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Change in Cropping Pattern and its Impact on the Society and the Environment

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ABSTRACT This paper gives the reasons which cause changes in the cropping pattern. Such changes may work towards preservation of the environment, while others may be detrimental in short as well as long runs. The paper accounts for the changes since 1965-66 to 1983-84 in the cropping pattern in Gujarat. Certain suggestions that may be resorted to by the state agencies are also discussed.

INTRODUCTION

Farmers try to maximize their profit through various factors. In this process, some farmers change their cropping pattern totally, some do it partially, while some do not change at all. This depends on the respective definition of profitability. Those, who consider profit to be the increase in net income, practice mono cropping, leading to commercialization of crops. They make maximum use of modern technology like high yielding variety of seeds, fertilizers, pesticides, irrigation facilities etc. ignoring their impact on environment and social damage.

On the other hand, the farmers, who consider long term benefits in terms of retaining soil fertility for a longer time, would change over to multi-cropping pattern to balance the nutrients of soil. They use agricultural inputs in a balanced manner. Farmers change their cropping pattern due to varied reasons. At times, such change is positive to environment and to society, but it may prove negative also.

OBJECTIVES

This paper studies change in the cropping pattern in Gujarat. It accounts changes since 1965-66 to 1983-84, at an interval of five years. The analysis is done at the state level, regional level and district level. After the regional level analysis, Surat District has been selected for district level analysis. Change in the cropping pattern in Surat has been analysed at taluka level. This study attempts to analyse the change in cropping pattern and to find out reasons leading to the changes. It also discusses the positive as well as negative aspects of the changes. The study, finally offers suggestions to give a balanced cropping pattern for Surat District, expecting prevention of environmental damages and positive impact on the society.

METHODOLOGY

Gujarat State is divided into four regions on the basis of cropping pattern, for study at regional level. The regions are: (a) North Gujarat, (b) South Gujarat, (c) Saurashtra, (d) Kachchh. All districts are ranked according to percentage of the crop for the total cropped area for the year 1965-66. For this, Cereals, Pulses, Oil-seeds and Cotton are considered. Cropping pattern is arrived at by their rank for each crop. Districts, similar in cropping pattern, are grouped together. Ranking is done on the basis of high average and low percentage of the crop to the total cropped area. Classification of Gujarat on the basis of agricultural regions is given below:

Agricultural Regions	*Districts*
1. North Gujarat	Ahmedabad, Banaskantha, Kheda, Mahesana, Panchmahal, Sabarkantha, Surendranagar.
2. South Gujarat	Vadodara, Bharuch, Valsad, Dangs, Surat.
3. Saurashtra	Amreli, Bhavnagar, Jamnagar, Junagarh, Rajkot.
4. Kachchh	Kachchh

Cropping pattern, region-wise, with the median in the state is given below:

Region	*Cereals (median 45%)*	*Pulses (median 5%)*	*Cotton (median 11%)*	*Oil seeds (median 12%)*
1. North Gujarat	High	Average	Average	Average
2. South Gujarat	Average	High	High	Low
3. Saurashtra	Average	Low	Low	High
4. Kachchh	Average	High	Average	Low

Source: Department of Agriculture, Gujarat State, Ahmedabad

ANALYSIS AT THE STATE LEVEL

There is a slight decrease in area under cereals (Table 1) and continuous increase in area under pulses, to the total cropped area in Gujarat. but it not enough to provide protein-food to large population. Area under oil-seeds, between 1970 to 1983 has increased consistantly, while area under cotton has decreased in general, except for the year 1975-76. This decrease in cotton cultivation is indication of the decline of cotton textile industry.

