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TECHNOLOGICAL DETERMINANTS OF AGRICULTURE

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TECHNOLOGICAL FACTORS

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The changes in agricultural production is a result of the whims of nature that have played our agriculture. But technological factors have a great influence on agriculture as the agricultural production is increased. Since 1970's our food-grains production is increasing and now the country is self-sufficient in the foodgrains production due to the technological development (Roy, 1971).

The first five year plan and particularly from 1955, the traditional face of agriculture is steadily changing. These changes are reflected in both, the expansion and intensification of cropping. The growth of sugar factories, has played an important role in the agricultural changes of the region. Therefore, the modern agriculture is a sector of economy which stands somewhat between subsistence farming and industries (Mishra, 1968). Thus, the technological factors have played a dominant role in the transformation of Indian agriculture.

#### TECHNOLOGICAL FACTORS :

The recently introduced technological factors of the region include irrigation, agricultural implements and machinery, adoption to improved seeds, use of chemical fertilizers, agricultural credit, etc. In the following lines, an attempt is made to analyse the regional pattern of these technological factors and changes therein in the region under study.

A. IRRIGATION :

Irrigation is more important factor in this district, because, the rainfall is very less and irregular. It is observed that the cultivators having irrigational facilities tend to adopt improved farm practices more than those cultivators without irrigation (Das Gupta and Das, 1966). Therefore, it is a pivot of modern agricultural growth.

Irrigation is the artificial application of water to overcome the deficiencies in rainfall for the growing of crops. It is essential for the better yield and for assurance of the crops. Irrigation development in Solapur district has to be viewed in the context of the climatic conditions, especially rainfall, with a wide difference in rainfall from one part to other part of the district and from year to year. Famines have occurred several times in the past. The area which is affected by the variations in rainfall is mainly located in the western part of the region. Agriculture is highly speculative venture under such harsh conditions which affect the agricultural production efficiency. Therefore, irrigation is vital for the success of agriculture in these parts. Moreover, rainfall of the district is seasonal and it is handicapped by lack of water from November onwards, hence, the Rabi crops usually fail (Singh, 1975).

Irrigation is practised since long time in the region and it is from wells, rivers and tanks which are the chief sources of irrigation. Solapur district has considerable area under irrigation.

Out of 1,62,530 hectares of cultivated area about 1,28,356 hectares (11.61%) is under irrigation. Out of 1,28,356 hectares irrigated area 29,369 hectares (viz.22.87%) is irrigated by tanks and canals (both government and private), 98,995 hectares (77.13%) by wells.

Fig.2.1 shows the proportion of irrigated area by tanks, canals and wells as the average for 1976-78 years. It reveals that overall intensity of irrigation varies makebly in different parts of the district. The highest intensity of irrigated area viz.54.63% is in Malshiras taluka. The taluka is intensively irrigated by Neera right bank canal. The proportion ranges between 10% to 20% in Karmala, Mangalwedha and Sangola talukas. The intensity is low in rainfed areas of north and eastern part of the district.

#### Tank irrigation :

There are many tanks such as Ekruk (N.Solapur), Buddehal (Sangola), Pathri (Barshi), Hotagi (S.Solapur), Gheradi (Sangola), Mangi, Wadshivane (Karmala), and Sapatane (Madha), Astri (Mohol), Jawale (Sangola) etc. spread all over the district. This area is reported as irrigated by them. These tanks are useful for irrigation and increase the agricultural production. After the widespread famine of 1972, Government of Maharashtra and Zilla Parishad, Solapur have constructed number of percolation tanks in this region under the Employment Guarantee Scheme. Unfortunately, very few of them are duly constructed and help to increase the watertable. Some area in Barshi and Sangola taluka is irrigated by tanks. Mangalwedha and South Solapur talukas also have some area under tank irrigation.

### Canal irrigation :

Canal irrigation plays minor role in the overall irrigation of the district. Canal irrigation include both the Government and Private canals. Government canals are an important source of irrigation in Malshiras taluka served by Neera Right Bank Canals. Private canals are drawn from the collected water behind the small bunds built across the streams and valleys. Private canals irrigate small areas in Barshi and Madha talukas.

