
DROUGHT PRONE AGRICULTURE

- A. RAINFALL AND AGRICULTURE
- B. DELIMITATION OF DROUGHT AREAS AND YEARS
 - 1) Drought year 1952-53
 - 2) Drought year 1965-66
 - 3) Drought year 1970-71
 - 4) Drought year 1972-73
 - 5) Drought year 1976-77
- C. CROPPING PATTERN
- D. MEASURES AND PROGRAMMES UNDERTAKEN TO OVERCOME THE DROUGHT CONDITIONS
 - 1) Watershed approach
 - 2) Employment guarantee scheme
 - 3) Soil and water conservation
 - 4) Water harnessing
 - 5) Block plantation on private land
 - 6) Farm forestry
 - 7) Animal husbandary
 - 8) Dairy societies
 - 9) Dry farming
 - 10) Grass cultivation
 - 11) Fertilizer use under dry-lands
 - 12) Proper planning of the crops to suit the soil capabilities
 - 13) Cropping system
 - 14) Programmes undertaken

CONCLUSION

REFERENCES

Drought is a complex natural phenomenon of short and irregular occurrence which is linked to climatic factors, biological factors such as the growth period and stage of the vegetation, environmental factors like site, soil properties and depth and agro-economic factors. In metrological terms drought has been defined as a deficiency in percent of the normal rainfall. Years with 50 percent or less rainfall than the normal rainfall are called drought years (I.M.D. 1971). According to rainfall drought fall into three distinct rainfall categories viz. arid, upto 375 mm; semi-arid 376 to 750 mm; and sub-humid 751 to 1,125 mm. (South Asia Projects Dept. General Agricultural Division, 1974). Drought can be also defined with the help of the aridity index (Thornthwaite, 1948) which expresses the annual water deficit in relation to the potential evapotranspiration or water need in percent ($Ia = \frac{D}{PE} \times 100$). Drought will be consequently defined by the departure from the mean of the aridity index. In socio-economic sense, drought is a period of intense economic stress, resulting from growing agricultural unemployment, acute shortage of water and fodder for livestock and a decline in cropped area. The soil scientist and ecologists define the drought in the context of the water balance of the soil and reduction in natural pasturage. To the farmer, the drought is a period during which his normal farm operations are hampered and the farm production suffers by decline to varying degrees. In the present study rainfall is used as a criteria for identifying the drought conditions.

A. RAINFALL AND AGRICULTURE :

Climate particularly rainfall plays an important role in functioning of agriculture in dry farming zone. It has a key position in success of dry farming. Generally, in India the rainfall is scanty, erratic and ill-distributed. Some times, the quantity of rainfall may not be limiting factor, but its distribution and uncertainty are the other two qualities which make the rainfed farming very difficult (Patil N.D and Umrani N.K. 1981).

Conventionally the low rainfall zone (i.e. less than 750 mm. per year) has been adopted as a 'Scarcity zone'. This standard is used as a criteria in the present study. But the differentiation in 'low rainfall or scarcity zone' has only a limited value, it does not account the actual availability of moisture and evapotranspiration. It is clear that scarcity conditions refer to crop failure due to scanty rainfall. It is clear that scarcity conditions refer to crop failure due to moisture deficiency (Jutta Dikshit, 1984).

The rainfall in the district is meagre, precarious and unevenly distributed. The climate is usually hot and the potential evaporation (PE) is far in excess of the precipitation, the normal rainfall is less than 750 mm., hence the region is classified as semi-arid. For example at Solapur with annual rainfall of about 724 mm. the potential evaporation is about 1800 mm. annually; resulting in deficit of 60 percent.