Table 1: Change in the cropping pattern in Gujarat

Crops	*Percentage of the total cropped area*				
	65-66	*70-71*	*75-76*	*80-81*	*83-84*
1. Cereals	44	48	45	40	41
2. Pulses	4	5	6	7	8
3. Oil seeds	23	19	20	26	25
4. Cotton	17	16	18	14	11

Source: Department of Agriculture, Gujarat State, Ahmedabad

ANALYSIS AT THE REGIONAL LEVEL

In North Gujarat total cropped area under cereals shows increase upto 1971, and thereafter there is decline. Area under pulses has increased consistantly but inadequetly. Area under cotton has decreased continuously, while area under oil seeds does not show any noticeable change. (Table 2)

Table 2: Change in cropping pattern in North Gujarat

Crops	*Percentage to total cropped area*				
	65-66	*70-71*	*75-76*	*80-81*	*83-84*
1. Cereals	53	59	55	52	52
2. Pulses	4	4	5	6	7
3. Oil seeds	11	8	8	12	12
4. Cotton	19	17	19	18	15

Source: Department of Agriculture of Gujarat State, Ahmedabad

In South Gujarat total cropped area under cereals and pulses is found increasing, while under cotton and oil seeds, total area shows heavy decline. Earlier, South Gujarat was a predominant region growing cotton and ground nut. Following are the reasons for the decline in area under cotton and groundnut to total cropped area.

1. Sugarcane production increased in South Gujarat, following the introduction of sugar factories.
2. Irrigation facilities encouraged cultivation of sugarcane, which in turn, increased salinity in soils and water-logging. The land then becomes insuitable for cotton cultivation.
3. Increasing demand for synthetic clothes has resulted in decrease in demand of cotton cloths. This reduced the production of cotton.
4. According to cotton growers, government policy favours production of synthetic fibre and discourages cultivation of cotton. This has resulted into low production of cotton.
5. In some places, cropped area under cereals and pulses has increased. This has resulted into decrease in area under cotton.