Canal irrigation contributes for 16.98 percent of region's irrigated area and highest irrigated area is found in Malshiras taluka (Fig.2.1A). The area under canal irrigation will increase by the Ujani Irrigation Project.

### Well irrigation :

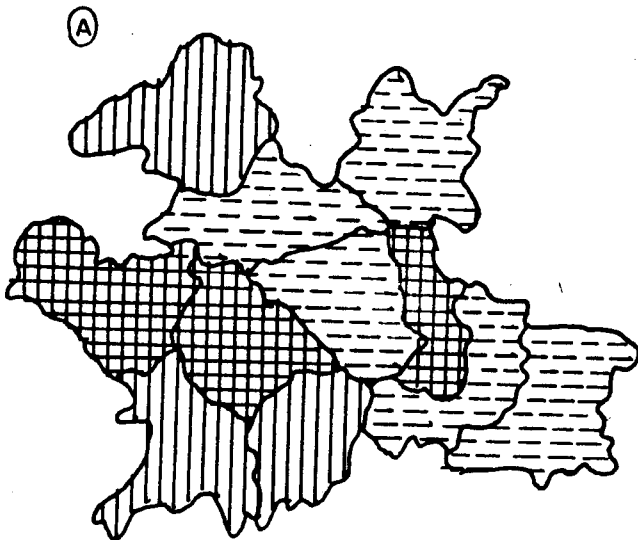
Wells are the major source of irrigation of the region and contribute for 83.02% of the irrigated area. Hence an attempt is made to study the density pattern of wells located in various physiographic divisions. Wells are rarely sunk in malran or high level lands.

Table 2.1 shows the distribution of wells in each taluka, classified as useful for irrigation and not useful for irrigation. There are about 60,126 wells in the district, out of them 3,884 are not useful for irrigation. The largest number of irrigation wells is in Akkalkot (14,015) followed by Sangola, Mohol, Madha talukas. The density is high in the low level/ed to moderate

# SOURCES OF IRRIGATION

## TANKS AND CANALS (1976-1978)

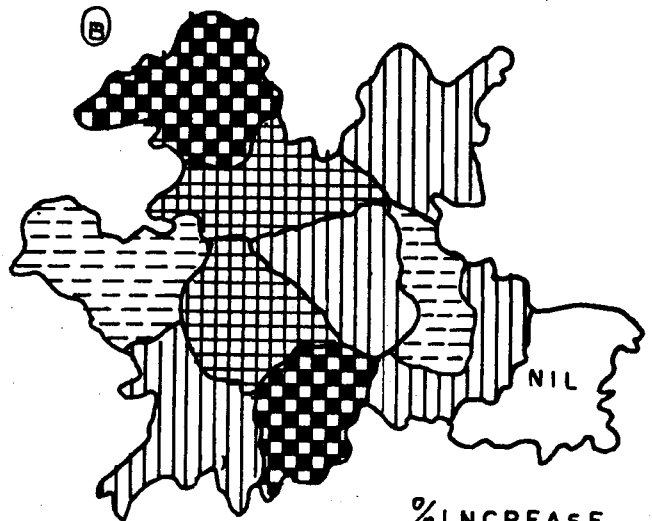
## CHANGES IN TANKS AND CANALS IRRIGATION AREA (1951-53 TO 1976-78)



