

CHAPTER-V

CROP PRODUCTION, CONCENTRATION, COMBINATION AND DIVERSIFICATION

INTRODUCTION

The agricultural development and problems of any area can be studied by various methods, some of the important methods for studying the agricultural development are study of variation in production level of various crops in regional structure i.e. village level, block level, district and state level which reveals the regional variation pattern. The crop concentration, combination and diversification are also applied for studying the problems, development and for further suggestion and future planning. These methods are usually applied for finding out the selection, dominance and future choice of crop in an area. These studies also reveal the underlying physiographic, socio-economic and cultural influence. Besides these studies have direct bearing on the changing land use pattern of any area.

5.1 CROP PRODUCTION

Productivity level of any crop is one of the important indicators of agricultural development. The sedentary nature of agriculture in South District does not indicate higher productivity of the crops. For the district ten selected crops productivity level is studied for 2004-05 for Gram Panchayat units as the data for block level is not available. The productivity of any crop depends on the various parameters, like suitable agro-climatic conditions, farmer's interest for cultivation of a particular crop, demand in the local markets, traditional practice of cropping, adaptability to the changing scientific agricultural methods of cultivation etc. The productivity levels amongst the crops are also very different. The production of crops has been measured in thousand kg.

5.1.1 Production of Maize: 2004-'05

Maize is the most important first ranking crop in the South District. Out of the total Gram Panchayat units, only two Gram Panchayat units (4.45%) are under the category of very low (<100'000 kg/ hectare).(Table5.1a) These Gram Panchayat are Rateypani and Sadam -Suntaley. Another two GPUs (4.45%) are in the category of

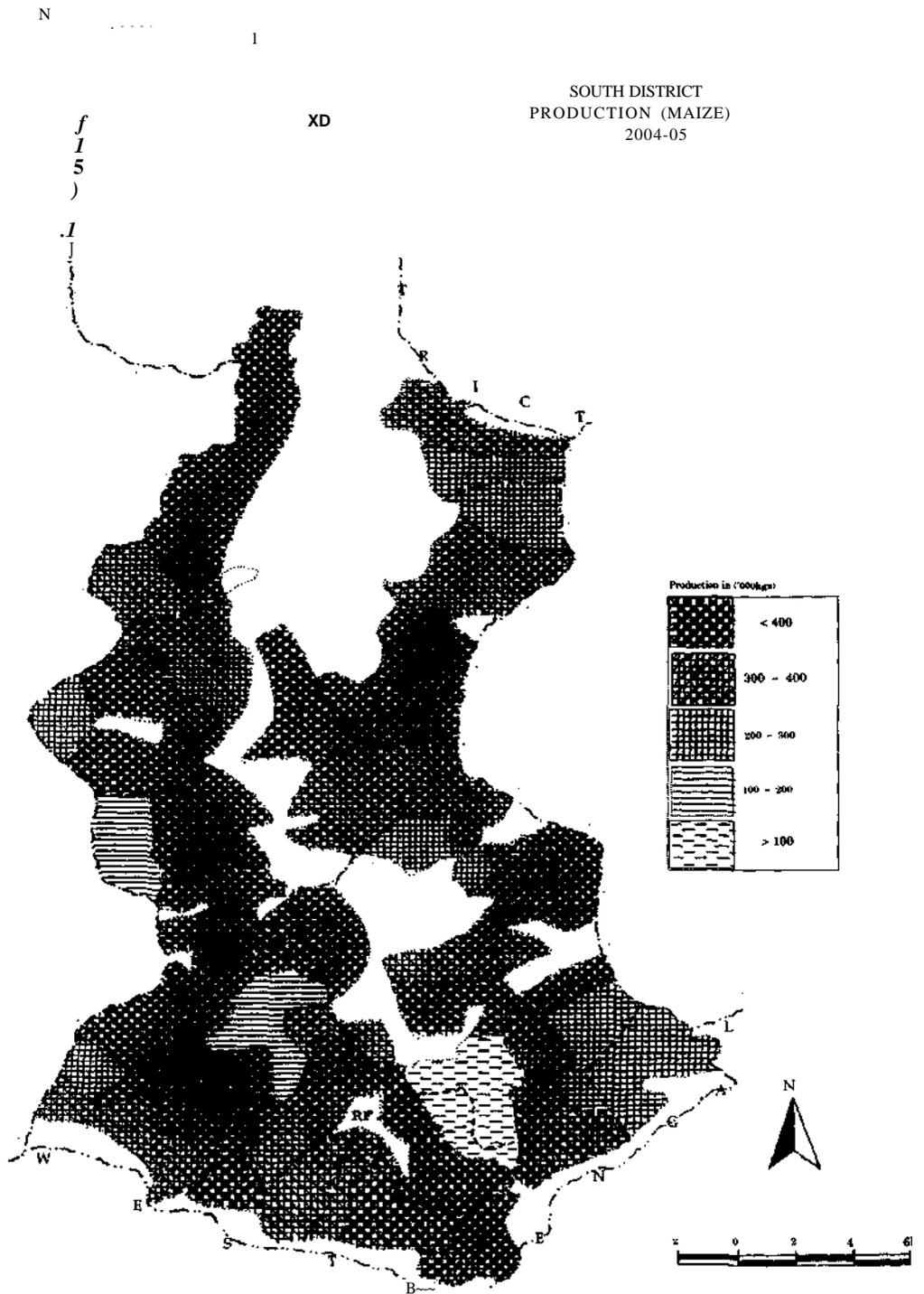


Fig 5.1

low (100 - 200)'000kg/hectare. They are Singithang-Boomtar and Sanganath GPUs. But the medium category (200-300'000kg/hectare) has been recorded in seven GPUs, occupying 16% of the total GPUs. These Gram Panchayat units are located in north-eastern and south-eastern parts of the district.

Table 5.1a Production of Maize,(South District.2004-05)

Production in('000)kg	Category	No of Gram Panchayat unit	Total Gram Panchayat unit %
<100	Very low	2	4.45
100-200	Low	2	4.45
200 - 300	Medium	7	15.56
300-400	High	17	37.77
>400	Very high	17	37.77
Total		45	100.00

*Source: Crop Production Statistics, Department of Agriculture Govt, of Sikkim 2004-05

The high (300-400'000 kg/hectare) maize production is observed in more than 37% of the total GPUs. Most of these GPUs are located in south-western part of the district. About 37% of GPUs are under very high (>400'000 kg/hectare) production category. These GPUs are scattered throughout the district, (fig 5.1). The production of maize in the South District can be concluded as high in comparison to the other districts of the State, as the percentage of high and very high category together constitutes more than 66% of GPUs of the South District.

5.1.2 Production of Rice: 2004-'05

Rice is the second ranking crop next to maize as the sizable area is under the rice cultivation, even though it is the main staple food crop of the district. Most of the rice cultivated tracts are located in the fertile river valleys, where the slope is gentle. Besides, it is also cultivated in the upper parts of hills by means of terrace farming.

Table 5.1b Production of Rice (South District. 2004-05)

Production in ('000)kg/hect.	Category	No of GPU	Total GPUs %
<25	Very low	10	22.23
25 - 50	Low	9	20.00
50 - 75	Medium	9	20.00
75 - 100	High	5	11.11
>100	Very high	6	13.33
NA		6	13.33
Total		45	100.00

* Source: Crop Production Statistics, Department of Agri Govt, of Sikkim. 2004-05

In comparison to maize, the production of rice in the South District is very low. The production ranges in between 0 and 100 kg. The very low (<25'000kg/hectare) rice category is recorded in ten Gram Panchayat units which occupy 22% of the total Gram Panchayat units and these are mostly found in the western and central parts of

the district. Exactly 20% of GPUs are in the next category of low (25,000 - 50,000 kg/hectare). (Table5.1b).

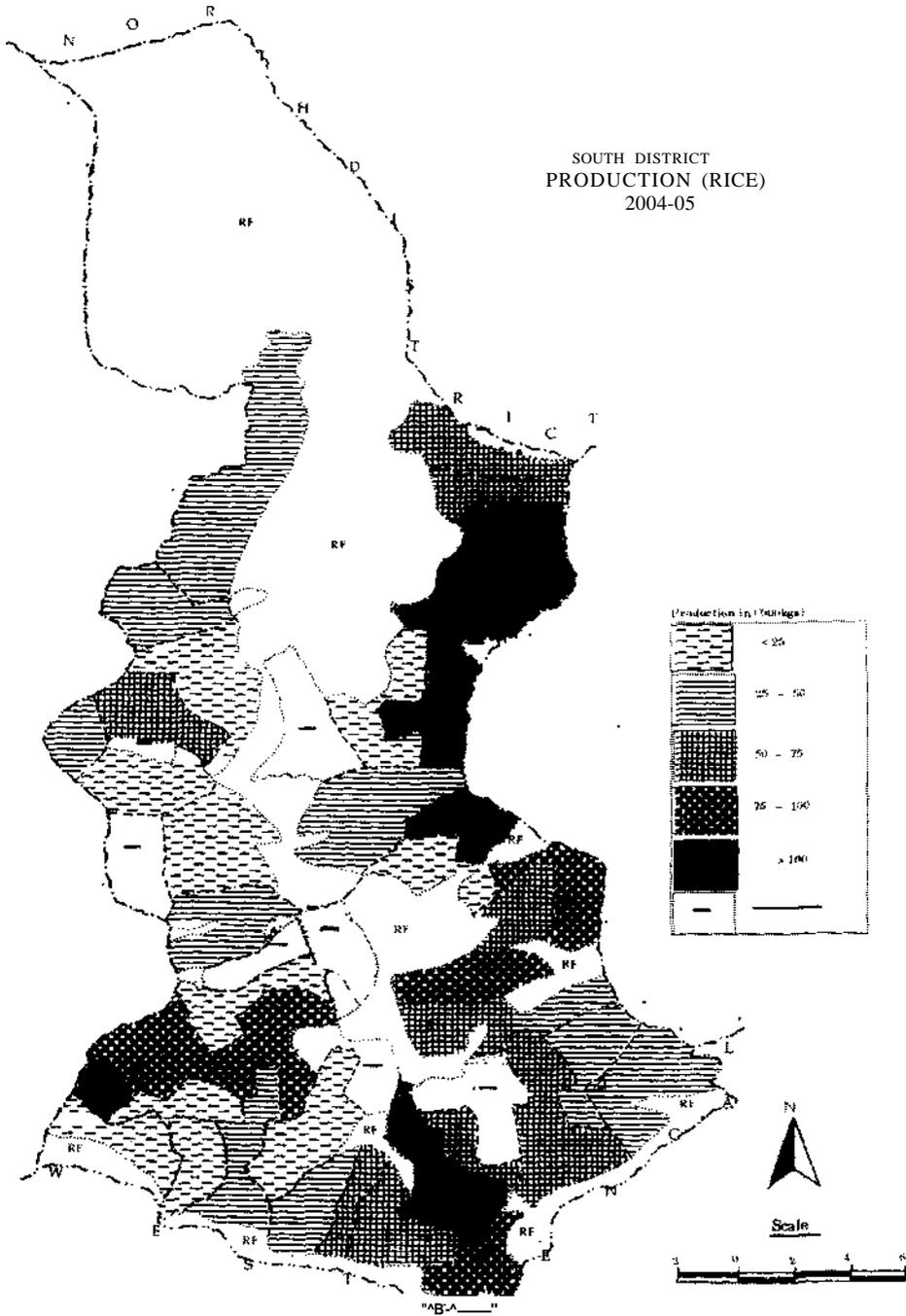


Fig 5.2

These Gram Panchayat Units are located in the eastern part of the district. About 20% of GPUs are also under the medium (50,000 - 75,000kg/hectare) production category. There are nine Gram Panchayat units in this category. But in the high (75,000 -

100,000 kg/hectare) rice production category, the percentage is less having only 11% GPUs and They are Namphok, Ramaeng-Nijameng, Melli-Mellidara, Poklok-Denchung and Singithang-Boomtar. In the category of high (>100'000kg/hectare), there are only 13% of the total Gram Panchayat units. Six Gram Panchayat units do not cultivate rice at all which occupy more than 13% of the total Gram Panchayat units, (fig 5.2)

Rice production in South District has the characteristics like other hilly areas having low production. As the hilly terrain do not suitable for rice cultivation. The percentage of very low, low and medium together constitutes more than 50% of the total Gram Panchayat units.

5.2.3 Production of Pulses: 2004-'05

The pulse is the third important crop next to the maize and rice in the South District. The favorable agro-climatic conditions support the large scale production of pulses in the district especially in the southern part of the district. (Table5.1c). In the very low (<20'000kg/hectare) production category , there are twelve Gram Panchayat units which accounts around 27% of the total Gram Panchayat units and these are located in the central parts of the district. The low (20-30'000kg/hectare) production category has more than 24% of the total Gram Panchayat units

Table 5.1c Production of Pulse (South District: 2004-05)

Production in ('000 kg/hect.	Category	No of GPU	Total GPUs %
<20	Very low	12	26.67
20-30	Low	11	24
30-40	Medium	4	8.89
40-50	High	3	6.67
>50	Very high	15	33.32
Total		45	100.00

* Source: Crop Production Statistics. Department of Agriculture & Food Security .2004-05

Most of the Gram Panchayat units which are under this category are found in the western part of the district. Around 9% of the total Gram Panchayat units are under the category of medium (30-40'000kg/hectare). These GPUs are mostly found near the peripheral areas of the high category. The high (40-50'000kg/hectare) pulse production category has occupied only 7% of the total Gram Panchayat units and they are Rameng-Nijameng, Tingrithang, and Rong-Bul. But in the high (>50,000kg.hectare) category pulse production, the percentage of GPUs is more than

33% and mostly found in the southern part the district. The production of pulses in this particular year is medium as the percentage of high and very high together constitutes more than half of the total GPUs. The higher concentration of pulse production is in the higher altitudes of southern parts, where the dry and warm climatic condition prevails, (fig 5.3).

