SOIL DEGRADATION IN KRISHNA CANAL COMMAND AREA (MAHARASHTRA): A Micro Level Analysis.

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ABSTRACT:

Irrigation plays an important role in agricultural development. It helps farmers to grow two or more crops from the same field within a year and it increases the productivity of the land. However, due to misuse of water and chemical fertilizers, the problem of soil degradation is arising in irrigated tracts. In view of this, present investigation aims to analyse the causes and consequences of improper management of soil by taking the case study of Krishna Canal in Karad Tahsil. The entire investigation is based on empirical data collected by employing schedule and questionnaire techniques. It is also supplemented by data collected though secondary sources. The collected data have been processed and presented in the tabular form whereas other related aspects are shown by graphs and coropleth maps. Sugarcane is the main cash crop cultivated without following the rotation system. Owing to excessive use of water and chemical fertilizers and unsuitable soil management practices, the problem of soil degradation is emerging rapidly in canal irrigated sugarcane tracts of the region.To combat this problem of soil degradation, physical, chemical and agronomical site specific measures recommended need to be implemented immediately.

KEY WORDS: Krishna canal, Irrigation, Soil degradation, Salinity, Water logging.

INTRODUCTION:

Irrigation is an integral part of sound infrastructure and it is one of the basic ingredients of agricultural inputs. To be successful and well developed, agriculture requires supply of water at regular interval and in required quantities. Importance of irrigation as an essential input, hardly-needs any emphasis. Moreover it is a pre-requisite for the adoption of new technology in agricultural sector. The availability of adequate irrigation facilities transforms the subsistence agricultural landscape gradually into commercial one making agrarian economy market oriented. Simultaneously, it creates healthy atmosphere to develop several agro-based industries providing employment opportunities to rural masses (Pawar, 1989). However, due to the excessive use of water and chemical fertilizers and unsuitable soil management practices, the problems of soil degradation are arising in irrigated tracts. The

problems like water logging, soil salinization and alkalization, particularly in sugarcane tracts are emerging rapidly.

OBJECTIVE:

In view of the above, present paper seeks to analyze the irrigation facilities, cropping pattern and agro-inputs, followed by investigating the problems related to soil and to recommend the suitable soil reclamation measures for combating the soil degradation in the study region.

METHODOLOGY:

The importance of the study lies in the fact that entire work is based on empirical data collected by intensive fieldwork. The schedule and questionnaire techniques are adopted for collection of data and information related with the various aspect of soil. The empirical data are supplemented by data collected through secondary sources such as Socio-Economic Review and District Statistical Abstracts, Census hand book, Reports of Irrigation Commission etc. For the soil analysis about 10 samples from each village of the study area have been collected. After soil testing, village wise results are aggregated for the purpose of analysis. The quality of soil is measured through standardized soil testing methods which are (1) 'pH' or soil reaction that indicates acidity and alkalinity (2) salinity, in terms soluble salts is determined through electrical conductivity test (EC). Similarly the facts regarding salt affected area were obtained from agricultural officer of Karad tahsil which were also confirmed by fieldwork and represented by choropleth method. The schedule and questionnaire techniques were employed to collect the first hand information about the use of irrigation water and fertilizer, area affected by salinity and waterlogging. For this purpose 20 farmers from each village were selected by stratified random sampling method .In all 280 farmers (1/3 each from small, medium and big size of holdings) were interviewed. The data collected were aggregated and shown by line graph. Conclusions are derived by inductive method.