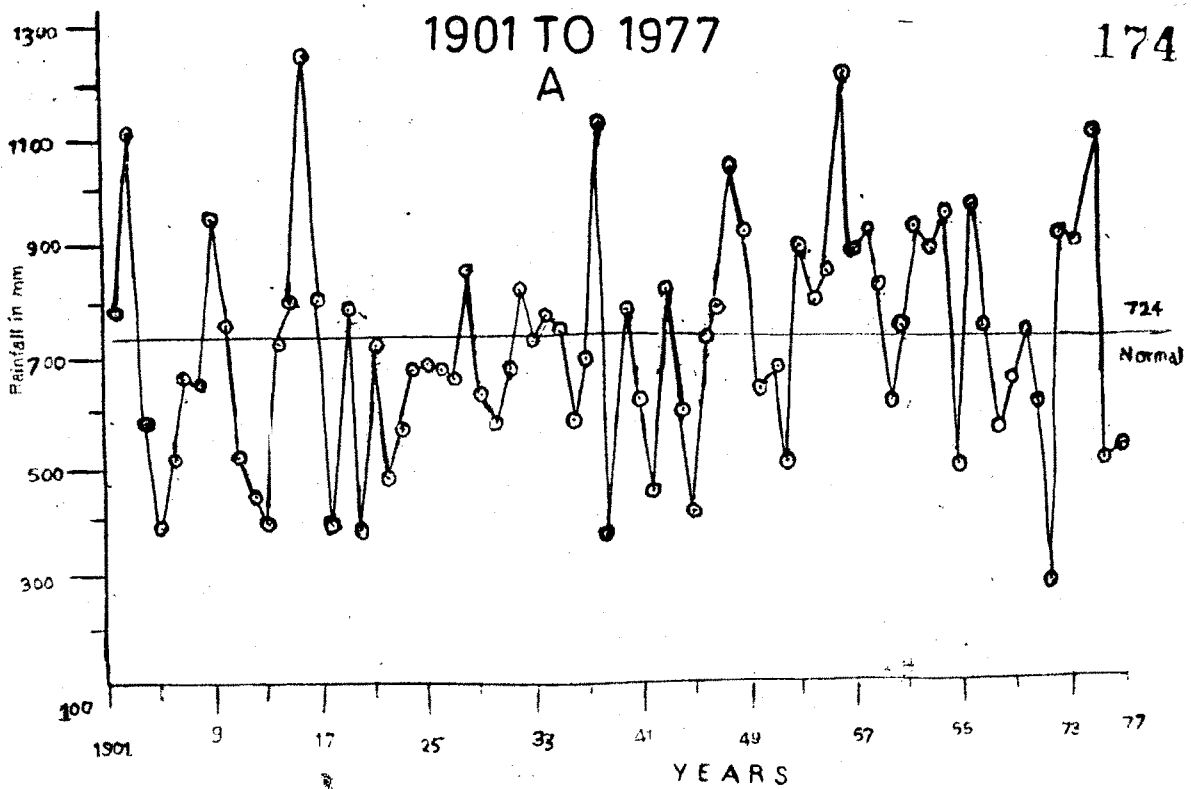
Rainfall being a single most important factor in the farming of Solapur district. From about 110 years of available record for Solapur, the lowest rainfall was recorded in 1876 and 1972 (about 270 mm.). The maximum rainfall is 1727 mm. during 1978. Year to year fluctuations are so much that there is no gurantee of a fixed quantity of rainfall (Fig.7.1A). So far as the weekly distribution of rainfall is concerned the rain starts in late June to early July. There is, however, depression during late July and early August. Again, there is a good rainfall in late August and September. The rainfall totally recedes by mid October. This is the usual pattern found in the drought prone areas of India.

Breaks in the monsoon season :

The climatic feature is the dry spells. Breeks in monsoon are normally experienced during late July and August. They may extend by 2 weeks to about 13 weeks at a stretch. A break is defined as a period receiving less than 15 mm. rainfall in the consercutive weeks, the normal rainfall during the week being more than 5 mm. Based on this critarion, the frequency and duration of the breaks in Solapur district are given in Table 7.1.

A duration of break, more than 4 weeks and frequency more than 3 times usually result in failure of crops. Such occassions, are usually experienced during Kharif season and hence Kharif season is risky.

