

UTILISATION OF CANAL IRRIGATION
FACILITIES IN MAHARASHTRA
(CASE STUDY OF GHOD AND PURNA PROJECTS)

A DISSERTATION SUBMITTED TO THE
UNIVERSITY OF POONA
IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF
MASTER OF PHILOSOPHY IN ECONOMICS

BY

MADHUKAR R. GITE

GOKHALE INSTITUTE OF POLITICS AND ECONOMICS
PUNE 411004

DECEMBER 1986

ACKNOWLEDGEMENT

I am extremely thankful to Dr.(Mrs.) Sulabha Brahme, Reader, Gokhale Institute of Politics and Economics, Pune for her able guidance, magnificent cooperation and constant encouragement without which it would not have been possible to complete this dissertation in the present form.

I owe deep sense of gratitude to the Principal, Shri S. M. Patel, for extending the whole-hearted cooperation and all the possible help during the study period.

The Command Area Development Authorities at Nanded and Pune gave me full cooperation and assistance in data collection. I am very grateful to them.

Special mention needs to be made of Shri and Smt. A. U. Patil for their everlasting inspiration and encouragement.

My heartfelt thanks are due to Dr. Ashok K. Mitra, Dr. Ambegaonkar, Shri Godbole (Deputy Engineer), Prof. R.K.Nayak, Dr. Rane, Prof. Patel, Prof. M. D. Patil and Prof. J.T.Patil for their valuable help in one form or other.

Lastly my sincere thanks to Shri S. K. Athale for his neat and prompt typing.

December 1986

M. R. Gite

PREFACE

In a country like India where agriculture is a dominant sector, the development of irrigation facilities assumes great importance. After Independence, highest priority has been accorded to the irrigation development in the country's five year plans. Although the overall picture of the utilisation of the irrigation potential so far created in the country seems to be satisfactory, the position of the states like Maharashtra is very disappointing in this respect. In fact, the state government is quite concerned about the full exploitation and efficient management of the available water resources ever since the formation of the state but the gap between the potential created and utilised is widening.

In the present study an attempt is made to examine the problems of utilisation of irrigation potential created on some of the major irrigation projects located in different physico-geographic regions of Maharashtra. In order to understand the actual position of utilisation and to arrive at definite conclusions it was felt necessary that the selected irrigation project should be fully developed where the irrigation potential should have been created not less than ten years prior to the study. Accordingly, two case studies of major irrigation projects viz. Purna and Ghod were selected where the irrigation potential has been created before 1970.

(iii)

The projects were selected from the two major agro-climatic zones of the state, viz. the assured rainfall zone in Marathwada and the drought prone tract of Western Maharashtra.

Objective

The specific objectives set for the present study are as under:

(i) To examine the cropping pattern actually developed on the selected irrigation projects and that proposed for these projects.

(ii) To find out the extent of utilisation of the potential created by the projects.

(iii) To analyse the reasons for the lag in the utilisation of the created potential.

(iv) To make a comparative study of these two cases in respect of different aspects such as cropping pattern, extent of utilisation, causes of under-utilisation.

(v) To suggest measures to improve utilisation.

Methodology and Collection of Data

The present study is primarily based on secondary sources of data. The relevant data and information have been collected from the concerned Command Area Development Authorities for the Purna and Ghod projects at Nanded and Pune respectively. This was supplemented by approaching Irrigation Departments at Basamathnagar and Sirur. Information

relating to the project history and its salient features, proposed cropping pattern, the area actually irrigated, rainfall, quantity of water available and utilised, transit losses, causes of under-utilisation of the irrigation facility was obtained from various published and unpublished sources like project reports, the Annual Administration Reports of CADA, Rainfall Data Register and Water Account Register.

Further, valuable information regarding the cropping pattern, causes for under-utilisation, the attitude of the farmers, impact of the project performance of the CADA and the related aspects was obtained through discussions with the Administrator, Executive and Deputy Engineers and Agricultural Officers. In addition, a few cultivators in the Purna command area were personally interviewed to learn about the problems they face in relation to the application of irrigation water.

There were a number of difficulties faced by the author in collecting the required data and information. In some cases data were not properly collected and maintained while in other cases available data were not reliable. In such cases, attempt was made to obtain the requisite data from alternative sources.

Besides these, non-availability of the concerned person was observed to be a common phenomenon which resulted in considerable wastage of time. A few officers and staff

members were not ready to provide the necessary data/information as they thought that these are of a confidential nature. However, on the whole, the cooperation given by the concerned authorities was satisfactory. All possible efforts were made to bring the data and information up-to-date.

In addition to the data collected on Purna and Ghod projects, information on irrigation development in Maharashtra, utilisation of the irrigation potential created, reasons for non-utilisation, etc. was obtained consulting a variety of published reports of the commissions and committees appointed by the Government - Maharashtra State as well as the Central Government.

This study is divided into five chapters. The First Chapter is an introductory chapter which gives a brief account of the water resources, ultimate irrigation potential, development of irrigation, irrigation potential created and its utilisation in India as well as in Maharashtra. Chapter II examines in detail the numerous reasons for under-utilisation of the available irrigation facility and the various measures that are necessary to accelerate the pace of utilisation. Chapter III and the Chapter IV deal with the Purna and Ghod projects respectively in which a brief history and the salient features of the project, planned cropping pattern and the area actually irrigated, extent of utilisation, problems of utilisation and other aspects are presented in detail. Chapter V gives a summary and conclusions of the study.

C O N T E N T S

	<u>Page No.</u>
ACKNOWLEDGEMENT	(i)
PREFACE	(11)
LIST OF TABLES	(vii)
LIST OF MAPS	(x)
LIST OF GRAPHS	(x)
 <u>Chapter</u>	
I IRRIGATION DEVELOPMENT AND UTILISATION	1
II REVIEW OF LITERATURE ON CAUSES OF UNDERUTILISATION OF THE CREATED IRRIGATION POTENTIAL	23
III PURNA RIVER VALLEY PROJECT	49
IV GHOD RIVER PROJECT	91
V SUMMARY AND CONCLUSION	132
APPENDICES	153
BIBLIOGRAPHY	169

LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
1.1	Outlay and Development of Irrigation Potential	6
1.2	Use of Maharashtra's Water Resources (1982)	10
1.3	Financial Investment and Development of Irrigation Potential in Maharashtra	14
1.4	Utilisation of the Created Irrigation Potential on Major and Medium Schemes in the State	16
2.1	Water Requirements of Different Crops	40
3.1	Soil Classification of the Command Area of Purna Project	54
3.2	Approved Cropping Pattern of Purna Project	55
3.3	Stages of Creation of Irrigation Potential on Purna Project	56
3.4	Area Irrigated During 1962-63 to 1967-68	56
3.5	Area Irrigated under Various Crops During the Period from 1968-69 to 1983-84	60
3.6	Classification of Cultivators into Different Group of Land Holding	64
3.7	Area Irrigated under Kharif Rice, Wheat and Rabi Jowar	69
3.8	Recommended Number of Waterings to Different Crops under Purna Command	70
3.9	Application of Irrigation Water from Canal and Wells	72

(viii)

<u>Table No.</u>		<u>Page No.</u>
3.10	Proportion of Area Actually Irrigated to the Proposed Cropping Pattern	78
3.11	Utilisation of the Project Potential in Purna Command	82
3.12	Transit Losses During the Rabi and Hot Weather Seasons	84
4.1	Distribution of the Soils in the Ghod Command Area	94
4.2	Proposed Cropping Pattern in the Command of Ghod Project	95
4.3	Revised Cropping Pattern for the Ghod Project	96
4.4	Stages of Creating Irrigation Potential	97
4.5	Irrigation Potential Created and Utilised in the Ghod Project	98
4.6	Details of Seasonwise Irrigation Potential Created and Utilised	99
4.7	Seasonwise Utilisation of Water	101
4.8	Area Actually Irrigated During the Period from 1970-71 to 1983-84	103
4.9	Potential and Seasonwise Utilisation of Water on Ghod Project	104
4.10	Area Irrigated under Various Crops During the Rabi Season	108
4.11	Area Irrigated During Hot Weather Season	109
4.12	Utilisation of the Project Potential	114
4.13	Reasons for Non-utilisation of Water During Kharif Season	118
4.14	Planned Utilisation of Water	121

(ix)

<u>Table No.</u>		<u>Page No.</u>
4.15	Seasonwise Area Irrigated and Water Utilised	122
4.16	Actual Utilisation as Percentage of Planned Water Utilisation During Different Seasons	123
4.17	Average Area Irrigated During the Period 1976-77 to 1983-84	124
4.18	Transit Losses on the Ghod Project : 1970-71	126
4.19	Transit Losses During the Rabi Season	127
4.20	Transit Losses During the Hot Weather Season	128
5.1	Comparison between Purna and the Ghod Projects	139

LIST OF MAPS

<u>Map No.</u>		<u>After Page No.</u>
11	Map Showing the Purna Project Command	52
22	Map Showing the Ghod-Weir Project Command	93

LIST OF GRAPHS

<u>Figure No.</u>		<u>After Page No.</u>
1	Percentage of Utilisation on Purna Project	81
2	Utilisation During Kharif, Rabi and Hot Weather on Purna Project	81
3	Utilisation of the Project Potential on Ghod Project	113
4	Utilisation During the Kharif and Rabi Season on Ghod Project	113

CHAPTER I

IRRIGATION DEVELOPMENT AND UTILISATION

1.1 Need for Irrigation

Agriculture occupies a very dominant place in India's economic development. It provides livelihood to about three-fourth of the country's population, employs over 74 per cent of the labour force and contributes about 42 per cent of the national income.¹ The net area sown in the country increased from 139.8 million hectares to 140 million hectares during the period from 1967-68 to 1979-80;² the scope for bringing additional area under cultivation is thus very limited. Moreover, additional areas could be brought under cultivation only by encroaching upon country's valuable but already inadequate and depleted forest resources which account for nearly 23 per cent of the geographical area of the country, whereas the National Forest Policy (1952) has recommended that 33.3 per cent of the geographical area should be under forest.³ If the requirements like food, fibre, etc. of an ever growing population are to be met, there is no other alternative but to increase the productivity of the existing land and irrigation is the basic input to augment agricultural production.

Further, the floods-drought-floods syndrome still haunts a large part of the country and brings in heavy

destruction of crops, wealth and life. The total flood damage during 1984 was Rs. 1651 crores as against Rs. 2460 crores in 1983 and this is the maximum during the period 1953 to 1983.⁴ About 326 talukas in 61 districts in the country are drought prone areas and comprise 16 per cent the area and 11 per cent the population.⁵ Even after Independence, India has experienced a number of severe droughts like the droughts of 1965-66 and 1985-86. A substantial quantity of foodgrains production in 435 lakh hectares cropped area was lost and about 14 crore people and about 11 crore cattlehead were in the grip of a fierce drought raging in 260 districts of 14 union territories and states during the year 1985-86 due to the widespread drought in the country.⁶ As irrigation averts severe famine conditions, the first place must unquestionably be assigned to works of irrigation to protect the country directly from drought.

Finally, about 70 per cent of the country's cropped area is exclusively dependent on the mercy of rainfall; this makes the Indian agriculture extremely vulnerable - a gamble in rain. Even where annual precipitation is high and sufficient, residual moisture is not in a position to support multiple cropping in winter and summer. Hence, irrigation is the only remedy to eradicate the drought menace. ✓

1.2 Water Resources of the Country

India has very copious water resources as it is

endowed with 14 major and 44 medium river basins. Rainfall in the country varies from place to place and year to year. But the average rainfall is about 120 cm. and the average annual precipitation 400 Mham.⁷ Of this, nearly 17.5 per cent (70 Mham) is lost to atmosphere, about 28.75 per cent (115 Mham) is surface run-off and the remaining 53.75 per cent (215 Mham) soaks into the ground.⁸ The total water resources of the country are assessed at 185 Mham. comprising 135 Mham. of surface water and 50 Mham. of groundwater resources.⁹ However, due to the limitations of topography, physiography, geology, dependability, etc., only a part of this can be utilised for irrigation. The aggregate utilisable water resources of the country have been assessed at 105 Mham. of which 70 Mham. are surface flows and 35 Mham. as underground water resources.¹⁰ All this water would not be available for irrigation alone since it has to be utilised for other purposes like domestic, industrial and hydro-electric power generation.

1.3 Review of Irrigation Development in India

Irrigation was practised in India as far back as fourth millennium B.C.¹¹ However, irrigation system was not developed at that time. Although a large number of dams and canals were constructed during the Mughal periods, the substantial development of irrigation took place only with the advent of the British rule. Frequent and severe famines gave impetus to irrigation development. The British Government

renovated, remodelled and constructed a number of large irrigation works. In the present century, there was some slackening in the tempo of irrigation expansion due to the Great Depression and the Second World War. Just before the partition of the country, India was one of the major irrigated countries in the world having 28.2 Mha. net irrigated area, but the partition of undivided India between Pakistan and India brought about uneven distribution of irrigation water. The proportion of the net irrigated area in India declined from 24 per cent to nearly 20 per cent while that in Pakistan increased to 48 per cent.¹²

1.3.1 Irrigation Development since Independence

India experienced a massive deficit in food supplies soon after Independence. As a result of this, the country was compelled to import a substantial quantity of foodgrains from abroad. The Planning Commission, therefore, assigned supreme importance to the early development of irrigation during planning era. After Independence, a number of irrigation projects like the Bhakra-Nangal, the Damodar Valley, Hirakud were taken up. In the first plan, there were in all 267 projects under construction of which 27 were major projects. The Second Five Year Plan included 195 new projects out of which 25 were major projects. Only 9 major and about 86 medium projects were introduced in the Third Plan because a great emphasis was placed on the completion

of the on-going schemes. During the three annual plans and the fourth and fifth plan period almost all the states in the country were preoccupied with the on-going projects. During the Sixth Plan, nearly 617 major and medium schemes were continued as spill-over schemes from the Fifth Plan. In addition, 381 new projects (115 major and 266 medium) were initiated. Besides these, a number of minor irrigation schemes have been taken up and completed, and many more are in progress. India is recognised today, as one of the great dam builders of the world and ranks third in this respect as it has already built 1575 large dams.¹³

Table 1.1 shows the outlays and the development of irrigation potential during the successive plan periods.

It will be seen from Table 1.1 that the total expenditure on irrigation increased substantially from Rs. 446 crores to Rs. 9318 crores during the period from the First Plan to the Sixth Plan. The Seventh Plan proposed an outlay of Rs. 11556 crores for major and medium irrigation schemes and only Rs. 2805 crores for minor irrigation. It means, the proposed outlay on major and medium schemes is higher by 38 per cent compared to that provided in the Sixth Plan while in case of minor irrigation, it is lower by more than 20 per cent.

During the planning period, the Cumulative Irrigation Potential (CIP) has risen from 22.6 million hectares to 67.9 million hectares i.e. from 9.7 million hectares to 30.5

Table 1.1 : Outlay and Development of Irrigation Potential

Plan	Outlay/Expenditure (Rs. in crores)			Irrigation potential cumulative (Million hectares)		
	Major & medium irrigation	Minor ir- rigation	Total	Major & medium irrigation	Minor ir- rigation	Total
Pre-plan benefits				9.7	12.9	22.6
First Plan	380*	66	446	12.20	14.06	26.26
Second Plan	380	142	522	14.30	14.79	29.09
Third Plan	581	328	909	16.60	17.01	33.61
Annual Plan (66-69)	434	326	760	18.10	19.00	37.10
Fourth Plan (69-74)	1237	513	1750	20.70	23.50	44.20
Fifth Plan (74-78)	2442	631	3073	24.82	27.30	52.12
Annual Plan (78-79)	977	237	1214	25.86	28.60	54.46
Annual Plan (79-80)	1079	260	1339	26.60	30.00	56.60
Sixth Plan (80-85)	7516	1802	9318	30.50	37.40	67.90
Seventh Plan (85-90)	11556	2805	14361	34.80	46.00	80.80

* Includes Rs. 80 crores incurred during the pre-Plan period.

Source : Seventh Five Year Plan 1985-90, Planning Commission, Government of India,
New Delhi, p. 73.

million hectares under major and medium schemes and from 12.9 million hectares to 37.4 million hectares under minor schemes. Further, the Seventh Plan (1985-90) envisages to create an additional irrigation potential of 12.90 million hectares during the plan. The cumulative irrigation potential would, thus, be of the order of 80.80 million hectares by the end of the Seventh Plan. Whereas the ultimate irrigation potential of the country from all major, medium and minor irrigation schemes is estimated at 113.5 million hectares comprising 58.5 million hectares from major and medium schemes and the rest 55 million hectares from minor schemes. This ultimate irrigation potential is likely to be created fully by 2010 A.D.

1.4 ✓ Development of Irrigation in Maharashtra

Maharashtra is the third largest state in India in terms of both geographical area as well as gross cropped area but the gross irrigated area is hardly 13 per cent as against more than 30 per cent in the country as a whole.

There are only a few perennial rivers in Maharashtra, The scope for extension of irrigation in the state is, however, very limited due to the rugged topography and scanty water resources. The State Irrigation Commission (1962) stated that "it is absolutely necessary to complete the work of fully exploiting the irrigation potential of the state, by 1980."¹⁴ Even at present, the position of the

state in this regard is far from satisfactory. Moreover, even if the full irrigation potential in the state is harnessed, it would be possible to irrigate only 30 per cent of the cropped area. The rest will remain subject to the vagaries of the monsoons.