STUDY REGION:

Krishna Canal command area in Karad Tahsil of Satara District is located at the South eastern part of Karad tahsil. (Fig. 1). It is one of the well watered and agriculturally prosperous part of the Karad tahsil. The region comprises 8846.59 hectares of area and supports 57,116 people. The physical landscape of the region is marked by the plain area. The study area is drained by the river Krishna. Climatically, the region enjoys a moderate type of climate with very little extremes of heat and cold .It is located in the rain shadow zone of the Western Ghats and receives about 65cm of average rainfall. The study area is a part of the great monsoon land. The soil is mainly derived from basalt rock. The region is dominated by deep black (over 70%)soil along the river bank followed by medium black and shallow black having good fertility status (Chavan ,2009). The soils are rich in nitrogen and potash but relatively poor in phosphate (Table.I)

A beginning of organized irrigation in the region was made in the early period of British rule with the opening of Krishna canal in 1870. The canal takes off from the village Khodashi near Karad where a weir is built across the Krishna river (Fig.2). It is the oldest canal on the Deccan plateau. Out of the total irrigated area of 4885 hectare (i.e. 55.22 per cent of net area sown) 41.53 per cent is shared by canal, 37.05 per cent by lift and 20.44 per cent by wells.

ANALYSIS AND RESULT:

1) Cropping pattern:

In the study region the gross cropped area was 7039.79 hectares in 2007-08. Out of this, 88.63 per cent area was devoted to food crops. Among the food crops foodgrains acquired 28.56 percent area and pulses shared only 0.88 per cent of the total cropped area. Sugarcane was the major non-food crop of the region sharing about 50.76 per cent of the total cropped area, and covering 76.05 per cent of total irrigated area. Sugarcane ranks first among total cultivated crops and among irrigated crops. Rice is the second important crop (20.23 per cent) followed by groundnut (9.46 per cent), jowar (4.00 per cent) and condiments and wheat.

2) Use of irrigation water:

The quantity of water used in irrigation is of immense significance in the context of land degradation (Pawar and Pujari, 2000). The abundance of water in the study region is responsible for its lavish and indiscriminate use. Monoculture of sugarcane crop also provides a ground for erratic water use. The major share of irrigated cropping (above 76 per

cent) is occupied by sugarcane alone leaving other crops in poor position in terms of water use.

