

## CHAPTER VI

### CROPPING PATTERNS AND CROP DIVERSIFICATION

The cropping pattern of any region is influenced by its agro climatic conditions. In Sikkim, due to an extreme variation in elevations, topography and climate, the agro climatic conditions vary so greatly that the cropping patterns of Sikkim, besides varying from the other states of the country, vary from village to village <sup>(1)</sup>.

#### Different types of cropping patterns

Whether crops are grown as pure crop, or mixed, or in definite sequence, the cropping patterns may be classified as follows —

1. Mixed Cropping — When the crop is grown with another crop the crop is known as mixed cropping.
2. Rotational Cropping — According to seasonal changes crops grown in definite sequence is called rotational cropping.
3. Mono cropping — When the land is occupied by a single crop during one season it is known as mono cropping.
4. Double cropping — It means growing two crops during one Season.

5. Multiple cropping — Under this cropping pattern when the two crops are grown in a year in a sequence.
6. Relay cropping — When one crop is grown under a standing crop it is called relay cropping.

### Classification of seasons in Sikkim

In Sikkim, the seasons are classified into -

- (1) Kharif season,
- (2) Rabi season.

#### 1. Kharif season

This season lasts from May to October. The crops grown during this season are known as Kharif crops, e.g. maize, rice, millet, etc.

#### 2. Rabi season

This season starts in October and continues till March. The crops grown during this season are known as rabi crops, e.g. wheat, barley, mustard etc. The crops such as buckwheat, pre-Kharif paddy etc. are grown between March and June in the paddy fields of mid and lower elevation respectively of the state may be categorised as zaid crops or pre-kharif crops.

These two seasons are not distinct in Sikkim, but overlapping on the following grounds —

- i. A very wide range of elevation from 990 ft. to 8860 ft.

- ii. A generally low temperature with occasional fluctuations at the time of precipitation (0"-27")
- iii. High rate of rainfall and occasion precipitation even during rabi season.
- iv. Occasional hail storm in March-April at higher elevations.
- v. Occasionally a longer duration of dry spell in January to February.
- vi. Longer duration of crops<sup>(2)</sup>.

Due to the influence of these factors kharif sowing starts in February and harvested by December, while rabi sowing starts in October and harvested by May depending upon the elevation and other local cropping system of different places of the state.

#### The Present Cropping Patterns

According to the sample survey on land utilisation conducted by the Bureau of Economics in 1980-81, the main crops included in the cropping pattern the district-wise areas occupied and their average yields are represented in the following table 6.1.

Table 6.1

Area under principal crops 1980-81

Crops	North District	South District	East District	West District	Sikkim	Percentage to total cultivation
1	2	3	4	5	6	7
1. Maize	1,596	14,898	4,808	9,621	30,921	36.28
2. Paddy	1,276	3,633	7,176	3,022	15,107	17.72
3. Millets	123	1,424	766	2,782	5,065	5.94
4. Pulses	782	1,021	807	1,007	3,617	4.24
5. Wheat	1,600	1,720	2,600	2,930	8,850	10.37
6. Barley	13	155	16	353	537	0.67
7. Cardamom	8,582	1,967	1,082	2,416	14,047	16.48
8. Potato	360	190	400	980	1,930	2.26 (3)

Table 6.2

Average yield of principal crops 1979-80

Crops	Average yield Kg/hect.
1. Maize	922
2. Rice	694
3. Millet	762
4. Pulses	600
5. Wheat	1,437
6. Barley	1,200
7. Cardamom	250
8. Potato	3,360 (4)

As mentioned above since the cropping pattern in Sikkim varies from village to village it is not possible to describe all the cropping patterns prevalent in the state. Only a broad picture of major cropping patterns can be presented by taking the major crops into consideration. The crop occupying the highest percentage of the sown area of the region is taken as the base crop and all other possible alternative crops which are sown in the region either as substitute for the base crop in the same season, or as the crops which fit in with the rotation in the subsequent season are considered in the pattern<sup>(5)</sup>.

### Kharif Season Cropping Pattern

Among the Kharif crops, maize, rice, finger, millet, ginger and seed potato are the prominent crops to be considered as the base crops for describing the Kharif cropping patterns.