ANNUAL RAINFALL FLUCTUATION AT SOLAPUR



WATER AVAILABILITY PERIODS

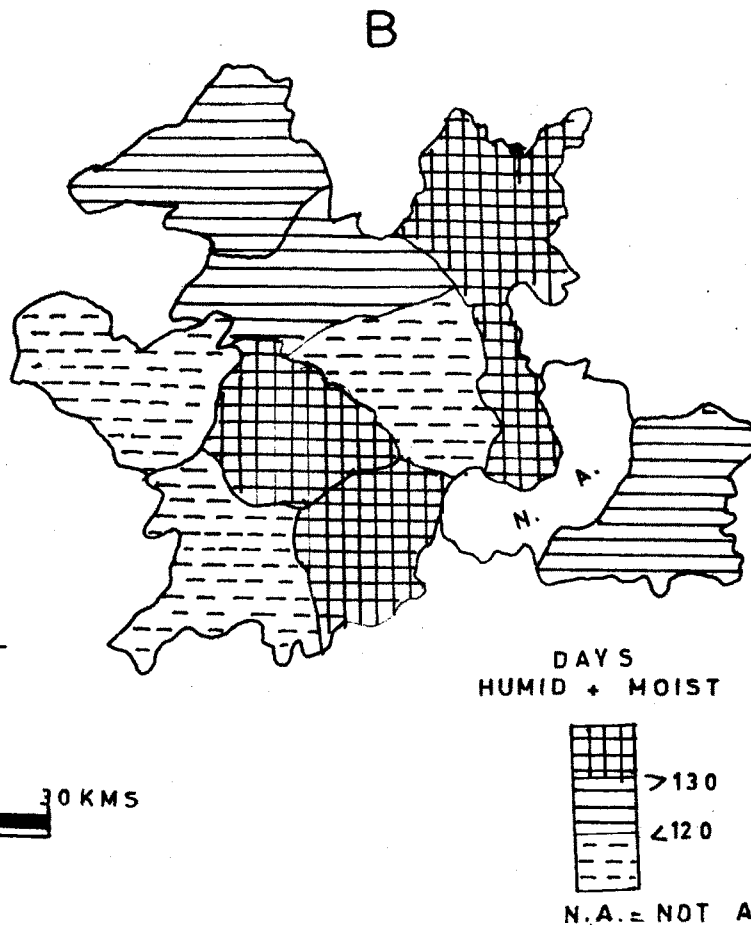


FIG. 7-1

Table 7.1 : Breaks in the monsoon season at Solapur.

Year	Number of Breaks	Duration of breaks in weeks
1951	1	2
1952	3	3,8,2
1953	2	2,2
1954	3	3,3,2
1955	3	2,3,2
1956	2	2,3
1957	3	2,3,5
1958	2,	6,4
1959	1	3
1960	3	3,4,3
1961	2	2,6
1962	2	2,3
1963	2	2,3
1964	3	2,4,2
1965	3	4,3,4
1966	2	3,3
1967	5	2,3,4,2,2
1968	3	2,3,2
1969	3	2,2,3
1970	2	3
1971	2	3,6,2
1972	3	2,9,4
1973	2	2,2
1974	3	3,3,2
1975	1	3
1976	2	2,7

SOURCE : Improved crop production technology for drought prone areas of Maharashtra, 1981, by Patil N.D. & Umarani N.K.

Spatial variation in the rainfall within the district is also observed. In case of Solapur district, the variation in annual rainfall is noticed from 500 mm. in the western part to about 700 mm. in the eastern portion (Fig.7.2).

Water availability periods :

Water availability period gives a rough idea about the extent of suitable periods for the crop growth. Water availability depends on the rainfall and the potential evapotranspiration (PE). Humid (when rainfall exceeds PE) and moist (when rainfall is less than PE but exceeds PE/2) period taken together provides congenial weather for active. The extent of water availability period in Solapur district is given in Fig.7.2B.

This is very useful to recommend the crop pattern for these districts. A minimum of about 70 days period is available in Malshiras in Solapur district. With such a short period available for active growth, successful cropping is difficult. In places where the period exceeds 125 days, there is a possibility of fitting in two short duration crops. Humidity is high during July and September. During February to May, it is low. During dry spell, less relative humidity is noticed. Evaporation demands are also accelerated with high temperatures and low humidity.