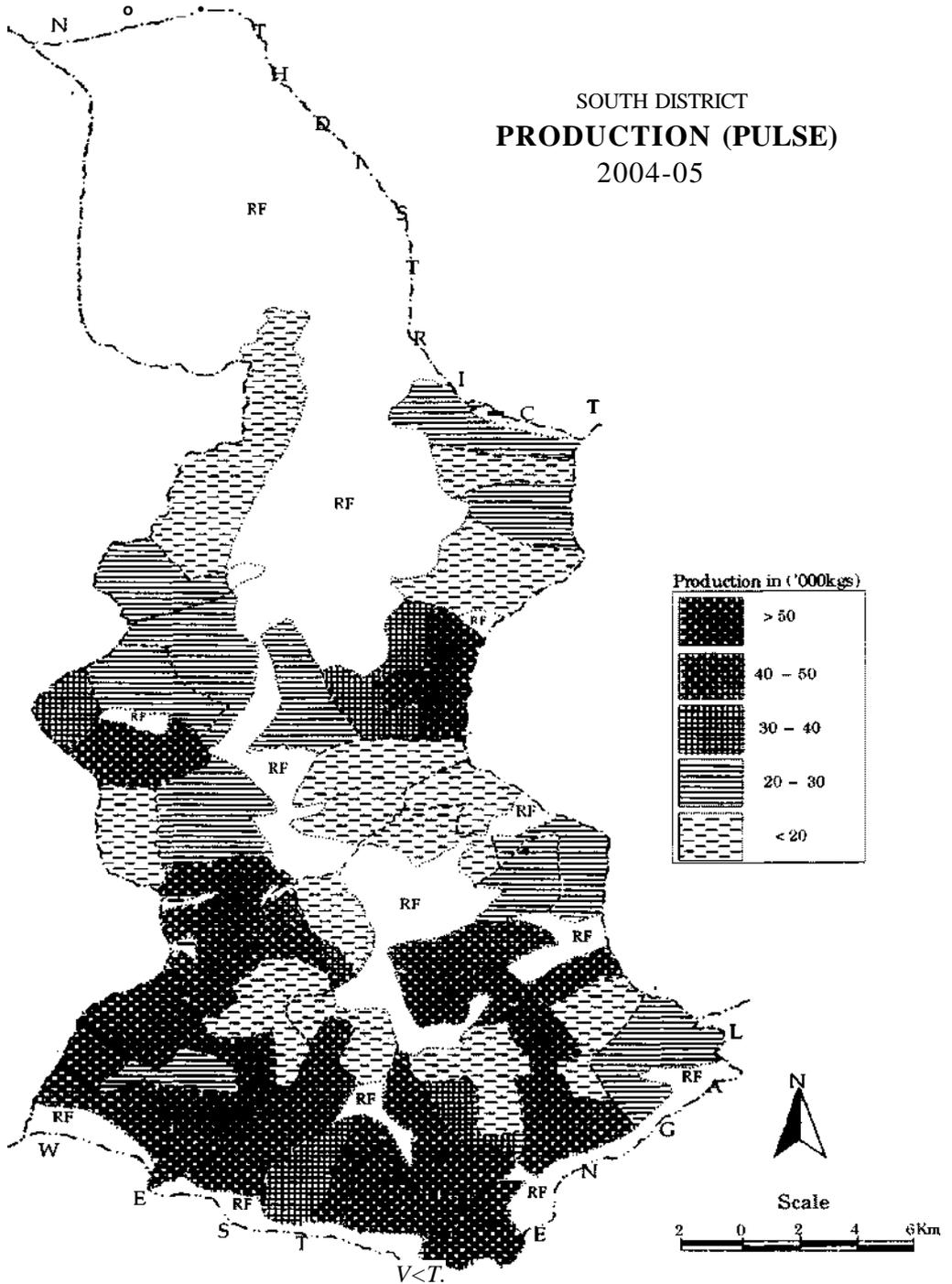


Fig 5.3

5.1.4 Production of Wheat: 2004-'05

Wheat is the third important cereal crops of the South District. The production pattern and distribution of wheat is different from pulse crop. The fig 5.4 depicts the production of wheat in the South District. The northern part of the district has the higher tendency of wheat production than the southern part of the district. The picture is vice-versa from the case of pulse production.

Table 5. Id Production of Wheat (South Dsitriect.2004-05)

Production in ('000 kg/hect.	Category	No of GPU	Total GPUs%
<20	Very Low	20	44.45
20-30	Low	10	22.22
30-40	Medium	5	11.11
40-50	High	5	11.11
>50	Very high	5	11.11
Total		45	100.00

* Source: Crop Production Statistics, Department of Agriculture & Food Security.2004-05.

In the very low (<20'000kg/hectare) category there are more than 44% of the total Gram Panchayat units. Most of these Gram Panchayat units are found in the south western part of the district. This due to the fact that, the southern part is drier and the farmers give emphasis to the cultivation of maize and rice. The low (20,000-30,000kg/hectare) category has occupied around 22% of the total Gram Panchayat and these are found in the southern part of the district. The three category viz, medium (30,000-40'000kg/hectare) high (40,000-50'000kg/hectare) and very high (>50'000kg/hectare) occupy same percentage of more than 11% GPUs each.The Gram Panchayat units which are under the medium category are; Paiyong, Naya-Mangzing, Narnyak, Tangji-Bikmat and Poklok-Dhenchung, and the Gram Panchayat uits which are registered in high category are Lingi, Lamting- Tingmo,Barfung, etc. The gram Panchayat units of Tokday, Tarku, Sadam etc. are in the very high category. (Table5.1d)

The production of wheat in the South District is very low as the percentage of very low and low together occupies more than 50% of the total Gram Panchayat units. As the food habit of the people in the district is changing due to the various factors. Again demand for the wheat in the market is decreasing, these factors leads to the decreasing wheat crop area in the district.

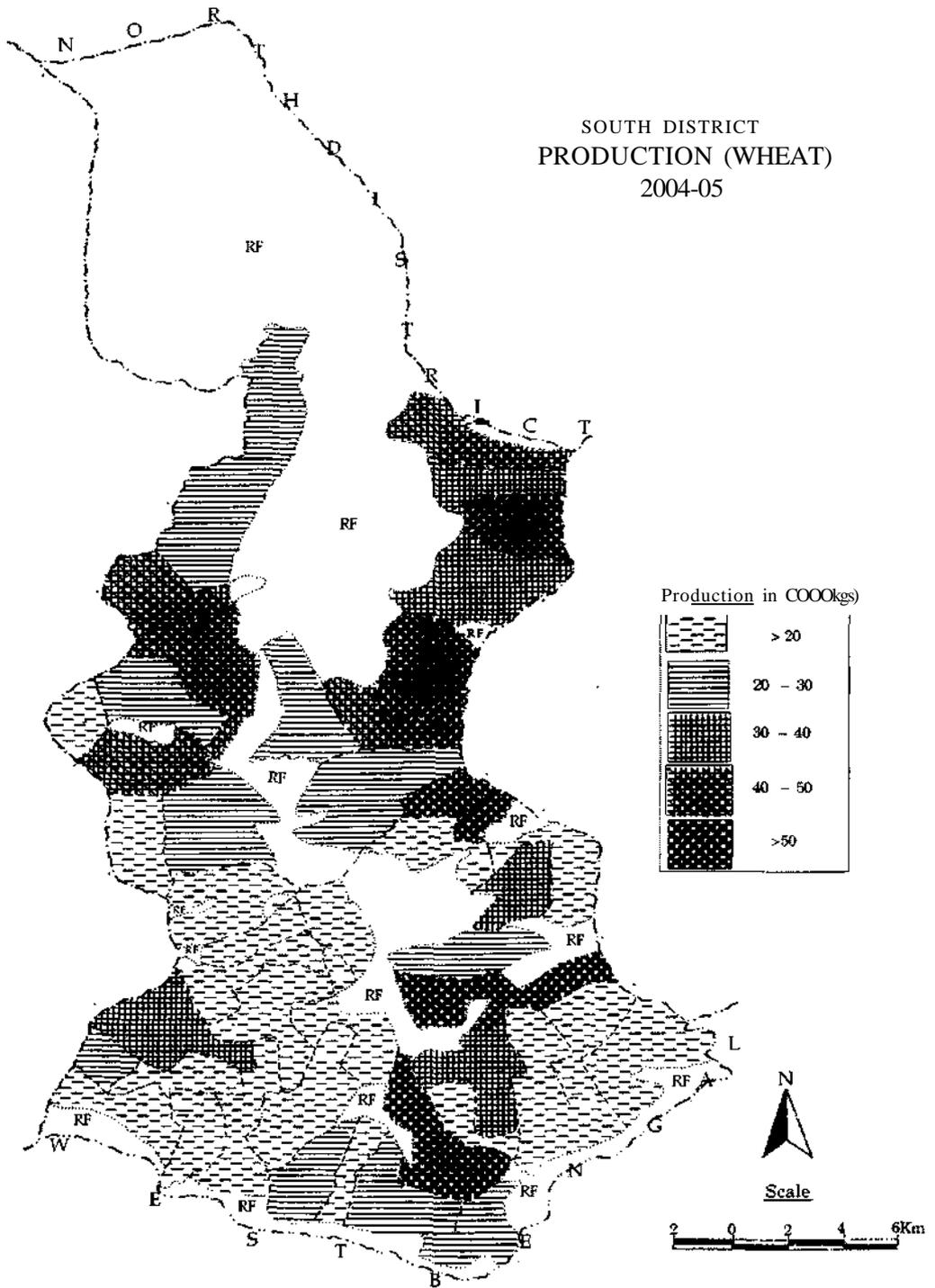


Fig 5.4

5.1.5 Production of Oilseed: 2004-'05

Oilseed is the most important rabi crop of the South District. The main crop cultivated fields are engaged by cultivating oilseed as a crop rotation. The general characteristic of oilseed productions in the district is that. The western and south-

western parts of the district have higher production than the northern and eastern parts of the district.

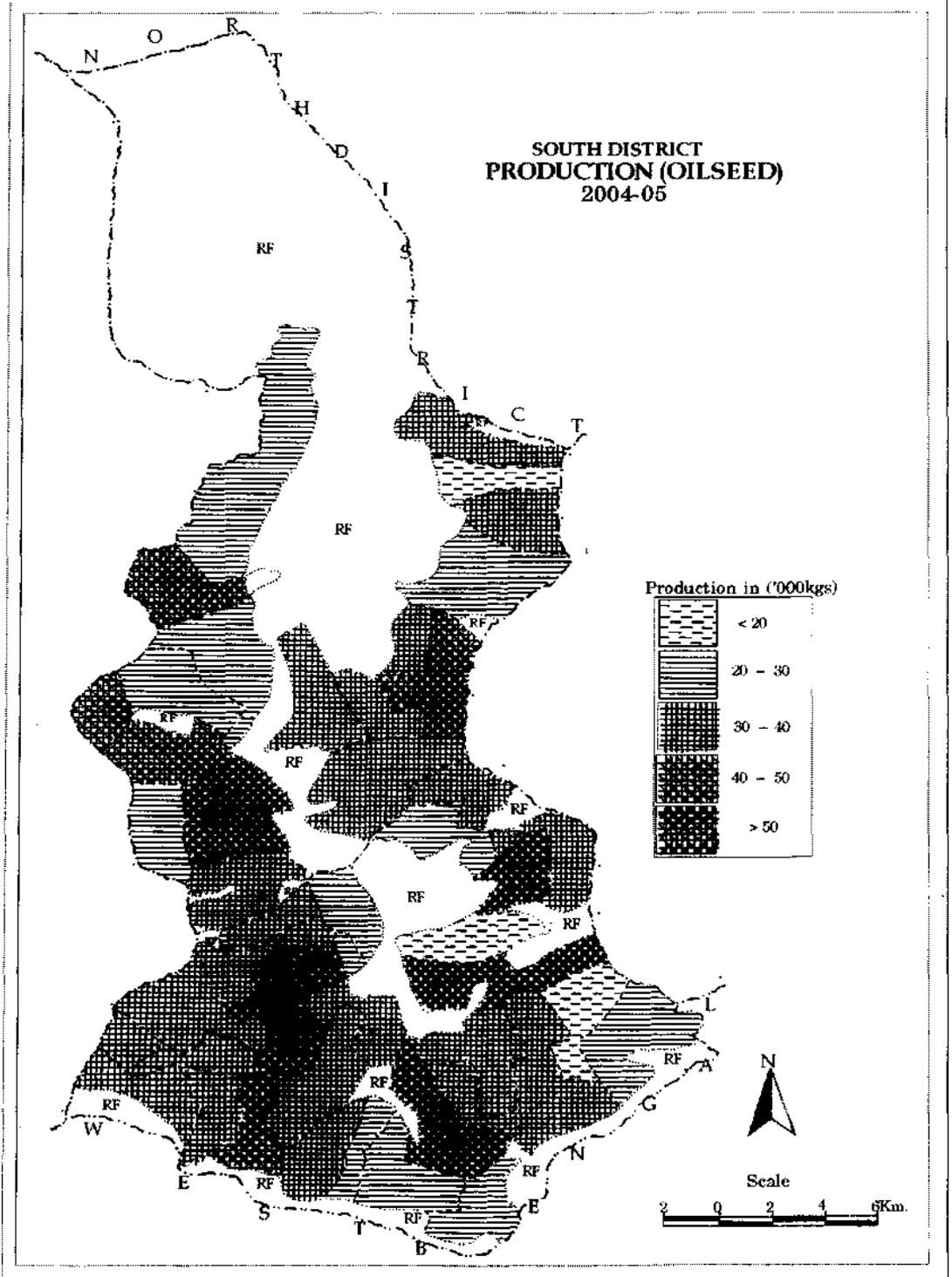


Fig 5.5

Table 5.1e Production of Oilseed (South district.2004-05)

Production in ('OOOkg/hect)	Category	No of GPU	Total GPUs %
<20	Very low	3	6.67
20-30	Low	11	24.45
30-40	Medium	21	46.67
40-50	High	5	11.11
>50	Very High	5	11.11
Total		45	100.00

* Source: Crop Production Statistics. Department of Agriculture & Food Security .2004-05.

The production pattern of oilseed in South District has unique characteristics. Table 5.1e shows that, in the very low (<20'000kg/hectare) category there are only 7% of the total Gram Panchayat units The Gram Panchayat units which are under this category are namely Paiyong, Rameng-Nijameng and Maneydara. About 24% are in the category of low (20,000-3 0,000kg/hectare) These Gram Panchayat are found in the north in the north-western part of the district. The medium (30,000-40,000kg/hectare) has the highest percentage of oilseed production having around47% of the total Gram Panchayat units. Most of these Gram Panchayat units are located in south-western and eastern parts of the district. But, the high (40,000-50,000kg/hectare) and very high (>50'000kg/hectare) have the same percentage having 11% GPUs each.