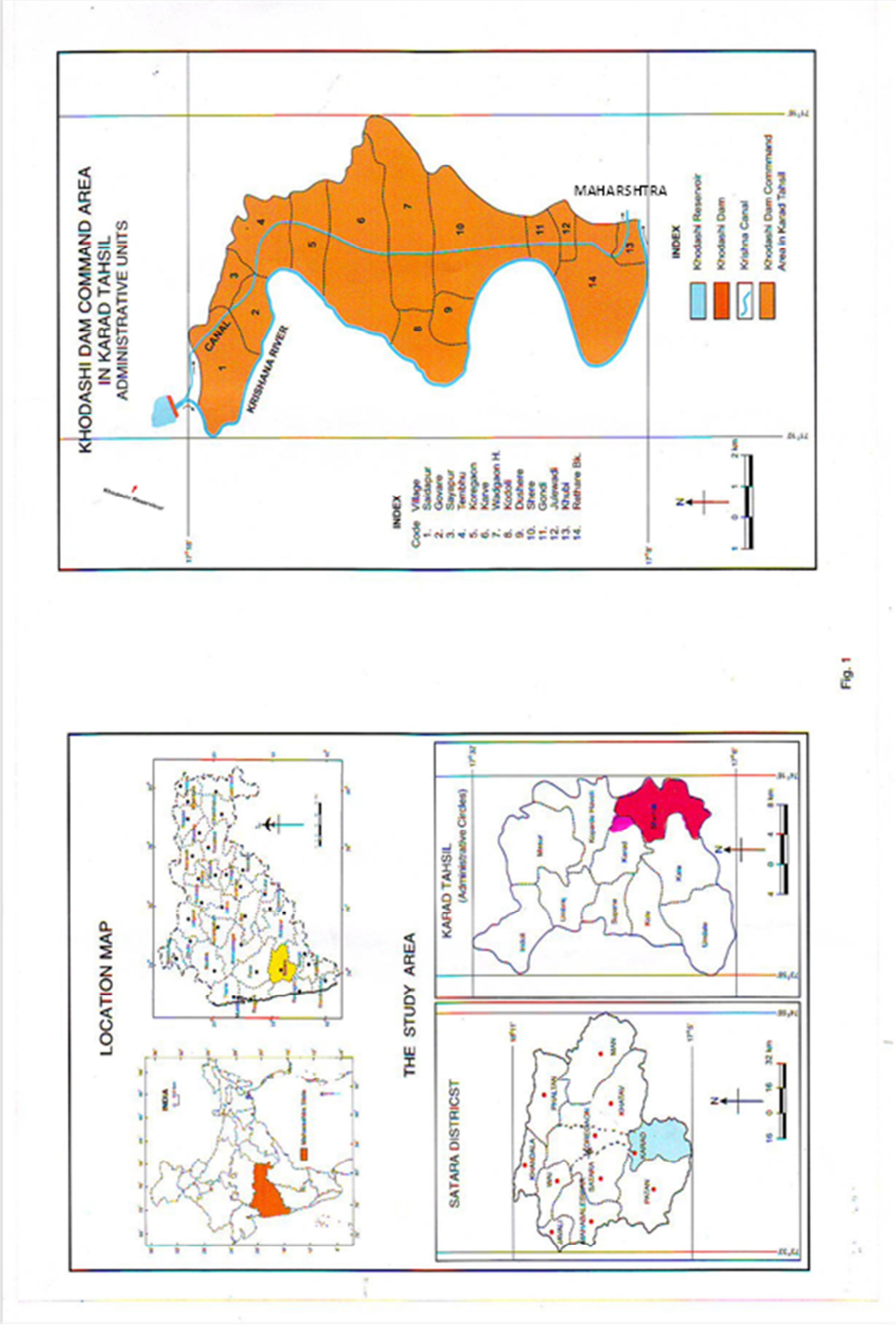

Fig. 1 & Fig. 2

The water use analysis reveals that the actual average water use by sugarcane is far more (fig.No.5.) than the standard requirement of 300 ha.cm. in the region (Govt. of Maharashtra

,1985). Heavy water use is confined to the highly irrigated sugarcane belt in the western part adjoining the river bank. The extreme use of water over 600 ha.cm. is observed in Rethare BK.village followed by Dushere ,Karve,Tembhu,Wadgaon and Khubi. The ample availability of water through Khodashi canal and through private co-operative lift irrigation schemes and misconception and ignorance about water use among cane growers are responsible for over use of irrigation water in the study region (Chavan, 2009).

3) Use of Chemical Fertilizers:

The study region witnesses heavy fertilizer consumption, particularly by sugarcane crop. There is a common misbelief that continued and intensive use of chemical fertilizers would give high returns in terms of high yields. Sugarcane is the single most important crop consuming bulk of fertilizers (over 70%) used in the study area. The average per hectare fertilizer use of 1750 kg for sugarcane is far more than the standard requirement of fertilizers of 740 kg. /hect. (Govt. of Maharashtra 1985). Heavy doses are applied particularly in Rethare Bk., Khubi ,Julewadi and Dushere villages (personal interviews and observation).

4) Soil Degradation:

The term soil degradation relates to loss in soil quality or productivity of soils as a result of human activities. Degradation is attributed to changes in soil nutrient status, loss of soil organic matter, deterioration of soil structure and toxicity due to accumulation of naturally occurring and anthropogenic materials (Pawar,Pawar Potdar and Panhalkar,2009.). Whitto (1984) stated that the process by which soil becomes weathered or highly leached denotes degradation.

Table I: Soil analysis of villages in study region.