B. DELIMITATION OF DROUGHT AREAS AND YEARS :

The drought prone areas of Solapur district have been a subject of study by different disciplines. Most of these studies

CHRONIC DROUGHT PRONE AREA IN SOLAPUR DISTRICT

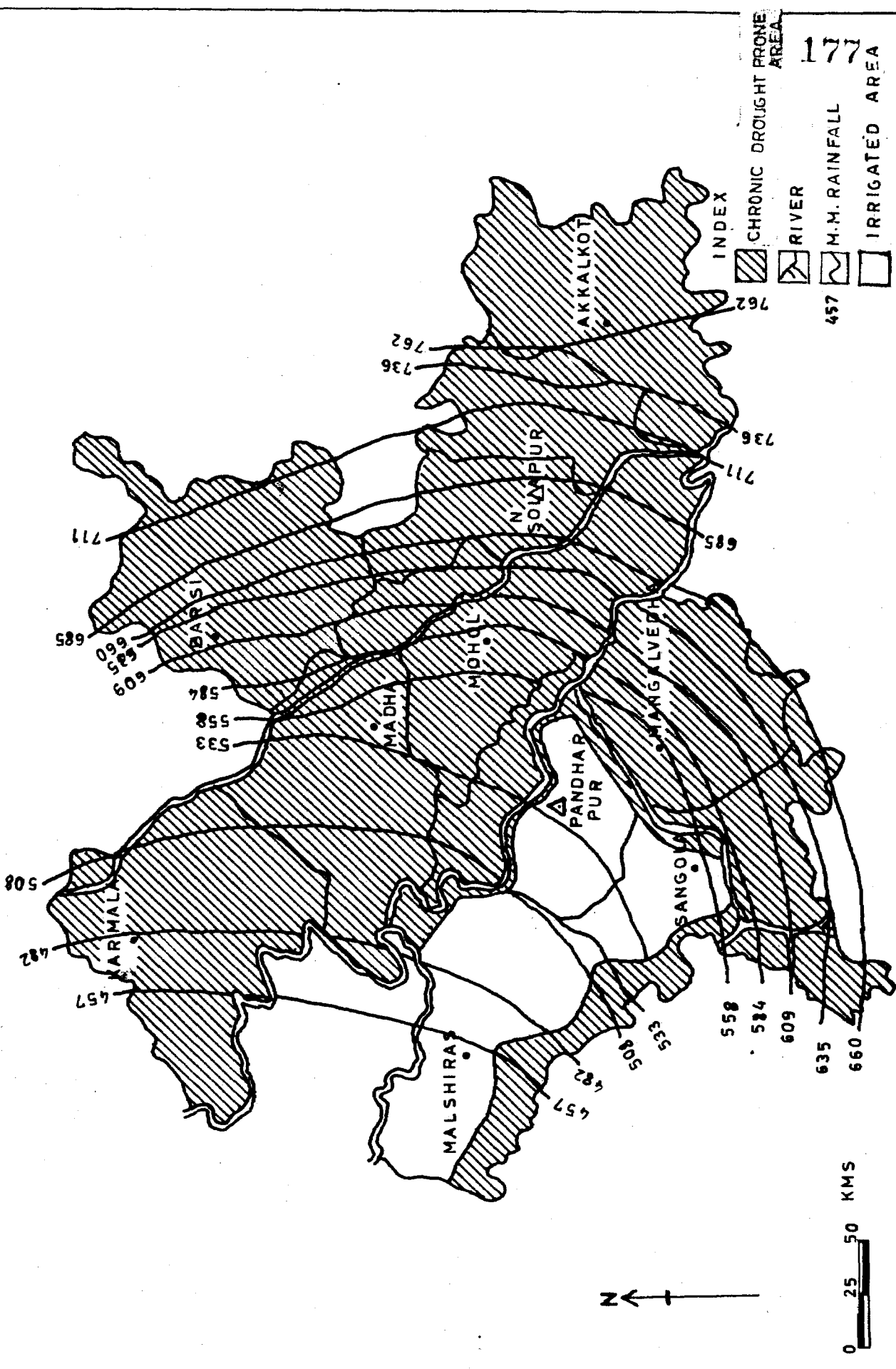


FIG. 7.2
SOURCE-DIRECTOR OF G.S. AND DEVELOPMENT AGENCY, GOVT. OF MAHARASHTRA.

have focused their attention on the delimitation of the drought prone areas, and the qualitative determination of the degree of drought proneness in the different parts of the region. The delimitations are based mainly on the inadequacy of rainfall.