Within the district, the south western part has higher and medium production of oilseed. The area coincides with rice cultivation, where oilseed is cultivated during winter season, (fig 5.5).

5.1.6 Production of Ginger: 2004-'05

Ginger is the second most important cash crop of the district next to cardamom in terms of market price. The production of ginger crop in the South district is one of the highest amongst the four district of Sikkim. Ginger is especially cultivated with maize as mix cropping as well as in the fallow land of step slopes, where the cultivation of rice and other crops is impossible.

Table5. If Production of Ginger (South District.2004-05)

Production in ('OOOkgVhect.	Category	No of GPU	Total GPUs %
<50	Very low	6	13.33
50-100	Low	5	11.11
100-200	Medium	11	24.45
200 - 300	High	8	17.78
.300	Very high	15	33.33
Total		45	100.00

* Source: Crop Production Statistics, Department of Agriculture and Food Security.2004-05

The production of ginger is higher and as the crop has registered higher production amongst the important crops of the district.

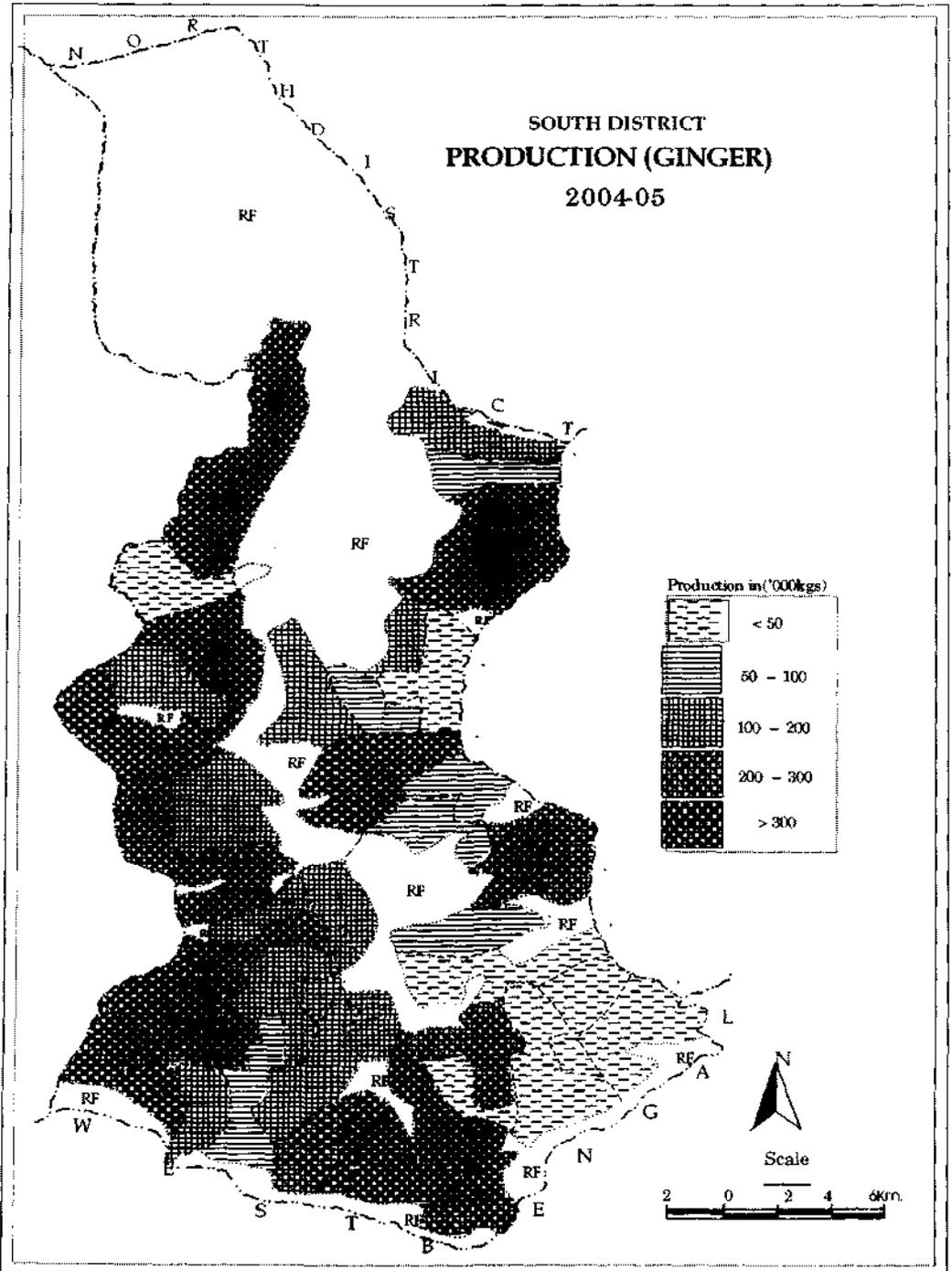


Fig 5.6

5.1.7 Production of Cardamom: 2004-'05

Cardamom is the most important cash crop of The South District in terms of price cardamom fetches higher income than the other crops cultivated in the district. The production of cardamom is not well distributed as the cultivation of cardamom

requires specific agro-climatic conditions. Some of the Gram Panchayat units where conducive climatic condition prevails, its production is high especially in the northern part of the district and low in the drier part especially in the southern part of the district.(fig 5.7)

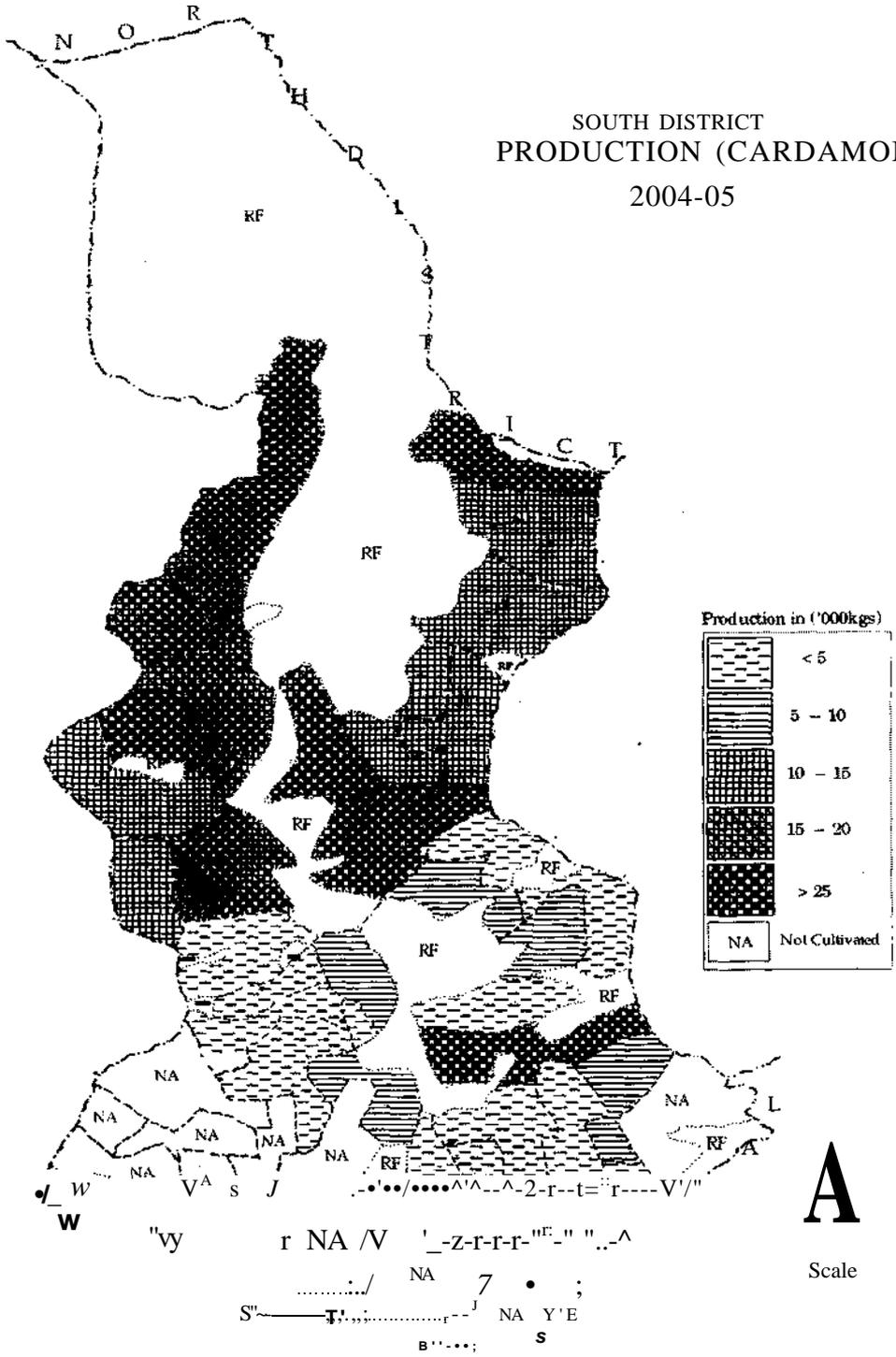


Fig 5.7

Table 5.1g. Production of Cardamom (South District, 2004-05)

Production in ('000kg/hectare)	Category	No of GPU	Total GPUs %
<5	Very low	11	24.45
5-10	Low	5	11.11
10-15	Medium	8	17.78
15-20	High	1	2.22
>20	Very high	8	17.78
Not Cultivated		12	26.66
Total		45	100.00

*• Source: Crop Production Statistics, Department of Agriculture and Food Security, 2004-05

Out of the total 45 Gram Panchayat units in South District, in 33 Gram Panchayat units or 73% is cardamom cultivated, due to the agro-climatic constraints. The remaining 12 Gram Panchayats units are located in low altitudes and warm climate which is not suitable for cultivation of cardamom. (Table 5.1g). In the very low (<5'000kg/hectare) cardamom production category, there are 11 Gram Panchayat units accounting more than 24% of the total GPUs. These GPUs are located in the southern parts of the district. Another 11% GPUs are under the category of low (5,000 -10,000kg/hectare) cardamom production and they are Damthang, Maniram-Phalidara, Temi, Barnyak, and Manetdara. Almost 18% of the Gram Panchayat units are found in the category of medium (10,000 - 15,000kg/hectare) and these GPUs are mostly located in the eastern part of the district. There is one Gram Panchayat i.e. Barfung in the category of high (15,000-20,000kg/hectare) cardamom production. Around 18% of GPUs are under the category of very high (20'000kg/hectare) cardamom production. These GPUs are located in western part of the district. The unique characteristic of cardamom production in the South District is that most of the Gram Panchayat units which fall in the category of medium, high and very high are found in the Ravongla sub-division.

5.1.8 Production of Potato: 2004-'05

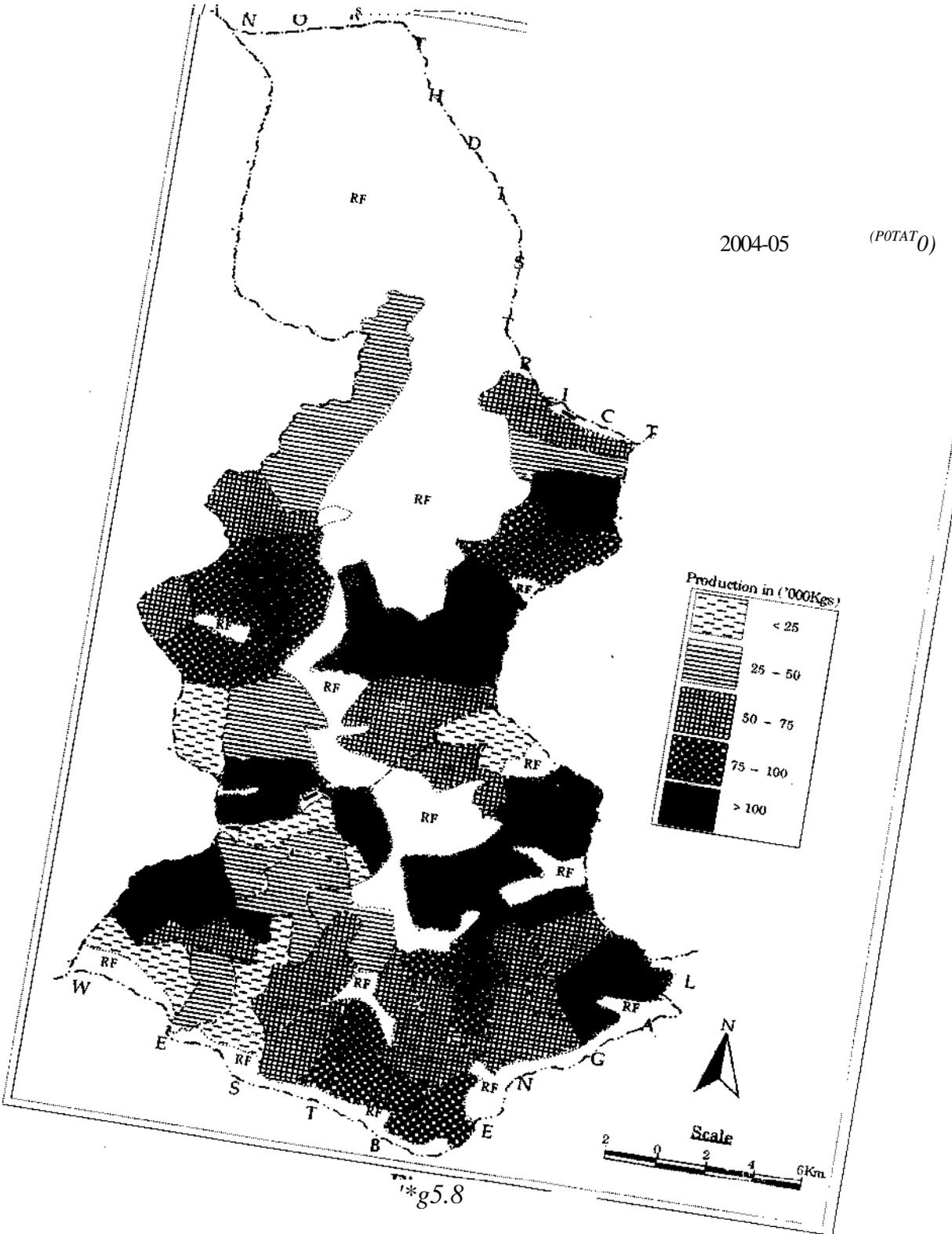
Potato is one of the important semi-cash crops, as it has been cultivated for household consumption as well as cash crop. The entire gram Panchayat units cultivated potato.