Sr. No.	Village	pH (mm hous/cm)	EC	N (Kg./ha)	P (Kg./ha)	K (Kg./ha)
1	Saidapur	7.60	0.17	1.85	0.95	2.55
2	Govare	7.63	0.14	2.00	1.0	2.45
3	Sayapur	6.86	0.04	1.80	1.0	1.90
4	Tembhu	6.98	0.04	1.90	1.10	2.0
5	Koregaon	7.56	0.12	1.85	2.10	2.01
6	Karve	7.40	0.23	1.90	2.25	2.00
7	Wadgaon H.	8.01	0.76	2.15	2.80	1.90
8	Kodoli	7.14	0.03	1.70	2.25	1.60
9	Dushere	6.36	0.15	1.44	1.61	1.72
10	Shere	7.29	0.04	1.70	2.21	1.50
11	Gondi	7.10	0.06	1.95	2.30	2.10
12	Julewadi	6.36	0.05	2.30	1.65	2.15
13	Khubi	7.64	0.49	1.85	1.95	2.45
14	Rethare Bk.	7.63	0.41	2.35	2.25	3.00

Source: - Soil analysed at Government soil testing laboratory, Karad.and Bhoomiputra Krushi Vidnyan Pratishthan, Karad.

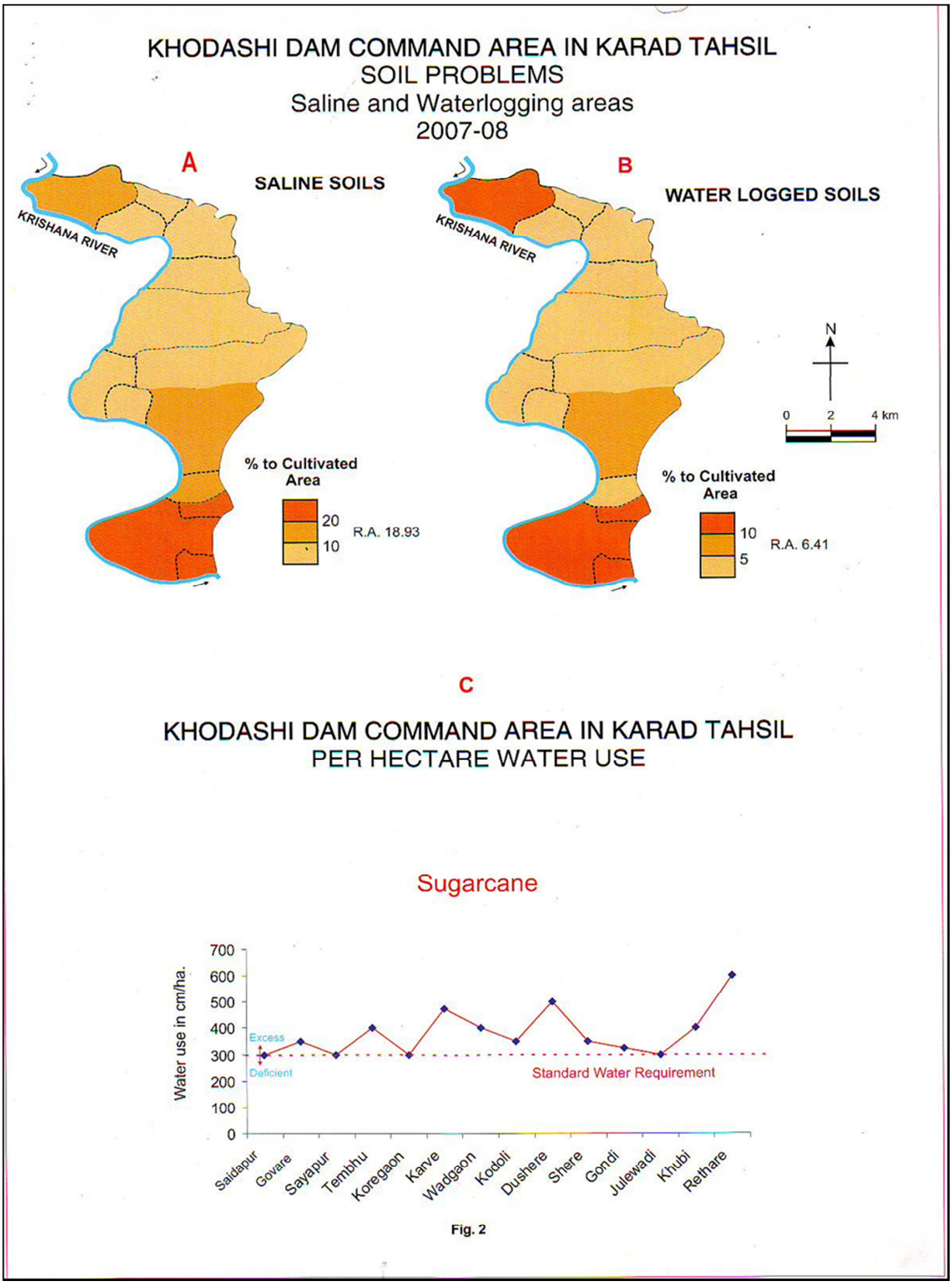
KHODASHI DAM COMMAND AREA IN KARAD TAHSIL
SOIL PROBLEMS
Saline and Waterlogging areas
2007-08
A
SALINE SOILS
KRISHANA RIVER
% to Cultivated Area
20
10
R.A. 18.93
B
WATER LOGGED SOILS
KRISHANA RIVER
% to Cultivated Area
10
5
R.A. 6.41
N
0 2 4 km
C
KHODASHI DAM COMMAND AREA IN KARAD TAHSIL
PER HECTARE WATER USE
Sugarcane
Water use in cm/ha.
700
600
500
400
300
200
100
0
Excess
Deficient
Standard Water Requirement
Saidapur
Govare
Sayapur
Tembhu
Koregaon
Karve
Wadgaon
Kodoli
Dushere
Shere
Gondi
Julewadi
Khubi
Rethare