The Solapur district has been recognised as a drought prone since long. The fact finding committee known as Sukhatankar Committee, appointed in 1972 has classified the whole district with the exception of areas covered by major and large irrigation projects as the drought prone area (Fig.7.2). Thus, scarcity conditions affect about 92 percent of gross cropped area of the district.

The revenue department of state government generally follow the evidence method for identifying the drought conditions as below. They perceives drought in terms of crop conditions and village life. The reporting is done by the village talathi to the district official through the Revenue Inspector and the Tahsildar. The prospects of the current crop standing in the field is estimated by field and spot inspection in the annewari system. In the annewari system, a normal crop yield is estimated as a 75 paise crop and the standing crop value at current prices is evaluated in terms of normal yield as shown below.

$$\frac{\text{Crop}}{\text{Normal Yield}} \times 75 \text{ paise}$$

The systematic reporting is done on the i) stage of crop failure, if any (at weeding, harvesting etc.). ii) weather all the crops, or some early/late sown crops are affected; iii) weather fodder was lost; iv) availability of water supply for livestock; v) expected duration of water availability in village wells/ponds; vi) number of households with supply of foodgrains to 12, 6, 3 or less months; vii) number of cattle being taken to the next cattle fair for sale; viii) scarcity conditions in nearby villages; and ix) the talathi's and village eldermen's opinions about future prospects in the next 4 to 8 months, on the basis of past experience. These village reports are tabulated at the district level, and reviewed to identify village clusters of scarcity.

This administrative scheme is basically sound, as it is built on evidences from below, at the village level and the spot inspection. As it helps to readily pin down, even as the event occurs, the spatial and temporal aspects of the drought. Based on this method and the annual rainfall of the district the following drought years are identified.

Drought Years :

1) 1952-53 Drought year :

In this district, the normal rainfall is 724 mm. but in this year the actual rainfall was only 495 mm. (Fig.7.1A). The rainfall is very low compared to normal rainfall and the

standard rainfall criteria used for defining scarcity, hence the year 1952-53 is a drought year. About 58 villages from Barshi, Pandharpur, Malshiras and Karmala and 56 villages from Sangola were suffered by severe drought conditions.

During the year 1952-53, Solapur district was affected by scarcity conditions due to the failure of crops. To overcome the scarcity many measures were undertaken by the Government to relieve the distress caused by the scarcity. Construction of roads, tanks, wells, bunding, metal breaking etc. were undertaken by the Government. Fodder was supplied on subsidised basis to the needy agriculturists, and free in deserving cases. Tagal loans were given liberally to the cultivators for the construction and repairs of wells and for purchase of fodder.

Skimmed milk powder received from UNICEF was distributed free to the children and expectant and nursing mothers. Similarly rice, wheat, cloth and clothes received from donors were also distributed free in the affected areas. Gratuitous relief was given in the form of doles to destitute. Famine Relief Committee were utilised for undertaking relief measures to alleviate the distress of the sufferers.

2) 1965-66 Drought year :

This year the annual rainfall was 504 mm. (Fig.7.1A). It is less than the normal rainfall and 750 mm. rainfall criteria.

During the year 1965-66, scarcity conditions prevailed in Solapur district till 30th September 1966, mainly caused by the failure of rains. About 6,64,807 people inhabiting over an area of 16,44,536 acres were affected. In this year few families were migrated to Kolhapur and Osmanabad districts in search of better wages. During the scarcity period cash doles amounting to Rs.86,025 were distributed among 10,170 persons. Free food, fodder were also distributed to these peoples. In addition biscuits, dried peas, vitamin tablets etc. were distributed to children below 14 years of age. Fodder tagai of Rs.85,431 was extended to 2,771 Khatedars during the scarcity period. Table 7.2 shows the distribution of tagai and other loans in Solapur district during the period of 1965-66.

3) 1970-71 Drought year :

The rainfall was 590 mm. in 1970-71 but the normal rainfall is 724 mm. During 1970-71, 956 villages in the district covering a population of about 18,60,119 were affected by scarcity. The total number of relief works undertaken during 1970-71 were 10,957 for which 1,44,025 persons were employed. The total expenditure incurred on these works was to the tune of Rs.6,88,792. Tagai loans distributed under Agriculturists Loans Act amounted to Rs.8,97,800. The number of villages to which full suspension in land revenue was granted was 870.