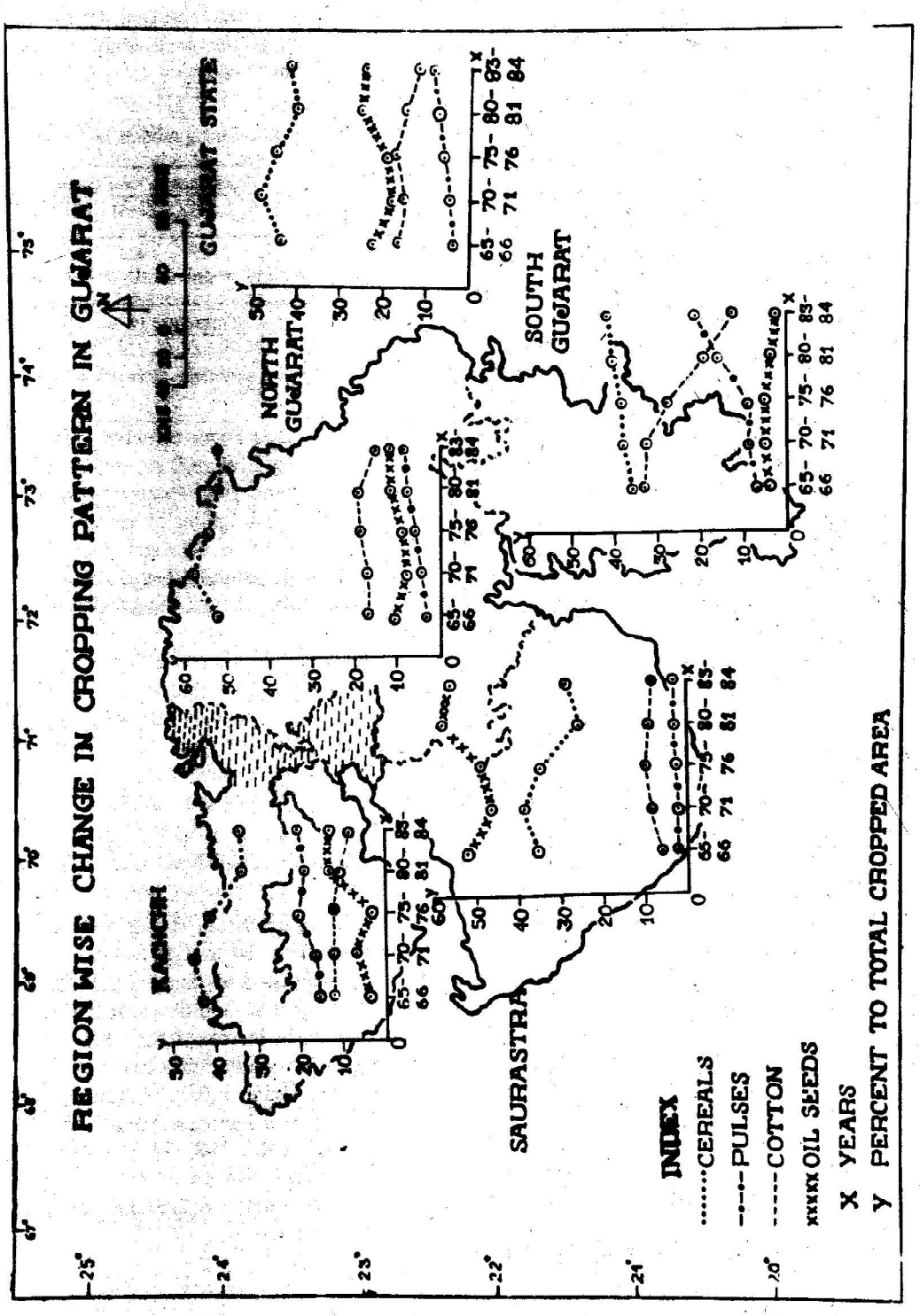

Fig. 1. Region wise change in cropping pattern in Gujarat

Table 3: Change in cropping pattern in South Gujarat

Cereal	*Percentage to total cropped area*				
	65-66	*70-71*	*75-76*	*80-81*	*83-84*
1. Cereals	35	37	38	40	41
2. Pulses	7	8	9	17	21
3. Oil seeds	6	5	6	4	3
4. Cotton	34	32	28	17	12

Source: Department of Agriculture, Gujarat State, Ahmedabad

Saurashtra shows decrease in area under cereals, but shows a remarkable increase in area under oil-seeds. This is so because Saurashtra is predominantly a groundnut producing region, there major part of the cultivated land is under groundnut production. Area under cotton and pulses is negligible and has remained more or less constant. Reasons for more emphasis on the production of groundnut are as follows:

1. Every part of groundnut can be put to some use. (a) leaves as fodder, (b) groundnuts for oil extraction (c) oil cakes for feeding animals and birds (d) oil cake used as manure.
2. Soil in Saurashtra is suitable to groundnut and cotton, but groundnut is more resistant to disease, while cotton is susceptible.
3. Groundnut is easy to grow and required less attention than cotton.
4. Number of oil mills increased in Saurashtra, so farmers find a ready market for their products in vicinity.
5. Groundnut was introduced in Saurashtra about sixty years ago from South India. Earlier, people consumed sesamum (til), but later on, switched over to groundnut. Its production has increased in recent years.

Table 4: Change in cropping pattern is Saurashtra

Crops	*Percentage to total cropped area*				
	65-66	*70-71*	*75-76*	*80-81*	*83-84*
1. Cereals	35	38	34	25	28
2. Pulses	1	1	1	1	2
3. Oil seeds	51	46	48	57	55
4. Cotton	6	8	10	8	7

Source: Department of Agriculture, Gujarat State, Ahmedabad

In Kachchh, area under crereals is decreasing, (Table 5) while it has increased remarkably for pulses and oil seeds. Area under cotton has remained almost steady.

Table 5: Change in cropping pattern in Kachchh

Crops	*Percentage to total cropped area*				
	65-66	*70-71*	*75-76*	*80-81*	*83-84*
1. Cereals	43	46	40	33	34
2. Pulses	15	16	20	24	21
3. Oil seeds	4	6	5	11	11
4. Cotton	12	11	12	10	9

Source: Department of Agriculture, Gujarat State, Ahmedabad

In general, area under cereals in North Gujarat is decreasing. In all regions, area under cotton cultivation is decreasing. There are two negative changes from social point of view. First, food grains available to the deprived class of people is less. Second, natural fibre from cotton has become rare, even though it is good from health point of view.