Further, the rains are most inadequate and uncertain and subject to frequent scarcity conditions in large areas of the state. The Sukthankar Committee has identified 87 talukas in 12 districts, which together account for nearly 35 per cent of the total area of the state, as chronically drought prone.¹⁵

The productivity of land in the state is rather low compared to that in the other states. It is below the national level on account of scanty and uncertain rainfall and limited irrigation facilities available in the state. As there is now hardly any scope in the state for increasing the area under cultivation, the only avenue available is to increase the area under irrigation.

1.4.1 Surface Water Resources in the State

There are three main inter-state rivers in Maharashtra viz. the Godavari, the Tapi and the Krishna. Besides these, there are a number of rivers flowing west in Konkan such as Tansa, Vaitarna, Savitri, etc. The annual surface flow is directly dependent on the nature, duration and quantity of rainfall received in that year. The total surface water

resources available in different river valleys and their utilisation were assessed first by the State Irrigation Commission (1962). According to the Commission's assessment, the total water resources of the state at 75 per cent dependability of different basins/sub-basins were 3,930.52 T.M.C. of these, nearly 1890.58 T.M.C. were utilisable, excluding Konkan for which master plan was not completed at that time.¹⁶ Thereafter, master plans for almost all the river basins/sub-basins were prepared and therefore, the estimates have been revised from time to time.

According to the latest assessment (1982), basinwise estimates of utilisable water resources and planned water-use of major, medium and minor (state sector) projects are given in Table 1.2.

1.5 Ultimate Irrigation Potential in the State

A systematic study of ultimate irrigation potential i.e. total possibility of irrigation, in the state had been undertaken by the State Irrigation Commission. The Commission (1962) estimated the ultimate irrigation potential both from the surface and underground resources at 61.94 lakh hectares of which 52.61 lakh hectares from the surface resources and the rest from underground resources.¹⁷ The ultimate irrigation potential of 52.61 lakh hectares from the surface sources comprises 40.27 lakh hectares from major

Table 1.2 : Use of Maharashtra's Water Resources (1982) b

River basin	Geographical area in Maharashtra (sq.km)	Permissible utilisable water (TMC)	Water use	
			Completed schemes (TMC)	Schemes under construction (TMC)
1. West flowing rivers	30,394	696	32.974 (4.74)	88.872 (12.77)
2. Tapi	51,254	242	58.342 (24.11)	64.341 (26.59)
3. Narmada	1,659	11	-	-
4. Krishna	70,114	594	239.741 (40.36)	283.960 (47.80)
5. Godavari	154,341	1,089	177.619 (16.31)	446.357 (40.99)
Total		2,632	508.676 (19.33)	883.530 (33.57)

Note : Figures in parentheses indicate percentage of water use to permissible utilisable water.

Source : Dandekar Committee on Regional Imbalance in Maharashtra, Bombay, 1984, p. 124.

and medium schemes and the remaining from the State Sector and Local Sector minor works. Recently, World Bank Team (1979) while appraising the Maharashtra Composite Irrigation Project II (MCIP-II) assessed the ultimate irrigation potential in the state at 89 lakh hectares including 27 lakh

hectares from underground water resources.¹⁸ This estimation is tentative and is expected to be revised in due course with the improvement in the water management system.

1.6 ✓ Development of Irrigation in Maharashtra

1.6.1 ✓ Pre-independence Period

Wells, surface tanks and small bandharas were the main traditional sources of irrigation used in the state since long. The first large scale irrigation work in the state was the construction of the Krishna Canal (1870) in the Satara district. When it was realised that the support of storage reservoir was the necessary conditions for the stable and permanent canal irrigation, several tanks and reservoirs were taken up and completed in the state since 1875. The more important were the Mutha canal, the Nira canal, the Ekruk tank, the Lekh canal and the Mahasawad, Shetpal and Khetpal tanks.

The first Irrigation Commission (1901-03) had stated that as many large storage reservoirs as possible should be constructed for carrying the supply into these tracts in which irrigation is most urgently needed.¹⁹ As a result of the Commission's recommendations, a number of new protective irrigation works like Girna Canal (1910), the Godavari Canals (1911) and the Nira Right Bank Canal (1930) were constructed. The Pravara and the Nira Canals were also

remodelled, improved and extended. During the first two decades of the present century, a large number of tanks were excavated in Vidarbha region like the Ramtek, the Chandapur, Khairbhanola, Chorkhamara, Bodulkasa, Kairee and Ghorajhari and Naleshwar Tanks. There was no significant work undertaken during the pre-independence period in the vulnerable Marathwada region. Nearly 25 years since 1930, irrigation development was quite slack and no new major works were commissioned in the state.

1.6.2 Post Independence Period

With the initiation of planning, irrigation development received a considerable impetus in the state's five year plans. About 8 major and 18 medium irrigation projects had already been completed before the First Five Year Plan. In the First Plan, 18 major and medium projects were undertaken. The Second Plan included 18 spill-over schemes of the previous plans and 31 new major and medium schemes. Besides 45 spill-over schemes, 27 major and medium schemes were taken up as new schemes in the Third Five Year Plan. During the three annual plans (1966-69), 28 new projects both were started. About 27 major and 66 medium projects were in progress in the Fourth Plan period. The Fifth Plan included 58 major and medium schemes as spill-over and 99 as new schemes. At the beginning of the Sixth Plan, 14 major and 105 medium projects had been completed and 50

major and 116 medium projects were under construction. During the Sixth Plan (1980-85), only 6 major and 10 medium new projects were taken up due to the large spill-over costs of the on-going projects and 3 major and 35 medium projects were completed. Further, 6 major and 50 medium schemes were already administratively approved by the government.

1.7 Financial Investment and Progress of Creation of Irrigation Potential

Planwise progress of creation of irrigation potential by major, medium and State Sector Minor Irrigation Works (irrigating more than 100 hectares) and expenditure incurred thereon is presented in Table 1.3.

Before the plan period a cumulative irrigation potential created and investment made thereon were 2.74 lakh hectares and Rs. 16.16 crores respectively. During the plan period from 1951 to 1985, the cumulative irrigation potential has reached the level of 22.70 lakh hectares by investing an amount of Rs. 2465.67 crores. Further, the Seventh Plan (1985-90) envisages an outlay of Rs. 1320.70 crores and the creation of an additional irrigation potential of 4.53 lakh hectares through major, medium and State Sector Minor Irrigation Schemes.

1.8 Irrigation Potential and its Utilisation

Even though the irrigation potential increased from

Table 1.3 : Financial Investment and Development of Irrigation Potential in Maharashtra

Period	Plan outlay (Rs.in crores)	Potential during the period (in lakh hectares)	Cumulative potential (in lakh hectares)
1. Pre-Plan 1951	16.60	2.74	2.74
2. First Five Year Plan (1951 to 1956)	8.11	0.40	3.14
3. Second Five Year Plan (1956 to 1961)	33.94	0.84	3.98
4. Third Five Year Plan (1961 to 1966)	64.99	1.72	5.70
5. Three Annual Plans (1966 to 1969)	59.79	1.48	7.18
6. Fourth Five Year Plan (1969 to 1974)	233.07	3.84	11.02
7. Fifth Five Year Plan (1974 to 1978)	425.51	4.68	15.70
8. Two Annual Plans (1978 to 1980)	307.37	1.50	17.20
9. Sixth Five Year Plan (1980 to 1985)	1341.00	5.50	22.70
10. Seventh Five Year Plan (1985 to 1990)	1320.70	4.53	27.23*

* Targeted

Source : i) Report of the High Power Committee, Irrigation Department, Government of Maharashtra, Bombay 1981, p. 4.

ii) Lokraja, Government of Maharashtra Publication, Bombay, February 16, 1986, Vol.41, p. 5.

2.74 lakh hectares in 1950-51 to 22.7 lakh hectares in 1984-85 the position of the state in respect of utilisation has been far from satisfactory. The utilisation today is less than 50 per cent of the potential created.

Table 1.4 shows the irrigation potential created through major and medium irrigation projects and its utilisation since the formation of Maharashtra State.

1.9 Comparison with Other States

A comparison of the utilisation in Maharashtra State with other states clearly shows that the utilisation in Maharashtra is the lowest in the country. The percentage of potential utilised by major and medium irrigation projects (1983-84) in some of the states was reported as under :

A.P. 91 per cent, Gujarat 63.2 per cent, Haryana 90.6 per cent, Karnataka 98.3 per cent, Maharashtra 58.6 per cent, Orissa 100 per cent, Punjab 98.3 per cent, Tamil Nadu 98.8 per cent and U.P. 81.8 per cent.²⁰ However, in a study by Satpathy it was noted that the under-utilisation in delta irrigation areas in Orissa (1979-80) was of the order of 10 to 25 per cent and 0 to 50 per cent in the mid and tail-end reaches of canals and this problem plagues state's irrigation system and constitutes a serious lacuna in its irrigation planning.²¹

The High Power Committee (1981) in Maharashtra has rightly observed that the utilisation figures in different

Table 1.4 : Utilisation of the Created Irrigation Potential on Major and Medium Schemes in the State

(lakh hectares)			
Plan period	Cumulative potential	Cumulative utilisation	Percent utilisation
1960-61	3.23	2.34	72.44
Third Five Year Plan (1961-62 to 1965-66)	4.51	3.20	71.00
Three -Annual Plans (1966-67 to 1968-69)	5.71	3.23	56.60
Fourth Five Year Plan (1969-70 to 1973-74)	8.37	4.11	49.50
Fifth Five Year Plan (1974-78)	11.25	5.73	51.00
Two Annual Plans (1978-80)	12.31	6.50	49.50
Sixth Five Year Plan (1980-85)	17.00	8.32	48.94
Seventh Five Year Plan (1985-90) (Target)	20.65	10.70	51.81

Source : 1) Sixth Five Year Plan (1980-85) and Annual Plan (1981-82), Planning Department, Government of Maharashtra, Bombay, Annexure A, p. 114.

11) Seventh Five Year Plan 1985-90, Planning Commission, Government of India, New Delhi, Vol. II, Annexure 3.2, p. 88.

states cannot be compared as different states are following different methodology and assumptions while assessing the irrigation potential and its utilisation. For instance, "in Uttar Pradesh, the utilisation of irrigation potential as stated is the sum of the ever maximum actually irrigated area over a number of years. Similarly, in Bihar also utilisation of irrigation potential is being taken as sum of the ever maximum actually irrigated area. In Gujarat State, it has been reported that the figures of utilisation as reported are the summation of the maximum area irrigated on each scheme irrespective of the year of its occurrence. In Tamil Nadu, whether the land in the command fully uses the irrigation water or not, as long as it is registered as an ayacut under command, a flat rate assessment is collected by the Revenue Department. Similar is the practice in Andhra Pradesh and Karnataka. Thus in all these states, the figures of utilisation do not show the area actually brought under irrigation whereas the figures of Maharashtra indicate the areas for which water was actually used."²²

It is important to decide upon the appropriate method for working out the extent of underutilisation of the irrigation potential created and to use same definitions, concepts and tools of measurement in different states so that the necessary corrective measures can be properly worked out.

1.10 Command Area Development Programme

As a substantial amount of public money is being locked up in the irrigation sector and also, most of the irrigation projects are caught up in a vicious circle of delayed schedules and escalating cost, the problem of under-utilisation naturally becomes a matter of great concern. Several committees and commissions have examined the various reasons for under-utilisation and suggested a number of remedial measures to improve the situation. Non-utilisation or under-utilisation is caused by inadequate planning of the project, inadequate and inefficient distribution system, inadequate drainage facility, lack of land levelling and shaping and lack of inputs like credit, fertilisers, seeds, etc.

Therefore, the Irrigation Commission and also the National Commission on Agriculture have emphasised the need for setting-up of special organisations in the command areas of the major irrigation projects so as to implement the programme for Integrated Command Area Development. Accordingly, this programme was launched in the beginning of the Fifth Plan and Command Area Development Authorities were set up for selected major and medium irrigation projects in the country.

The main objective of the Command Area Development

programme is to bridge the gap between potential created and utilisation thereof, and to optimise agricultural production through better land and water management in the command area of selected major and medium irrigation projects. The CAD programme generally involves the following activities : construction and lining of field channels and water courses, construction of field drains, land levelling and land shaping, consolidation of holdings, adoption and enforcement of a suitable cropping pattern, introduction of warabandi or the rotational supply of water, conjunctive use of surface and ground waters, supply of inputs like credit, seeds, fertilisers and pesticides, education and training for farmers, construction of markets and godowns, etc.

At present, there are 102 on-going CAD projects in 17 states and the union territory with a total area of 16.5 million hectares. The outlay proposed in the Seventh Plan for this programme is nearly Rs. 1671 crores from the public sector and Rs. 100 crores from institutional sources.

In Maharashtra, eight Command Area Development Authorities are set up covering 16 major and medium irrigation projects as under:

- 1) Command Area Development Authority for
Jayakwadi Project, Aurangabad
- 2) CADA for Ghod & Bhima projects, Pune
- 3) CADA for Girna, Upper Tapi (Hatnur) Project,
Jalgaon

- 4) CADA for Krishna and Warna Projects, Satara
- 5) CADA for Bagh-Itiadh and Pench Projects, Nagpur
- 6) CADA for Kukadi, Mula Projects, Ahmednagar
- 7) Command Area and Minor Irrigation Development Authority, Konkan
- 8) CADA for Purna and Upper Penganga Projects, Nanded

The irrigation potential brought under CAD programme has increased from 2.06 lakh hectares to 7 lakh hectares during the period from 1975-76 to 1984-85. It is further proposed to bring an area of 4 lakh hectares under this programme with the State Plan outlay of Rs. 297 crores during the Seventh Plan.²³

References

1. Annual Report of the Department of Agriculture & Cooperation, 1984-85, Ministry of Agriculture and Co-operation, Government of India, New Delhi, p. 29.
2. Bhagirath, Central Water Commission, Ministry of Irrigation, New Delhi, April 1984, Vol. XXXI, No.2, p. 77.
3. Annual Plan 1984-85, Planning Commission, Government of India, New Delhi, p. 63.
4. Annual Report 1984-85, Ministry of Irrigation and Power, Government of India, New Delhi, p. 12.
5. Report of the Irrigation Commission, Ministry of Irrigation and Power, Government of India, New Delhi, 1972, Vol.1, p. 66.

6. Indian Express, Bombay, April 29, 1986, p. 11.
7. Report of the National Commission on Agriculture, Ministry of Agriculture and Irrigation, Government of India, New Delhi, 1976, Part V, p. 3.
8. S. Giriappa, Water Use Efficiency in Agriculture, Institute for Social and Economic Change, Bangalore, 1981, p. 25.
9. Op.cit., National Commission on Agriculture, p. 6.
10. Ibid., p. 9.
11. Ibid., p. 1.
12. Op.cit., Report of the Irrigation Commission, p. 69.
13. Bhagirath, Central Water Commission, Ministry of Irrigation, Government of India, New Delhi, October 1983, Vol. XXX, No.4, p. 200.
14. Report of the Maharashtra State Irrigation Commission, Government of Maharashtra, Bombay, 1962, p. 56.
15. Report of the Fact Finding Committee for Survey of Scarcity Areas, Maharashtra State, Government of Maharashtra, Bombay, 1973, Vol. I, Table No. II, pp. 80-83.
16. Op.cit., MSIC, Appendix F, Table No. 30, p. 335.
17. Op.cit., MSIC, pp. 182-83.
18. Annual Plan, 1980-81, Planning Department, Government of Maharashtra, Bombay, p. 84.
19. Report of the Indian Irrigation Commission (1901-03), Office of the Superintendent of Government Printing, Calcutta, 1903, p. 118.
20. Report of the Eighth Finance Commission, Ministry of Finance, Government of India, New Delhi, 1984, p. 196.
21. T. Satpathy, Irrigation and Economic Development, Ashish Publishing House, New Delhi, 1984, pp. 86-87.

22. Op.cit., Report of the High Power Committee, p. 7.
23. Seventh Five Year Plan, 1985-90 and Annual Plan, 1985-86, Planning Department, Government of Maharashtra, Bombay, Part I, p. 130.

CHAPTER II

REVIEW OF LITERATURE ON CAUSES OF UNDERUTILISATION OF THE CREATED IRRIGATION POTENTIAL

In the previous chapter, we reviewed the development of irrigation in India as well as in Maharashtra and also the utilisation of irrigation potential created in Maharashtra. In this chapter we shall first describe certain concepts that are used in the field of irrigation like irrigation potential, utilisation, gross irrigated area, etc., and then examine various factors responsible for under-utilisation of the available irrigation facility.

2.1 Definitions of Irrigation Potential and Utilisation

In India, emphasis has been laid on fast development of irrigation facilities since the beginning of the planning era. To depict a correct picture of utilisation, it is necessary to ensure that the methods adopted for assessing the irrigation potential created and its actual utilisation are scientific. Irrigation potential has been defined by the Planning Commission as under:

"Irrigation potential is the gross area that can be irrigated from a project in a design year (1st July to 30th June of the succeeding year) for the projected cropping

pattern and assumed water allowance on its full development. The gross irrigated area will be the aggregate of the areas irrigated in different cropping seasons, the areas under two seasonals and perennial crops being counted only once in a year."¹

Thus, there are three important considerations which are necessary to declare irrigation potential created from an irrigation project such as,² (i) availability of water for the area proposed to be irrigated in each season during the irrigation year, (ii) the availability of the conveyance system to carry the water upto the outlet head, and (iii) the adherence to the projected cropping pattern.