Fig. 2

Salinity affected areas:

Saline soils may be defined as those which contain excess of salts and with pH above 7.5. Salinization is also an important problem that the cultivators are confronted with. After industrial revolution, there has been more use of chemical fertilizers in the developed countries and developing countries are also applying fertilizers in substantial quantities mainly in the irrigated areas. In the study region about 1332.7 hectares are affected by salinity. It comes to about 18.93 per cent of the total cultivated area. The main cause of increase in saline and alkaline soils is the application of high doses of fertilizers and of irrigation water. Similarly unsuitable methods of application of water in the study region are also a contributing factor for increase in saline & alkaline soils in the region. Mostly corrugation and flood methods of irrigation are applied by farmers in the region. The demerit of these methods is that water is not spread equally on the surface. In addition, absence of surface drainage in the field restricts water movement within the soil, resulting in upward movement of salts due to capillary action.It is evident from the soil analysis that most of the sample villages have pH more than 7. (Table I).

Over 20 per cent of the cultivated area affected by salinity is observed in lower part of the canal command area. It covers the villages namely Julewadi, Khubi and Rethare Bk. (Fig. 3.). Rethare Bk. has the highest area (980 ha.) affected by salinity (Table II). The moderate proportion of saline soil (10 to 20 %) is noted in the villages viz. Gondi, Shere and Saidapur.

Waterlogged Areas:

Surface waterlogged land is that land where the water is at or near the surface and water stands for most of the period of the year. However, land with surface water like lakes, ponds and tanks do not fall under this category. .Water logging is a distinct hazard in the development of agriculture. Water logging results from the excess use of water in the absence of drainage.

The soils in the study region have high water table (personal observation and farmers interviews) just near the surface level, in most of the irrigated tracts. The erratic water use, seepage and leakage from unlined canals distributaries, absence of drains etc. have led to steady increase of water table in the irrigated belt. As a result, 451.20 hectares are affected by water logging (Table – II). Its high concentration (above 10 % cultivated area) is observed in Rethare Bk., Khubi and Saidapur villages (Fig. 4.). The moderate concentration (5 to 10 %) is noted in the village Shere.

Table – II : Krishna Canal Command area in Karad tahsil – Saline and waterlogged areas (Area in hectare).