Table 5.1h represents the production of potato in South district. There are more than 11% of GPUs in the very low (<25'000kg/hectare) potato production category. These Gram Panchayat units are located in the south-western and western parts of the district. Another 15% GPUs are under the category of low (25,000-

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category (75,000-100,000kg/hectare) production is observed in 17% of the total GPUs and these GPUs are found in the eastern and southern parts of the district. But the very high (>100'000kg/hectare) production category has almost 29%. Of the total GPUs and these are Tuning, Mamring, Chuba-Perbing, Rameng-Nijameng, Damthang, Poklok-Denchung etc. (fig 5.8)

Table 5.1h. Production of Potato (South District.2004-05)

Production in ('000kg/hect.)	Category	No of GPU	Total GPUs %
<25	Very low	5	11.11
25 - 50	Low	7	15.56
50 - 75	Medium	12	26.67
75 - 100	High	8	17.78
>100	Very high	13	28.88
Total		45	100.00

* Source: Crop Production Statistics, Department of Agriculture and Food Security.2004-05

The potato production pattern in South District has high nature as the category of medium, high and very high constitutes around 70% of the total Gram Panchayat units. This is due to the fact that, the potato is one of the important food items of vegetables in hilly area. It is simply boiled or taken as main meal by villagers. The cultivation of potato does not require specific climatic condition like cardamom. In hilly area potato can be cultivated in any available piece of land easily.

5.1.9 Production of Olericulture (Vegetable): 2004-'05.

The study of production pattern of vegetable in South District has a direct bearing to the understanding of economic condition of the people. More than 80% of the vegetables in the district are imported from outside the state. Another important aspect of study of vegetables production is that, the locally produced vegetable is totally depends on the bio-fertilizer or organic farming. So the demand of locally cultivated vegetables is very high in local market. This is another branch of agriculture which has further development prospects.

Table 5.1i Production of Vegetables. (South District 2004-05)

Production in ('000kg/hectare)	Category	No of GPU	Total GPUs %
<50	Very low	1	2.22
50 - 75	Low	9	20.00
75 - 100	Medium	11	24.45
100 - 125	High	24	44.45
> 125	Very high	4	8.83
Total		45	100.00

* Source; Crop Production Statistics. Department of Agriculture & Food Security:2004-05

Table 5.1 i shows the vegetable production pattern of South District. Only a single GPU i.e. Assangthang is in the very low (<50'000 kg/hectare) category which is the driest GPU in the South District. The low production of vegetable (50,000 -75,000kg/hectare) category has 20% of the GPUs. These are mostly located in the western part of the district. Another 24% GPUs are in the medium (75,000 -100,000kg/hectare) production category. These GPUs are scattered in north-western and south-western parts of the district. The high (100,000-125,000kg/hectare) production has the highest percentage amongst the categories, having more than 44% of the total GPUs. More than 8% of the total GPUs are under the category of very high (>125'000kg/hectare) vegetable production. The high and very high categories of vegetables production are found in the south and western parts of the district, where the warmer climate prevails. (fig5.9)



Photograph 5.6 Oreliculture(Sustainable Agricultural Practice)

In general, the production of vegetables in the South District of Sikkim can be considered as medium. Further policy and planning is required for its increase production. The use of organic fertilizer has fetched higher price, but most of the farmers are still not willing to shift from the traditionally used inorganic ones. Besides, large scale cultivation of vegetables is limited except some selected farmers. This is due to the sedentary nature of the agriculture. Lack of knowledge about the profitable markets of vegetables is some of the problems for large scale production of vegetables in the district.

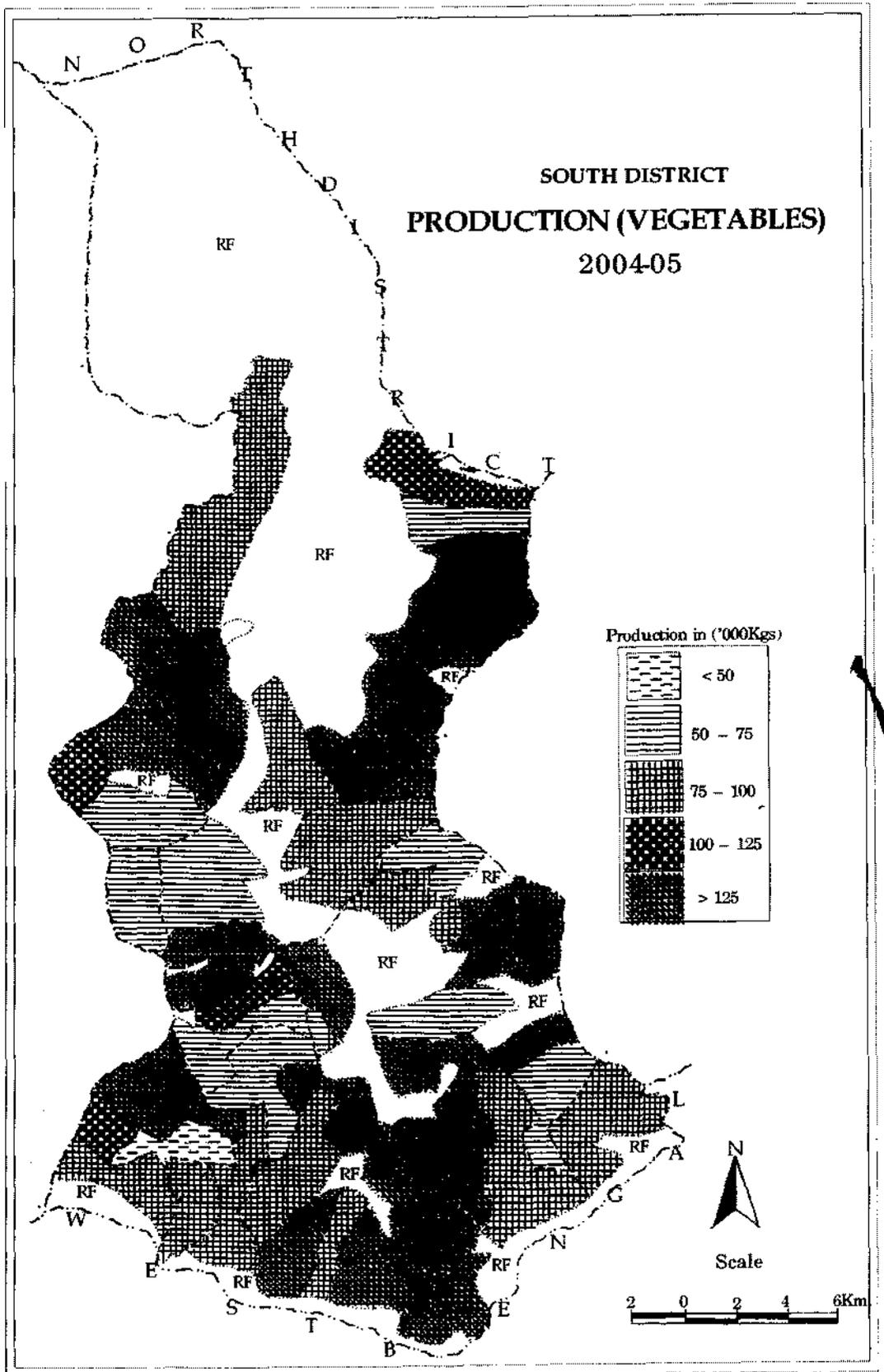


Fig 5.9

The Crop Production in the South District has the following characteristics:

- i). Out of the important selected crops viz, maize, rice, wheat, pulses, oilseed, cardamom, ginger, potato, and vegetables. The crops like maize, pulse, ginger, potato, and vegetables have well distribution of production and similar pattern of intensity of production.
- ii). The crops like rice, cardamom and wheat have regional pattern of production as they have been concentrated in only some selected specific Gram Panchayat units as the cultivation of these crops is more or less controlled by the availability of fertile and well drained soil as well as specific-agro-climatic conditions.
- iii). The production of ginger, potato and vegetables can be increased if the intensity of cropping area is increased e.g. vegetables cultivation has been practiced as hobby in the small kitchen garden areas. If the farmers are pursued to use the land for the cultivation of vegetables instead of less productivity and low market demand crops, will automatically benefit the farmers and indirectly increase the income level of farmers.
- iv). Amongst selected the crops, highest level of productivity is found in three crops i.e. ginger, potato, and vegetables. The average yields of these three crops are 7000kg/hectare, 4500kg/hectare and 2500kg/hectare respectively in 2004-05. And rice has the lowest yield amongst the crops having only 800kg/hectare.
- v). The farmers are still clinging to traditionally cultivate low production crops like rice, cardamom, and maize even though their productivity is low due to certain socio-economic constrains, e.g. farmers can not instantly changes from these low production crops to higher market price crops due to the lack of knowledge and unfavorable agro-climatic conditions. And on the other hand, they can not dump due to the lack of ideas and knowledge for new crops and higher capital inputs requirement do not allowed them to change. This leads to low productivity of some of the crops.
- vi). The low productivity of most of the crops indicates proper policy and planning is required for agricultural development in the South District.
- vii). The policy and planning should be locally suitable methods, many a time the modern scientific methods are experimented in the plain area where they are suitable

these technologies are pushed into the hill without necessary and appropriate modification for suitable in hilly areas the name of modernization of agriculture.

5.2 CROP CONCENTRATION

Crop concentration means the variation in the density of any crop in an area/region at a given point of time. The concentration of crop in an area is largely depends on its terrain, temperature, moisture, and pedological conditions. As each crop requires a maximum and minimum and optimum of temperature, soil moisture, duration of sunshine etc, and the tendency to have high concentration in the area of ideal agro-climatic conditions prevail and the density of concentration is declined as the geographical condition become less conducive.

South District has its own agro-climatic conditions which lead to the development of own unique feature of crop concentration. The crop concentration in the district has been studied by applying Bhatia's (1968) relative concentration methods. The study is for selected crops which have direct bearing to generation of gross domestic product in the district. They are as cereals, pulses, potato, cardamom, oilseed and horticultural crops.

5.2.1 Crop Concentration Cereal. 2004-'05

The cereal includes maize, rice, wheat, and oat. These are mainly cultivated in the South District. Out of these, cereal crops cultivation of oat is very negligible and maize occupies the first rank amongst the cereal in terms of coverage which is cultivated in slopes of available field. Rice is in the second position and traditionally concentrated in the lower river valleys and wheat concentrated in middle and higher altitude.

The mean(X) value has been calculated as 1.11 and SD 1.13 and three categories has been found out viz. low category(X-1SD to X), medium category(X+1SD) and high category(X+2SD)

Table 5.2a Crop Concentration, Cereal (South District, 2004-05)

Concentration Index	Category	No of Gram Panchayat Unit	Total Gram Panchayat Unit %
0.02-1.11	Low	18	40.00
1.11-2.24	Medium	25	55.56
2.24-3.37	High		4.44
Total		45	100.00

* Source: Crop Area Statistics, Department of Food Security, Govt, of Sikkim. 2004-05

Table.5.2a represents the cereal concentration picture in The South District. The low (0.02 -1.11) category has occupied 40% of the total Gram Panchayat units. Most of these Gram Panchayat

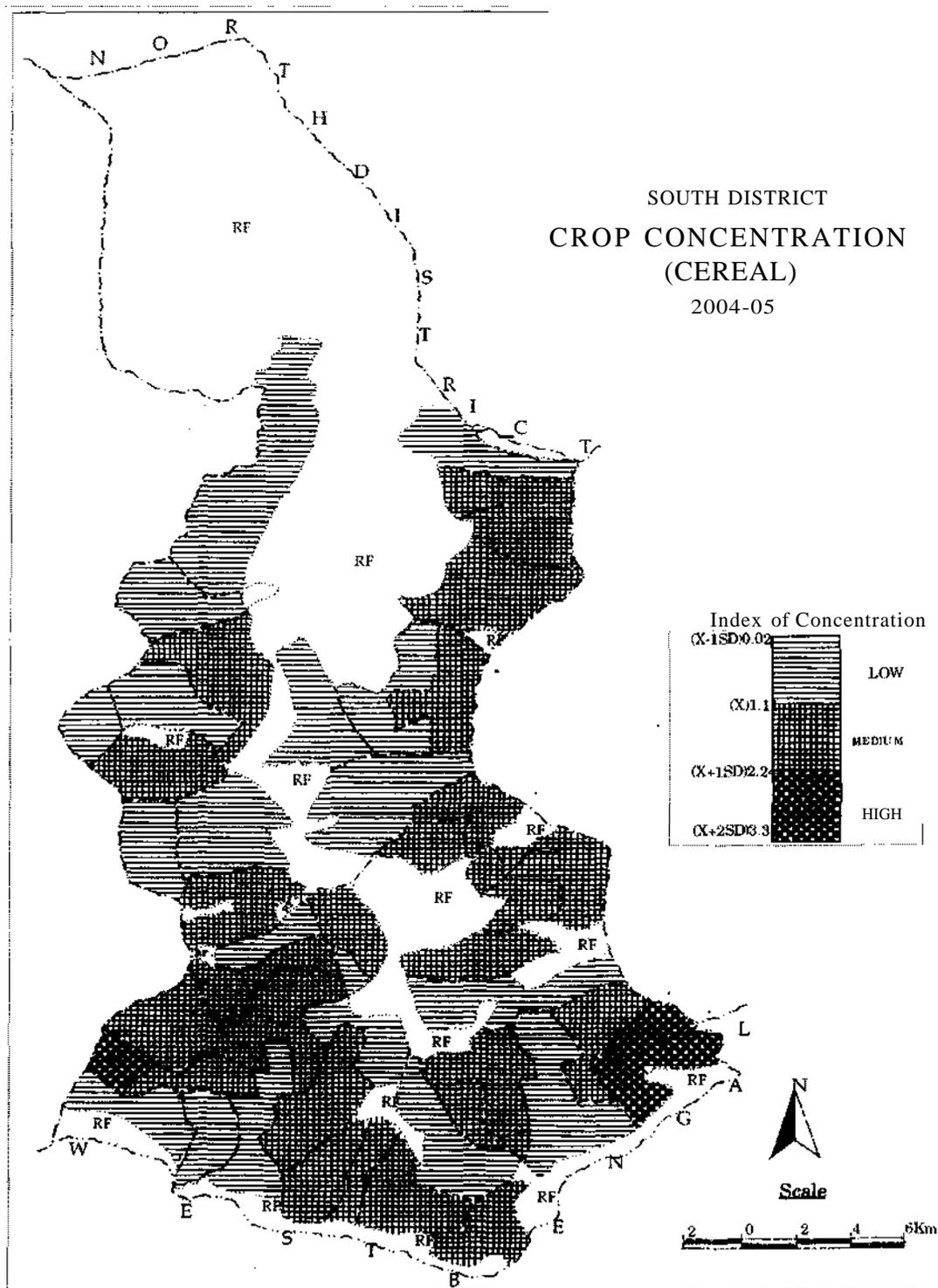


Fig 5.10

units are found in western, central and south-western parts of the district. Amongst the Gram Panchayat units which falls in this category, Ben-Namphok has the lowest having 0.39 and Kewzing -Bhakhim has the highest 0.98. The medium (1.11-2.24) category constitutes around 54% of the total Gram Panchayat units. Out of the Gram Panchayats units which are under this category Sumbuk-Kartikey has the lowest value. These Gram Panchayats units are located in eastern and south-western parts of the district. Another 4.44% are under the category of high (2.24-3.37) having only two GPUs namely Tinik - Chisopani and Tuning -Mamring (fig 5.10). The picture of cereal concentration in South District is medium because half of the total Gram Panchayat units come under the medium category.