The term "irrigation potential utilised" means the total gross cropped area actually irrigated by a project in any one year prior to the year under consideration.

2.2 Extent of Utilisation of Created Potential

According to the definition given by the Planning Commission, noted above, if the area actually irrigated in a particular year is smaller than the area proposed to be irrigated (i.e. potential created) then there is under-utilisation. Though this definition is accepted widely, it is not entirely satisfactory for assessing the problem of utilisation of the created irrigation potential. There are various practical considerations and due to them, the

utilisation percentage estimated as above gives a distorted picture of the actual utilisation. Irrigation projects are designed on the basis of certain dependability, the existing cropping pattern and the water requirements of different / crops. As the irrigators are generally free to grow crops according to their choice, they do not consider the suggested crop pattern as sacrosanct. They prefer to grow that crop which fetches higher returns and also their decision regarding the cultivation of crops depends on various other factors such as the availability of water for irrigation, financial position and other resources at their command. It is, therefore, obvious that the area actually irrigated could be different from the projected one since the water requirements of different crops are different and vary from season to season. Moreover, effective potential which is based on actual replenishment received during a given year varies from the planned one which is based on the designed dependability. These are the vital factors and should, therefore, be taken into account while considering the utilisation of irrigation potential.

In view of the above, the Maharashtra State Irrigation Commission³ had emphasised that this was a very unsatisfactory measure of utilisation of irrigation potential and pointed out that such a comparison is not valid unless both the figures of acreages are converted to 'standard crop acres'. Without such conversion, there may appear under-

utilisation even if the entire available water is fully booked. Further, the Commission recommends that the extent of non-utilisation in a particular year should be correctly assessed by considering the actual storage supply in a given year, the quantity overflowing the pick-up or waste weir in the monsoon and the canal capacity.⁴

In the same context, the High Power Committee (1981) appointed by the Government of Maharashtra to study the problems of under-utilisation of irrigation potential in the state has rightly observed: "The irrigation potential available during a particular year for utilisation fluctuates from year to year depending upon the actual storage. Similarly, on a number of projects, the traditional crops envisaged in the project report are being replaced by high yielding and hybrid varieties of cereal crops. High yielding varieties need more water than the traditional varieties. Thus, although water is consumed the area irrigated apparently appears to be lower than that envisaged in the project. Similarly, some times in the hot weather season, crops like summer rice, groundnut etc. not originally envisaged, are grown. As these crops need more water the area irrigated by them appears to be low. Hence, we agree that in order to have a meaningful comparison of utilisation, the actual gross irrigated area should be compared with the "effective potential" worked out on the basis of actual

storage and also taking into consideration the different requirements of water for different crops, actually grown under irrigation rather than the projected potential. The gross areas both for potential and utilisation should be worked out on the same basis considering the type of crops, the water requirements and availability of storage during that particular year. If the figures of potential and utilisation as reported are not worked out on this basis, it will give a very distorted picture of actual position."⁵

(Similarly, the Fact Finding Committee on Regional Imbalance in Maharashtra (1984) appointed by the Government of Maharashtra suggested that "irrigation potential of a project must be expressed not only in terms of a gross area with an assumed cropping pattern that can be irrigated by the project as designed but also in terms of the quantum of water that the project is designed to make available for irrigation in different seasons."⁶) Lastly, the Committee was of the opinion that it will be better to define the irrigation potential of a project in terms of quantum of water designed to be made available at the canal head during different seasons viz. kharif, rabi and summer, and this duly corrected for extra evaporation losses. This is an essential part of the design data of an irrigation project. It is, therefore, more appropriate to compare the irrigation potential created by an irrigation project in terms of these parameters rather than gross area with an assumed cropping pattern that the project is designed to irrigate.⁷

It will be clear from the foregoing discussion that the present practice of assessing the utilisation i.e. to express the percentage of actual irrigated area to the potential created, is unsatisfactory since the water requirements of the crops grown in different seasons are different. For a meaningful and realistic comparison of utilisation with the potential available, the concept of 'effective potential' that is the actual storage of water available in a given year and the water requirements of different crops actually grown under irrigation rather than the assumed cropping pattern, should be taken into consideration. If this is done, the estimates regarding the utilisation of created potential will stand up on a firmer and realistic footing.

Now we propose to discuss the methods that are used in estimating the extent of utilisation of potential already created. There are two alternative methods by which the extent of utilisation/under-utilisation is worked out.

a) To compare the quantum of water (in mm^3) actually used during different seasons in a given year with the quantity available for irrigation in each season in that year.

b) To express the area actually irrigated under different crops during a given year and the area proposed to be irrigated in the project in terms of an equivalent 'Base/Standard crop area'. These areas can be readily reduced

to the base crop area by comparing their water requirements (duties)* with that of the base crop. Rabi crops are usually taken as a 'Base/standard crop' for this conversion. In this way the comparison made between these two areas which are obtained in terms of base crop area, would be meaningful and would give the correct picture of utilisation provided that the storage actually available for irrigation purpose in a given year is not less than the projected one.

2.3 Factors Responsible for Under-utilisation

So far as the aspect of utilisation and the reasons for lag in the utilisation of the created irrigation potential are considered these have been studied and analysed by several commissions and committees from time to time in the past, the more important among them being

* The term duty of a crop implies the area of a crop which can be brought to maturity by a discharge of one cusec of irrigation water delivered at the distributary head during its life time. The life time of a crop in which water is required to be given to it is called 'base period'. Duty of a crop is normally measured at the distributary head. Crop duty differs from one distributary to another as the length of distributaries and the transit losses of water are not homogeneous. Rainfall, type of soil, nature of crops, season, condition of the distribution system and transit losses are some of the principal factors in determining the duty of a crop. One cannot estimate the total water requirement of the crops proposed to be irrigated if the duty of a crop and the area under it are known. As the seasonal water requirements of different crops are different, the term seasonal duty of a crop is used to estimate the seasonal average discharge required for irrigating the crop in each of the three cropping seasons. The term seasonal duty connotes the area of a crop that can be irrigated in a particular cropping season by one cusec of water delivered at the distributary head.

1) The Bombay Irrigation Inquiry Committee of 1938 under the chairmanship of Shri Vishweshwarayya.

ii) Maharashtra State Irrigation Commission, 1962, under the chairmanship of Shri S. G. Barve.

iii) Evaluation of Major Irrigation Projects - Some Case Studies - Programme Evaluation Organisation, Planning Commission, 1965.

iv) All India Irrigation Commission, 1972 i.e. Second Irrigation Commission appointed by the Government of India.

v) Committee of State Irrigation Ministers (1973) appointed by the Government of India under the chairmanship of Shri Vasantdada Patil.

vi) The High Power Committee appointed by the Government of Maharashtra (1981) under the chairmanship of Shri S. B. Jain.

Besides these, a large number of eminent scholars and researchers have studied the problem of irrigation potential and its utilisation. A number of reasons for lags in utilisation as identified by the above commissions and committees are summarised below.

2.3.1 Defects in the Construction of Canal and Distribution System

Absence of or incomplete and defective works of the canal, water courses and field channels is one of the main

reasons behind the under-utilisation of available water resources. According to the Irrigation Act, the Government is responsible to construct the distribution system upto the outlet which normally commands an area of 40 hectares. Beyond this limit, it is the concerned farmer's responsibility to construct field channels upto his field. The construction of field channels is not obligatory for all the farmers in the command area of the project as irrigation is not compulsory. There is a provision in the Act that the government can undertake this work at the instance of farmers if they are unable to do the same, and the expenditure incurred thereon could be recovered from them in 15 yearly instalments.

There are a number of difficulties such as financial, engineering, technical, legal and practical which hamper the quick development of water courses and field channels. Very often the work of water courses and field channels is carried out half-hazardly and without proper technical guidance; consequently the water does not flow smoothly in the water courses unless the main channel is over topped which leads to frequent breaches and interruptions in the supply of water. The construction of water courses, no doubt, requires fundamental knowledge of hydraulics and engineering; appointment of untrained or inexperienced staff on such a critical work has resulted in a colossal infructuous expenditure. Hence, the High Power Committee⁸ (1981) opined that the staff

employed on the ayacut development works should be given special training and in no case untrained persons should be employed on this very important work. Further, the work on improving the defective water courses completed so far should be undertaken without any further delay in order to bring the distribution system to the required standard.

Although a project is completed with entire storage capacity, the area actually brought under irrigation remains low compared to the proposed one because the canal and other channels are not in a position to carry the designed discharge or they are not constructed to the designed section. For instance, the maximum discharging capacity of some of the main canals in Maharashtra is only 66 per cent of the designed discharge.⁹ It is, therefore, pointed out that the Special Executive Engineer (Technical Cell) in the CADA project should certify and hand over the water courses to the farmers only if they are constructed to the designed requirements, specifications and tested for the designed capacity.¹⁰

2.3.2 Inadequate Preparation of Land/ Slow Progress in the Land Levelling and Shaping

Full use of water is not possible in the case of small and scattered land holdings. Consolidation of land holding is essential in order to reap the maximum benefits from the collective use of all the inputs together with water. In

India, the work of consolidation of holdings has, however, not made much progress. It was, therefore, suggested that there should be proper coordination between the Consolidation Department and the Irrigation Department and the state government should introduce compulsory consolidation of holdings before the commencement of irrigation.¹¹

Proper preparation of land for irrigation e.g. land levelling and land shaping is a prerequisite for irrigated agriculture. The levelling of undulated land needs not only machinery like bulldozers and other mechanical equipments but also technical assistance. Moreover, it is the cultivators' responsibility to undertake all these activities of land levelling and land shaping. For this, they need a sufficient amount of capital. However, the cultivators are not in a position to incur such a heavy investment. In this regard, the Committee of Ministers¹² pointed out that the state should provide the necessary technical guidance and assistance to the farmers. If they fail to do so, the state should execute these activities on behalf of the farmers and recover the expenditure from them in reasonable instalments.

2.3.3 Non-maintenance of or Ill-maintained Distribution System

Non-maintenance or poor maintenance of the distribution system is one of the most important factors that results in under-utilisation of the existing capacity. There is a provision made in the Irrigation Act that every irrigator

should maintain the field channel. But there is a lack of cooperation among the farmers. Moreover, there is some misunderstanding among the farmers and Irrigation Department itself about the provisions made in the Act and its implementation. It is believed that only those farmers are responsible for maintaining the field channels through whose fields the field channels passes. In fact, it is a joint responsibility of all the irrigators to maintain the distribution system since all are deriving the benefits from the same field channel.

Farmers at the upper reaches often obliterate the water courses and do not allow water to reach the lower-reaches. Ploughing of field channels is a common practice. Some times, the field channels are blocked or breached by the upstream farmers due to family disputes. It is no wonder that the small farmers think it wise to cultivate the land without irrigation than to enter into arguments. Though obstruction or obliteration of the water course is an offence and the offender is subjected to fine or even imprisonment, farmers never bother about this provision since no offender is punished under this Act, even though this is a very serious offence. Inadequate provisions for maintenance and repairs i.e. only Rs. 20/- per hectare, also contribute to ill-maintenance of the distribution system and thereby inadequate supply of water. Now, the revised norms are Rs.40/- per hectare but these norms should be about Rs. 75/- per

hectare inclusive of establishment.¹³ To sum up, the maintenance of canal and distribution system is as important as the maintenance of a railway line. Unfortunately, this work is callously neglected not only by the beneficiaries but also by the department itself.

2.3.4 Lack of or Inadequate Drainage Facility and Problems of Seepage and Water Logging

Factors like lack of or inadequate drainage facility, heavy percolation, seepages and leakages and thereby water logging, salinity and alkalinity of the soil give a serious setback to proper utilisation of the irrigation facility. The problem of seepage and water-logging had become more acute in some command areas like Hirakud¹⁴ and Purna project¹⁵ where soils are mostly deep and ill-drained with low permeability. This was mainly due to the inadequate drainage arrangements, percolation and leakages, over-irrigation and misuse of water, delay in disposal of accumulated surface water and also due to the interception of natural drainage lines by the embankments, canals, roads and railways. The level of groundwater table, no doubt, invariably increased after the introduction of canal irrigation in the command area. It was observed in some command areas that the sub-soil water level came almost to the ground level while there was always 1 to 2 feet of water standing in some lands. In the course of time, lands have obviously become saline and

alkaline and have ultimately become unfit for cultivation. Field drains are not excavated properly as per the correct alignment, grade and depth; there is an urgent need to prevent further damage to lands as well as to undertake reclamatory measures by providing the required technical guidance. It was also found that the seepage of water from the canals in the Lower Bhawani Project area affected the dwelling houses in the villages close to the canals.¹⁶ It is, therefore, necessary that the work of the drainage system must be properly planned and implemented.

As a matter of fact, transit losses are very heavy due to the non-maintenance of field channels, careless handling of water supply, defective construction, seepages and leakages from the canal and distribution system. These losses were estimated at 50 per cent of the water utilisation for irrigation.¹⁷ Even the High Power Committee recently observed that the effective utilisation on some of the irrigation projects in Maharashtra was as low as 35 to 40 per cent.¹⁸ Lining of the distribution system is an effective measure for reducing these losses to a considerable extent. High priority is given to canal lining in Maharashtra, particularly on the World Bank aided major irrigation projects. However, the quality of lining work is found to be unsatisfactory. When S. B. Jain Committee (i.e. the High Power Committee) saw the poor quality of lining work, it expressed its opinion in the following words : "it would be

better that the lining is not provided at all so that it will at least save a large quantity of scarce material like cement and avoid infructuous expenditure on the same."¹⁹

2.3.5 Maldistribution of the Available Water and Tail-end Problems

There is often inadequate demand for water from the cultivators particularly in the case of new projects as well as the farmers at lower reaches because of the maldistribution of the available supplies and the unreliability of the water supply. According to the present system of irrigation, sanctions are given to the farmers on a seasonal basis and the preliminary irrigation programme which is tentative and subject to modifications is prepared every year on 1st October by considering the actual storage available, the anticipated overall river gains or losses and the trend of water application in the past. But, in actual practice, this planned schedule and the announced rotation intervals are seldom followed. In particular the tail-enders are reluctant to avail of the irrigation facility due to the uncertainty in getting adequate quantity of water and at the proper time because the cultivators at upper reaches do not allow water to flow in sufficient quantity by over-irrigating their fields, wastage or misuse and unauthorised irrigation. The tail-end problems arise, by and large, due to the irresponsibility or carelessness and indiscipline of the farmers particularly in the upstream sections of the

command area. In addition to this, political interference and influence of rich farmers worsen the condition of the down-stream farmers.

Although sufficient provisions have been made in the Irrigation Act against the unauthorised irrigation, out of "turn" irrigation as well as to safeguard the interest of tail-end cultivators, these provisions are hardly enforced. The Committee of Ministers (1973), therefore, recommended that adoption of 'Varabandhi' system should be made compulsory so as to achieve equitable distribution of available supplies to the cultivators.²⁰ The High Power Committee (1981) also strongly recommends that "the Rotational Water Supply System (RWSS) may be followed on all the irrigation projects without any further delay."²¹

2.3.6 Availability of Alternative Source of Irrigation

The facility of canal water, though available, is not used to the fullest extent as farmers have their own alternative irrigation source like wells with enough water for irrigation. The wells located in the command area of the project get sufficient quantity of water through percolation from canal and field channels. Adequate and timely supply of water to the crops is therefore possible by lifting water from wells. Although canal facility is available, farmers prefer well irrigation as there is no need of fulfilling any type of official formalities. Also, water

can be applied on time. Well irrigation is used particularly in case of mixed irrigable area i.e. the area which can be irrigated both from the canal and well. Well irrigation is used in the case of that area which is not sanctioned for growing perennial crops.

2.3.7 Unrealistic/Unrealised Cropping Pattern and Water Allowances

While designing a project, a tentative cropping pattern is worked out for the utilisation of the potential by taking into account the existing cropping pattern, the possibilities for future development, etc. But the crops actually grown could be different from those assumed in the project report since the cropping pattern depends on the needs of the farmers and cannot be forced on them. The traditional crops like jowar, wheat, etc. with low water requirements as originally proposed in the project are being replaced by high yielding and hybrid varieties. As these crops need more water than the traditional crops proposed in the project, the area actually irrigated i.e. utilisation, falls short of the projected potential. The water requirements for the selected crops are given in Table 2.1. In a number of projects, crops like summer paddy and groundnut though originally not envisaged, are grown in the hot weather in lieu of seasonal/rabi/two-seasonal crops. For instance, on Ghod project, hot weather seasonals like groundnut are grown extensively instead of two seasonals though these

Table 2.1 : Water Requirements of Different Crops

Name of the crop	Life period (days)	Total water requirements (metres)
1. Hybrid bajri (kharif)	95	0.450
2. Jowar (rabi)	135	0.450
3. Hybrid jowar (rabi)	120	0.525
4. High yielding wheat	120	0.525
5. Paddy drilled (kharif)	135	0.825
6. Groundnut (kharif)	120	0.550
7. Groundnut (hot weather)	115	0.900
8. Long staple cotton (pre-seasonal)	180	1.050
9. Turmeric and ginger - two seasonals	180	1.725
10. Other perennials (orange and mosambi)	-	1.950
11. Sugarcane (plant)	410	3.375
12. Sugarcane (adsali)	540	4.275
13. Banana	525	4.800

Source : Report of the Fact Finding Committee for Survey of Scarcity Areas, Maharashtra State, Government of Maharashtra, Bombay, 1973, Vol. I, Appendix No. XIII, p. 168.

crops were not proposed in the planned cropping pattern. In such a situation, although the entire available water is consumed, the area actually irrigated under these crops appear to be lower than that envisaged in the project.