Table 7.2 : Distribution of Tagai and other loans in Solapur District during the scarcity period 1965-66.

Kind of loans	Amount advanced in rupees	Number of persons benefited
(1) Distribution under Land Improvement Loans Act.		
Bunds	12,250	17
Oil engines	22,54,098	726
Wells	2,77,936	282
Total	25,44,284	1,025
(2) Distribution under Agriculturists Loans Act.		
Bullocks	29,82,325	6,378
Fodder	5,33,391	2,867
Total	35,15,716	9,245

SOURCE : Gazetteer of Solapur District.

4) 1972-73 Drought year :

The rainfall was lowest during the year 1972-73 i.e. 270 mm. (Fig.7.1A). It is very less than the normal rainfall of Solapur district. During 1972-73, 953 villages in the district, covering a population of 16,37,288 were affected by famine and chronic scarcity. The total expenditure incurred on these works

was to the tune of Rs.12,89,55,079. Tagai loans were distributed under the Agriculturists Loans Act.

Thus, Solapur district was passed through a period of drought for three years 1970-71, 1971-72 and 1972-73 in succession.

5) 1976-77 Drought year :

In the drought year 1976-77 the annual rainfall was 498 mm. (Fig.7.1A). It is also less than the normal rainfall of Solapur district. Scarcity conditions were prevailed in few villages in the district. Many programmes and measures were also started in this year.

C. CROPPING PATTERN :

The cropping pattern of drought prone area is dependent on quantity and distribution of rainfall, soil type and its depth and also home requirements. The rainfall is irregular and scanty, there is tendency to grow low prices non cash crops. Groundnut is the only cash crop grown as a pure crop out of several crops. Recent years, the area under the crop is dwindling very fast because of uncertain rainfall and high prices of seed.

The cropping during kharif season is less assured. This is because of the dependability of these rains is very low. On the contrary, the rains in September are more assured and as such farmers prefer to take rabi crops even in medium deep soils.

The trends of production potential are however, in favour of kharif season. Production of kharif crops like bajara, green gram, red gram are much higher compared to sorghum and gram grown in rabi season. Farmers have a tendency to adopt low cost and minimum risk technology. About 25 to 30 percent area is cropped during kharif, rest of the area is kept for rabi season.)

Mixed cropping is extensively followed for kharif crops. Usually 4-5 crops are mixed. Their proportion varies from place to place. Bajara, redgram, horsegram, moth bean and sesamum is a common mixture. Usually 12.15 rows of sorghum are followed by 3 rows of safflower.

Almost 80 to 85 percent area under Rabi crops is accounted for sorghum. This is followed by safflower usually taken as a mixed crop. Dry wheat is a minor crop and the area is dwindling fast because of better prices for sorghum. The spatial pattern and actual area under principal crops for Solapur district of drought prone area is given in Chapter IV (Table 4.1).

D. MEASURES AND PROGRAMMES UNDERTAKEN TO OVERCOME

THE DROUGHT CONDITIONS :

To overcome the drought conditions of the region and to provide the minimum needs of the population of district, are undertaken by the state government as below.

1) Watershed approach :

The drought prone area programmes for Solapur district adopted a watershed approach and initially 10 watersheds, one in each taluka excluding Pandharpur, comprising of 113 villages, were selected. Ten more watersheds were added in 1977-78 to utilise expected savings in the project outlay.

2) Employment guarantee scheme :

The employment guarantee scheme is being implemented since March 1972. The aim of scheme is to provide employment to all rural adults seeking manual un-skilled work and utilising the manpower so available for the creation of durable productive assets. The scheme has now been extended to the work seekers residing in 'C' class municipal area also. The nature of work is productive viz. minor irrigation, land development, afforestation.

3) Soil and water conservation :

Drought prone areas are severally affected by soil erosion which depletes the capacity to retain moisture in the soil for the required period. Thus soil and water conservation methods become basic activity for any programme taken in drought prone areas for sustained agricultural production. Soil conservation aims at improving lands by adopting suitable techniques according to the topography, rainfall and landuse capability.

Nala bunding, contour bunding and land levelling works are undertaken in soil and water conservation measures in drought prone areas of district.