Land under pulses is increasing in North Gujarat, South Gujarat and Kachchh. Similarly area under oil seeeds, especially groundnut, is increasing in Saurashtra and Kachchh. This is a positive social change is continued, because pulses and groundnut are protein-rich food.

SPECIAL STUDY OF SURAT DISTRICT

Here, irrigation has a strong impact on the cropping pattern, District is evident from the taluka-wise analysis of change in cropping pattern with increased facilities of irrigation, area under sugarcane increased remarkably against decrease in area under other crops. Area under sugarcane cultivation in Bardoli, Kamrej, Palsana and Walod taluka increased from 2 to 13% in 1970-71 to 40-50% in 1983-84. This corresponds to substantial increase in total area under irrigation during the same time phase for all these four talukas. (Table 6)

Table 6: Change in cropping pattern and irrigated area in agriculturally developed talukas of Surat District

Talukas	*Percentage to total cropped area*											
	Cereals		*Sugarcane*		*Pulses*		*Oil seeds*		*Cotton*		*Irrigated area*	
	70-71	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*
1. Bardoli	36	27	13	41	16	5	5	7	16	1	35	50
2. Kamrej	22	15	7	43	6	9	8	2	32	0	31	78
3. Palsana	29	22	6	47	8	1	8	0	17	0	37	71
4. Walod	43	40	2	38	13	17	14	5	19	0	7	42

Source: Department of Agriculture, Gujarat State, Ahmedabad

Table 7: Change in cropping pattern and irrigated area in agriculturally less developed Talukas of Surat

Talukas	*Percentage of total cropped area*											
	Cereals		*Pulses*		*Oil seeds*		*Cotton*		*Sugarcane*		*Irrigated Area*	
	70-71	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*
1. Mangrol	37	53	6	21	9	7	31	2	0	1	4	9
2. Mandavi	47	66	8	10	12	5	22	3	0	3	6	6
3. Nizar	73	59	12	26	14	3	3	3	0	4	9	13
4. Songarh	59	57	12	13	10	10	8	1	0	0	3	6
5. Urchchan	68	58	18	19	6	6	6	7	0	0	1	2
6. Wyara	51	53	12	12	16	9	15	7	0	4	6	9

Source: Department of Agriculture, Gujarat State, Ahmedabad

Mangrol, Mandavi, Nizar, Songarh, Urchchhan, and Vyara talukas of Surat Disctict have less area under irrigation. Nizar has 13 percent and other talukas have less than 10 percent area under irrigation. In these talukas, area under sugarcane is negligible but area under cereals and pulses is increasing, and area under oilseeds and cotton is decreasing, which is significant. Pests and diseases, and labour problems affected in the decrease in cotton growing area. This is so because laborers from these talukas might have moved to areas producing sugarcane and were not available for cotton picking at proper time.

In contrast, area under irrigation in Muhua, Olpad and Chorasi talukas has increased but sugarcane is not introduced there, because market is not readily available. In next plan, sugar factories will be established in these talukas, which will encourage farmers to change over to sugarcane cultivation. There is an increase in area

Table 8: Change in cropping pattern and irrigated area in talukas of medium level in development process of Surat District

Talukas	*Cereals*		*Pulses*		*Oil seeds*		*Cotton*		*Sugarcane*		*Irrigated area*	
	70-71	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*	*70-71*	*83-84*
1. Mahua	45	53	10	11	14	1	11	1	2	8	17	25
2. Olpad	35	26	4	25	4	6	40	19	0	7	26	57
3. Chorasi	38	31	6	9	6	2	14	4	0	8	23	35