% AREA



REGION AVERAGE = 16.98%



% INCREASE



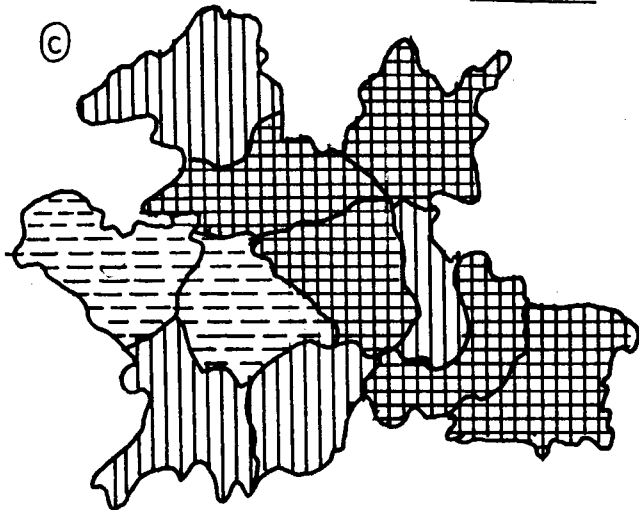
% DECREASE



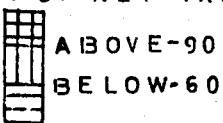
REGION AVERAGE = 0.27%

## TUBES AND OTHER WELLS (1976-78)

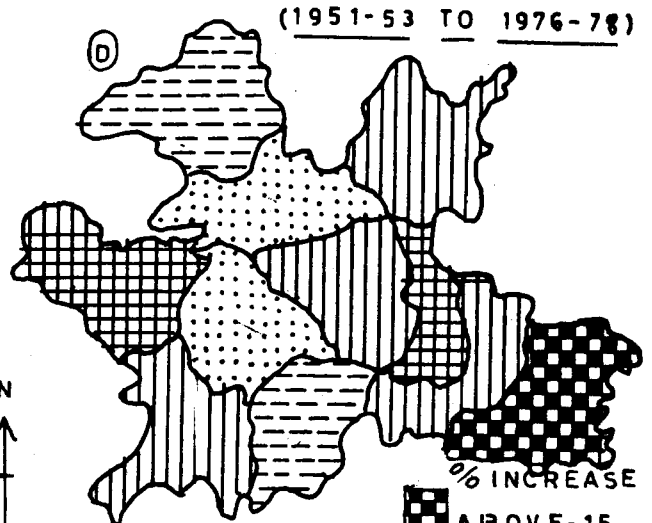
## CHANGES IN TUBES AND OTHER WELL IRRIGATION AREA (1951-53 TO 1976-78)



% OF NET IRRIGATED AREA



REGION AVERAGE = 83.02%



% INCREASE



% DECREASE



REGION AVERAGE = 9.37%

0 15 30 KMS



FIG. 21

undulating terrain of the district than the hilly terrain. The number of wells not useful for irrigation are more in the Sangola, Mohol, Akkalkot and Madha talukas. In all other talukas, the major source of irrigation is wells.

Table 2.1 : Density of irrigation wells in Solapur district (1978).

Sr. No.	District/ Taluka	Total Wells	Useful for irrigation	Not useful for irrigation
1.	North Solapur	2,324	2,170	63
2.	Barshi	5,020	4,613	18
3.	Akkalkot	14,015	12,685	330
4.	South Solapur	2,620	2,500	12
5.	Mohol	5,643	4,475	873
6.	Mangalwedha	2,347	2,018	34
7.	Pandharpur	5,024	4,750	125
8.	Sangola	7,983	6,393	1,155
9.	Malshiras	4,606	4,295	49
10.	Karmala	3,987	3,138	62
11.	Madha	6,430	6,030	245
District		60,126	53,067	3,884

SOURCE : Socio-Economic Review and District Statistical Abstract of Solapur District, 1978.

To lift the water from wells, previously, mols were in use. They were either of iron or leather. Now they are mostly replaced by oil engine or electric moter pumps. Fig.2.1C shows the distribution of well irrigation intensity in the region.

The intensity is high (above 90%) in the talukas of Akkalkot, Mohol, South Solapur, Barshi and Madha and decrease towards west. Rest of the area record under 60 percent of net area irrigated.

Net irrigated area :

The proportion of net irrigated area by wells, tanks and canals is shown in Fig.2.2A. It reveals that about 11.61 percent of net sown area is irrigated.

Spatial distribution is varying between above 26 percent to below 6 percent. Malshiras (above 26 percent) is the leading irrigated taluka. Madha, Karmala, Sangola, Mohol, Pandharpur, Mangalvedha, North Solapur and Akkalkot record 6 to 16 percent. Below 6 percent is observed in Barshi and South Solapur talukas. Fig.2.2B reveals the changes that have occured in irrigated areas during 1951-53 to 1976-78. Intensity of irrigation has increased over 4 percent in Madha, Malshiras and Sangola talukas. It is below 2 percent in Barshi, Mohol, North Solapur, Mangalvedha, South Solapur and Akkalkot. Elsewhere 2 to 4 percent intensity is noted.

