Ethnic Community-wise Distribution of Land-holdings in Sikkim (1976-83)(Area in ha)

Caste	Total Paddy Fields(%)	Total Dry Lands(%)	Wastelands(%)	Cardamom(%)	Total Cultivated land(%)
Bhutia	27.12	16.13	24.18	27.05	20.32
Lepcha	14.97		17.53	32.72	20.38
Nepali	57.19	64.95	62.00	22.37	58.66
Total Public	99.28	99.56	99.60	82.15	99.36

Source: Human Development Report of Sikkim, 2001, GoS, Gangtok

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