Source: Department of Agriculture, Gujarat State, Ahmedabad

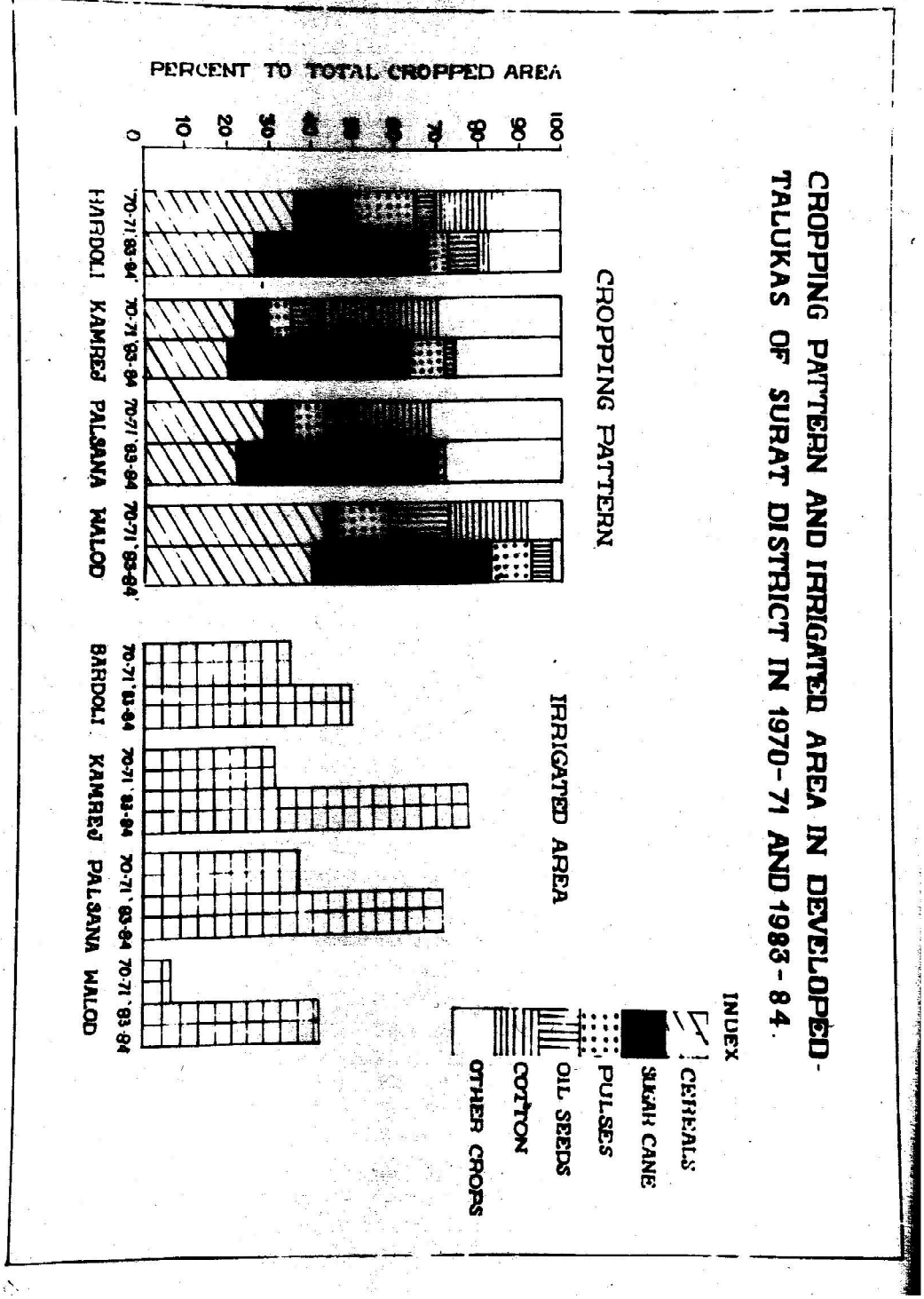

Fig. 2. Cropping pattern and irrigated area in developed talukas of Surat District in 1970-71 and 1983-84

under cereals and pulses, but decrease under oil seeds and cotton. As a result, once increased in irrigation, is utilised for fruit plantations.