Solapur district is rainshadow area so that there is a more need of irrigation. Firstly, the major and medium irrigation



projects like the Nira right bank canal is not utilized sufficiently. Wells become dry in summer period and also increase the problem of drinking water but when Ujani canal will be completed the problem of irrigation can be solved in some parts of the district.

B. FARM IMPLEMENTS AND MACHINERY :

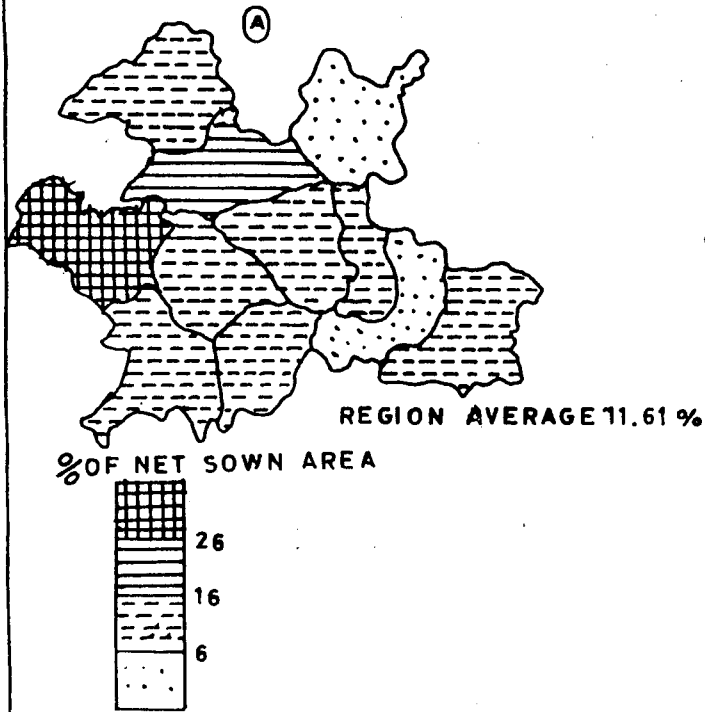
Farm implements are closely adjusted to their environment that there is little possibility of changes (Singh, 1975). The agricultural implements in the region under study are few in number, small in size and light in weight. Tilling, cultivation and many agricultural operations are dependent on the various types of implements and machinery. The implements and machinery used in the region under study are ploughs for ploughing, harrows for crushing the clods, seed driller for sowing, hoes for inter culture, mols, oil engines and electric pumps for water lifting, carts for transport and tractor for many agricultural operations. Out of them ploughs - wooden and iron, carts and water pumps are wide spread implements and machinery in the district. In the following lines an attempt is made to analyse the regional distribution pattern of ploughs and carts.

Ploughs :

Locally, they are called as 'Nangar'. They are of two types viz. wooden and iron and both are widely used all over the region, but there are regional variations in the distribution

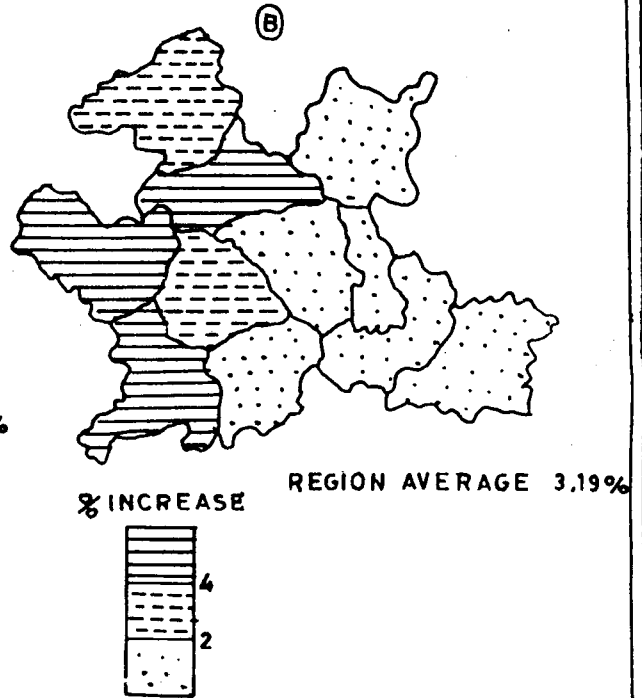
### NET IRRIGATED AREA

(1976-78)