In many states, it has been found that the crop pattern developing under the projects widely differs from the proposed one. Also the originally proposed duties and irrigation water requirements are unworkable in various cases. This is due to inadequate knowledge of the local conditions regarding rainfall, soils, crops and farmers' preferences. The Committee of Ministers²² (1973) was, therefore, of the opinion that the developed cropping pattern should be examined in the context of the original one and a periodic re-examination of the position should be taken once in five years.

2.3.8 Inadequate Response for Kharif Utilisation

The problem of non-utilisation or under-utilisation of irrigation water is observed to be very serious in the kharif season due to the reluctance on the part of the farmers to practice kharif irrigation. By and large, the cultivators are not interested in kharif irrigation as rainfall is adequate for the crops traditionally grown in different tracts. In a region like Konkan, kharif utilisation is almost nil due to the heavy and assured rainfall. There is a general tendency to wait for the rains and demand

water only when the rains are inadequate or delayed. Hence, the Irrigation Authorities are not always in a position to accede to all the demands of the cultivators made at the eleventh hour. Sometimes, lack of or inadequate replenishment in the storage at the time of sowing or thereafter also contributes to the shortfall in utilisation in kharif season. The kharif utilisation in the state as observed by the High Power Committee (1981) was 30 per cent excluding the pre-plan schemes and paddy growing areas. For ensuring kharif utilisation in the state, the Committee had made the following recommendations:²³

i) the agreement system currently in use in Bhandara and Chandrapur districts for supply of water should be introduced in paddy growing areas of Konkan region where rainfall is heavy and assured and hence, the kharif utilisation is almost nil. According to this system, there is an agreement between the government and the farmers and the supply of water is guaranteed to them for a specific period of time.

ii) block system should be introduced without any further delay and casual sanctions should not be given in order to induce the farmers to apply for blocks.

2.3.9 Large Operational Holdings and Fear of Application of Land Ceiling Act

The existence of large operational holdings and a

fear of introduction of ceiling on land holding is another factor leading to under-utilisation of irrigation facility. Some cultivators having large holdings do not irrigate their entire lands also on account of their physical and financial constraints. They keep some land fallow or grow the rainfed conventional crops.

2.3.10 Inadequate and Untimely Supply of Credit, Inputs and Infra-structural Facilities

Lack of credit and infrastructural facilities as well as inadequate and untimely availability of agricultural inputs are some of the other factors that restrict full utilisation of the existing potential. Inputs like HYV seeds, fertilisers, pesticides, machinery, etc., are equally essential for achieving higher productivity and yields. Further, irrigated agriculture requires increased use of these inputs to realise full benefits of irrigation. Farmers should have sufficient finance for acquiring these required inputs. Unfortunately, Indian farmers do not possess enough money nor do they get adequate credit from banks at the right time.

Absence of nearby organised market facility and unstable prices come in the way of utilisation of water resource. Adequate and scientific storage facilities are required at market centres for storing the agricultural produce so as to enable the farmer to wait until he will

receive a higher price for his produce. The development of cooperative marketing could be one of the solutions to this problem. The condition of transport facilities especially road transportation in rural areas is poor while communication facility is lacking. In the absence of agro-based industries and processing factories such as sugarcane, cotton ginning and pressing and weaving, paper making, dairy products, etc., farmers do not have any incentive for bringing more area under irrigation.

2.3.11 Traditional Outlook of Farmers and Lack of Adequate Agricultural Experimental and Demonstration Farms as Well as Training and Extension Facilities

Cultivators in India are reluctant to switch over to irrigated agriculture immediately after the development of the irrigation facility. They hesitate to shift from the old conventional pattern of crops to the new ones, though it may be more profitable, because of variety of factors. There is a belief amongst the farmers that irrigation is not necessary for their present variety of crops and also soils are not suitable for irrigated farming. A study undertaken by Sangle and others²⁴ (1979) for finding out the factors responsible for under-utilisation of canal water in the Purna command area indicated that 14 per cent of farmers did not use irrigation water due to the above reasons. Irrigated agriculture requires not only a

considerable amount of investment in preparation of land and to purchase various inputs, but a thorough knowledge and training in land and water management and also the scientific practices of irrigated farming for the judicious use of available water. In real practice, cultivators are not in a position to get proper technical advice and extension services so as to bring desired changes in the existing cropping pattern. They need to be guided and trained to switch over to irrigated farming by demonstrating to them the modern techniques and the additional benefits accruing therefrom.

Maharashtra State Irrigation Commission²⁵ had recommended in the past that trial-cum-demonstration farms should be opened up in newly irrigated areas as soon as the project construction starts. Accordingly, state government established such farms on various projects at the project cost but the problems for which the farms were established, unfortunately, remained unattended. It was, therefore, suggested by the High Power Committee²⁶ that the Agricultural Department should take a review of the work carried out on such farms and should take effective steps in order to fulfil the objective for which such farms were set up.

2.3.12 Lack of Proper Cooperation between the Different Departments

There is lack of a close cooperation and proper coordination among the different government departments though

this is essential for speedy utilisation of existing irrigation potential. In fact, this task of improving utilisation is not the responsibility of the Irrigation Department alone but, a joint responsibility of all the concerned departments like Irrigation, Agriculture, Cooperation, Soil Conservation, Revenue, etc. The problem of coordination relates to the timely supply of water and its equitable distribution, the timely and adequate supply of credit and various inputs and the imposition of irrigation dues etc. Due to lack of proper coordination and cooperation amongst these departments the Command Area Development Authorities have been constituted by the Government on selected major irrigation projects in the country. Then also, the required emotional integration in the CADA is still lacking. It is, therefore, suggested that a close cooperation and emotional integration on the part of the different officers is a pre-condition for successful functioning of CAD Organisation and thereby for the speedy utilisation of the irrigation potential already created.

References

1. Report of the High Power Committee, Irrigation Department, Government of Maharashtra, Bombay, November 1981, p. 5.
2. Ashok K. Mitra, "Underutilisation Revisited : Surface Irrigation in Drought Prone Areas of Western Maharashtra", Economic and Political Weekly, Vol. XXI, No.17, April 26, 1986, p. 752.

3. Report of the Maharashtra State Irrigation Commission, Government of Maharashtra, Bombay, 1962, p. 152.
4. Ibid.
5. Op.cit., Report of the High Power Committee, p. 7.
6. Report of the Fact Finding Committee on Regional Imbalance in Maharashtra, Planning Department, Government of Maharashtra, Bombay, 1984, p. 146.
7. Ibid.
8. Op.cit., Report of the High Power Committee, p. 24.
9. Ibid.
10. Ibid.
11. Report of the Committee of Ministers on Under-utilisation of Created Irrigation Potential, Ministry of Irrigation and Power, Government of India, New Delhi, 1973, p. 37.
12. Ibid., p. 36.
13. Report of the Seventh Finance Commission, Ministry of Finance, Government of India, New Delhi, 1978, Appendix I.13, p. 28.
14. Evaluation of Major Irrigation Projects - Some Case Studies, Planning Commission, Government of India, New Delhi, 1965, p. 21.
15. L. W. Ambegaonkar, A Study of the Utilisation of Irrigation Potential of the Purna Irrigation Project, A thesis submitted to the University of Poona for Ph.D. Degree, 1979, pp. 172-73 (unpublished).
16. Op.cit., Evaluation of Major Irrigation Projects - Some Case Studies, p. 21.
17. Report of the Sukthankar Committee, Government of Maharashtra, Bombay, 1973, Vol.I, p. 136.
18. Op.cit., Report of the High Power Committee, p. 31.
19. Ibid.
20. Op.cit., Committee of Ministers on Under-utilisation of Created Irrigation Potential, p. 40.

21. Op.cit., Report of the High Power Committee, 1981, p. 31.
22. Op.cit., Report of the Committee of Ministers, p. 38.
23. Op.cit., Report of the High Power Committee, pp. 13-17.
24. Sangle, Solunke and Chole, "Factors Associated with Under-utilisation of Canal Irrigation," Behavioural Sciences and Rural Development, January 1979, p. 45.
25. Op.cit., Maharashtra State Irrigation Commission Report, p. 157.
26. Op.cit., Report of the High Power Committee, p. 21.

CHAPTER III

PURNA RIVER VALLEY PROJECT

The Aurangabad Division of the State, popularly known as Marathwada region, was a part of the Hyderabad State prior to the reorganisation of states in 1956. This region has a great potential for its agricultural development on account of the fertile soils and the rich but unharnessed water resources. The river Godavari is the major river flowing through the region. Besides this, there are a number of important rivers like Purna, Manjra, Dudhana, Painganga, Terna, Manyad, Sindhphana, etc. The rainfall in this region is, by and large, adequate and well distributed except for the drought affected talukas of the region. Soils in the region are mostly deep black and medium black, the cropping pattern of the region is dominated by foodgrain crops; cotton is the most important cash crop in the region.

3.1 Brief History

In spite of all the above favourable factors, Marathwada region has remained one of the most, both agriculturally and industrially, backward regions of the State due to the lack of development of irrigation and power. The lands, particularly in Parbhani and Nanded districts are fertile and give fairly high yields even without irrigation

but in the absence of irrigation facility, there is hardly any scope for multiple cropping and the cultivation of perennial crops. The Purna Project was, therefore, taken up as a multi-purpose river valley scheme to provide irrigation as well as power for the development of rural areas of the region.

The Purna project has a long history. The Public Works Department of the ex-Hyderabad State had conceived the project in 1921. The progress of the scheme was, however, held up until 1934. A scheme of partial development was prepared to create an irrigation potential of 5,500 acres by constructing a pick-up dam at Sidheshwar. But the scheme did not make any progress upto Independence. Even after Independence, the progress on this project was sluggish due to the unstable political situation in the State of Hyderabad. When the Hyderabad State was merged into the Indian Union in 1948, a fresh detailed project report was prepared. The report was submitted to the Central Water & Power Commission for its technical sanction in 1953. The team of the Commission inspected the project site and suggested some modifications in the scheme. This revised proposal was submitted to the Government of Hyderabad in October 1956 for administrative approval. The sanction was, however, further delayed due to the reorganisation of states in 1956. After the reorganisation of states, the entire scheme was re-examined again by the Government of Bombay and administrative approval was finally given in January 1957.

3.2 Salient Features of the Project

The Purna project is the first single biggest multi-purpose project ever to be undertaken in the Marathwada region. The project is located on the Purna river which rises in the Ajanta hills of Aurangabad district and joins the river Godavari near Purna railway junction. It comprises two storage dams across the Purna river, one near Yeldari village in Jintur taluka and another about 40 miles downstream near Sidheshwar in Hingoli taluka of Parbhani district. The catchment area of the river at Yeldari dam site is 2,830 sq.miles whereas at Sidheshwar dam site, it is about 3,000 sq.miles. The main components of the project are as under:











- 1) A reservoir at Yeldari to store 33,000 m.c.ft. of water.
- 2) A power house at the toe of Yeldari dam with an installed capacity of 22,500 k.w.
- 3) A diversion dam at Sidheshwar with gross storage capacity of 8,859 m.c.ft. of water.
- 4) A left bank canal about 44 km. long to carry a discharge of 2,000 cusecs at head.

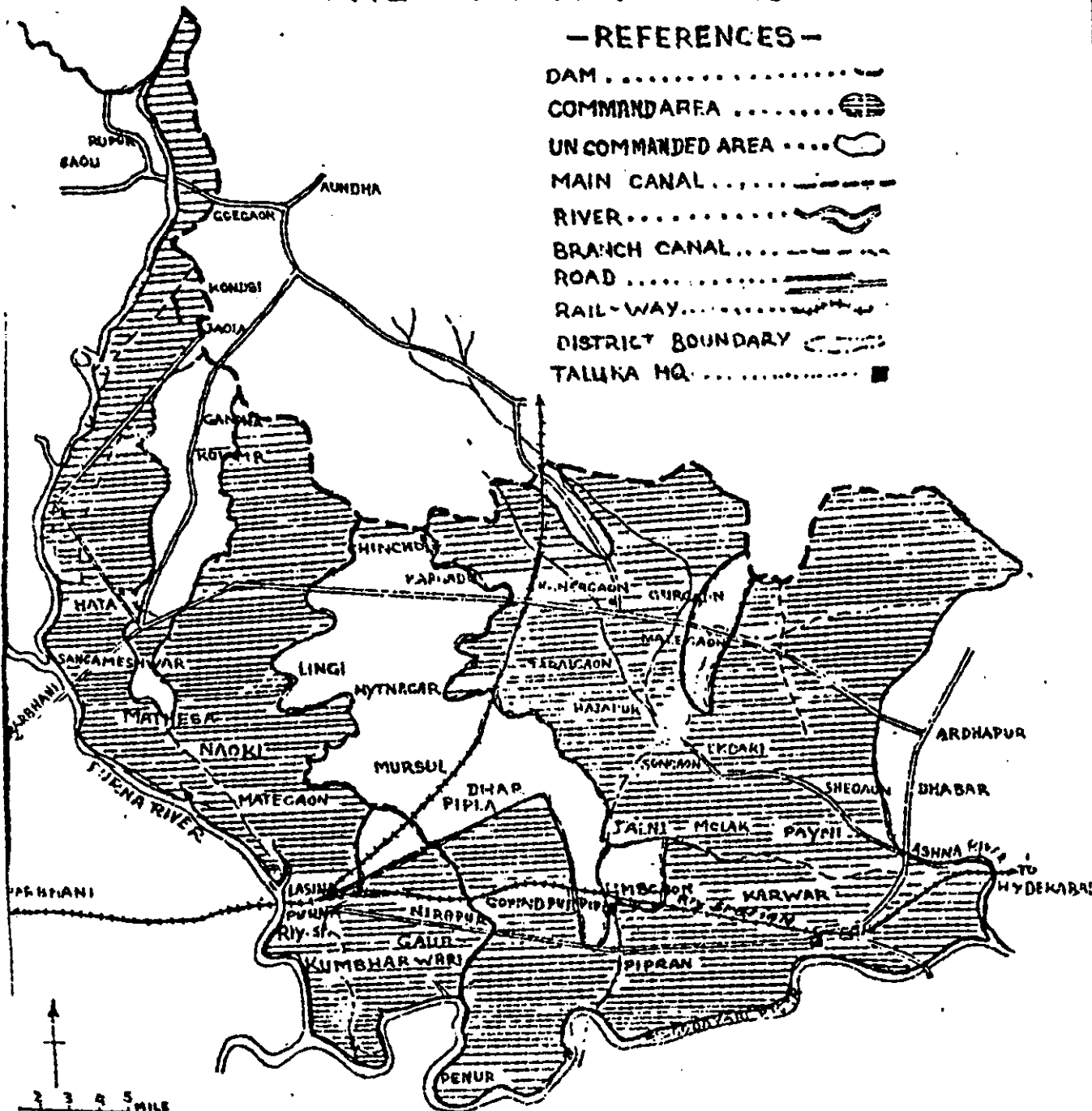
The salient features of the project are as under:

Particulars	Yeldari reservoir	Sidheshwar reservoir
Longitude	76°-0'-45"	76°-57'-30"
Latitude	19°-0'-43"	19°-0'-20"
Catchment area	2,830 sq.miles	3,000 sq.miles
Maximum flood discharges	3,70,000 cusecs	3,81,000 cusecs
Maximum height of dam	51.21 metres	38.25 metres
Length of dam	4431.80 metres	6658.32 metres
Storage capacity at F.R.L.	33,000 m.c.ft.	8,859 m.c.ft.
Live storage	31,460 m.c.ft.	2,850 m.c.ft.
Gross command area	-	1,86,644 acres (75,532 Ha.)
Culturable command area	-	1,69,462 acres (68,575 Ha.)
Irrigation command	-	1,52,000 acres (61,540 Ha.)
Cost of the project	Rs. 1,961.265 lakhs	
i) Irrigation part	Rs. 1,693.978 lakhs	
ii) Power part	Rs. 267.287 lakhs	

MAP SHOWING THE PURNA PROJECT COMMAND

- REFERENCES -

- DAM 
- COMMAND AREA 
- UN-COMMANDED AREA 
- MAIN CANAL 
- RIVER 
- BRANCH CANAL 
- ROAD 
- RAIL-WAY 
- DISTRICT BOUNDARY 
- TALUKA HQ 



The work on the project was started in 1957-58 and was completed in 1968. There are in all 216 villages to receive irrigation from six talukas of Parbhani and Nanded districts. The irrigable command area is 61,540 hectares benefiting 15,746 cultivators.

3.3 Soil Classification and Rainfall

The command area of this project comes under agro-climatic zones VII and VIII i.e. 'assured rainfall with kharif cropping' and 'moderate to moderately high rainfall'. The normal rainfall in the command area is 39.3* inches (983 mm). The rainfall is received mainly during the four months of monsoon from the south-west monsoon. The soils in the command area vary from brown to deep black. The classification by soil type is given in Table 3.1.