IMPACT OF SUGARCANE PRODUCTION

Sugarcane was introduced in Surat region in 1958. Soon, Sugarcane factories were established on cooperative basis giving assurance of ready market for sugarcane produced. Initially, large farmers adopted to sugarcane cultivation, followed by medium and small farmers in due course, as this crop proved to be more profitable. So much so, that total cultivable area of few villages was covered by sugracane only.

Sugarcane takes fourteen months and three crops can be taken in one plantation. It means that if sugarcane is planted once, that lend cannot be used for any other purpose for three and a half years. Farmers of this area grow only sugarcane, as it gives a very high economic returns. Once in four years, paddy is grown, because sugarcane cannot be planted during monsoon, Sugarcane plantation is carried out around Sept. and Oct. Therefore, they plant paddy before. Sugarcane is very convenient to grow. It requires labour in first four months and then at the time of harvest. In between, labour is required for irrigation. Other crops may require continuous labour.

Continuous production of sugarcane requires continuous irrigation, which creates water-logging and problems of salinity in soil. Land potentiality (pH value) has gone down to above 8.0, indicating an alarming rate of salinity in soil. pH value of soil in Kamrej Taluka is between 8.2 to 8.3. In eastern Kamrej, about 100 hectare of land has become unsuitable for cultivation because of increase in salinity. Moreover, crops like jowar, cotton, pulses and wheat cannot be grown because of water-logging.

Farmers in this area have switched over to mono-cropping pattern. Earlier, jowar, cotton, pulses, wheat, groundnut and vegetables were grown as mixed crops. Now, only sugarcane is grown. Paddy is taken as a subsidiary crop. Such a change has disturbed the biomass and ecological system.

In monocropping pattern, less number of crops make ecosystem immature or less complex. Here, crops are less stable and cannot survive unless constant protection is given. Many diseases and pests have very specific needs of food. They attack just one variety of a crop *e.g.* white fly pest generally attack sugarcane crop. The ecosystem becomes weak in monocropping pattern, hence pesticides are used to protect the crops. As time passes, pests build up a resistance power against chemicals. This requires stronger pesticides to kill the pests. These pesticides may also harm other plants and animals. In Surat District, diseases and pests have already started affecting sugarcane crop. Farmers use pesticide three or four times in a year. Pesticides are sprayed over the crops, which can prove harmful to people and animals around. The inhalation of poison, contained in pesticides causes eye and skin problems. In mono-culture system, the fertility of the land is reduced over a period. Hence, chemical fertilizers must be added to increase the fertility. They are harmful to the health. Chemical fertilizers enter into soil and water, making them harmful for lives. After using the fertilizers and pesticides in sugarcane fields, the farmers in Surat District drain the extra water into small channels, built around the fields. This water is then diverted to canal and then into river Tapi. Villagers of Sevani village of Kamrej taluka reported death of their bullocks after drinking the polluted water of Tapi. Fish in the river are also reported dead. The water, polluted by pesticides and fertilizers, percolates into wells. This water, when used for drinking purpose by human beings, generates health hazards.

Mosquitoes become resistant to insecticides because of water logging and continuous use of pesticides. As a result, the cases of malaria are increasing in this region. Data for last three years, indicate heavy increase in the cases of Malaria (Table 9). There are many cases of other hazardous diseases also. Usually, such deseases are caused due to excess use of pesticides and irrigation. Cases of such diseases are on increase

recently. Many cases are not recorded also because many villagers do not visit doctors, and apply their own treatment. So, it is possible that the situation is worst that what the data shows.

Table 9: Number of cases of different diseases recorded in Surat District

Diseases	*Number of cases*		
	1986	*1987*	*1988*
1. Chicken Pox	6	17	25
2. Whooping Cough	19	34	45
3. Influenza	1660	1842	1925
4. Dysentery/ Diarrhea	2783	2360	2717
5. Measles	582	799	865
6. Pneumonia	80	92	112
7. Malaria	3,90,000	432,000	562,800

Source: Department of Economics and Statistics, Surat District, Gujarat

Earlier, people used to get a variety of food to eat because of multi cropping pattern. The situation has changed because of monocropping of sugarcane. Poor people have suffered due to their process of change. Their consumption of pulses has gone down. Earlier, they grew pulses and were used to get pulses as wages. But not they can neither grow or buy from market, where it is very expensive for them. Now, production of groundnut, which is also nutritious food and a rich source of protein, has also practically stopped.