5.2.2 Crop Concentration, Pulse: 2004-'05

Pulse is one of the important crops which supplement the economy as well as the protein intake of the native of South District. The important types of pulse cultivated in the district are urad, rice bean, raj amah, fields' pea, cow pea, arhar and black gram. The cultivation of pulse crop is increasing, but the concentration of pulse is low in South District.

Table 5.2bCrop Concentration Pulse (South District. 2004-05)

Concentration Index	Category	No of Gram Panvhayat uni	Total Gram Panchayat units %
0.25—0.97	Low	32	71.11
0.97—1.68	Medium	7	15.56
1.68—2.39	High	6	13.33
Total		45	100.00

* Source: Crop Area Statistics. Department of Food Security. Govt, of Sikkim. 2004-05

The concentration of pulses is represented by table 5.2b in the South District. The mean value for all forty five Gram Panchayats units is 0.97 and Standard deviation is 0.72, three categories have been found out as low, medium, and high. In the low (0.25-0.97) category of crop concentration, there are 32 Gram Panchayat units, which account more than 71% of the total Gran Panchayat units. These GPUs are found western, northern and south-western parts of the district. Out of the GPUs which fall in this category, Lingi has the lowest value (0.09) and Rateypani has the highest value (0.88). Another 16% are in the medium category (0.97-1.68). The GPUs which are in this category are mostly concentrated in south-eastern and eastern parts of the district. Some of the important Gram Panchayat units which are under this category are Sumbuk-Kartikey, Sorok-Shayampani and Wak-Omchu etc.(fig5.2) But

the high category gas only 13% of the total Gram Panchayat units and these are found in GPUs of Likship-Linzo, Sanganath, Temi, Tarkua and Nagi- Pamphok etc. In comparison to cereal crops, pulses concentration is more as the number of Gram Panchayat units which fall in high category is more.

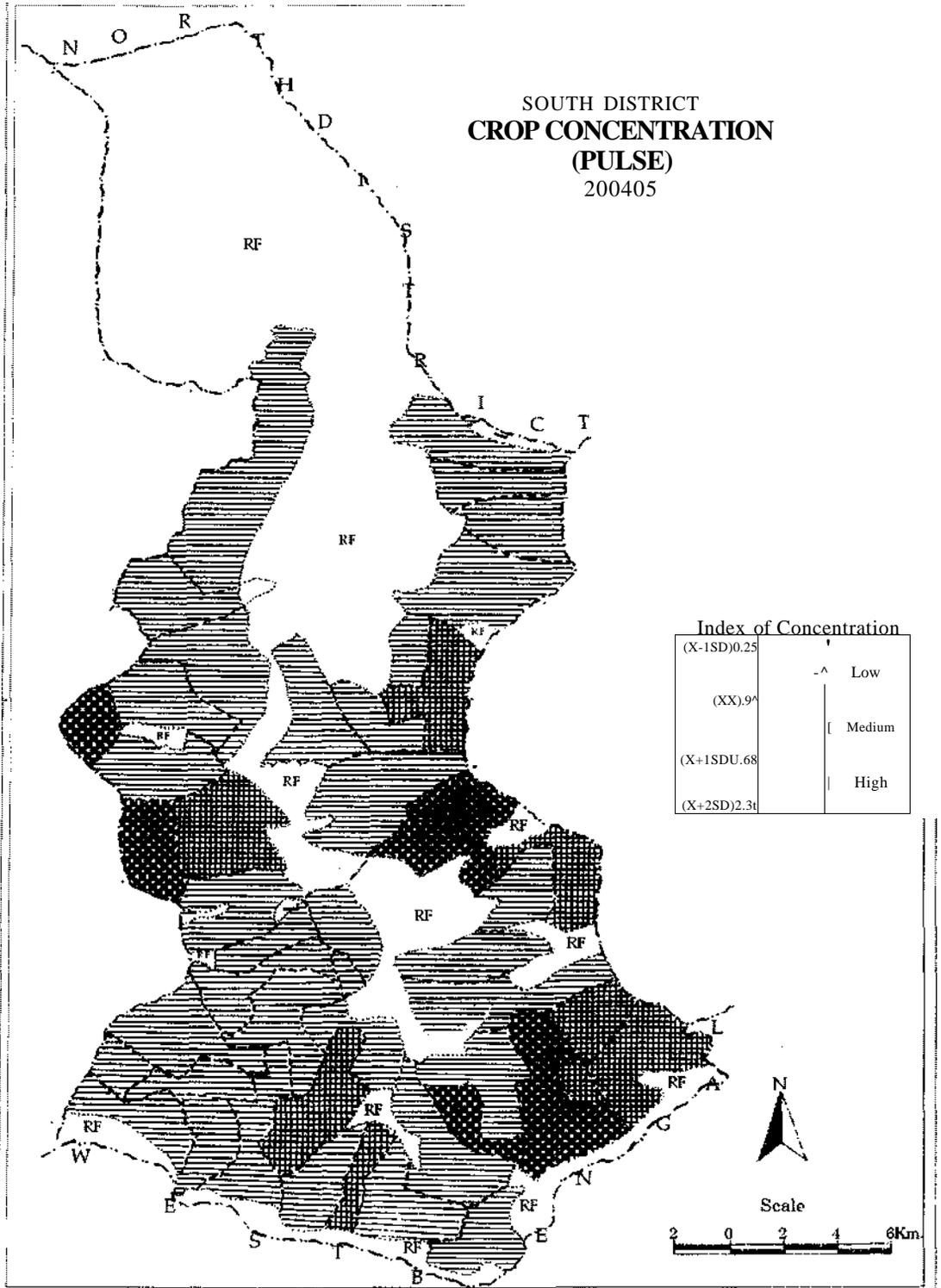


Fig 5.11

5.2.3 Crop Concentration Large Cardamom: 2004-'05

Large cardamom is the most important cash crop of South District. Unlike other crops cardamom require specific climatic agro-climatic conditions. The natural habitant of cardamom is sub-tropical semi-evergreen forest of mountainous sub-Himalayan region. Cardamom is shade loving plant..

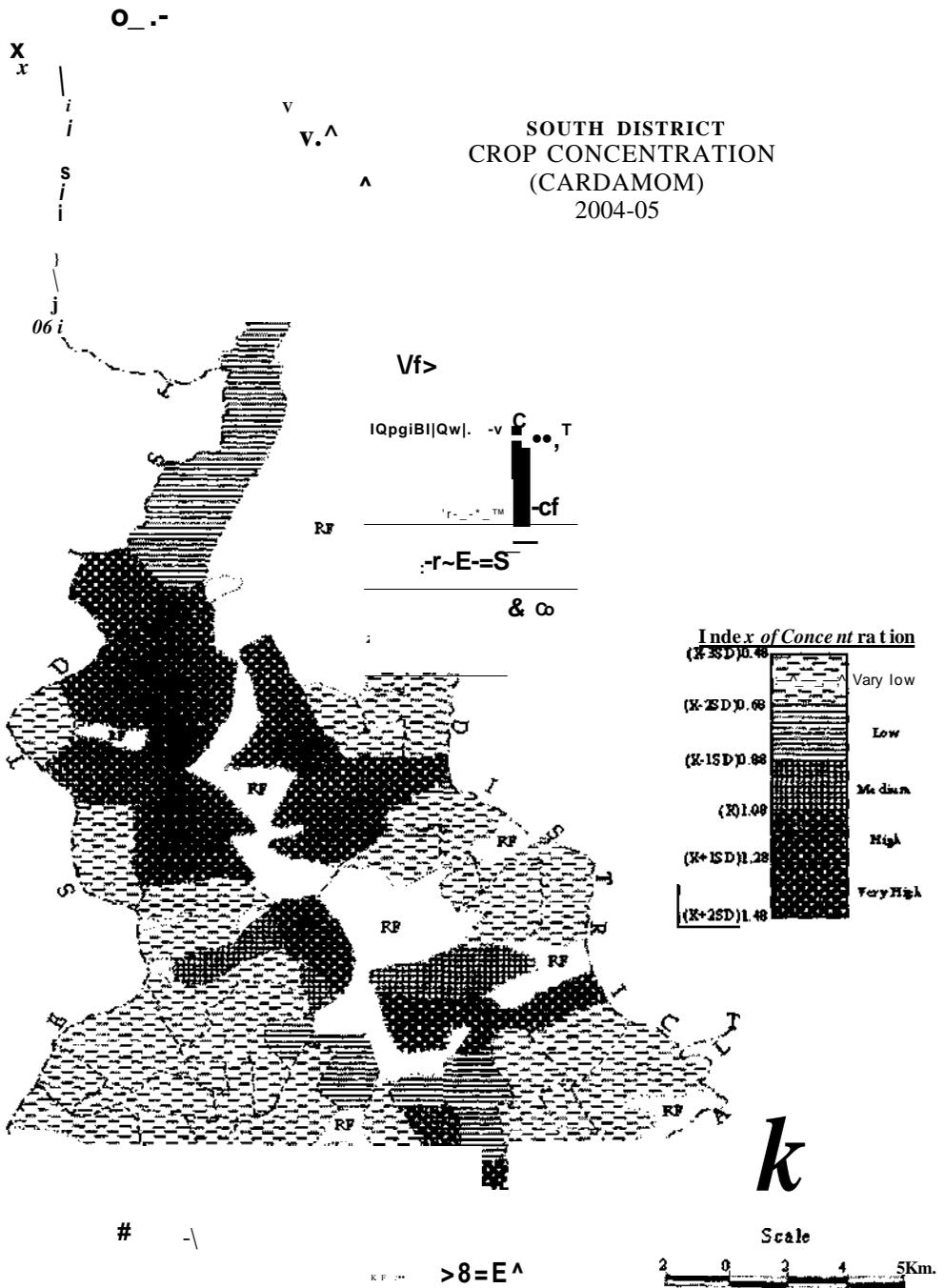


Fig. 5.12

Table 5.2c Crop Concentration Large Cardamom (South District.2004-05)

Concentration index	Category	No of GPU	Total Gram Panchayat unit %
0.48 - 0.68	Very low	27	60.00
0.68 - 0.88	Low	3	6.67
0.88-1.08	Medium	2	4.44
1.08-1.28	High	2	4.44
1.28-1.48	Very High	11	24.45
Total		45	100.00

* Source: Crop Area Statistics, Department of Food Security, Govt, of Sikkim.2004-05.

The table 5.2c shows the picture of cardamom concentration in the South District. Very low concentration of cardamom (0.48-0.68) is found in 27 Gram Panchayat Units constituting 60% of the total Gram Panchayat units. These GPUs are mostly located in Namchi Sub-division. This is due to the fact that the climatic condition of Namchi is drier which is not suitable for cardamom cultivation. The low (0.68-0.88) category has occupied only around 7% of the total GPUs. They are namely Pamthang, Mainram -Phalidara, and Tangi-Bikmat. The categories of medium (0.88-1.08) and high (1.08-1.28) have 4.44% each. The earlier one is recorded in the GPU of Rameng-Nijameng and tingrithang. And the later one is found in the GPUs of Rateypani and Lamting- Tingmo. But the very high (1.28-1.48) category of cardamom concentration has higher percentage having more than 24% of the total GPUs. The GPUs which fall in this category are mostly found in the Ravongla sub-division. (fig5.12). The cardamom has higher concentration in the Ravongla Sub-division than the Namchi Sub-division.

5.2.4 Crop Concentration Potato: 2004-'05

Potato is important cash cum vegetable crop of South District, which is cultivated through out the year. The cultivation of potato does not require specific climatic conditions like cardamom. Its cultivation in recent years has shown significant increase due to the huge market demand. The cultivation of potato does not require intensive labours this is another factor which support the increase in potato cultivation.

Table 5.2d Crop Concentration, Potato (South Sikkim.2004-05)

Concentration Index	Category	No of Gram Panchayat Unit	Total GPUst %
0.12-0.97	Low	29	64.45
0.97-1.87	Medium	8	17.78
1.87-2.97	High	8	17.78
Total		45	100.00

* Source: Crop Area Statistics, Department of Food Security, Govt, of Sikkim.2004-05.