#### The Maize Based Cropping Patterns

Maize is cultivated in an area of 30,921 hectare which constitutes the largest area 36.28% of cultivable land among all the crops of the state. This is a staple food of the rural people. Out of the total area under maize, South District has the highest area (14,898 hec.) followed by West District (9,621) and East (4808 hec.) and North (1,596 hec.).

Using maize as the base crop, the state has 12 cropping patterns. Dry unirrigated fields throughout the state irrespective

of elevation, rainfall and climatic variation maize is grown as the base crop. The main alternative crops under this cropping pattern are as follows -

Table 6.3

Kharif	Rabi	Zaid
1. Finger millet	1. Wheat	1. Buckwheat
2. Pulses	2. Barley	
3. Potato	3. Mustard	
4. Ginger	4. Potato	
5. Vegetables	5. Rabi maize	
	6. Vegetables	

However, seed potato and ginger growing areas of the state may be excluded from this category as they also form the base crops.

In South District, pulses, ginger, vegetables, wheat, barley, mustard, potato, millet and buckwheat are the main alternative crops.

The important alternative crops of West District under this cropping pattern are millet, pulses, vegetables, potato, ginger, wheat, barley, mustard and buckwheat.

In East District, the alternative crops are vegetable, potato, wheat, barley, mustard, buckwheat, millet, finger and pulses.

The North District has vegetable, potato, wheat, barley, buckwheat, pulses and mustard as alternative crops.

Generally millet and pulses are relay cropped. Potato and ginger are inter cropped<sup>(6)</sup>.

#### The Rice Based Cropping Pattern

Rice cultivated in Sikkim in all irrigated and terraced land ranging from 300 to 1700 metres. Rice is considered as a prestigious crop of the state, though its cultivation may not be economical in the field. It occupies 15,107 hectares (17.72%) of cultivable land, out of which 7,176,3633,3022 and 1276 hectares are scattered in East, South, West and North Districts respectively.

Nine rice based cropping patterns have been identified in the state. The alternative crops in this cropping pattern are maize, wheat, buckwheat, mustard, vegetable, potato, pulses on paddy field bunds, fodder and vegetables. Maize and potato in this case are relay cropped in triple cropping at lower elevation specially at Darandim and Majitar areas.

In West District, buckwheat, wheat, maize, vegetable, potato, maize fodder and mustard are the important alternative crops of this cropping pattern.

In North District, wheat and buckwheat, in South District, wheat, mustard, buckwheat, maize and vegetable and in East District wheat, mustard, buckwheat, maize and vegetable form the important alternative crops<sup>(7)</sup>.

### The Seed Potato Based Cropping Patterns

The areas situated about 1700m above m. sea level are suitable for seed potato cultivation in Sikkim. Out of the total 1930 hectares brought under potato crop in Sikkim, about 600 hectares are under seed potato cultivation.

The important regions where seed potato is considered as base crop are the following:

Table 6.4

West District	East District	North District	South District
1. Okharey	1. Padamchin	1. La-chung	1. Rabhong
2. Ribdi	2. Zaluk	2. La-chen	
3. Bhareng			
4. Sepreynagi			
5. Haltaben			
6. Thambong			
7. Buriakhop			
8. Sribadam			
9. Upper Bermiok			
10. Hec Potal			
11. Sankhu			
12. Uttarey			
13. Yoksom			



The important alternative crops in this cropping pattern are pea, maize, wheat, barley, cabbage and radish. Pea is cultivated as mixed crop specially in West District, Maize is sown as mixed crop in other areas of the state. About six cropping patterns are identifiable in seed potato based cropping pattern in the state.<sup>(8)</sup>

#### The Ginger Based Cropping Pattern

Presently ginger is being cultivated as a commercial crop in Sikkim. The important ginger growing areas where ginger is taken as a base crop are the following:

Table 6.5

West District	South District	East District
1. Chakhung	1. Taruk	1. Rhenok
2. Takuthang	2. Sambuk	2. Rongli
3. Zoom	3. Payong	3. Rorathang
4. Chucen	4. Tarku	4. Pandam
	5. Kalikhola	
	6. Namchi	
	7. Bermiok	

The important alternative crops in this cropping pattern are maize and paddy. Only three cropping patterns are identifiable under this cropping pattern. One as pure crop and the other mixed crop with maize and the third with rotational cropping with paddy.<sup>(9)</sup>

### The Millet Based Cropping Patterns

Finger millet is an important crop of Sikkim and is cultivated in an area of 5065 hectares.