After the mono-cropping patter for sugarcane is introduced, the total income of the region has increased, but its distribution is unequal. Experienced labour from outside, instead of local labour, is brought to harvest the crop of sugarcane. Thus, this system has deprived the local labourers of their employment. Unlimited use of fertilizers, pesticides and irrigation facilities, by large farmers made the land of small farmers infertile, even though they wanted to save their land from the damage. At present, small and marginal farmers want to grow crops, other then sugarcane, but they are unable to grow because of increased water logging, land salinity and pest attack. Similarly, large farmers also get larger share of income. This increases the gap between rich and poor. Thus, the change from multi-cropping to mono-croping system of sugercane in Surat District has proved more harmful than beneficial for common mass. Farmers are doing long term damage by going for short term heavy gains.

PLANNING ASPECT

The agricultural situation is deteriorating and it is necessary to formulate a plan which can save the agricultural land from distruction and people from health hazards.

Firstly, the cropping pattern has to be changed. Though sugarcane is a more profitable crop its sole cultivation is damaging to the environment. Alongwith sugarcane other crops should also be grown to maintain a proper balance. In this area paddy, wheat, jowar, groundnut and pulses can be grown in rotation with sugarcane. If two crops of sugarcane are taken from a piece of land, then in kharif season, paddy, jowar, groundnut and vegetables can be taken and in rabi, wheat, pulses and vegetables can be taken. Then the cycle can start again with sugarcane production. In this way land will remain fallow during the period March-April to June-July in Ist year and March-April to Sept-Oct. in IInd year to regenerate its energy and nutrients. The diagram No. 2 is a suggested plan of crops for Surat district.

Secondly, It should be understood that at a time, only 50 per cent of cultivated land should be used for sugarcane production, 25 percent of the land should be used for cereals and pulses, 15 percent for vegetables and 10 percent of the land should be kept fallow. This pattern will help to save the fertility of land and it will provide balanced food to the people.

Thirdly, the land which is becoming saline because of continuous irrigation, requires atleast 40 tonnes of compost per hectare every year to regain its fertility. Salinity in some of the areas has reached a level where land cannot even grow grass. Green manuring of these areas is also necessary.