3.4 Approved Cropping Pattern of the Project

The original cropping pattern envisaged in the project report gave priority to heavy perennials and other perennials; the area proposed to be irrigated under these crops was 25 per cent. After the availability of detailed soil survey a realistic cropping pattern was designed and the same was submitted in 1962 to the International

* Report dated 31st March 1964 by N. D. Gulhati, Consultant Water Resource Development on Purna Project, p.1. Mentioned in L. W. Ambegaonkar's Ph.D. Thesis, 1979, p. 97.

Table 3.1 : Soil Classification of the Command Area of Purna Project

Soil type	Area (hectares)	Percentage
Light soils	7,097	7.67
Medium soils	45,116	48.79
Deep soils	40,262	43.54
Total	92,475*	100.00

* The gross area for which a soil survey was carried out by the Soil Survey Division of the Department of Irrigation and Power, Pune.

Source : Report of the Soil Survey of the Areas Commanded by Purna Left Bank Canal in the Marathwada Areas of Maharashtra State, Irrigation and Power Department, Government of Maharashtra, 1964, Vol.I, p.7.

Development Association (I.D.A.) in order to obtain financial assistance. In this cropping pattern, high priority was accorded to two seasonals and the kharif crops. The proposed area under cash crops, mainly sugarcane and cotton, was nearly 55 per cent while that under other crops, mainly rabi crops and kharif rice, was about 45 per cent. In February 1967, the Irrigation Department suggested certain changes in the cropping pattern by taking into account different types of soils and the recently developed high yielding varieties of foodgrains. The revised cropping pattern of Purna project is presented in Table 3.2.

Table 3.2 : Approved Cropping Pattern of Purna Project

Crop	Area (hectares)	Percentage
Sugarcane and banana	6,478	10.53
Other perennials	3,036	4.93
Kharif rice	6,154	10.00
Kharif seasonals	4,453	7.24
Rabi seasonals	21,255	34.54
Hot weather seasonals	3,644	5.92
Two seasonals	4,048	6.58
L.S. cotton	11,338	18.42
Hybrid crops in hot weather season	1,134	1.84
Total	61,540	100.00

In the revised cropping pattern the area planned to be irrigated under rabi seasonals is as much as 34.5 per cent followed by L.S. cotton with 11,338 hectares (18.42 per cent). About 10 per cent of the area each is proposed to be put under perennials and kharif rice. A new hybrid crop in hot weather season is also proposed in the cropping pattern.

3.5 Irrigation Potential and Utilization on Purna Project

The ultimate irrigation potential of Purna project is

61,540 hectares which was created in 1968-69. In Table 3.3 are given stages of creation of irrigation potential on Purna project.

Table 3.3 : Stages of Creation of Irrigation Potential on Purna Project

Year	Potential created (ha)
1962-63	3,239
1963-64	5,263
1964-65	5,972
1965-66	24,049
1966-67	40,486
1967-68	61,540

In Purna project the water for irrigation purpose was made available from the year 1962-63. The area actually irrigated during the period 1962-63 to 1967-68 is shown in Table 3.4.

Table 3.4 : Area Irrigated During 1962-63 to 1967-68

Year	Area irrigated (ha)	Planned utilisation (ha)
1962-63	61	81
1963-64	1,080	1,195
1964-65	877	1,230
1965-66	1,545	8,100
1966-67	7,510	30,375
1967-68	8,332	61,540

Table 3.4 indicates that the actual utilisation did not keep pace with the planned utilisation. The farmers were reluctant to avail of the irrigation facility even though enough irrigation potential was created. In this regard the Committee of official and non-official members¹ (1972) appointed to find out the causes of under-utilisation of the irrigation potential put forth the following main causes responsible for the under-utilisation of the project potential : lack of ayacut development, lack of infrastructural facilities and adequate credit facilities to purchase the required inputs like fertilisers, improved seeds and pesticides, lack of improved implements, traditional outlook of the farmers and absence of distribution system and storage facilities.

There was a slow growth in utilisation of created potential during the initial period. D. Lal and P. Daune² (1971) while reappraising the Purna project observed that the utilisation achieved seven years after completion, was only 15 per cent due to the overestimated water requirements of crops, scarcity of agricultural labour, inadequate infrastructure, lack of execution of necessary supporting off-farm and on-farm infrastructure and also less yields under irrigation compared to forecast level. Similarly, V. V. Borkar and M. D. Padhye³ (1972) in their study 'Purna River Valley Project' found that hardly 1/5th of the irrigation potential was actually utilised by 1970-71. This low degree of utilisation was attributed "to the lack of motivation and

knowhow among the cultivators and of the necessary physical facilities and inputs, the absence of both, the will and the ability. There exist even strong disincentives. This is because of the failure of the Government to think ahead and anticipate the problems connected with the full use of irrigation facilities once they are available on a hitherto unknown scale to a dry farming area unfamiliar with the methods and practices of wet cultivation."

3.6 Area Actually Irrigated
During the Period from
1968-69 to 1983-84

The cropping pattern in a particular region is governed by agro-climatic factors like the nature of rainfall, soil type, temperature, etc. For instance, cool and dry climate as well as loam and sandy loam soils are most favourable for the growth of wheat crop, whereas paddy thrives in warm and humid climate and requires clayey soils with low permeability. But rainfall is the principal factor in determining crops most suitable for a region. The irrigation water requirements differ from crop to crop and also from season to season. Farmers utilising the canal water are free to grow crops according to their choice and suitability, except the perennials. It is, therefore, obvious that the area actually irrigated could vary from the area designed to be irrigated and the actual cropping pattern could be different from that proposed in the project even when the entire available water is utilised.

The data regarding the distribution of irrigated area under various crops during the period from 1968-69 to 1983-84 are presented in Table 3.5.

It will seem that the area irrigated recorded some increase during the period from 1968-69 to 1972-73 but the figure of potential utilised reached only about 40 per cent. The main reasons for the lag in utilisation were as under: incompleting work on field channels and land shaping, late formation of organisation for command area development, lack of adequate agricultural demonstration farms, credit facilities and infrastructure facilities for agricultural development.⁴

Utilisation showed a considerable improvement after the formation of the CADA for this project in 1974-75. Maximum utilisation was observed in 1975-76. This achievement was chiefly because of the various steps taken by the authority such as work on field channels, land levelling and shaping, concessional water supply facility, demonstration farms and provision of credit and infrastructure facilities. Besides these, the authority nearly compelled the cultivators to grow a new variety of kharif rice. Hence, the area brought under the cultivation of rice was large in 1975-76. Further a considerable area was put under irrigated wheat as wheat was taken as a second crop after kharif rice. Thereafter, utilisation fluctuated widely during the remaining period of study.

In order to study the problem of utilisation of irrigation potential of the Purna irrigation project, L. W.

Table 3.5 : Area Irrigated under Various Crops During the Period from 1968-69 to 1983-84

Crop	(Area in hectares)-							
	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
1. Sugarcane & banana	1,448.18 (12.6)	1,939.27 (19.8)	1,972.06 (14.8)	3,162.34 (12.3)	2,321.00 (9.8)	1,762.00 (8.7)	1,719.00 (7.6)	2,424.00 (4.8)
2. Other perennials	184.21 (1.6)	164.77 (1.7)	207.69 (1.6)	58.71 (0.2)	31.00 (0.1)	39.00 (0.2)	18.00 (0.1)	101.00 (0.2)
3. Kharif rice	418.62 (3.7)	887.45 (9.0)	259.52 (1.9)	3,069.23 (12.0)	6,196.00 (26.1)	1,420.00 (7.0)	2,214.00 (9.8)	10,083.00 (20.0)
4. Kharif seasonals	384.21 (3.3)	293.93 (3.0)	21.05 (0.2)	1,937.65 (7.6)	1,452.00 (6.1)	403.00 (2.0)	467.00 (2.0)	6,012.00 (12.0)
5. Rabi seasonals	7,246.96 (63.2)	4,621.06 (47.1)	6,577.33 (49.6)	9,078.14 (35.4)	12,339.00 (52.0)	9,419.00 (46.5)	11,412.00 (50.2)	19,055.00 (37.8)
6. Hot weather seasonals	449.80 (4.0)	667.21 (6.8)	2,191.90 (16.5)	4,544.13 (17.7)	-	5,205.00 (25.7)	4,711.00 (20.7)	5,607.00 (11.1)
7. Other two seasonals	733.20 (6.4)	997.16 (10.1)	1,417.00 (10.7)	1,534.41 (6.0)	913.00 (3.9)	891.00 (4.4)	551.00 (2.4)	2,409.00 (4.8)
8. L.S. cotton	600.81 (5.2)	250.20 (2.5)	621.46 (4.7)	2,243.73 (8.8)	473.00 (2.0)	1,060.00 (5.2)	1,627.00 (7.2)	4,111.00 (8.2)
9. Hybrid crops in H.W.	-	-	-	-	-	52.00 (0.3)	1.00 (N)	553.00 (1.1)
Total	11,465.99 (100.00)	9,821.05 (100.00)	13,268.01 (100.00)	25,628.34 (100.00)	23,725.00 (100.00)	20,251.00 (100.00)	22,720.00 (100.00)	50,355.00 (100.00)

Contd...

Table 3.5 : (Continued)

Crop	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
1. Perennials	3,944 (9.12)	4,505 (12.36)	3,518 (12.34)	2,680 (8.16)	3,054 (8.35)	3,824 (16.54)	2,919 (20.55)	2,050 (6.00)
2. Kharif rice	11,753 (27.19)	6,367 (17.47)	3,591 (12.60)	3,100 (9.44)	4,021 (11.00)	2,440 (10.56)	2,062 (14.52)	-
3. Kharif seasonals	1,168 (2.70)	905 (2.48)	506 (1.77)	936 (2.85)	685 (1.87)	313 (1.35)	446 (3.14)	-
4. Rabi Seasonals	20,485 (47.38)	15,962 (43.80)	11,980 (42.03)	13,678 (41.66)	11,697 (31.98)	12,781 (55.30)	8,242 (58.02)	13,160 (38.49)
5. Hot weather seasonals	4,945 (11.44)	7,892 (21.66)	8,100 (28.42)	10,387 (31.64)	15,716 (42.97)	3,174 (13.73)	-	18,516 (54.15)
6. Other two seasonals	427 (0.99)	456 (1.25)	510 (1.80)	1,153 (3.51)	530 (1.45)	286 (1.24)	536 (3.77)	445 (1.30)
7. L.S. cotton	501 (1.16)	359 (0.98)	296 (1.04)	901 (2.74)	864 (2.36)	297 (1.28)	-	-
8. Hybrid crops	8 (0.02)	-	-	-	9 (0.02)	-	-	21 (0.06)
Total	43,231 (100.00)	36,446 (100.00)	28,501 (100.00)	32,835 (100.00)	36,576 (100.00)	23,115 (100.00)	14,205 (100.00)	34,192 (100.00)

(Figures in parentheses indicate percentage to the total area irrigated in the particular year).

Source : 1) L.W.Ambegaonkar, A Study of the Utilisation of Irrigation Potential of the Purna Irrigation Project - A thesis submitted to the University of Poona for Ph.D. degree, 1979, p. 235 (unpublished).

2) Annual Administration Report of CADA, Purna, Nanded, 1983-84, Annexure V, p. 30.

Ambegaonkar⁵ (1979) made a detailed investigation regarding the extent, causes and the economic consequences of the under-utilisation. A number of reasons advanced by the cultivators were: alternative source of irrigation, absence of outlets and field channels, defective and ill-maintained distribution system, disputes over field channels, lack of or inadequate drainage channels, water logging, maldistribution of available water and tail-end difficulties, lack of credit, inputs and infrastructure, inadequate preparation of land, inadequate manpower and draught power and traditional outlook of the farmers. In the same way, a survey conducted by D. A. Solanke and others⁶ (1979) revealed that the under-utilisation of irrigation facility in Purna command area was due to the following reasons: lack of finance, existing beliefs that irrigation is not necessary for the existing crops, administrative problems and non-availability of irrigation water for the crops preferred by the farmers.

In connection with the utilisation of irrigation potential of a project, the State Irrigation Commission⁷ (1962) has recommended that the period for the full development of irrigation 'should be shortened to eight years from the starting of construction work or five years from the starting of irrigation'. Further, the Committee of Ministers⁸ (1973) on under-utilisation of created potential has recommended that the state governments should aim to achieve full utilisation of irrigation potential within three to five years after its creation.

In the case of Purna project, the gross utilisation of project potential is around 40 per cent whereas the ultimate irrigation potential was already created 15 years back (in 196⁸-69). It would be instructive to examine in detail the seasonal variation in utilisation so that the specific factors constraining irrigation utilisation could be identified.

3.7 Utilisation Achieved in Different Cropping Seasons

3.7.1 Kharif Seasonals

It will be noted from the data given in Table 3.5 that the area irrigated under kharif seasonals has remained quite low compared to the projected area of 10,607 hectares during the entire period except for the year 1975-76 when the water was made available free of charge. Demand is lacking because of the assured and well distributed rainfall and the fertile nature of the soils in the command area. The local varieties of jowar (Pivala and Varahadi) and cotton are the major kharif crops grown in this area. These crops need relatively less working capital and labour as compared to the hybrid variety of jowar and L.S. cotton. Further, they are quite sturdy and by and large, do not require irrigation. Moreover, there is seldom any need of applying irrigation water for kharif crops as this area lies in the assured rainfall zone. Consequently, there is a general tendency amongst the farmers to wait for the rains and demand water only if there is a long break in

monsoons. Cultivators are also reluctant to avail of the irrigation facility since the Irrigation Department charge for water is for the entire season even if only one watering is taken. There is a tendency particularly on the part of the big farmers to grow rain-fed local varieties due to the fear of application of the Land Ceiling Act.* The land holding size-wise classification of 15,746 cultivators from 216 villages covering an area of 2,53,014 acres under the Purna command given in Table 3.6 shows that about 26 per cent of the cultivators owned more than 20 acres of land.

Table 3.6 : Classification of Cultivators into Different Group of Land Holding

Size of land holding (acres)	Number of cultivators	Percentage
0 - 5	3,782	24.1
5 - 10	3,280	20.8
10 - 15	2,574	16.3
15 - 20	1,921	12.2
Above 20	4,189	26.6
Total	15,746	100.0

Source : Purna Project, Department of Agriculture, Government of Maharashtra, Pune, 1970, p. 16.

* The Maharashtra State Ceiling Act (2 October, 1975), has fixed the ceiling limits for perennially irrigated land and dry land at 7.28 hectares (18 acres) and 21.85 hectares (54 acres) respectively.

The area under irrigated jowar has remained quite low during the period under study. Farmers in this area prefer to grow the traditional varieties of jowar (rather than hybrid varieties) which grow well under rainfed conditions. These varieties are preferred to hybrids because of the better quality of the grain and higher yields of fodder. During the initial years, the area under rice was also low but thereafter, though the cultivators in Marathwada region were not familiar with the cultivation of rice, the irrigated area under this crop increased considerably through the efforts of the CADA. The area under irrigated rice in 1972-73 was high, slightly more than the proposed area of 6,154 hectares, because the rainfall received in that year was only 50 per cent of the normal rainfall. A considerable area was brought under rice during the years 1975-76 and 1976-77 mainly due to the introduction of a new variety of rice known as 'Jaya'. In the initial years, 'Tuljapuri' variety of rice was popular amongst the farmers; in 1975 the CAD Authority almost compelled the farmers to grow this new variety of rice and water was provided free of charge to encourage spread of irrigation. However, this Jaya variety of rice totally failed and many farmers experienced heavy losses. Even the CADA could not find out any reasons for such a complete failure. Naturally, the area irrigated under this crop declined in the subsequent years.

It was further reported by the authority that the beginning of free trade of rice between Maharashtra State and

Andhra Pradesh during the Janata regime gave a setback to the cultivation of rice in this area. Cultivators were not in a position to extend the area under kharif rice on account of the free movement of better quality rice at a lower price from A.P. to Maharashtra. There was no need of supplying irrigation water in 1983-84 as the rainfall was very heavy. (Rainfall data for the period from 1968-69 to 1983-84 are given in Appendix A.)

3.7.2 Rabi Seasonals

This command area is popularly known as the rabi tract. The major crops grown during the rabi season are wheat, jowar, gram, etc. There is no need of applying irrigation water due to the late monsoon and deep black soils which retain sufficient residual moisture for the growth of rabi crops other than the wheat crop. However, as wheat requires irrigation water, the position of rabi utilisation is comparatively satisfactory as compared to that noted in the kharif season. Excepting the two years 1975-76 and 1976-77, the area actually irrigated under rabi crops was around 50 per cent of the projected area of 21,255 hectares.

Wheat is the most popular rabi crop in this area. It occupied a major proportion of the irrigated area in the rabi season. As stated earlier, the area irrigated under kharif rice increased considerably in 1975-76 because of the introduction of 'Jaya' variety of rice and declined after 1976-77

because of the failure of Jaya variety. Since wheat was grown as a second crop after kharif rice, area irrigated under wheat shot up and got reduced with the changes in the area under Jaya variety. Subsequently the crop rotation followed by the farmers was to grow rabi jowar after green gram (Mung) in kharif season. As rabi jowar can be grown without irrigation the area irrigated under rabi crops remained around 12,000 hectares.