4) Water harnessing :

Water harnessing is carried out through joint efforts of private land holders and government. In respect of percolation tanks harnessing is achieved through digging of wells/bore wells in the down streams of percolation tanks in the fields owned privately.

5) Block plantation on private land :

To increase the fodder productivity of marginal farmers and to increase the carrying capacity of these land and to put the marginal and sub marginal land to proper landuse a block plantation on private land development programme is designed in the region.

6) Farm forestry :

To encourage farmers to grow trees of economic value yielding small timber, fuelwood and fodder for his domestic use a scheme of plantation of trees by individual farmer either on bunds of his farm in the farm is undertaken.

7) Animal husbandary :

The drought prone areas are endowed with reputed breeds of cattle and sheep and their number also is quite

large. However, their milk yield is very low, so it does not help much in diversifying sources of income of drought prone area farmers. Additionally this livestock population adds tremendously to soil erosion through overgrazing. This in turn has led to critical livestock food supply situation. It is also noticed that in these areas rearing of sheep and goats on organised lines is not only negligible but is positively discouraged. Due to this, the farmers in these areas lose an opportunity to further diversify their sources of income. In this background the objective of animal husbandry and dairy development programmes in drought prone areas would be to upgrade the breed of cattle to increase the milk yield to organise marketing of milk on co-operative and scientific basis and to develop sheep goat rearing on organised lines.

8) Dairy societies :

Arrangements have been made for marketing of increased milk production so that the livestock owners receive timely and economic returns. For this purpose the programme of establishment of dairy societies is undertaken in the region.

9) Dry farming :

The rainfall is irregular and scanty so that dry farming is very important. Dry farming research was established in 1933 at Solapur. The research station was started with an object to carry out scientific research on allied aspects of dry farming,

so as to get reasonable production of rabi jowar, sorghum, safflower, important pulses, sunflower etc; even under adverse conditions of soil, climate and rainfall. Subsequently, emphasis is given on the production technology of all dryland crops. The research station also serves as a centre of demonstration for the newly evolved technique in dry farming to the farmers of drought prone areas of Maharashtra.

10) Grass cultivation :

Grasses have a special place in dry farming in stabilizing bunds, conservation of soil and in areas usually not suitable for field crops. It has been estimated that grasses are more economic on shallow and very shallow soils compared to the field crops. Blue panic (*panicum antidotale*) and Marvel-8 (*Dicanthium annulatum*, staf) are the two promising varieties recommended for this purpose. Soo-babhul (*Laucaena laucocephala*) is a perennial leguminous deep rooted shrub or tall tree and has ability to fix atmospheric nitrogen. It is useful as fodder, fuel, timber, medicinal and as field border plants especially under dryland conditions. Hence a measure of grass cultivation is also suggested for full drought prone area.

11) Fertilizer use under drylands :

Soils of dryland areas falling under semi-arid agro-climatic zone are low to medium in available nitrogen (112 to 480 kg./ha.) and phosphorus (10 to 35 kg. average P_2O_5 /ha.) but

rich in potassium (250 to 900 kg. average K_2O /ha.). Fertilizers are used in drylands only by a few farmers. In fact there is disbelief amongst the farmers that fertilizers would be harmful in dry lands. It has, however, been proved that fertilizer is important next to moisture in drylands. Good response to fertilizer application has been obtained for bajara, setaria, sunflower during kharif and jowar and jowar and safflower during rabi.

In year 1969-70, a sample survey carried out by the station revealed that practically no farmer uses any fertilizer in drylands. Therefore a use of fertilizers under drylands has been recommended.

12) Proper planning of the crops to suit the soil capabilities :

Scientific crop planning according to soil capability is essential in drought conditions. Therefore, lands upto 45 cm. depth need to be diverted for kharif crops. Shallow soils upto 20 cm. deep should be diverted for grass cultivation and pasture. Such landuse planning measure is also under taken in some parts of the district.