Table 5.2d, represents the concentration of potato in South District. The low (0.12-0.97) category concentration has occupied more than 64% of the total GPUs. Most of these GPUs are located in north-eastern and south-western parts of the district.



Photograph 5.1 Cultivation of Potato (Rabi)

The medium (0.97-1,87) category concentration has occupy 8 GPUs constituting around 18% of the total Gram Panchayat units and are mostly found in the western part of the district. The high (1.87-2.97) category potato concentration has also the same percentage like medium having around 18% GPUs. The gram Panchayat units which are under this category are namely, barong-Pamthang, Ralong-Namlung, Barfung, Damthang, Tringrithang, Chuba-Perbing, Maneydara and Melli etc (fig 5.13).

SOUTH DISTRICT
CROP CONCENTRATION
(POTATO)
2004-05

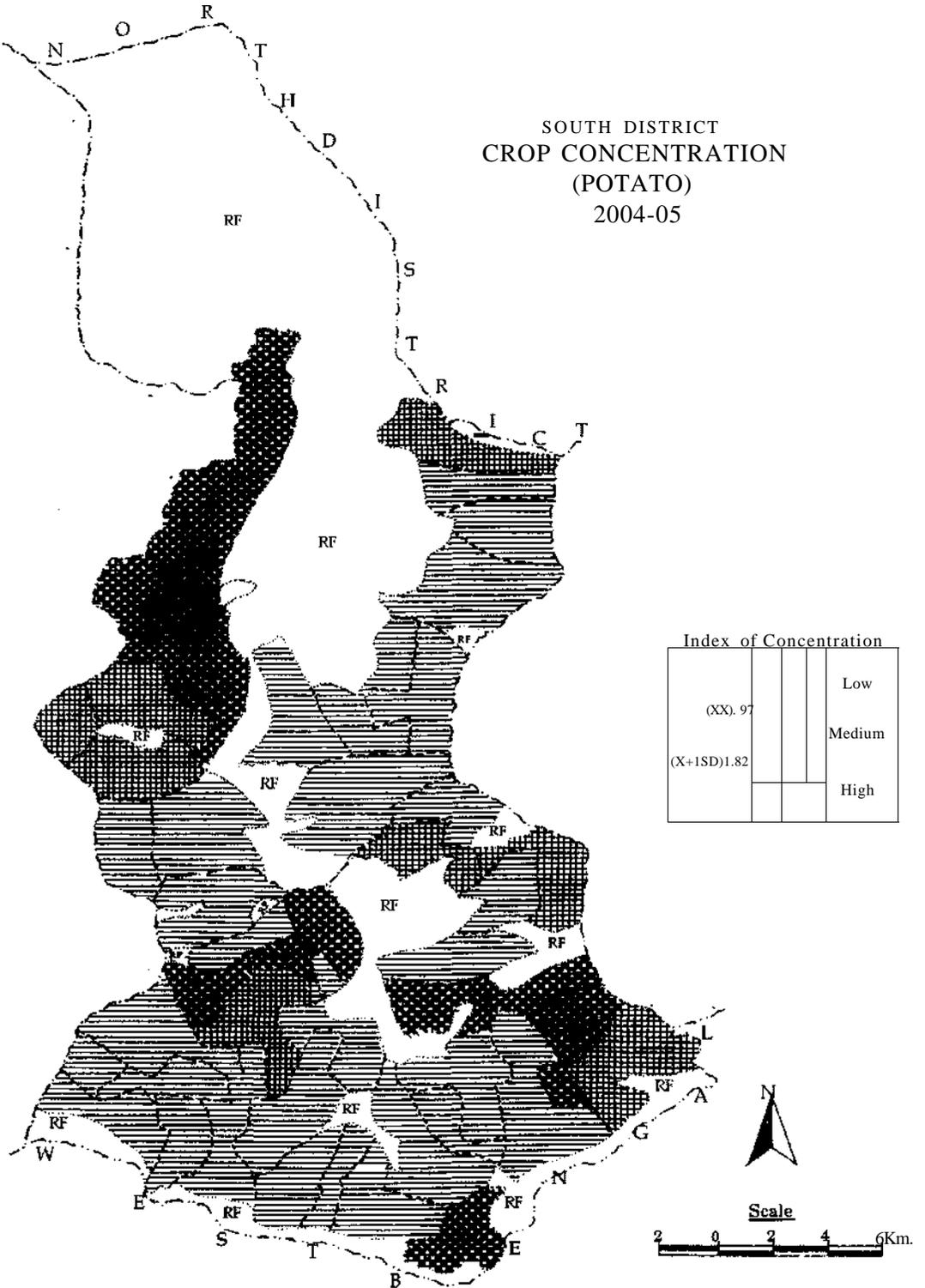


Fig 5.13

5.2.5 Crop Concentration, Oilseed: 2004-'05

Table 5.2e Crop Concentration, Oilseed (South District.2004-05)

Concentration Index	Category	No of GPU	Total Gram Panchayat unit %
0.37-0.95	Low	27	60.00
0.95-1.08	Medium	5	11.11
1.08- 1.66	High	13	28.89
Total		45	100.00

* Source: Crop Area Statistics, Department of Food Security, Govt, of Sikkim 2004-05

Oilseed is another crop which registers in crop area in South District in 2004-05. The low category (0.37-0.95) has the highest percentage having 60% GPUs Table5.2e. All the entire Gram Panchayats which are under this category have been equally distributed in all parts of the district. But medium (0.95-1.08) concentration category has only 11 % of the total Gram Panchayat units. The GPUs which are under this category are Sripatam-Gangchung, Namphing, Maneydara, Mikhola-Kitam, and Mainram-Phalidara. The high (1.08-1.66) category accounts more than 28% of the total GPUs. Some of the the important Gram Panchayat units which fall in this are; Sanganath, Raiyong-Tinkitam, Turung-Mamring etc. The concentration of oilseed in South District of Sikkim during 2004-05 is generally medium (fig5.14)



Photograph 5.2 Oilseed Cultivation(mustard)

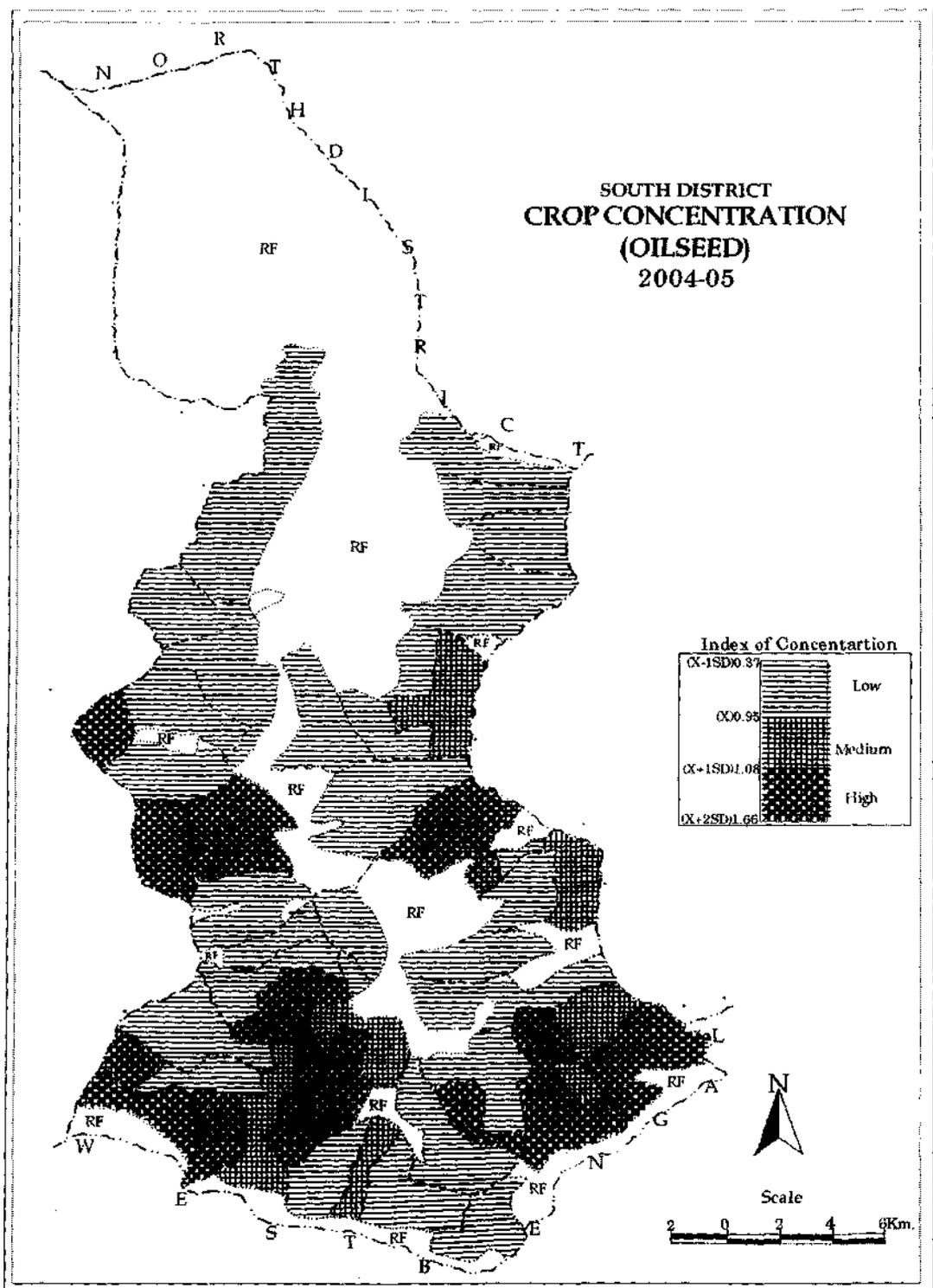


Fig 5.14

5.5.2.6 Crop Concentration, Horticulture: 2004-'05

Horticulture is one of the important fields of economy which can be further increase, because this practice can be of multipurpose benefit for agro-forestry purpose. The fragile environment conditions of South District require the protection of environment as well as the land should get economically benefited. The important

fruits cultivated are mandarin orange, guava, litchi, papaya, banana, passion fruits, peach, avocado, plum, and walnut.

Table 5.2f Crop Concentration, Horticulture (South District.2004-05)

Concentration Index	Category	No of GPU	Total Gram Panchayat unit %
0.34-1.03	Low	28	62.22
1.03-1.73	Medium	10	22.22
1.27-2.40	High	7	15.56
Total		45	100.00

* Source; Crop Area Statistics, Department of Food Security, Govt of Sikkim. 2004-05

Horticulture crop concentration in South District for 2004-05 is represented by table 5.2f. The low concentration (0.34-1.03) has more than 62% of the total Gram Panchayat units. These GPUs are mostly located in north-western, western and south-western parts of the district. Another 22% of GPUs are in the category of medium (1.03-1.73) and they are mostly found in southern and eastern parts of the district. But high category (1.27-2.40) has low percentage; having only around 16% of total Gram Panchayat units. These GPUs are located in south-eastern parts of the Districts. In spite of tremendous increase in crop area in horticulture, total area under this crop is less because the concentration trend shows that there is maximum percentage in low category of concentration (fig 5.15)



Photograph 5.3 Passion Fruits (An Important Horticultural Crop)

SOUTH DISTRICT
CROP CONCENTRATION
(HORTICULTURE)
2004-05

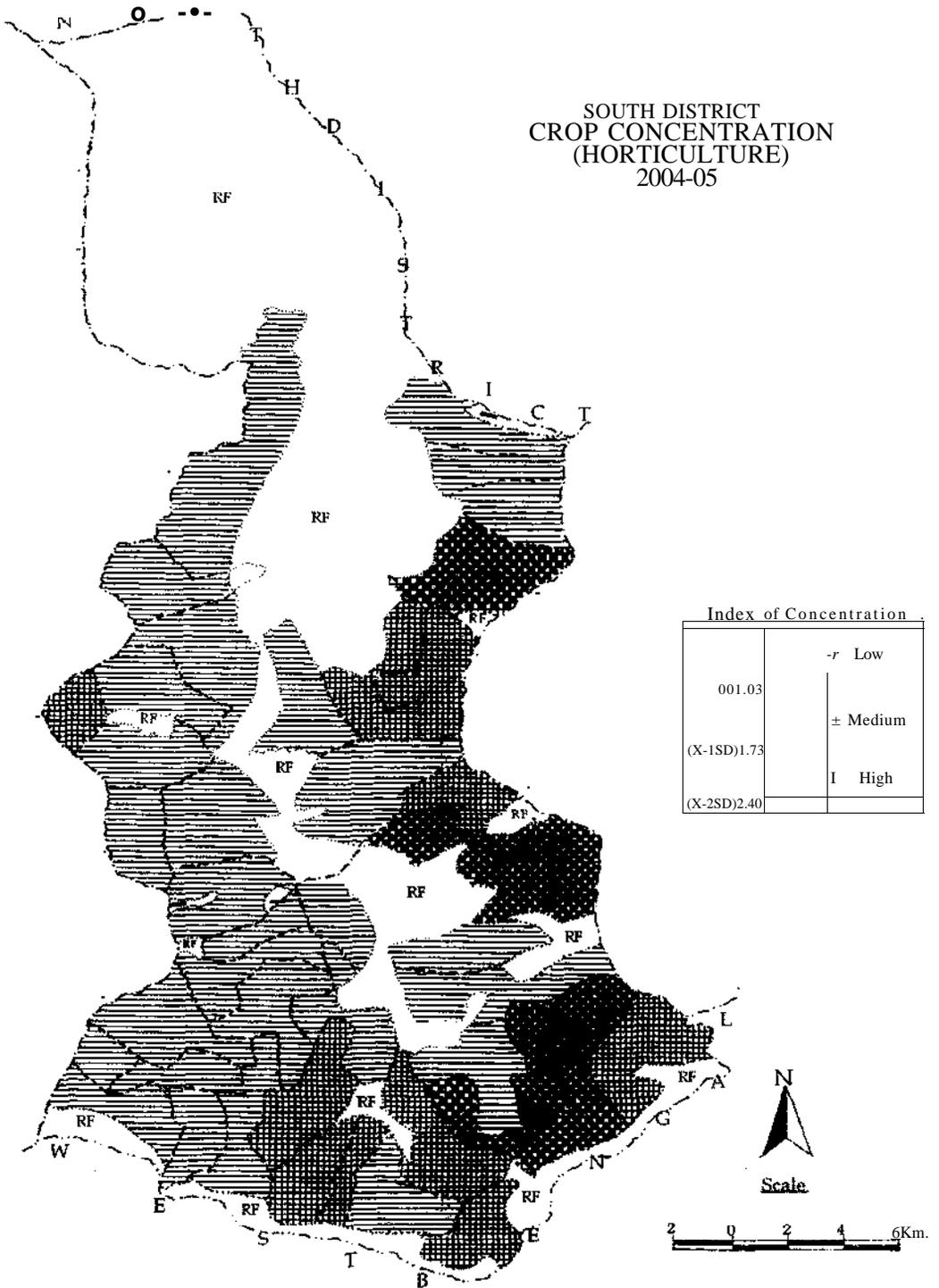


Fig. 5.15

The Crop Concentration in South District has the following characteristics.