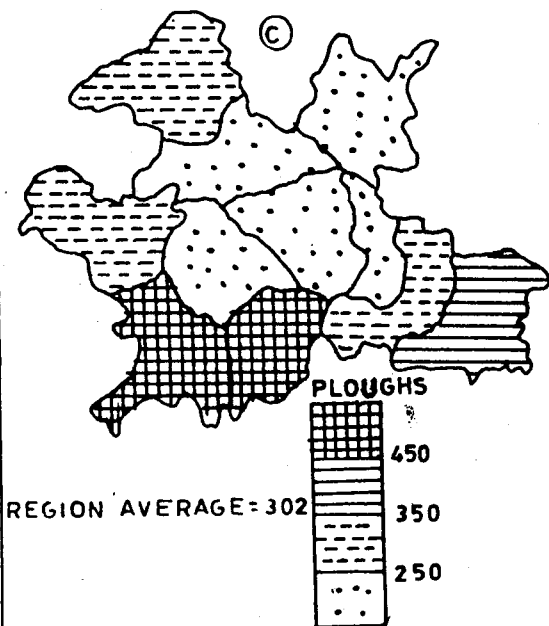
### CHANGES IN NET IRRIGATED AREA

(1951-53 TO 1976-78)



### PLOUGHS PER 100 HECTARE OF CULTIVATED AREA

1951-53



1976-78

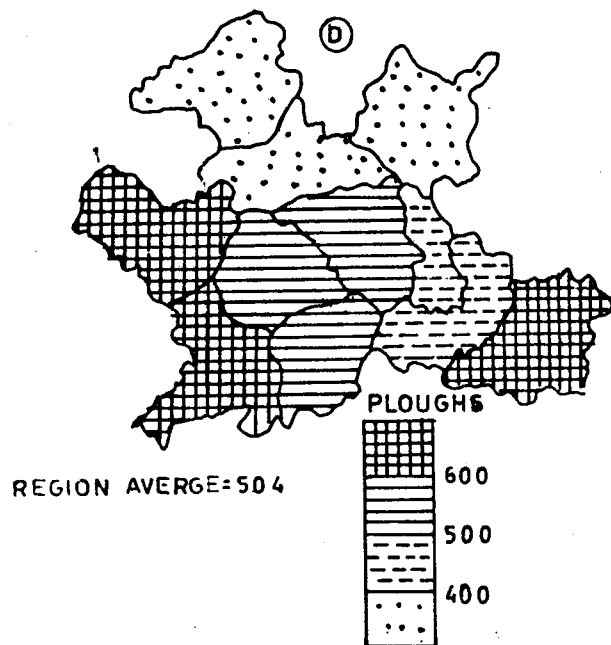


FIG. 2-2

(Fig.2.2 C,D). Wooden ploughs are dominant in the region particularly Akkalkot, South Solapur, Mohol, Pandharpur and Mangalwedha, where per 100 hectare of cultivated area density is high. The region's average number is 504 ploughs per 100 hectare of cultivated area. It is due to its lightness, 'poverty of farmers', and cheaper repairing facilities within the villages and the black soil of river basin. The number decreases from south to north in the region. In the central part, there are 400 ploughs per 100 hectare of cultivated area. In some talukas (excluding Mangalwedha and Sangola) above 400 to under 450 number of ploughs per 100 hectare of cultivated area are noted.

Iron ploughs are relatively less than wooden ploughs but now adays many farmers are using them. The distribution of iron ploughs shows the sharper contrast to the distribution of wooden ploughs. The number of iron ploughs are more in Malshiras taluka i.e. 5,793 and also in Karmala, Akkalkot, Sangola and Pandharpur talukas.

During 1951 to 1978 the total number of wooden ploughs have increased from 11,700 to 14,844 and iron ploughs from 21,800 to 39,801, because of increasing sub-divisions of holdings and agricultural households (Table 2.2).