About 16,685 hectares were put to irrigated wheat in 1975-76 and 19,236 hectares in 1976-77 due to the special drive taken up by the Centre and the State Government to popularise high yielding varieties of wheat. HYVs are very thermo-sensitive and require at least 5 to 6 waterings during the life time. Subsequently, the cultivation of wheat has been adversely affected by changes like the absence of low temperatures at the flowering time and pest infestation due to adverse climatic conditions. In the case of HYVs of wheat, low winter temperatures at the time of germination is quite essential. Further, the cultivation of wheat has been affected by economic factors such as low net returns because of the increase in the prices of various inputs and the low support price fixed by the government. The area under wheat declined to 11,441 hectares in 1978-79 and there was only a small increase in the subsequent years. Wheat is the main irrigated rabi crops and there is no alternative in this season. Further, wheat has more or less, become an item of staple diet of some

among the medium and large farmers in this area. Hence, the area under irrigated wheat has stabilised around 12,000 hectares in the Purna command area.

The conventional varieties of jowar (Talki) is another important rabi crops grown in this command area. This crop could be grown even without irrigation as the region receives assured and sufficient rainfall. It is seen from Table 3.7 that the area irrigated under rabi jowar was negligible during the period from 1971-72 to 1983-84. Even though a special drive was launched by the government in 1974-75 to popularise the hybrid varieties of jowar, very few cultivators switched to these varieties. The local varieties of rabi jowar are preferred because of the following reasons:

1) The keeping quality of hybrid jowar is poor and it cannot be stored for a long time like local varieties of jowar.

2) It does not give the taste of the traditional varieties.

3) The production of fodder is also much less as compared to that of the local varieties.

3.7.3 Perennials and Other Perennials

Sugarcane and bananas are equally popular perennial crops grown in this command area. There is a persistent demand for these crops particularly sugarcane as this crop is quite sturdy and at the same time, gives high returns.

Table 3.7 : Area Irrigated under Kharif Rice, Wheat and Rabi Jowar

Year	Kharif rice	Wheat	Rabi jowar	(Area in hectares)	
				% of wheat in the total rabi area	% to planned rabi seasonals
1971-72	3,069	7,268	975	80.10	34.19
1972-73	6,196	10,920	569	88.50	51.38
1973-74	1,420	7,365	422	78.20	34.65
1974-75	2,214	10,245	595	89.77	48.20
1975-76	10,083	16,685	830	87.56	78.50
1976-77	11,753	19,236	220	94.00	90.50
1977-78	6,367	15,291	-	95.80	71.94
1978-79	3,591	11,441	31	95.50	53.83
1979-80	3,100	11,354	-	83.01	53.45
1980-81	4,021	11,229	36	96.00	52.83
1981-82	2,440	12,001	-	93.90	56.46
1982-83	2,062	7,336	21	89.01	34.51
1983-84	Nil	12,323	73	93.64	57.98

Source : Table compiled from the statement showing season-wise/cropwise area irrigated, CADA, Purna Project, Nanded, 1983-84.

However, cultivators are not free to grow perennial crops beyond the limits fixed by the authority, because the water requirements of these crops are very high. If strict control is not put on the area under perennial crops, the total irrigable area might get reduced considerably. (The water requirements of different crops under Purna command area as recommended by the Department of Agriculture of Maharashtra State are given in Table 3.8).

Table 3.8 : Recommended Number of Waterings to Different Crops under Purna Command

Crops	No. of waterings
Sugarcane (plant)	28-29
Banana	56-60
Cotton : Long staple (pre-seasonal)	6
Cotton : Long staple (June sowing)	2
Turmeric	16
Kharif paddy (drilled)	2
Kharif hybrid jowar	1
High yielding wheat	7
Groundnut (hot weather)	12

Source : Department of Agriculture, Maharashtra State, Pune
Water Requirement of Crops in Different Agro-
Climatic Zones, Agricultural Bulletin No. 574,
 1975, p. 23.

The areas under perennial crops in Purna command are restricted to pre-determined limits and sanctions are given on each distributaries on the basis of soil suitability. These limits of sanction on each catchment are called as x-limits. In this command area, only M_1 and D_2 soils with good drainage capacity are approved for growing perennials.

1) M_1 soils : Medium soils which drain directly into some natural drainage.

2) D_2 soils : Deep soils within a belt of 1/2 mile along the rivers Purna, Godavari and Asna taken as well-drained.

As canal irrigation is not dependable there is no guarantee that adequate quantity of water would be available at proper time, sugarcane and bananas are grown extensively under well irrigation. In 1978, more than 70 per cent of the total area irrigated by wells was devoted to the cultivation of perennials.⁹ Table 3.9 indicates the number of waterings applied to perennials from canal as well as wells and the interval between two consecutive waterings in different seasons. Farmers utilising canal irrigation reported that they could not get the recommended number of irrigation waterings due to mismanagement and mal-distribution of the available water and inability of the irrigation staff to enforce the irrigation rules strictly. Further, in the case of canal irrigation the interval between two consecutive waterings was longer as compared to that under well irrigation.

Table 3.9 : Application of Irrigation Water from Canal and Wells

Crops	No. of waterings given	Rotation followed		Existing rotation (days)
		Season	Interval (days)	
<u>Canal</u>				
Sugar-cane	17-25	Kharif	20-25	Kharif 18
		Rabi	20-25	Rabi 21
		Hot weather	10-18	Hot weather 10
Banana	38-41	Kharif	20-22	
		Rabi	20-25	
		Hot weather	10-18	
<u>Wells</u>				
Sugar-cane	24-32	Kharif	15-20	
		Rabi	12-15	
		Hot weather	8-10	
Banana	50-56	Kharif	12-15	
		Rabi	8-10	
		Hot weather	4-6	

Source : L. W. Ambegaonkar, A Study of the Utilisation of Irrigation Potential of the Purna Irrigation Project, pp. 146-150.

Sugarcane is mainly cultivated at the upper reaches of the command area due to existence of cooperative sugar factory near Basmathnagar whereas banana is grown mostly on private wells at the lower reaches of the command in the eastern part of the Basmathnagar taluka. Banana is a popular crop as the returns are high and markets are readily available at Parbhani, Nanded, Akola, Pune, Hyderabad, etc. The cultivation of bananas is indirectly dependent on canal irrigation since the wells located in the command area receive their supplies through the percolation of water from the distribution system. There was an increasing tendency amongst the farmers to dig wells so as to accrue the benefits of increased groundwater level due to the percolation of canal water. The Sub-division of CADA, Basmathnagar, informed that nearly 3,000 to 4,000 new wells were excavated in the command area during 1982-85 period and therefore the total number of wells went to 12,000.

The area irrigated under orange, mosambi etc., crops was only 208 hectares in 1970-71 as against the proposed area of 3,036 hectares. These crops have been neglected by the farmers; they prefer to grow sugarcane and bananas. Even though the soils are quite suitable for the growth of fruit trees the cultivators do not prefer fruit crops on account of large initial investment and a long gestation period. Further, they do not want to take a risk of growing these crops as their failure results in very heavy losses.

3.7.4 Hot Weather Seasonals

In hot weather season, the problem of under-utilisation of irrigation water does not arise since there is a large demand for hot weather crops like groundnut. On the contrary, the quantity of water available in reservoir and the transit and evaporation losses which are very heavy in the hot weather season, together determine the utilisation in this season. The crops grown in this season are mostly cash crops like groundnut, vegetables. A total area of 3,644 hectares was planned to be irrigated in the hot weather season, whereas the area actually irrigated was often at a higher level compared to the proposed area.

The hot weather irrigated area has increased from 450 hectares in 1968-69 to 18,516 hectares in 1983-84. The principal reason for such an increase was that summer groundnut proved a most suitable crop from the point of view of higher yield, high prices in the market and an ideal crop rotation which leaves a sufficient time for the preparation of land for the kharif sowing. It also gives a very good quality of green fodder at a proper time when there is a need of fodder for the farm animals. There was no area irrigated in hot weather seasons of 1972-73 and 1982-83 since no water was available in the storage, while the area irrigated in 1981-82 was less on account of availability of limited water i.e. only 7,992 m cft (226.30 mm^3) on 1.3.1982. On the

other hand, a total area of 18,516 hectares was brought under irrigation in 1983-84 which was a record year in the project history, because of the availability of abundant water in the reservoir; the available live storage on 1.3.1984 was 23,296 m cft (659.64 mm^3) as against the total live storage of 31,456 m cft. (890.70 mm^3). It was possible to bring an additional area under irrigation in the hot weather season due to the availability of additional water for irrigation which was left unused in the kharif as well as rabi season.

3.7.5 L.S. Cotton and Other Two Seasonals

Cotton is one of the major cash crops of this area. The cultivators in this area have been growing cotton since long but the varieties grown are mostly local ones i.e. gaoran. The area envisaged to be irrigated under L.S. cotton is 11,338 hectares while the area actually irrigated under this crop was less than 1,000 hectares in most years. Though the cropped area under canal irrigation appears to be quite low, actually L.S. cotton was grown extensively under well irrigation. As this is an assured rainfall zone, this crop requires only 1 or 2 waterings so as to supplement rainfall. Even if one watering is taken from canal, cultivators have to pay the water charges for the entire season. Hence, farmers think it wise to give the required, 1 or 2 waterings from well instead of applying water from canal. Further, the cultivation of L.S. cotton like H-4 and Varlaxmi, needs costly inputs such

as fertilisers, HYV of seeds, pesticides and insecticides; hence the bigger farmers are in a position to grow L.S. cotton and not the smaller ones. Most of the rich and well to do farmers in this command area were growing L.S. cotton as they do have alternative source of irrigation while the farmers having no wells have to rely on canal irrigation to grow L.S. cotton.

Among the other two seasonals, turmeric is the only two seasonal that is popular in this area. Though a total area of 4,048 hectares has been proposed to be irrigated under these crops, the actual irrigated area has been lagging behind the proposed one. These crops showed an increasing trend during initial years. Maximum irrigation was achieved in 1975-76 but thereafter, the irrigated area under these crops decreased in the subsequent years. Cultivators do not prefer to grow other two seasonals though they may prove profitable. The reason is that perennial crops like sugarcane and bananas are more profitable than these crops.

3.7.6 Hybrid Crops in Hot Weather Season

Though it has been planned to irrigate a total area of 1,134 hectares under hybrid crops in the hot weather season, there was no response to these crops excepting the year 1975-76 in which a total area of 553 hectares was irrigated. This was chiefly due to the tendency on the part of the farmers to prefer more profitable cash crops like groundnut in this season.

3.8 Proportion of Area Actually Irrigated to Proposed Cropping Pattern ||

The proportion of area actually irrigated under various crops to the proposed area in the cropping pattern is shown in Table 3.10.

It will be seen from Table 3.10 that the irrigated area under perennials was below the area proposed to be irrigated though there has been a large demand for these crops. Really speaking, farmers were growing perennials extensively on their wells as the cultivation of these crops has been restricted to the predetermined limits i.e. only M_1 and D_2 soils approved for growing perennials. Other perennials received very inadequate response from the farmers. In the case of kharif rice, only during 1975-76 - 1977-78 period the area actually irrigated was higher than to projected one. Thereafter, the irrigated area under rice decreased due to a variety of reasons already discussed. Excepting the year 1975-76 in which facility of free water was available, there was very little demand for kharif irrigation because of fairly adequate and assured rainfall received in this command area.

Area irrigated in rabi season appeared satisfactory mainly due to the cultivation of wheat crop. On the other hand, the area brought under other rabi crops like jowar, gram, was small on account of assured rainfall and very fertile soils. In the case of hot weather season, the utilisation

Table 3.10 : Proportion of Area Actually Irrigated to the Proposed Cropping Pattern

Crop	Proposed cropping pattern	(Area in hectares)						
		1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75
1. Perennials	6,478 (100.00)	1,448.18 (22.35)	1,939.27 (29.94)	1,972.06 (30.44)	3,162.34 (48.82)	2,321.00 (35.83)	1,762.00 (27.20)	1,719.00 (26.53)
2. Other perennials	3,036 (100.00)	184.21 (6.07)	164.77 (5.43)	207.69 (6.84)	58.71 (1.93)	31.00 (1.02)	39.00 (1.28)	18.00 (0.60)
3. Kharif rice	6,154 (100.00)	418.62 (6.80)	887.45 (14.42)	259.52 (4.22)	3,069.23 (49.87)	6,196.00 (100.68)	1,420.00 (23.07)	2,214.00 (36.00)
4. Kharif seasonals	4,453 (100.00)	384.21 (8.63)	293.93 (6.60)	21.05 (0.47)	1,937.65 (43.51)	1,452.00 (32.61)	403.00 (9.05)	467.00 (10.49)
5. Rabi seasonals	21,255 (100.00)	7,246.96 (34.10)	4,621.06 (21.74)	6,577.33 (31.00)	9,078.14 (42.71)	12,339.00 (58.05)	9,419.00 (44.31)	11,412.00 (53.70)
6. H.W. seasonals	3,644 (100.00)	449.80 (12.34)	667.21 (18.31)	2,191.90 (60.15)	4,544.13 (124.70)	-	5,205.00 (142.84)	4,711.00 (129.28)
7. Other two seasonals	4,048 (100.00)	733.20 (18.11)	997.16 (24.63)	1,417.00 (35.00)	1,534.41 (38.00)	913.00 (22.55)	891.00 (22.01)	551.00 (13.61)
8. L.S. cotton	11,338 (100.00)	600.81 (5.30)	250.20 (2.21)	621.46 (5.48)	2,243.73 (19.79)	473.00 (4.17)	1,060.00 (9.35)	1,627.00 (14.35)
9. Hybrid crops in H.W.	1,134 (100.00)	-	-	-	-	-	52.00 (4.58)	1.00 (0.09)
Total	61,540 (100.00)	11,465.99 (18.63)	9,821.05 (16.00)	13,268.01 (21.56)	25,628.34 (41.64)	23,725.00 (38.55)	20,251.00 (33.00)	22,720.00 (37.00)

Contd...

Table 3.10 : (Continued)

Crop	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
1. Perennials	2,424.00) (37.42))								
2. Other perennials	101.00) (3.33))	3,944 (41.45)	4,505 (47.35)	3,518 (37.00)	2,680 (28.17)	3,054 (32.10)	3,824 (40.20)	2,919 (30.68)	2,050 (21.55)
3. Kharif rice	10,083.00 (163.84)	11,753 (191.00)	6,367 (103.46)	3,591 (58.35)	3,100 (50.37)	4,021 (65.34)	2,440 (39.65)	2,062 (33.51)	-
4. Kharif seasonals	6,012.00 (135.01)	1,168 (26.23)	905 (20.32)	506 (11.36)	936 (21.02)	685 (15.38)	313 (7.03)	446 (10.01)	-
5. Rabi seasonals	19,055.00 (89.65)	20,485 (96.38)	15,962 (75.10)	11,980 (56.36)	13,678 (64.35)	11,697 (55.03)	12,781 (60.13)	8,242 (38.78)	13,160 (62.00)
6. H.W. seasonals	5,607.00 (153.87)	4,945 (135.70)	7,892 (216.57)	8,100 (222.28)	10,387 (285.04)	15,716 (431.28)	3,174 (87.10)	-	18,516 (508.12)
7. Other two seasonals	2,409.00 (59.51)	427 (10.55)	456 (11.26)	510 (12.60)	1,153 (28.48)	530 (13.10)	286 (7.10)		
8. L.S. cotton	4,111.00 (36.26)	501 (4.42)	359 (3.17)	296 (2.61)	901 (8.00)	864 (7.62)	297 (2.62)	536 (3.48)	445 (2.90)
9. Hybrid crops in H.W.	553.00 (48.76)	8 (0.70)	-	-	-	9 (0.80)	-	-	21 (1.85)
Total	50,355.00 (81.82)	43,231 (70.25)	36,446 (59.22)	28,501 (46.31)	32,835 (53.35)	36,576 (59.43)	23,115 (37.56)	14,205 (23.08)	34,192 (55.56)

(Figures in parentheses are the percentages of area irrigated in each year to the proposed area in the proposed cropping pattern.)

was satisfactory. The irrigated area in this season showed a continuous increase throughout the period. This was chiefly due to the availability of adequate quantity of water for irrigation in the reservoir except for the year 1982-83. The response received by L.S. cotton and other two seasonals was not satisfactory. Only 3 per cent of the proposed area was irrigated under these crops in 1983-84. But L.S. cotton was grown extensively on well irrigation as it require only a few waterings in order to supplement rainfall.

On the whole, no specific trend was observed in the utilisation where the extent of gross utilisation varied from 16 per cent to 82 per cent. During the initial period, utilisation was very low but it showed a gradually increasing trend in the subsequent years. It was highest in 1975-76 due to the various measures adopted by the CADA to improve the utilisation like facility of free water, introduction of newly 'Jaya' variety of rice, proper maintenance of distribution system, etc. The gross utilisation was more than 50 per cent during the period from 1975-76 to 1983-84 excepting a few years. The lowest utilisation at 23 per cent was experienced in 1982-83 because of non-availability of irrigation water in the storage in the hot weather season.

So far we have considered the gross area utilisation that takes into account only the area under irrigation and not the water requirements of the various crops upon which water utilisation depends.

To assess the extent of under-utilisation more accurately the proposed area to be irrigated and the actual area irrigated under various crops are converted into base crop area by taking rabi seasonals as a base crop. Details regarding the conversion of areas irrigated under various crops during the period under consideration in terms of equivalent rabi seasonals are given in Appendix D and the results obtained from it are presented in Table 3.11 and figures 1 & 2. It will be seen from Table 3.11 that there is a considerable divergence between the figures of gross area utilisation (Table 3.10) and the estimation of under-utilisation worked out on the basis of conversion of area irrigated in different seasons into equivalent area of rabi seasonals. Figures of gross area utilisation are higher than those derived using the base crop area. This has to be borne in mind in making comparisons between projects for assessing the extent of utilisation particularly if there are large variations in the seasonal cropping pattern between projects.