- i). Cereal has the characteristics of uniform concentration pattern amongst the Gram Panchayat Units as still cultivation and production of staple food crop is the main sources of income in the district
- ii). The concentration of pulses has similar characteristics with cereal, because pulse is cultivated along with cereal crops as mix crops. Next to cereal, pulse has been given importance for cultivation while choosing by the farmers.
- iii). The oilseed also has the same pattern as cereals and pulses as the oilseed crops are cultivated in that area during lean season or inter cropping, especially mustard and soybean. The farmers give oilseed as second choice after cereals and pulses.
- iv). The concentration of cardamom has the tendency to concentrate in some pockets only, as the cultivation of cardamom is entirely controlled by the climatic conditions, which is prevail in northern part of the district.
- v). The high potato cultivation also has the tendency to concentrate in some pockets areas. Even the area of potato cultivated area is increasing, because most of the farmers cultivate potato for subsistence crop not for commercial purpose.

The facts and figure shows that agricultural development in the district can be further developed by increasing intensity of cropped area by means of practicing double and multiple cropping by providing proper policy and planning. The policy and planning should be in accordance with the local specification means and methods like, terrace farming which control the soil moisture especially in hilly topography of the district. The plantation of broom plant will support the water retaining for the crops for the crops like rice, and as a farm fodder as well as cash crop along the contour banding, which will supplement the economy of the farmers. Above all, provision for the irrigation practicing like rain water harvesting should be encouraging and encouragement of farmers to participate in the development and management of watershed should be done, because lack of irrigation facility is the most important problem for agricultural practice in the hilly areas like the district. Besides, proper advice to the farmers is necessarily, while selecting the crop in accordance with the suitable local agro-climatic conditions. The development of proper mechanism of local market facilities will increase the crop concentration.

5.3 CROP COMBINATION

The concept of crop combination is scientific methods of study about the existing spatial relationship of crops in association with each other in land utilization study. Such study is necessary in order to have a more composite structure of agricultural region. By employing the method, one can find out the dominant crop of a particular area and proper planning can be formulated for the future agricultural development of the area. The idea of crop combination could be best utilized in understanding the existing agricultural situation, the land use pattern of a region and planning of crops keeping with the local nature of socio-economic and physical conditions for the future.

The crop combination in South District has been studied by using Weaver's (1954) methods. By employing the methods, up to seven crop combination picture of Gram Panchayat units has been found out for 2004-05.

Table 5.3. Crop Combination. (South District, 2004-05)

Crop Combination Index	No of Gram Panchayat units	Total GPUs(%)
Three crops	3	6.67
Four crops	10	22.22
Five crops	16	35.56
Six crops	11	24.11
Seven crops	5	11.11
Total	45	100.00

* Source: Crop Area Statistics, Department of Agriculture Govt, of Sikkim.2004-05

Table 5.3 shows that there is no single Gram Panchayat units where there is mono crop and 2 crop dominances in the district. The three crop combinations also have only in 7% of the GPUs and they are found in the Gram Panchayat units of Tingithang, Kamrang-Mamley and Chuba -Perbing. Another 22% of the GPUs have four combinations. These Gram Panchayats are mostly located in the southern parts of the district; where the conducive conditions like warm climate, low and middle altitude with gentle slope and well distribution of rainfall are prevail. The highest percentage having 36% of GPUs is occupied by the five crop combination. The Gram Panchayat units which have five crop combinations are located in the south-eastern and western parts of the district. The six crop combination has more than 24% of the total GPUs. Most of these GPUs which fall in this category are found in the southern part of the district. And the seven crop combinations have found more than 11% of the total Gram Panchayat units. (fig5.16)

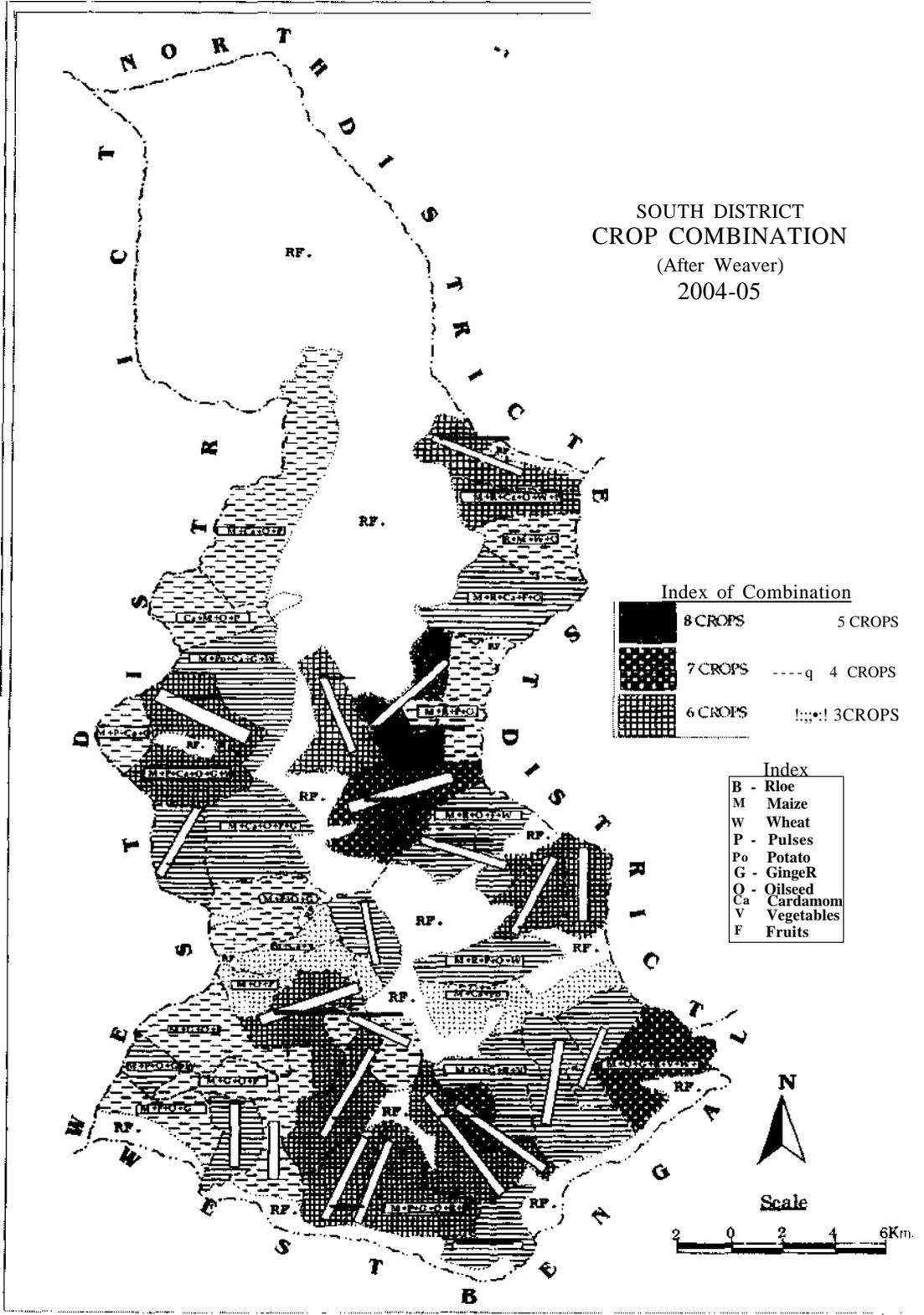


Fig 5.16

The Crop Combination in the South District has the following characteristics:

i). Out of the total Gram Panchayat units, 41 Gram Panchayat units have maize (91%) as the first ranking crop and the 5 Gram Panchayats (9%) have the cardamom as the first ranking crop. Sixteen Gram Panchayats have recorded pulse as the second ranking crop. Nineteen Gram Panchayat units have rice as second ranking crop. There is only a single Gram Panchayat unit which has recorded potato as the second ranking crop. Three Gram Panchayat units have oilseed as the second ranking crop. Two Gram Panchayat units have fruits as second preference crop.

ii). The overall characteristics of crop combination pattern in the South District shows the micro crop region in the district as the maize and pulses in western part of the district. The second micro crop region is that of maize-rice in the western part of the district and third maize cardamom in the central and northern part of the district.

iii). The crop combination pattern shows that the traditional combination pattern still prevails in the South District in spite of low production. The farmers of the district are still clinging to the old practice of crop combination. The farmers do not know about the scientific practice of cultivation which may give more productivity.

iv). All the above facts and figures indicate that the farmers of South District lack scientific knowledge of cropping.

v). The character of maize dominance in crop combination pattern reveals that still climatic condition especially soil moisture condition is the most dominant factor for cultivation of crops in hilly region.

vi). Encouragement to farmers for using HYV seed of maize, pulses, oilseed and potato will change the crop combination as well as increase the agricultural productivity in the district.

vii). The system of mono and bi-cropping pattern should be encouraged; the higher percentage of 5 and 6 crop combination pattern shows low agricultural development in the district.



Photograph 5.4 Mix Cropping (Pea & Potato)

5.4 CROPDIVERSIFICATION

Crop diversification is another method by which the level of agricultural development is determined as it explains why it is possible or necessary to raise various forms of agricultural activities. Essentially, it is an indicator of multiplication of agricultural activities which obviously involve intense competition among various activities for space. The keener the competition, the higher the magnitude of diversification, and lesser the competition greater will be the trend towards specialization or mono-cultural farming where emphasis is on one or two crops.

Table 5.4 Crop Diversification (South District.2004-05)

Diversification Index	Category	No of Gram Panchayat unit	Total Gram Panchayat unit %
<50	High	2	4.44
50-60	Medium	1	2.22
60-70	Low	17	37.79
>70	Very low	25	55.56
		45	100.00

Source: Crop Area Statistics, Department of Agriculture Govt, of Sikkim.2004-05

Table 5.4 represents the crop diversification of South District. There are various methods which can determine the crop diversification. The crop diversification study for South District is based on Bhatia's (1965) methods, in which crop area is considered as objective measurement of crop diversification. Out of the

total Gram Panchayat units, only two GPUs are in the category of high (<50) crop diversification accounting 4.44% of total GPUs. The two Gram Panchayat units which fall in this category are namely, Nagi-Pamphok and Mainram-Phalidara. One Gram Panchayat unit is under the medium category (50-60) crop diversification, having only 2.22% of GPUs and it is found in the Gram Panchayat unit of Tinik-Chisopani. Around 38% of the total Gram Panchayat units are under the category of low (60-70) crop diversification. More than 55% of the total gram Panchayat units are in the category of very low (>70) cop diversification. Most of these Gram Panchayat units are located in southern, eastern and western part of the district, (fig 5.17)



Photograph 5.5 Floriculture(An Alternative Agriculture)

The crop diversification in the South District has strong characteristics of mono-crop culture specially rice in river valley, maize in middle altitude and cardamom in higher altitude. This mono-crop culture is not by the agriculture development and advance farm management, but due to constraints laid by the physio-climatic conditions. The steep slope is not suitable for rice cultivation. The farmers are compelled to cultivate maize or cardamom as found in the western part of the district. The case is the same in eastern and southern parts where rice and pulses have dominant characteristics. Rice is cultivated in the fertile river valleys and pulses in the higher slopes. Maize is cultivated in the southern part where the cultivation of rice is not possible.