#### Carts :

The carts are usually used for many purposes, therefore carts have a significant variation in the distribution pattern in the region (Fig.2.3 A,B). Region's average density is 453 carts

per 100 hectares of cultivated area. They are more in Malshiras, Mohol and Barshi talukas (above 600 carts per 100 hectare of cultivated area). They are uniformly distributed throughout the region. There is a significant increase in number of carts, as they are increased from 37,025 in 1951 to 51,049 in 1978.

Table 2.2 : Growth of agricultural implements and machinery in Solapur district.

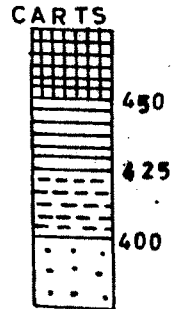
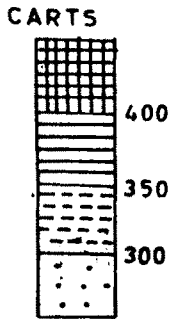
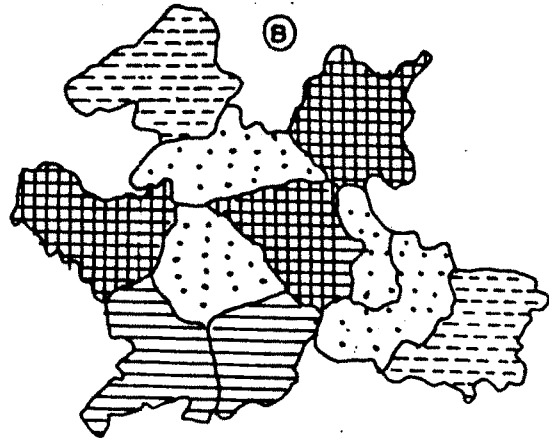
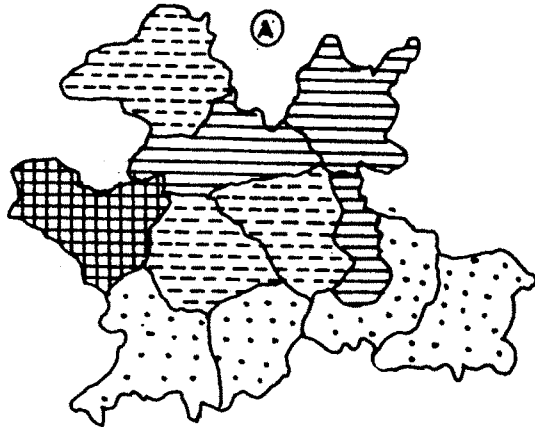
Sr. No.	Agricultural implements/ machinery	1951	1972	1978
1.	Ploughs	33,978	53,376	54,645
	a) Wooden	11,700	15,863	14,844
	b) Iron	21,800	37,513	39,801
2.	Carts	37,025	49,922	51,049
3.	Oil engines with pumps for irrigation purpose	1,022	16,420	16,681
4.	Electric pumps for irrigation purpose	81	6,370	23,022
5.	Sugarcane crushers	1,590	917	1,123
	a) Worked by power	483	736	1,064
	b) Worked by bullocks	1,107	181	59
6.	Tractors	60	204	429

SOURCE : 1) District Census Handbook of Solapur District, 1961.  
2) Socio-Economic Review and District Statistical Abstract of Solapur District, 1978.

# CARTS PER 100 HECTARE OF CULTIVATED AREA

1951-53

1976-78



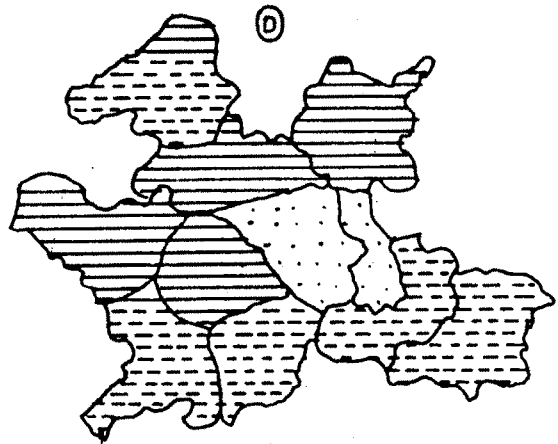
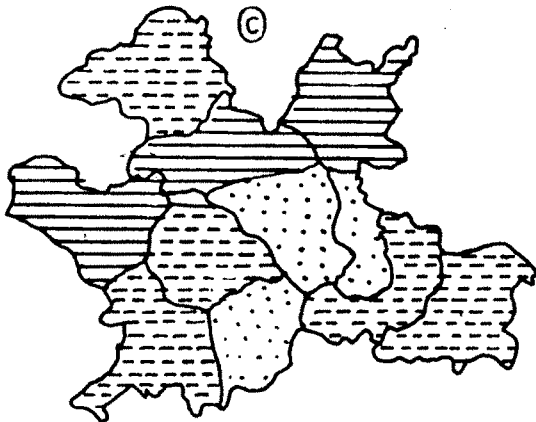
REGION AVERAGE = 327