3.9 Transit Losses on Purna Project

A broad assessment of the transit losses during the rabi and hot weather season on this project is given in Table 3.12. It will be seen from Table 3.12 that the estimated loss of water in transit during the rabi season was about 45 per cent excepting the year 1978-79 in which the figure was 54 per cent. The estimated losses during the hot weather season varied between 54 per cent and 58 per cent.

FIGURE 1

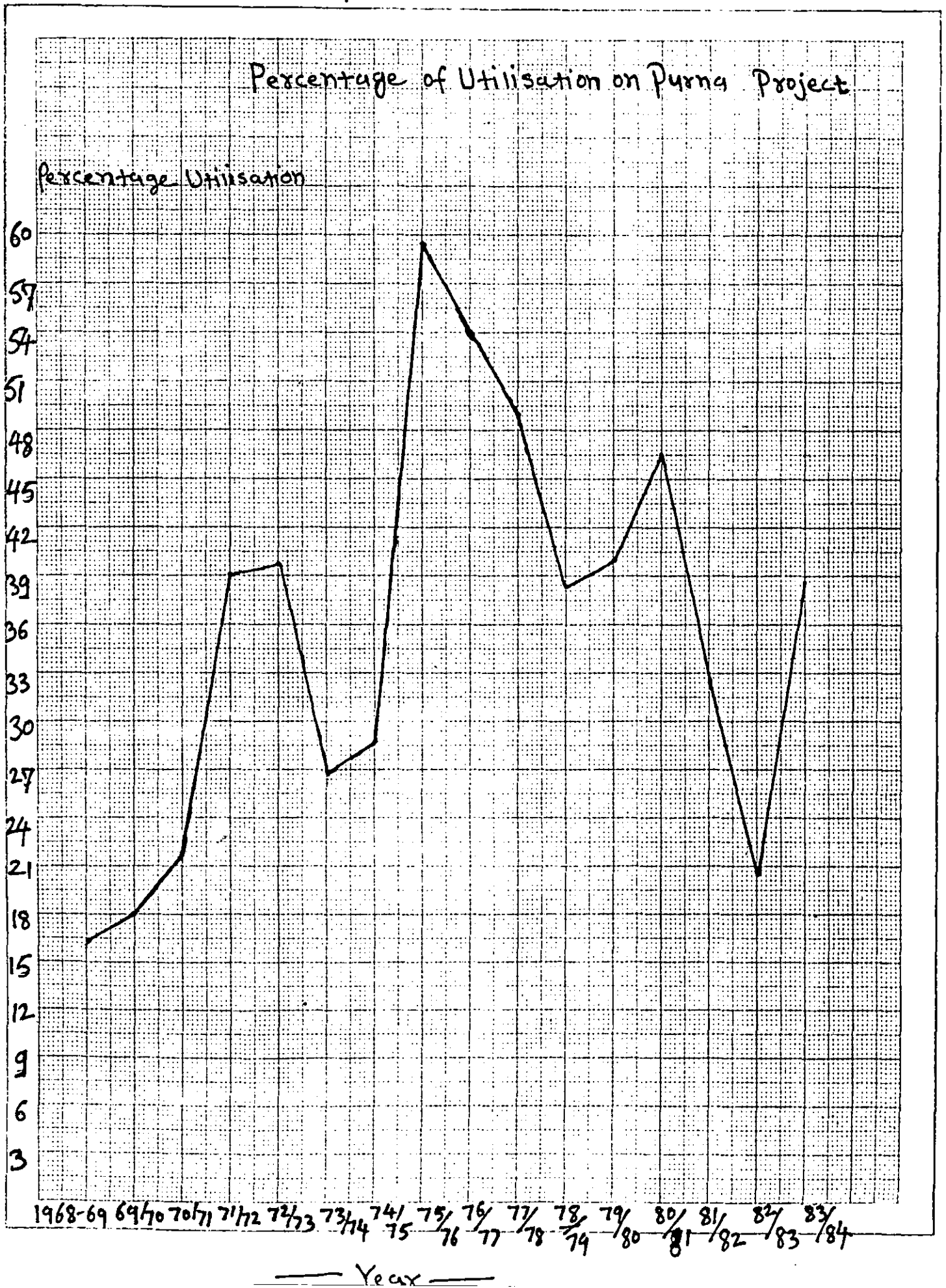


FIGURE 2

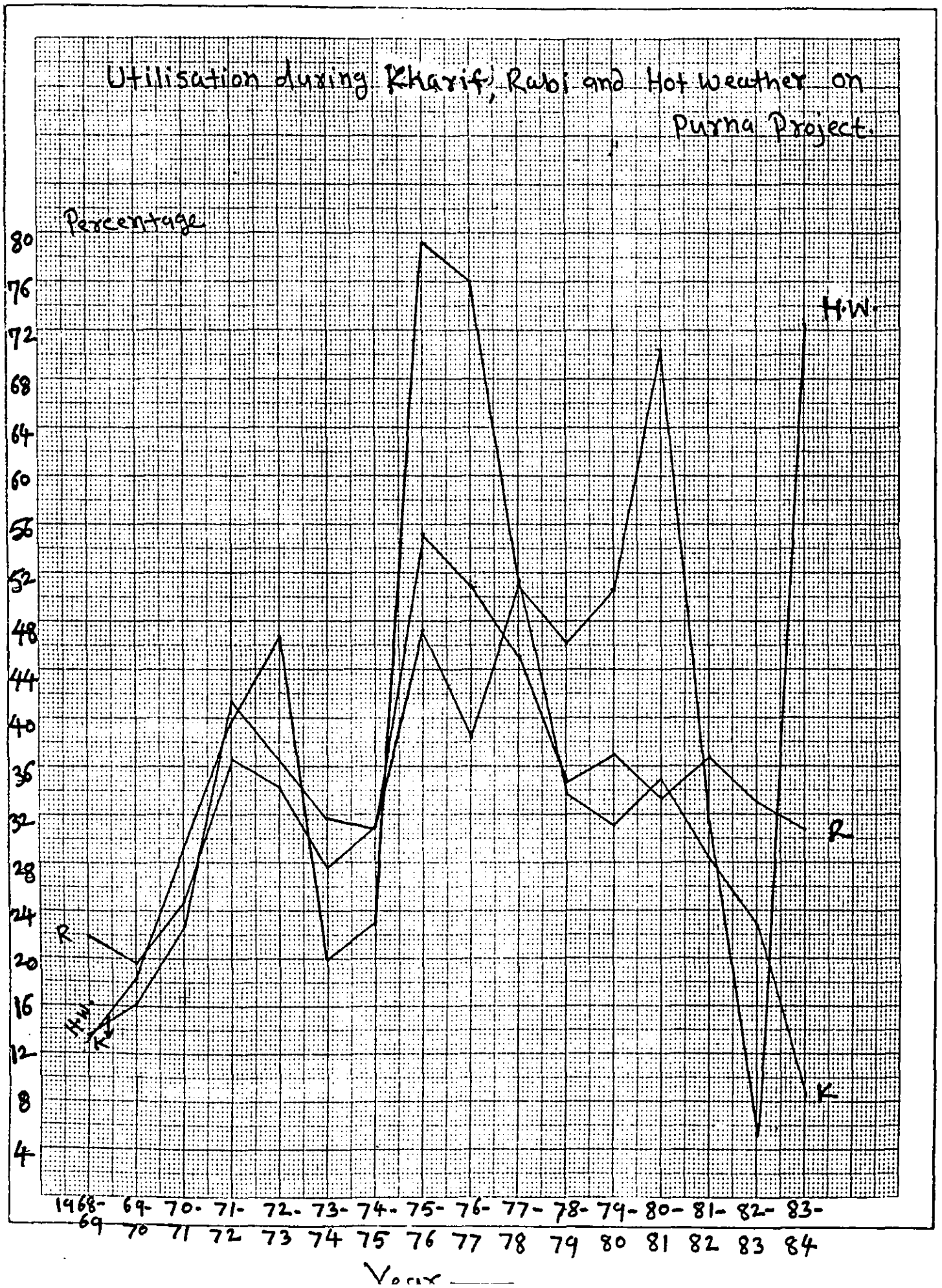


Table 3.11 : Utilisation of the Project Potential in Purna Command

Year	(Area in hectares)			
	Kharif	Rabi	Hot weather	Total
Base crop area to be irrigated as per the approved cropping pattern of the project	45,962.41	58,041.48	54,184.74	1,58,188.63
<u>1968-69</u>				
Base crop area irrigated	6,011.16	12,744.44	7,187.93	25,943.53
Percentage utilisation	13.08	21.96	13.27	16.40
<u>1969-70</u>				
Base crop area irrigated	8,391.90	11,386.90	8,880.30	28,659.10
Percentage utilisation	18.26	19.62	16.39	18.12
<u>1970-71</u>				
Base crop area irrigated	7,734.16	14,359.11	12,291.56	34,384.83
Percentage utilisation	16.83	24.74	22.68	21.74
<u>1971-72</u>				
Base crop area irrigated	18,266.12	21,206.77	22,401.51	61,874.40
Percentage utilisation	39.74	36.54	41.34	39.11
<u>1972-73</u>				
Base crop area irrigated	21,492.60	19,939.87	-	41,432.47
Percentage utilisation	46.76	34.35	-	39.84
<u>1973-74</u>				
Base crop area irrigated	9,194.53	16,071.00	17,236.43	42,501.96
Percentage utilisation	20.00	27.69	31.81	26.87
<u>1974-75</u>				
Base crop area irrigated	10,615.18	17,966.27	16,669.42	45,250.87
Percentage utilisation	23.10	30.95	30.76	28.61
<u>1975-76</u>				
Base crop area irrigated	36,441.31	32,082.57	25,057.73	94,181.61
Percentage utilisation	79.29	55.28	47.35	59.54

Contd...

Table 3.11 : (Continued)

Year	Kharif	Rabi	Hot weather	Total
<u>1976-77</u>				
Base crop area irrigated	34,939.31	29,577.55	20,887.79	85,404.65
Percentage utilisation	76.02	50.96	38.55	53.99
<u>1977-78</u>				
Base crop area irrigated	23,689.89	26,184.65	27,614.27	77,488.81
Percentage utilisation	51.54	45.11	50.96	48.98
<u>1978-79</u>				
Base crop area irrigated	15,537.46	20,127.13	25,069.95	60,734.54
Percentage utilisation	33.80	34.68	46.27	38.39
<u>1979-80</u>				
Base crop area irrigated	14,346.72	21,446.40	27,498.95	63,292.07
Percentage utilisation	31.21	36.95	50.75	40.01
<u>1980-81</u>				
Base crop area irrigated	16,025.73	19,402.10	38,151.60	73,579.43
Percentage utilisation	34.87	33.48	70.41	46.51
<u>1981-82</u>				
Base crop area irrigated	13,074.02	21,270.52	17,085.32	51,429.86
Percentage utilisation	28.44	36.65	31.53	32.51
<u>1982-83</u>				
Base crop area irrigated	10,456.91	14,798.70	2,921.88	28,177.49
Percentage utilisation	22.75	25.50	5.39	17.81
<u>1983-84</u>				
Base crop area irrigated	3,986.91	17,835.27	39,298.84	61,121.02
Percentage utilisation	8.67	30.73	72.53	38.64

Table 3.12 : Transit Losses During the Rabi and Hot Weather Seasons

Particulars	(Quantity in Mm ³)			
	1977-78	1978-79	1979-80	1980-81
<u>Rabi Season</u>				
Total quantity of water drawn at canal head	248.28	310.83	259.35	263.63
Total quantity of water used at head of distributary	217.17	225.89	212.41	234.21
Total quantity of water lost in transit	31.11	84.94	46.94	29.42
Percentage of losses	12.53	27.32	18.10	11.16
Water lost in the distribution system at 25% (assumed)	54.29	56.47	53.10	58.55
Quantity of water available at outlets	162.88	169.42	159.31	175.66
Water lost in field channels and water courses at 16% (assumed)	26.06	27.11	25.49	28.10
Quantity of water available at field head	136.82	142.31	133.82	147.56
Percentage of transit losses	44.90	54.22	48.40	44.02
<u>Hot Weather Season</u>				
Total quantity of water drawn at canal head	260.77	285.32	244.65	363.73
Total quantity of water used at head of distributary	217.90	243.90	201.46	288.38
Quantity of water lost in transit	42.87	41.42	43.19	75.35
Percentage of losses	16.43	14.52	17.65	20.71
Water lost in the distribution system at 33.3% (assumed)	72.56	81.22	67.09	96.03
Quantity of water available at outlets	145.34	162.68	134.37	192.35
Water lost in field channels and water courses at 20% (assumed)	29.07	32.54	26.87	38.47
Quantity of water available at field head	116.27	130.14	107.50	153.88
Percentage of transit losses	55.41	54.39	56.06	57.69

Source : Water Account Register, Command Area Development Authority for Purna Project, Nanded.

Almost similar results were obtained by using the water requirements of different crops given in the report of Sukthankar Committee (Vol. I, Appendix No. XIII, p. 168) to calculate the transit losses on this project. For instance, the losses during the hot weather are about 52 per cent. Such heavy transit losses mean not only a loss of valuable water resource but also percolation and seepage that accentuate problem of water logging and thereby salinity and alkalinity.

3.10 Problem of Water Logging

The groundwater table rises in the command area of a project due to the canal irrigation and leads to water logging. Water logging or the water logged land means the land where underground water table is very near the ground level that the soil pores are saturated, the normal circulation of air is restricted and the level of carbon dioxide is increased. As water logging leads to salinity and alkalinity of soil and adversely affects the growth of a crop, it is one of the important factors for under-utilisation of irrigation water. Water logged lands as classified by G. S. Pandya¹⁰ are given below.

Depth of water table below ground level	Remarks
0 to 1.5 metres (0-5 feet)	Fully damaged
1.5 to 3 metres (5-10 feet)	Damaged
3 to 4.5 metres (10-15 feet)	Protected
More than 4.5 metres (15 feet)	Safe

A total area affected by water logging and salinity in the command of Purna project is shown as under:

(Area in hectares)				
Area irrigated (1981-82)	Water logged area	Salt affected area	Total	Percentage to the irrigated area
23,115	3,241.08	272.25	3,513.33	15.20

The problem of water logging is mainly due to the heavy percolation, seepages and leakages from the canal and the distribution system as well as over-application of water. Moreover, the soils in this command area are deep black, ill-drained having low permeability.

N. D. Gulhati,¹¹ Consultant, Water Resources Development observed that there was an alarming rise in the groundwater table in the command area after the introduction of canal irrigation.

L. W. Ambegaonkar¹² also noted similar conditions in his field survey in this command. He observed that in some fields, the sub-soil water level has risen to very unsafe limits - almost below the ground level while in other cases, 1 to 2 feet of water was always standing and the fields were fully infested with weeds. In case of some farmers, their lands turned almost barren due to high salinity and alkalinity and the salt incrustation was quite visible throughout the

fields. Further, water level in some open wells was almost to the ground level within some inches from the ground level.

The problem of water logging and salinity in this command area has thus become quite serious and urgent measures are therefore required to solve this problem.

3.11 Suggested Measures

Thus, it may be concluded that the under-utilisation of irrigation potential on Purna project is a matter of serious concern. Certain effective steps need to be taken to avoid the under-utilisation of irrigation facility created by large investment. The following measures may be useful to improve the utilisation on this project.

(i) Due to the assured rainfall and fertile soils, kharif as well as rabi utilisation on this project is low. If block system is introduced and more area is sanctioned for sugarcane and banana, the position of the kharif and rabi utilisation may improve to some extent.

(ii) CADA can play a crucial role to improve the utilisation on this project by adopting various measures such as land levelling and land shaping, proper maintenance of the distribution system and field channels, extension services, credit and infrastructural facilities, proper irrigation management, timely supply of water, training and guidance to the farmers etc.

(iii) As the problem of water logging, salinity and alkalinity is serious in the Purna command area, the CADA

should undertake certain effective measures like proper drainage system, underground drainages, digging of wells, lining of the distributaries and field channels and their proper maintenance, to reclaim the water logged area and to prevent further damage to lands due to water logging.

(iv) The Rotational Water Supply System (RWSS) should be introduced on this project so as to avoid several malpractices, wasteful use of water and irregular supply of water, to reduce the conveyance losses and to improve the efficiency and management of water.

(v) Transit losses on this project are heavy due to the construction defects and non-maintenance of the field channels and water courses. Consequently, there is heavy percolation, seepages and leakages and growth of weeds. These losses should be minimised by adopting measures like lining of the distribution system, proper maintenance, modern water management practices, etc.

It must be noted in conclusion that the utilisation of irrigation potential during the kharif and the rabi season is quite low on the Purna project despite the measures taken by CADA. The study of the utilisation of irrigation potential on Purna project thus brings out the need of a thorough study before taking up an irrigation project in assured rainfall areas. The Government must take into account the various factors like the pattern of rainfall, soil type, crops grown

to assess realistically the crops likely to be grown after the availability of irrigation facility. If the prospects of utilisation are not bright alternative project schemes should be explored.