Millet based cropping pattern is identified only in the case of "Bhadaurey" crop. This variety of finger millet is transplanted in May and harvested in Bhadau (August) in the marginal lands of 1300 to 1800 metres elevation.

Alternative crops of this cropping pattern are wheat and barley. Three cropping patterns are identifiable under millet based cropping patterns in Sikkim. The land is kept fallow during rabi season or alternated with wheat or barley crop<sup>(10)</sup>.

#### The Rabi Season Cropping Patterns -

Among the rabi crops, wheat and barley and buckwheat are the main base crops.

#### The Wheat and barley based cropping patterns-

Wheat and barley are grown in identical climates and can be grouped together as base crops identifiable at higher elevations on marginal lands. The crop is grown during September and harvested in May. The land is mostly kept fallow during June to August. Soybean, pulses and potato are often sown as alternative crops.

#### The buckwheat based cropping pattern —

The buckwheat based cropping pattern is identifiable in

slopy marginal lands of higher elevation where the crop is sown as pure crop. Such lands are mostly kept fallow during kharif or alternately cropped with maize<sup>(11)</sup>.

#### Crop Diversification —

Sikkim though a tiny state, faces the problem of feeding its fast growing population. The state, therefore, has to secure maximum crop production by making the best use of the limited cultivable land and by putting into practice the latest methods of crop production technology. Crop diversification is thought to be one of such approaches for future planning. Crop diversification refers to bringing about a desirable change in the existing cropping patterns towards more balanced cropping systems to meet the ever increasing demand for cereals, pulses, oilseeds, fibre, fodder, fuel etc. At the same time it aims at improving the soil health and agro ecosystem<sup>(12)</sup>.

#### Experimental Findings —

Following are some of the important achievements of the agronomic research carried out at I.C.A.R. Research Complex for N.E.H. Region Sikkim Centre, Tadong which can be well fitted in crop diversification in Sikkim —

1. Inter cropping of two rows of soybean (30 cm. apart) between two paired rows of maize has been found profitable and yielded jointly 15 to 20g per hectare more grain as compared to pure crop of maize.

2. Wheat with mustard intercropping in the ratio of four rows of wheat and can help in meeting the oilseed requirement of the farmers.

3. In dairy oriented cropping system, out crop is found highly promising during rabi season.

4. The green fodder from out and pea (green pod stage) could be obtained upto 97.9 g/hect. if both are sown together. This combination was better than pure crop of out, or its combination with mustard.

5. In rice-wheat rotations, though the application of full dose of fertiliser, Nitrogen, Phosphorous 80 Potassium 60 Kg./hect to rice and N 100 P 80 K 60 Kg/hect. to wheat yielded the maximum followed by application of half dose of fertiliser to both the crops. The latter was found more economical.

6. In three crop rotations, maize, potato, radish has given the maximum return.

7. Two protective irrigations - firstly at joining stage and secondly at flowering stage have been found to give 5-8 kg/hect. more grain yield in wheat under Sikkim condition. Top dressing in wheat with 50 kg/hect. increased the yield significantly<sup>(13)</sup>.

8. The following sowing times are found ideal for different crops

<u>Crops</u>	<u>Time of sowing</u>
1. Soybean	15th May to 10th June
2. Maize (a) Local (b) Short	25th Feb. to 28th March
<u>Duration varieties</u>	<u>March - May</u>
3. Wheat	10th to 30th October
4. Rice	15th to 30th May (Nursing sowing)
5. Blackgram	
6. Rajma, Rice Bean	25th May - 10th June
7. Pea	15th - 25th October
8. Mustard	25th October - 10th Nov.

Diversified cropping programme aims at achieving higher food production which in its turn leads to increased cropping intensity. Intensive cropping requires higher and efficient use of inputs like fertiliser and irrigation water.