REGION AVERAGE = 453

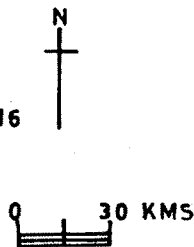
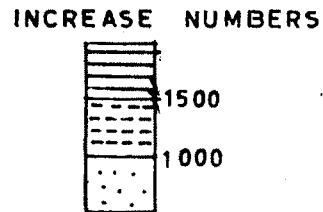
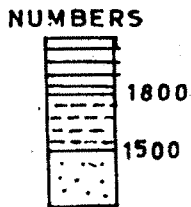
## AGRICULTURAL MACHINERY

OIL ENGINE  
1978

CHANGES IN OIL ENGINE  
1961 - 78



REGION AVERAGE - 1516



REGION AVERAGE - 1170

### Agricultural machinery :

The application of mechanical power to agriculture is one of the major technical developments of the post independence period. The mechanisation of agriculture in India simply means the use of tractors and power-operated pumps sets (Singh, 1979). It is labour and time saving and gives more time to look other farm work.

Spatial difference in the use of modern agricultural machinery is closely related to irrigation, size of holdings and poverty which mainly control the use of modern machinery. Change in the implements is more significant in the areas of commercial farming. The modern agricultural machinery used in the region under study are oil engine, sugarcane crushers, electric pumps, tractors and others (Table 2.2). In the following lines an attempt is made to show the distribution pattern of oil engines, electric pumps, sugarcane crushers and tractors.

### Oil engine :

It is used to lift the water from rivers and wells. Their number is increased viz. from 1,022 to 16,681 during the period 1951-53 to 1976-78. Table 2.2 and Fig.2.3C shows that the oil engines are more in Malshiras, Madha and Barshi taluka and low in Mangalwedha and Mohol talukas. Changes in the number of oil engines in the period of 1951-53 to 1976-78 is seen specifically in Malshiras, Madha, and Barshi talukas (Fig.2.3D).

**Electric pumps :**

Electric power is available for irrigation purpose with the increasing rural electrification and so the number of electric pumps in the district has increased from 81 in 1951 to 6,370 in 1972 and 23,022 in 1978 (Table 2.2). They are more in Malshiras and Pandharpur talukas because of more irrigation facilities. Elsewhere less number of electric pumps is observed.

**Sugarcane crushers :**

Gur making is a rural traditional industry in this district. Previously, the sugarcane crushers were bullocks driven, but now they are operated with the help of oil engines or electricity. In 1951 there were 1,590 crushers and out of them 483 worked by power and 1,107 worked by bullocks. In 1978 the number of crushers worked by bullocks decreased and there is a increase in the number of crushers worked by power. But totally the number of sugarcane crushers is decreased from 1,590 to 1,123. because of development of the sugar industry (Table 2.2).

**Tractors :**

With the use of tractors many farm implements driven by bullocks were improved while others were replaced by better and more efficient implements. In the region, in 1951 the number of tractors was only 60 but in 1972 the number was 204 and in 1978, 429 tractors were recorded. Particularly the concentration and increase is more in Malshiras, Pandharpur and Barshi talukas

(above 30 and low in Mangalwedha, Madha, Mohol and Karmala (below 15) (Table 2.2).

C. IMPROVED SEEDS :

Generally, the big as well as small cultivators, preserve seeds from their previous harvest. Only the poor cultivators who can not afford to do so depend on the outside supply for meeting their seed requirements. Besides, those cultivators who want to replace their old seed for new promising varieties and those who want to undertake cultivation afresh, also depend upon the outside supply. The cultivator is very careful about the selection of good quality seeds. He takes care that the gains preserved by him are bold and healthy and are lustrous in colour.