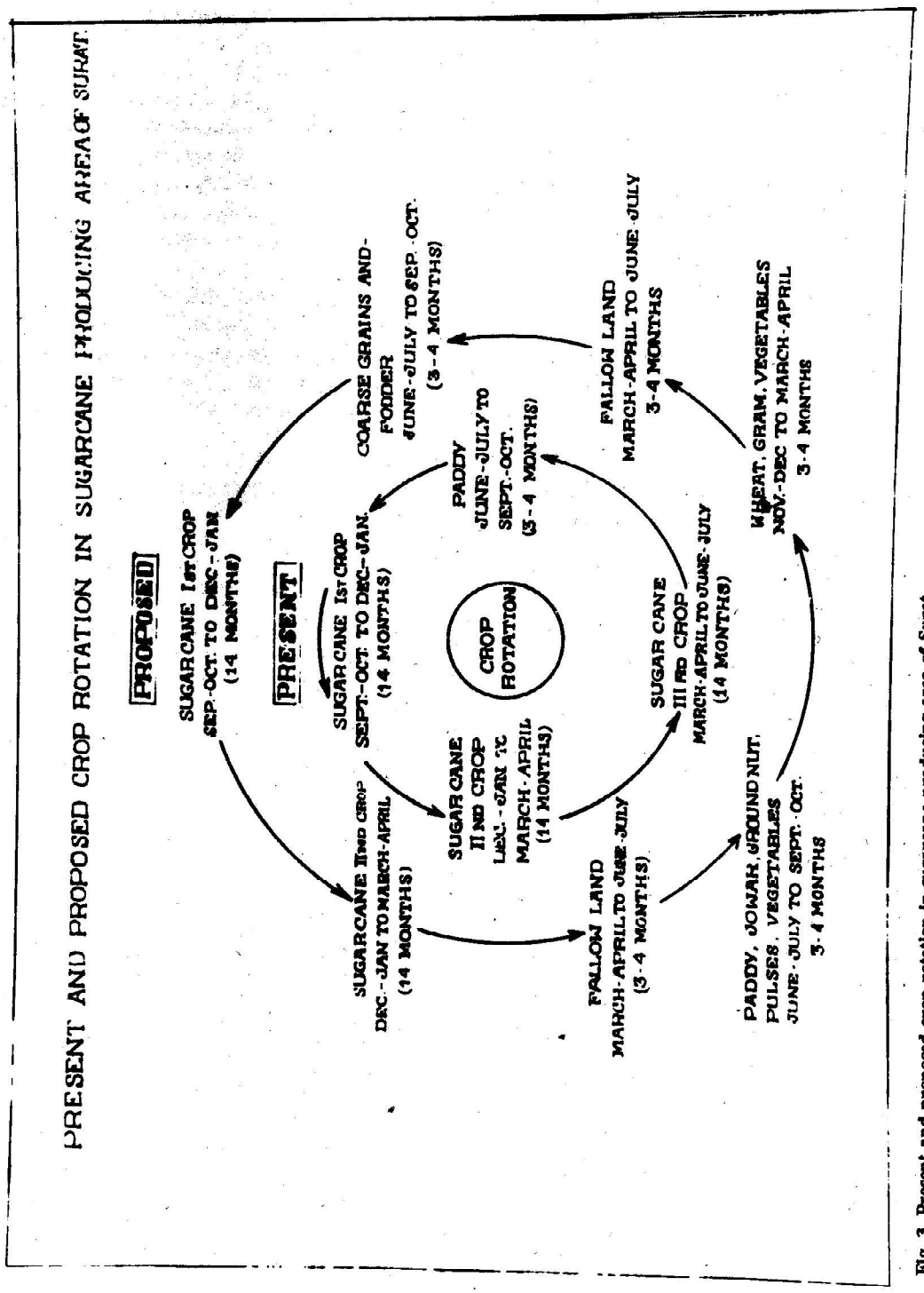

Fig. 3. Present and proposed crop rotation in sugarcane producing area of Surat

Fourthly, the use of irrigation should be done carefully, In fact, salinity of land has increased mainly because of careless use of water. In the sugarcane fields water level is required upto 75 mm, while farmers allow this level to 90 upto 150 mm. For fear that they may not get water again. Farmers irrigate their fields more than 30 times while sugarcane crop requires only 16 times irrigation in one cropping season. All this excess water makes land waterlogged and saline. There is a need to educate farmers on the proper use of irrigation facility.

Fifthly, farmers should be made aware of disasters of mono-cropping pattern. Mono-cropping pattern and use of excess irrigation, chemical fertilizer, pesticide and high yielding variety is harmful for them and their own society. Ultimately it affects them.

So there is an urgent need in sugarcane producing areas of Surat to device a plan to save the land from becoming infertile, and provide people with a reasonably balanced diet.

CONCLUSION

There are many reasons which cause the cropping pattern to be changed. Sometimes this change is positive and beneficial for the preservation of environment and people, but sometimes it may prove harmful to the environment and the human race itself. In such cases government should take initiative, and either put total ban on production of such crops or put heavy tax to discourage farmers from growing those harmful crops. An example is the teora pulse (Khesari Dal) which was banned by the Government of India as it was found to cause paralysis. On production of opium farmers have to pay very high tax. Introduction of irrigation makes farmer to go for mono-culture like sugarcane. In this case Government should restrict the area under certain crops and also restrict the water supply, so that farmers do not grow only those crops which require more irrigation. It is very important to assess the change continuously, and regulate the trend of change. If change is negative, proper precautions should be taken to prevent the ill effects.

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