With the introduction of wheat and H.Y.V rice in Sikkim, the cropping pattern made a distinct shift in favour of rice and wheat system in these areas endowed with assured irrigation, because the two crops had greater and assured returns compared to other crops.

Areas not suited for food production may be conveniently used for planting quick growing plants suited for different agro-climatic conditions. Crop diversification would also require the

system of producing food quality seeds for which development of seed villages could be attempted.

Newly developed cropping system may also create problem such as deterioration in soil health, multiplication of pests, weeds and diseases and intensive use of energy. All these aspects should, therefore, be taken into consideration in the process of adopting new cropping system in the state<sup>(14)</sup>.

Crop diversification nevertheless, would increase productivity from land both in terms of quantity and quality.

#### Cropping Patterns in La-chen and La-Chung

La-chen and La-chung situated at altitudes of 8,960 ft. and 8610 ft. respectively differ from other parts of the state so far as the classification of season and cropping patterns are concerned.

These two valleys remain about half of the year, beginning from the end of October to the early part of April under snow. Being under sub-Alpine and Alpine climatic zone, rainfall in the uplands of La-chen and La-chung is scanty, about 60 mm only<sup>(15)</sup>. The arable plots of land are scattered at different steep terrains. Cultivation within such constraints is a very difficult and tedious task, In these two valleys mono cropping only is possible.<sup>(16)</sup>

On La-chen side, in Thangu valley and in its vicinity potatoes, some barley and radish are cultivated. Sowing of potato seeds, barley and radish is done here from May onwards and harvested by the end of October. After October till April no farming operations are possible, because snowfall starts and people with their animals migrate downwards to lower regions<sup>(17)</sup>.

On La-chung side, in the lower regions, such as Maltin, Khedum, Beumnalla etc. maize is grown as mono crop. Potatoes are also cultivated in La-chung to be used as potato seeds. Apples are also grown in both La-chen and La-chung<sup>(18)</sup>.

In recent years, it is realised that both La-chen and La-chung specially the latter, have tremendous potentiality for producing off season vegetables in the month of July and August. During this period due to heavy and incessant rain in other parts of the state, vegetable cannot be grown so much. Off-season vegetables such as cabbage, peas and radish are now being cultivated in La-chen and La-chung, mostly in the valley of La-chung. This is advantageous for the farmers in the sense that they are able to get better price for the vegetables during this peak price season since vegetable production in the lower plains becomes difficult on account of unfavourable heavy rainfall. It is for the first time during 1984-85 that La-chung valley alone has produced over 200 tonnes of cabbage and the entire produce was channelised to Gangtok and Siliguri markets<sup>(19)</sup>. Apples grown in these two valleys are also brought to Gangtok for sale.

### Summary

In Sikkim ecological conditions vary greatly at very short distance which limit the adaptation of crop species and their varieties within a narrow range. Accordingly only a broad picture of the major cropping patterns can be presented.

The crop occupying the highest percentage of the sown area of the region is taken as the base crop and all other possible alternate crops grown in the region, either as substitutes for the base crop in the same season, or as the crops which fit in the rotation in the subsequent season. For describing the kharif patterns, paddy, maize, millet, ginger and seed potato are the prominent base crops.

For maize as the base crop, the main alternate crops are finger millet, pulses, potato, ginger and vegetables in kharif, and wheat, barley, mustard, potato, rabi, maize and vegetables in rabi and buckwheat in zaid are the main alternative crops of the cropping pattern.

If the base crop is rice, the alternative crops are - maize, wheat, buckwheat, mustard, vegetable, potato, pulses on paddy field bunds, fodder and vegetables.

When seed potato is cultivated as the base crop, the alternative crops are pea, maize, wheat, barley, cabbage and radish.



For ginger based cropping patterns, only three cropping patterns are identifiable - one as pure crop and other mixed crop with maize and the third rotational cropping with paddy.

For millet as the base crop, the important alternative crops are wheat and barley.

Under rabi season cropping patterns, the main crops are wheat, barley and buckwheat. The wheat and barley based cropping patterns are found to have soybean, pulses and potato as alternative crops.

The buckwheat based cropping pattern in higher elevation is mono cropping. Such lands are mostly kept fallow during kharif or alternately cropped with maize.

For improving cropping patterns in Sikkim crop diversification has also been planned.

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