The improved varieties of foodgrain crops evolved by the department of agriculture give about 10 to 15 percent increased yield over the local varieties. The Agriculture Department has recommended the following seeds of improved variety and strains for the use in the district.

- i) Jawar - M-35-1
- ii) Wheat - N-917, N-747-19, N-59, HY-65
- iii) Bajri - Pusamoti, 23-15 HY-35
- iv) Paddy - Krishnasal, Basmati
- v) Cotton - Laxmi
- vi) Gram - Chaffa, N-59
- vii) Groundnut - K-4-11.K-3
- viii) Tur - N-84
- ix) Safflower - N-62-8
- x) Mug - Jalgaon



There are ten taluka seed multiplication farms established in the district and the foundation seeds of various improved strains are produced on these farms. The foundation seeds are further distributed to the seed villages through Zilla Parishad.

The hybrid seeds such as Jawar-CSH-1, CSH-2, Bajri-HB-1, Maize Deccan double hybrid are also produced on the cultivator's field under the supervision of seed certification authorities and the same are purchased by the marketing federation. The taluka level data about improved seeds is not available. Hence, the regional distribution pattern of seed use is not tried.

D. CHEMICAL FERTILIZERS :

The most essential requirement in stepping up agricultural production is the use of adequate manures and fertilizers. The application of fertilizers and manures has become essential to make agronomy more profitable and to meet the increasing demand for foodgrains. The farmyard manure which is prepared out of dung, urine of cattle, ash and other refuse is not enough to meet the local requirements. The cultivators, therefore, have started applying the chemical fertilizers extensively to crops grown in the district. The use of chemical fertilizers in the district is shown below.

Use of Chemical Fertilizers

a) Ammonium sulphate	7,802 ton	d) Urea	2,172 ton
b) Super-phosphate	255 ton	e) Others	1,775 ton
c) Fertilizer Mixture	-		

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SOURCE : Gazetteer of Solapur District.

The chemical fertilizers requires abundant supply of water. Heavy doses of fertilizers are applied wherever irrigation facilities are available. They are used for food crops and nonfood crops and also for commercial crops. The cultivators have realised the value of chemical fertilizers due to the fact that they have obtained higher yield through their application.

E. AGRICULTURAL CREDIT :

Majority of the villages in this district have co-operative credit societies. The following table shows the position of agricultural credit societies in the district for 1960-61, 1970-71 and 1978-79.

Sr. No.	Items	Credit facilities given during		
		1960-61	1970-71	1978-79
(Rs. in '000')				
1.	Number of primary agricultural societies	857	888	870
2.	Number of membership	93,777	1,39,913	2,12,191
3.	Share capital	6,088	25,195	41,136
4.	Working capital	20,657	84,669	2,03,076
5.	Loans advanced	15,070	47,141	87,417
6.	Loans recovered	N.A.	39,294	59,153
7.	Loans outstanding	N.A.	73,123	1,65,866
8.	Loans overdue	N.A.	28,818	87,186

N.A. = Not available

SOURCE : Socio-Economic Review and District Statistical Abstract of Solapur District, 1978.

It is observed that number of agricultural credit societies are decreasing gradually in recent time. However, there is increasing trend in respect of their membership. It is however, discouraging to note that with an increased advances over 1960-61 the amount of overdue are also increasing year by year.

F. ROADS :

Roads plays an important role in agricultural development as they contribute in the mobilization of resources and reduce the gap between rural and urban communities. The use of new inputs added new dimensions to agricultural expansion and the input factors can be moved easily by roads. This way the roads play an important role in economic life of man. In the Solapur district in 1951 to 1978 the roads are increased more and connected many small villages to each others.

CONCLUSION :

Wells are the major source of irrigation followed by tanks. Ploughs and carts are the chief agricultural implements of the district. The application of chemical fertilizers has increased substantially, though the quantity used has been much smaller than those recommended. Co-operative agricultural credit societies, improved rural roads, market facilities, other inputs and services have forced to make the agricultural development of the district.

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