SOUTH DISTRICT
CROP DIVERSIFICATION
2004-05

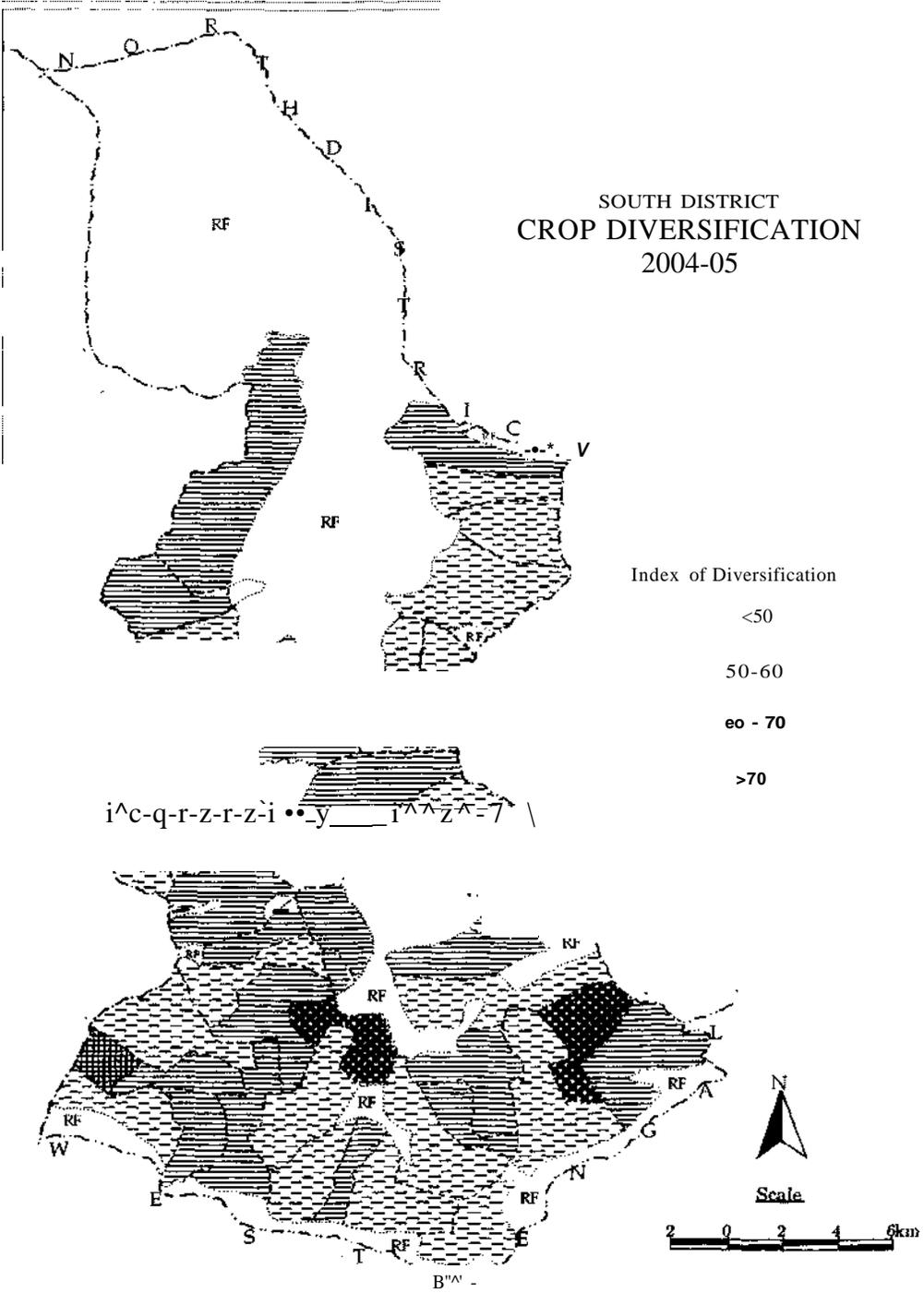


Fig5.17

The overall character of agricultural land use in the district is low as the percentage of low crop diversification in more than 50% of GPUs. More planning and policy based on the local specific problems and condition should be implemented, for the further development of agricultural production. The attitude of sedentary nature of

the farmers should be changed. The higher agricultural production is needed for the ever increasing population in the district. The mon-crop culture only supports the sedentary agriculture. The farmers of the district should be encouraged for more diversification of different crops or system at different time of the year. This will be possible only after addressing the existing the local problem of agro-climatic zones. Diversification is also an effective way of optimizing the use of socio-capital (e.g. rural labour) in rural areas where unemployment and under employment are high, this will increase and ensure the agricultural productivity and food security

5.5 CROP EFFICIENCY

Crop efficiency is an important concept of determining the level of agricultural productivity and its help to formulate policies and planning for further agricultural development. Crop efficiency for South District is calculated by using Kendall's (1939) ranking co-efficient method and (mean value is found as 22.79 and standard deviation as 7.2)

Table 5.5 Crop Efficiency (South District.2004-05)

Efficiency	Category	No of GPU	Total Gram Panchayat unit %
1.19-8.39	Very high	1	2.22
8.39-15.59	High	5	11.11
15.49-22.79	Moderate	14	31.11
22.79 - 29.90	Low	16	35.56
29.90-32.10	Very low	9	20.00
Total		45	100.00

* Source: Crop Area Statistics, Department of Agriculture Govt, of Sikkim. 2004-05

The category of very high crop efficiency (1.19-8.39) has only a single Gram Panchayat units accounting only 2.22% and found in the GPU of Nagi-Pamphok. Another 11% are under the high crop efficiency (8.39-15.59) category and are registered in the Gram Panchayat of Lingmo-Tokday., Lamting-Tingmo, Poklok-Denchung, Sripatam-Namphok and Chuba-Perbing. The moderate (15.59- 22.79) category have 31% of GPUs. These Gram Panchayat units are mostly located in southern and south-eastern parts of the district. The low category (22.79—29.90) have around 36% of the total GPUs and are located in the western parts of the district. The very low (29.90 - 32.10) category occupied 20% of the total Gram Panchayat units and most of them are located in the south-western parts of the district, (fig 5.18).

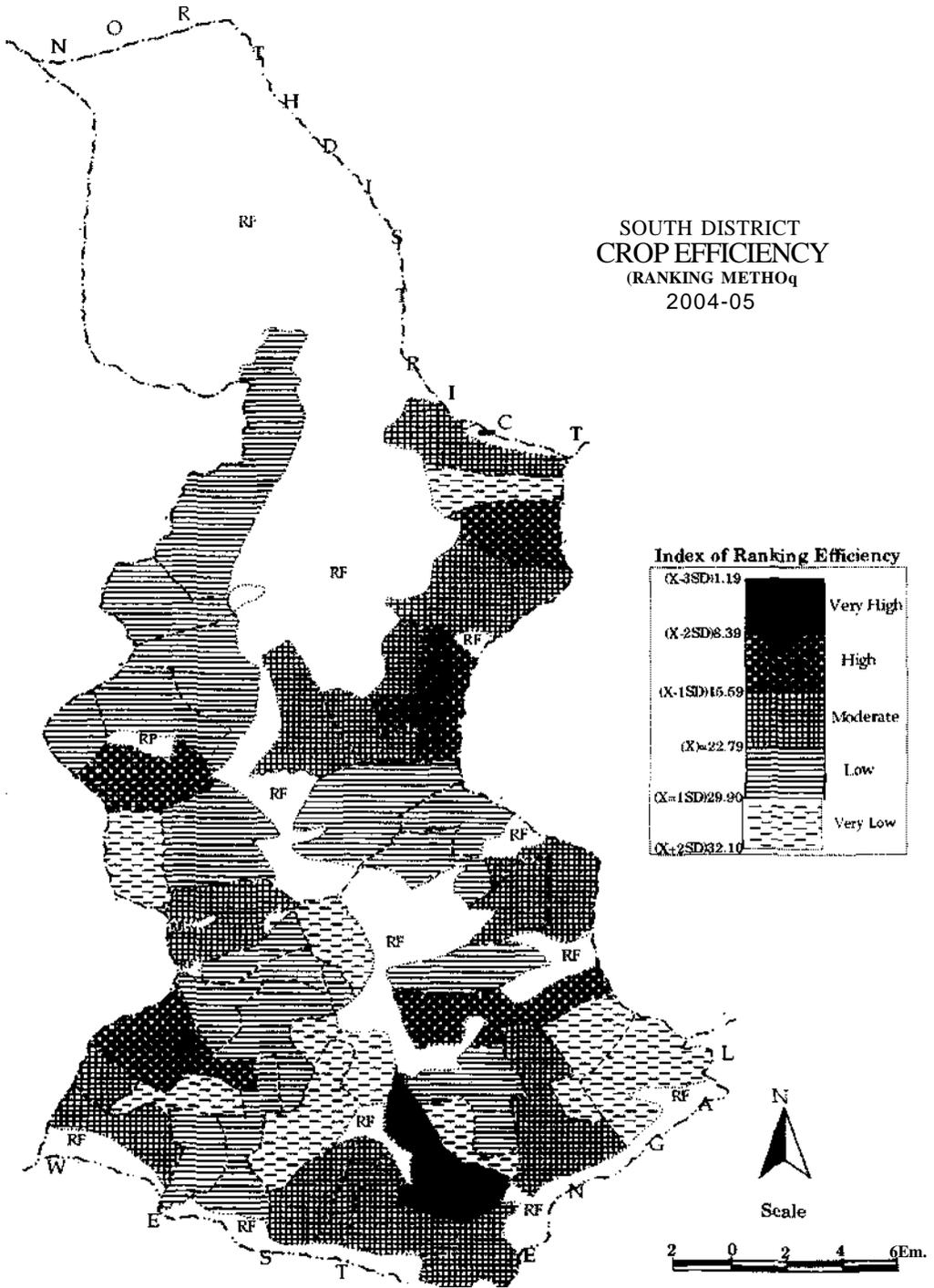


Fig 5.18

The crop efficiency or the productivity is very low as the percentage of low and very low categories constitutes more than 55% of the total Gram Panchayat units. The sedentary nature of cultivation and the lack of irrigational facility in the district are the main problems of low productivity.

5.6 ANIMAL HUSBANDARY

Animal husbandry and agriculture can not be separated especially in hilly or upland agricultural practice because of the higher dependency of animal labour for agricultural purpose as well as manures and income supplements for the farmers in the forms of dairying, poultry, piggery and rabbit rearing, which help the diversification of occupation in the rural areas.

Table 5.6 Live Stock Population (South District. 1997-2007)

Live Stock	1997	Total %	2003	Total %	Decadal Changes 1997-2007
Cattle	12080	23.59	43892	22.16	263.34
Sheep	2325	4.55	2700	1.36	16
Buffalo	61	0.12	1487	0.75	2337
Pig	3135	6.13	9791	4.75	212.31
Goat	8375	16.35	34678	17.52	314.06
Horse	1322	2.58	13	0.006	-99
Yak	2167	4.24	0	0	-0
Rabbit	54	0.10	41	0.02	-24
Poultry	21680	42.34	1.5409	53.23	386
Total	51199	100.00	198011	100.00	

*Source: Live Stock Census 2003:

Table 5.6 shows the live stock population in the South District. In 1997 out of the total population of live stocks poultry has occupied 42.34 %, because in most of the households rearing of fowls and duckling is common practice for food supplements. The cattle occupied second largest share of live stock population, having 23.59%, goat 16.35%, pig 4.55%, Yak4.24%, horse2.58%, buffalos 0.12% rabbit0.10 respectively.

The picture of live stock population in the district in2003 has another picture. Still poultry constitutes the highest percentage having 53.23% of the total live stock population. And cattle 22.16%, goat17.52%, pig 4.04%, sheepl.36% Buffaloes 0.75%, horse0.006% and rabbit 0.02%.

During the period changes of the live stock population has promising picture. Positive increase is observed in cattle, buffaloes, pig, goat, and poultry. These changes indicate some underlying fact of diversification of occupation from the traditional practice of agriculture. Another factor of these positive changes is due to the increase demand of meat and milk by product in the district. This also shows a promising trend for the development of agricultural and allied sector. But in the same period the number of horse, rabbit, and yak population show negative growth. The

decreased in the rabbit population shows that the policy and planning is either not suitable to local problems or fully implemented in the district. The policy and planning in the rabbit rearing should be re-oriented and re-think. Where as decreased in the case of horse is due to the decreased use of horse as beast of burden and development in road network transportation in the district. Decreasing of Yak population has another different factor it due to the government's policy of environmental protection, as the transhumance practice which exists in the higher altitudes especially northern parts of the district is prohibit inside the National Sanctuary of Kanchanzungha.

The discussion shows that animal husbandry can be further develop in the district, especially in dairying, poultry, piggery and goatery, if adequate support and planning and policy is implemented. This will solved the problem of underemployment and unemployment in the rural areas of the district

5.7 PISCICULTURE

Even though the economy derived from pisciculture is negligible in the district, it can be further develop in the low lying river valleys of the district. The development in this sector will lessen the burden up on the agriculture and supplements the economy of the farmers.

Table 5.7 Number of Fishing Family (South District.2005)

Type of Family	Rural	Total % of Rural	Urban	Total % of Urban
Fishing Family	181	72.65	36	27.91
Fish Marketing	10	4.07	8	6.21
Repairing of fishing net	25	10.04	19	14.73
Fishing gear	11	4.42	22	17.05
No of Hooks	22	8.83	44	34.10
Total	249	100.00	129	100.00

* Source: Live Stock Census, Sikkim. 2003

Table 5.7 represents the pisciculture and related occupation in the district. Out of the total pisciculture households 72.65% are located in the rural areas and another 27.91 are in the urban area. The fish business or marketing family occupies 4.07% in rural and 6.21% in urban population. Another part of this economy i.e. repairing of fishing nets 10.07 % and 14.73% in rural and urban households. More than 4.42% and 17.05% of the total fishing community in the district are engages in the preparation of fishing gear in rural and urban area respectively. Off the total house 8.83% in rural

area and 34.10% in urban area has fishing hooks. But the pisciculture practice by urban household is for the leisure time only.

In order to lessen the pressure in the agricultural land use pisciculture can be develop in the district by proper planning and support in these areas, especially in and around the Rangit and the Tista river valleys as flesh water pisciculture and surrounding low land area can be develop in the forms of small fish ponds of locally suitable variety.

CONCLUSION

The agro-climatic conditions has influence the development of own unique feature of crop production, concentration, combination, and diversification. The production pattern of the ten selected crops shows variation. Out of these crops maize, ginger, potato vegetable has higher productivity level and they shows increasing trend and the crops like oilseed and rice have medium range of production, where as cardamom and wheat have general low production. The production pattern also shows that maize, pulse, ginger, potato, and vegetable have well distributed production pattern and similar pattern of production intensity. But the crops like rice, cardamom, wheat and horticulture has regional pattern of production, because these crops has been controlled by specific agro-climatic conditions^ The cereal concentration have shown that in the lower altitudes specially the rice. The character is same in the case of pulse, Potato, oilseed, and horticultural crops. But the cardamom has the tendency to concentrate in the higher altitudes. And the maize has uniform concentration pattern The crop combination has sown maize dominance as the 91% of the GPUs have maize as the first ranking crop and another 9% of the GPUs have cardamom as the first ranking crops. Besides these two crops other crops which farmers give importance for combination are rice, ginger, potato, pulse and oilseeds The diversification pattern also shows that the percentage of high diversification is very low and has mono-crop characteristics having the characteristics of rice in the lower valley, maize in the middle and cardamom in the higher altitude. These characters of mono-crop culture are not by the advancement of farm managements, but due to the constants laid by the physio-climatic conditions. This shows that farmers are still clinging to traditional methods of cultivation due to the limitations of climatic condition and lack of improved scientific method as well as lack of institutional facilities. The agricultural related economy like animal husbandry and pesiculture are

also shows that lack of development and due to the various factors. Even though the demand for milk and meat production is very high in the district due to the lack facilities and development policy and planning there is a huge gap between demand and supply of meat and milk. And the pisciculture is not fully exploited due to the lack of knowledge and scientific methods of rearing and practice in spite of having high demand for fish in the local market. These also indicate the need of proper policy and planning which will be suited to the existing condition of the district.