13) Cropping system :

Research on pure, inter and sequence crop system is in progress to increase the production. Some of the important measures are suggested as under.

a) Early sowing of rabi crops :

As a measure to correct it, early sowing of rabi crops has been recommended. This helps to make moisture available for plant growth. It has been found useful for both rabi jowar and safflower in this region. On the average of 4 years, jowar yields have been improved by 30 percent additional grain production and 93 percent fodder production. For safflower, the yield increase has been found to be of the order of 78% over the traditional sowing. First fortnight of September has been found to be best suited for both these crops. High yielding varieties of jowar are found to respond better to early sowing.

b) Sequence cropping :

Rainfall received during June to August is conserved and then rabi crops are sown. In order to explore the possibilities of growing two crops by using available soil moisture during June to August, sequence cropping is recommended. The sequence of green gram followed by rabi jowar or bajara followed by gram are the best suited.

c) Intercrop system :

Intercrop system is also useful for increasing the cropping intensity on soils with depth upto 30-40 cms. Several crops have been tried as intercrops in a crop of bajara. It has been observed that bajara and redgram are the best suited crops for such system in the district.

Besides these measures some special programmes are also under taken to over the drought conditions of the district.

14) Programmes undertaken :

The rural work programme was started in 1970-71 as a central sector scheme in selected areas identified as drought prone, but it was converted into Drought Prone Area Programme (D.P.A.P.). D.P.A.P. was implemented from 1974-75 as an additive programme in the identified drought prone blocks/districts with 50% central assistance. About 1.12 lakhs hectares of the states area is drought prone and the programme covered this area. In the first year of the fifth five year plan, the World Bank (IDA) in conjunction with the central and state governments implemented this programme in the districts of Ahmednagar and Solapur. At the begining of revised sixth five year plan (1980-85) Government of India, appointed a Task Force headed by Dr.M.S.Swaminathan, member of planning commission, to assess the work done under D.P.A.P. The objectives of DPAP includes the following :-

- i) Restoration of ecological balance;
- ii) Raising the productivity status of the land and water, livestock resources through their optimal use;
- iii) Raising the economic status of the poorer sections of the rural population through measures like improvement in cropping pattern, yields and through supplementary occupations like dairy, forestry, fisheries etc.

- iv) Promoting more productive dry land agriculture on the basis of the soil, water, climate resources of the area;
- v) Development and productive use of the water resource of the area;
- vi) Soil and moisture conservation including promotion of proper landuse practices;
- vii) Afforestation including farm forestry, and
- viii) Livestock development including development of pastures and fodder resources.

In view of deplorable conditions prevailing in the drought prone areas, the state government has undertaken in the fifth plan, a programme for drought proofing in 87 talukas of 12 districts of the state, which have been identified by the state government as drought prone. Out of these 12 districts, two districts viz. Solapur and Ahmadnagar have a massive drought prone areas programme for which assistance from the International Development Association, has been negotiated.

CONCLUSION :

The Solapur district is a drought prone area. Generally, the rainfall is scanty, erratic and ill-distributed. So the crop cultivation and production is very difficult. The crops are not growing well because of water availability period is very short. In the drought year 1972-73 the intensity is very

high compared to other drought years. Many programmes and measures to overcome drought conditions are under taken by state government such as nalla bunding, contour / graded bunding and levelling and shaping, water harnessing, block plantation, farm forestry, animal husbandary, dairy societies, crops sequence cropping, inter crop system etc.



R E F E R E N C E S

1. The Maharashtra Census Office Bombay (1977) : Maharashtra State Gazetteer Solapur District. p.134.
2. Government of Maharashtra (1972) : Drought prone areas programmes. pp.1-5.
3. I.M.D. : Climatological Tables of Observatories in India, Government of India (1971) : Rainfall and Droughts in India.
4. Jutta Dikshit (1984) : Identification of drought prone areas and production of crops expectations in Maharashtra. Geographical Review of India, Vol.45, Dec.1984.,pp.48-77.
5. Kadam, S.K. and Bangar, A.R. (1983) : Activities of dry farming research station Solapur. Golden Jubilee Volume, Mahatma Phule Agricultural University, Rahuri, Solapur station., pp.15-16.
6. Patil, N.D. and Umarani, N.K. (1981) : Improved crop production Technology for Drought Prone Areas of Maharashtra., pp.1-6.
7. South Asia Project Department General Agricultural Division (1974) : Appraisal of Drought Prone Areas Project in India. Report No.533a - In Document of the International Bank for Reconstruction and Development International Development Association.,p.2.
8. Thornthwaite, C.W. (1948) : An approach towards a rational classification of climate. Geographical Review, Vol.38.