Sr. No.	Villages	Saline Soil	Water logged Soil
1	Saidapur	52.40	100.96
2	Govare	05.00	10.04
3	Sayapur	02.00	02.00
4	Tembhu	01.00	4.80
5	Koregaon	44.00	18.00
6	Karve	15.00	20.00
7	Wadgaon H.	16.00	20.00
8	Kodoli	12.00	10.14
9	Dushere	10.00	14.04
10	Shere	70.00	25.00
11	Gondi	50.00	10.00
12	Julewadi	34.80	70.00
13	Khubi	40.50	20.50
14	Rethare Bk.	980.00	125.00
Total		1332.70	451.20

Source : Compiled by Researchers through village Records. (2007-08)

Decrease in Crop Yield:

In the study region, influence of lift and canal irrigation in association with increased use of fertilizers has led to decrease in the soil productivity. (Personal interviews of farmers.) The investigation made by Pawar and Bansode (2003) also proved that productivity of the saline soil declines continuously .During the field trip it has been observed that more than 65 per cent farmers mainly complain about constant decrease in per hectare yield of crop. As stated by Jadhav(1984),thousands of hectares of cane lands have gone out of cultivation in upper Krishna basin due to salinity and alkalinity of soils.

RECOMMENDATIONS:

The process and practices involved in bringing saline and alkaline soils into productive condition are known as reclamation measures. Following reclamation measures are recommended for the study region.

The physical measures consist of scarping surface salt from saline patches, leaching and draining away of salts by rain and irrigation water and providing artificial drainage to affected area. These measures need to be practiced in the region on individual level by the farmers in the villages viz. Rethare Bk., Khubi, Shere, Karve, Koregaon etc.

Chemical measures include the addition of gypsum, sulphur and molasses to the affected soils in order to replace sodium in the clay complex by calcium. The rate of application of gypsum is usually 2.5 to 5.0 tons per hectare, but more quantities may be added as required (Vaidya and Sahastrabuddhe, 1979). Of all the calcium compounds gypsum is supposed to be the best which helps to reduce soil pH and to improve the physical condition of the soil, sulphur is also spread on the soil to reduce the alkalinity of the soil. The use of gypsum is recommended in Rethare Bk.,Julewadi, Saidapur, Dushere and Wadgaon H., villages. In sugar factory areas, farmers can use molasses and press mud to reclaim alkaline soils.

The green manuring of 'dhaincha' (a sort of plant) along with gypsum is useful in restoring physical condition and enriching the soil in nitrogen and organic matter. Mulching reduces the moisture evaporation from surface soil and prevents salinization. Suitable crop rotation including salt tolerant crops has also proved successful. The conjunctive use of surface and groundwater particularly in canal and lift irrigated region must be ensured as it helps to reduce the water table thereby operating as drainage to check the salinity of the land. These measures need be practiced in the villages' viz. Rethare Bk., Khubi, Shere, Wadgaon H. and Karve.

In addition of these, other measures like controlled irrigation at regular intervals, pre-monsoon land preparation along with heavy application of manures, composts of press mud, construction of surface drains, frequent interculturing etc. are also useful to minimize the intensity of salinity (Joshi and Bindu, 1964).

To utilize degraded soils for fish farming as an alternative landuse has been proved successful both as a measure to reclaim the saline soil and to get good economic returns from such degraded soils (Pawar, 2006). To reclaim the soil, Central and State Government launched various schemes by providing incentatives to the farmers. However, it is observed that various schemes, plans sanctioned by Government are not reaching the farmers. In this context the studies carried out by Pawar and Ghapure (1991, 1992) indicate the need of Agro-Service Centres at the nodal locations, through which required technical know-how, agro-inputs, innovative soil management practices etc. can be extended up to farmers immediately.

To overcome the problem of soil degradation, the proper measures, both for soil and water management need to be taken on priority basis. The awareness among the farmers to use the agricultural inputs cautiously must be created by organizing training camps, demonstration etc. The aforesaid site specific measures recommended will definitely help to reverse the process of soil degradation in the region.

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