References

1. Report of the Committee of Official and Non-official Members to find out the causes of under-utilisation of irrigation potential of Purna Project (in Marathi), Bombay : Government of Maharashtra, 1972, p. 4.
2. C. Clark and I. Carruthers, The Economics of Irrigation, The English Language Book Society and Liverpool University Press, Liverpool, 1983, p. 146.
3. V. V. Borkar and M. D. Padhye, Purna River Valley Project, Aurangabad : Marathwada University, 1972, pp. 199-200.
4. Report of the Committee of Ministers on Under-utilization of Created Irrigation Potential, Ministry of Irrigation and Power, Government of India, New Delhi, 1973, p. 115.
5. Op.cit., L. W. Ambegaonkar, Ph.D. Thesis, pp. 152-182.
6. D. A. Solanke, G. K. Sangle and R. R. Chole, "Factors Associated with Under-utilisation of Canal-Irrigation", Behavioural Sciences and Rural Development, January, 1979, pp. 43-47.
7. Report of the Maharashtra State Irrigation Commission, Government of Maharashtra, Bombay, 1962, p. 45.
8. Op.cit., the Committee of Ministers on Under-utilisation, p. 42.
9. Op.cit., L. W. Ambegaonkar, Ph.D. Thesis, pp. 105.
10. G. S. Pandya, "Waterlogging Causes and Measures for its Prevention in Chambal Command of M.P.", Symposium on Waterlogging Causes and Measures for its Prevention, 1972, Vol. II, p. 53.

11. Op.cit., L. W. Ambegaonkar, Ph.D. Thesis, p. 174.
12. Ibid., pp. 172-73.

CHAPTER IV

GHOD RIVER PROJECT

4.1 Brief History

The eastern parts of Pune district and the adjoining parts of Ahmednagar district are chronically drought affected areas as the rainfall in this tract is scanty and unevenly distributed. The annual precipitation varies from 450 mm to 600 mm. Soils in this area are suitable for cultivation but in the absence of an assured supply of water the yields are uncertain and low. Though Beale and others carried out extensive investigations on the river Ghod and its tributaries viz. the Kukadi and the Mina, for protective irrigation works in the first decade of the present century, the Ghod project was taken up only after the widespread drought of 1952-53.

Initially, it was proposed to construct only a weir on the river and two canals for diverting the monsoon and the post-monsoon flow mainly for kharif irrigation and only to a small extent during the rabi season. It was, however, felt necessary to have some storage at the weir site so as to provide an assured irrigation facility to these areas. The earlier proposal was therefore revised. Finally, it was decided to construct a full-fledged dam to ensure the necessary storage.

4.2 Salient Features of the Project

The Ghod project was undertaken mainly to protect the famine affected areas of Pune and Ahmednagar districts from the frequent drought and to mitigate the distress of the people in these areas. The project comprises a storage dam across the river Ghod which rises near Bhimashankar in the Sahyadri range. The river forms the district boundary of Pune and Ahmednagar districts, flowing from west to east and finally meets the river Bhima near Daund town about 12 miles below the Ghod Dam site. The dam site is 10 miles downstream of the bridge at Sirur on the Pune-Nagar road and is located near the village Vadgaon in Shrigonda taluka (Ahmednagar district) on one side and Chinchani in Sirur taluka (Pune district) on the other. The catchment area of the river at the site of the dam is 3,627 sq.km. and the average yield of water is 40,000 m.c.ft. The lake submerged an area of 2,846 hectares and 7 villages.

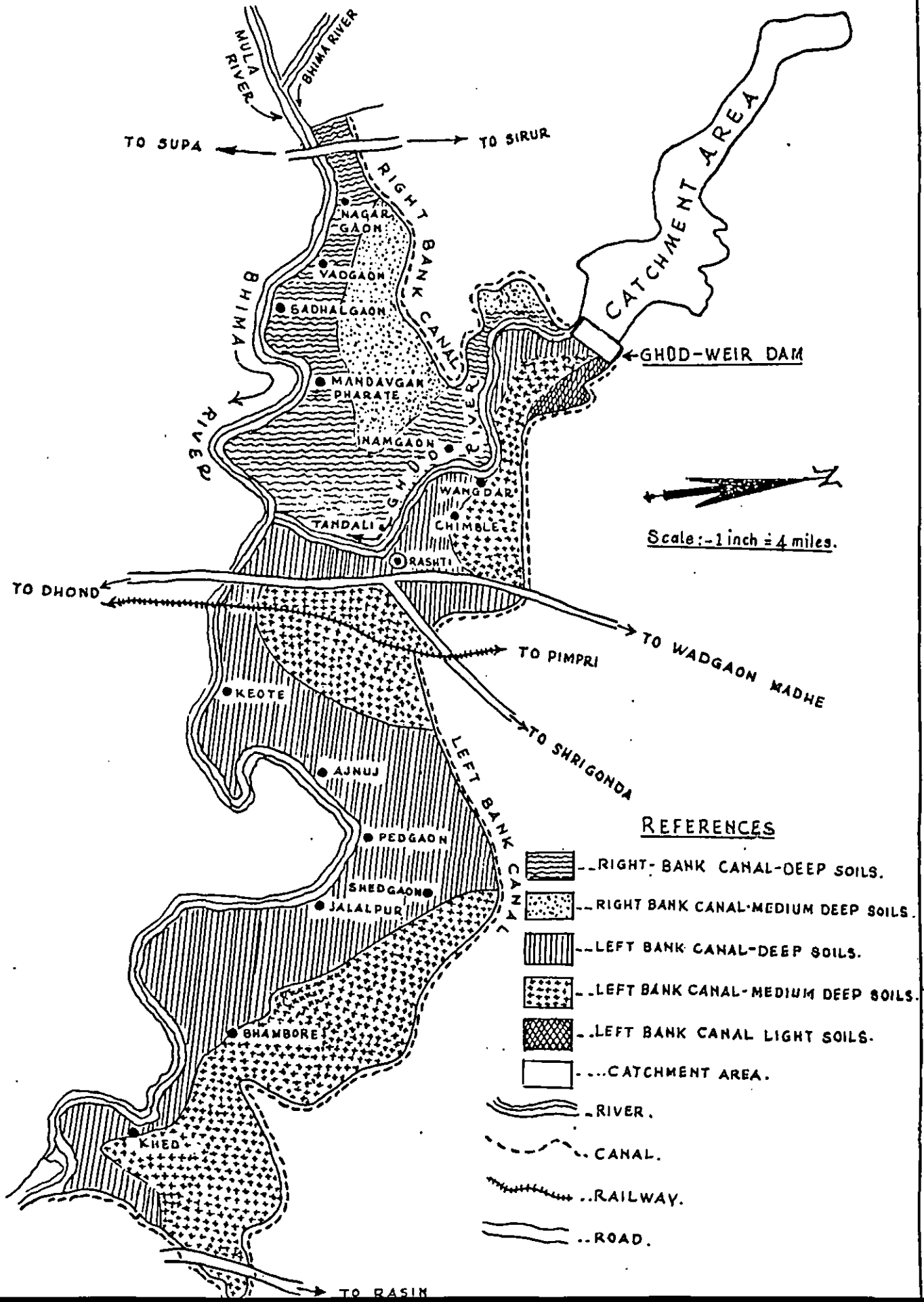
There are two canals viz. Ghod Left Bank Canal and Ghod Right Bank Canal. The Left Bank Canal is 54 miles long and has a discharging capacity of 500 cusecs; with irrigable command of 17,920 hectares. The Right Bank Canal is 21 miles long having a discharging capacity of 185 cusecs to irrigate an area of 7,040 hectares. The total irrigable command area of the Ghod project is 24,960 hectares (62,400 acres) belonging to 6,243 cultivators in 41 villages from three talukas; of these 14 villages are in Sirur taluka, 16 villages in

Shrigonda taluka and 11 villages in Karjat taluka.

The actual work on dam construction commenced in 1954 and the work was completed in 1964-65. The salient features of the project are given below:

Sr.No.	Item	Details
1.	Type of head work	Composite dam
2.	Longitude	74°30'
3.	Latitude	18°40'
4.	Catchment	3,627 sq.kms.
5.	Yield of catchment	1,134 mm ³
6.	Maximum flood discharge	2,61,700 cusecs
7.	Maximum height of dam	28.64 metres
8.	Length of dam	2,664 metres
9.	Storage capacity	216.31 mm ³
10.	Live storage	154.81 mm ³
11.	Dead storage	61.50 mm ³
12.	Command area	
	a) Gross command area	53,008 hectares
	b) Cultivable command area	41,964 hectares
	c) Irrigable command area	24,960 hectares
	d) Irrigation intensity	49%
	e) Cropping intensity	100%
13.	Ultimate irrigation potential	24,960 hectares
14.	Total cost of the project	Rs. 5.95 crores

MAP SHOWING THE GHOD-WEIR PROJECT COMMAND.



Scale: - 1 inch = 4 miles.

REFERENCES

- RIGHT BANK CANAL-DEEP SOILS.
- RIGHT BANK CANAL-MEDIUM DEEP SOILS.
- LEFT BANK CANAL-DEEP SOILS.
- LEFT BANK CANAL-MEDIUM DEEP SOILS.
- LEFT BANK CANAL LIGHT SOILS.
- ...CATCHMENT AREA.

- RIVER.
- CANAL.
- RAILWAY.
- ROAD.

4.3 Soil Classification and Rainfall Pattern

The Ghod project lies in the scarcity tract under the agro-climatic zone III. Soils in this command vary from light to deep black. Deep black and medium deep black soils are found in the areas adjoining the rivers Ghod and Bhima. The Soil Survey Officer, Department of Irrigation, Pune Division, has carried out a survey of a total area of 1,24,450 acres (50,384.6 hectares) in the command area. The distribution of the soils in the command area is presented in Table 4.1.

Table 4.1 : Distribution of the Soils in the Ghod Command Area

Type	Area (ha)	Percentage
Light soils	18,664.0	37.04
Medium soils	17,781.4	35.30
Deep black soils	13,939.2	27.66
Total	50,384.6	100.00

Source : Ghod Project, Department of Agriculture, Government of Maharashtra, Pune, 1970, p. 6.

4.4 Proposed Cropping Pattern

The cropping pattern for Ghod project has been designed by taking into consideration the existing crop pattern, the future possibilities of development as well as the scarcity

conditions in the area. In the original project report the crop pattern proposed was as follows : Kharif 33.33 per cent, two seasonals 33.33 per cent and rabi 33.33 per cent. No perennials were proposed since the canal was designed to be operated for eight months only. In order to increase the percentage return (from 1.21% to 2.87%), the original crop pattern was revised at the time of submission of the project to the C.W. & P.C. As perennials were included in the revised cropping pattern, the area to be irrigated was reduced from 75,000 acres to 62,400 acres due to the heavy water requirements of the perennial crops. Table 4.2 shows the cropping pattern proposed for the Ghod command area.

Table 4.2 : Proposed Cropping Pattern in the Command of Ghod Project

Crops	Area (ha)	Percentage
Cane	1,920	7.7
Overlap cane	640	2.6
Two seasonals	5,600	22.4
Kharif	10,000	40.1
Rabi	6,800	27.2
Total	24,960	100.0

Source : Revised Administrative Approval for Ghod Project, Ahmednagar Irrigation Division, Irrigation & Power Department, Government of Maharashtra, p. 25.

4.5 Revised Cropping Pattern, 1979

As the response to the above cropping pattern was not very encouraging, it was felt necessary to replace this cropping pattern taking into consideration the demand of the farmers. There was no demand for the traditional two seasonal crops. Cultivators were reluctant to apply for water in the kharif season. The demand for rabi irrigation recorded an increase to a certain extent while there was a very heavy demand for the hot weather cash crops like groundnut because this crop is quite paying. Accordingly, the CADA prepared a revised cropping pattern for this command area and submitted it to the Government in 1979. The revised cropping pattern is given in Table 4.3.

Table 4.3: Revised Cropping Pattern for the Ghod Project

Crop	Area (ha)	Percentage
Kharif	8,400	40.98
Rabi	9,000	43.90
Hot weather	1,200	5.85
Perennials	1,900	9.27
i) Cane	1,000	4.88
ii) Overlap	500	2.44
iii) Other perennial	400	1.95
Total	20,500	100.00

As the farmers were cultivating the high water consuming crops like summer groundnut instead of low water consuming crops like kharif and two seasonals, the CADA found that it was not possible to irrigate the entire area of 24,960 hectares with the available quantity of water. Hence, the total proposed area to be irrigated has been reduced from 24,960 hectares to 20,500 hectares in the revised cropping pattern. In this cropping pattern, the absolute area under kharif seasonals has been reduced from 10,000 hectares to 8,400 hectares. Two seasonals are altogether dropped in the revised cropping pattern, whereas hot weather crops are newly proposed in lieu of the two seasonals.

Table 4.4 indicates the stages in which water became available for irrigation on this project.

Table 4.4 : Stages of Creating Irrigation Potential

Year	Area (ha)
1964-65	12,800
1965-66	20,800
1966-67	24,960

Though it was planned to create the irrigation potential in 1966-67, the work did not keep pace with the planned schedule and the full potential was created only during

1968-69. Partial irrigation on this project was started since 1959-60.

4.6 The Findings of the Study Undertaken by Pawar and Kadam

J. R. Pawar and C. S. Kadam have studied the problem of under-utilisation of the project potential on this project for the period from 1965-66 to 1971-72. The findings of the study are presented in Table 4.5.

Table 4.5 : Irrigation Potential Created and Utilised in the Ghod Project

Year	(Area in hectares)		
	Irrigation potential created	Irrigation potential utilised	Utilisation per cent
1965-66	19,262.68	16,050.35	83.32
1966-67	18,048.64	17,523.48	97.08
1967-68	24,118.81	20,373.18	84.46
1968-69	25,251.91*	20,550.40	81.38
1969-70	25,251.91	16,943.54	67.09
1970-71	25,251.91	15,250.02	60.39
1971-72	25,251.91	15,306.56	60.61

* Project authority used conversion factor as 2.5 acres = 1 hectare hence irrigation potential is 24,960 ha.

The percentage of utilisation of the available irrigation potential was relatively higher during the initial years.

This was mainly due to the supply of irrigation water at concessional rates to the cultivators. If we consider the year 1968-69, the year of the full development of potential, we find that the proportion of utilisation decreased from 81 per cent to 61 per cent during the period 1968-69 to 1971-72.

To understand the problem of under-utilisation of created potential in its right perspective, it is necessary to find out the extent of utilisation during different cropping seasons. The details of irrigation potential created and utilised during different seasons for the period from 1969-70 to 1971-72 are presented in Table 4.6.

Table 4.6 : Details of Seasonwise Irrigation Potential Created and Utilised

Year	(Area in hectares)		
	Kharif	Rabi	Summer
Potential	13,273.44	9,874.14	2,104.33
<u>Utilisation</u>			
1969-70	3,926.28 (29.58)	9,746.52 (98.71)	3,270.74 (155.43)
1970-71	3,965.19 (29.87)	8,803.75 (89.16)	2,481.08 (117.90)
1971-72	3,356.88 (25.29)	8,194.57 (82.99)	3,755.11 (178.45)

Figures in parentheses indicate the percentage of area irrigated to potential created.

It is seen from Table 4.6 that only 25 to 30 per cent of the potential was utilised in the kharif season during the years 1969-70 to 1971-72. The problem of under-utilisation was, thus, quite serious, nearly 70 to 75 per cent of the available potential remained unused. In the case of rabi season, the actual utilisation had shown a decreasing trend from 98.71 per cent to 83 per cent during the same period. There was, however, over-utilisation of the available potential in the summer season. The reason was that the water left unused in the rabi season was made available for bringing an additional area under irrigation in the summer.

It was reported that late availability of irrigation water in kharif season, long interval between two waterings, lack of adequate credit for acquiring the required inputs, lack of infrastructure facilities and various defects in the irrigation system were the reasons for under-utilisation of the available irrigation facility.

4.7 National Commission on Agriculture, 1973

The National Commission on Agriculture¹ (1973) in its 'Interim Report on Modernising Irrigation System and Integrated Development of Commanded Areas' made a critical appraisal of some of the irrigation projects in different states; the Ghod in Maharashtra was one of the projects selected for this purpose. The area actually irrigated in 1971-72 was less than half (49 per cent) of the planned area and the irrigation

intensity was very low at 28 per cent. The seasonwise utilisation of water is shown in Table 4.7.

Table 4.7 : Seasonwise Utilisation of Water

Season	Utilisation of water (1971-72) available at canal head(m.cu.m.)	Percentage	Designed seasonal allocation (percentage)
Kharif - July to October	45	22.39	52.5
Rabi - October to February	88	43.78	39.2
Hot weather - March to June	68	33.83	8.3
Total	201	100.00	100.0

The problem of under-utilisation during the kharif season was noted to be quite serious on this project. This is because, water (replenishment) for irrigation in the kharif season becomes available only in July and is late for growing kharif crops like cotton, jowar, etc. Hence, the Commission suggested that if some water is kept as a carry over in the storage during summer for sowing of cotton towards the end of April or early May and jowar and other kharif crops in June, the kharif utilisation can be substantially increased.

4.8 Area Actually Irrigated : 1970-71 to 1983-84

The physical area irrigated under different crops and their proportion to the proposed cropping pattern (i.e. planned utilisation) are presented in Tables 4.8 and 4.9 respectively.

4.8.1 Kharif Seasonals

Kharif irrigation depends on a number of factors like rainfall pattern, soil type, the nature of crops grown in the area, demand for irrigation water and the availability of adequate water in the reservoir. Of these the rainfall is the principal factor which determines the use of water during the kharif season.

The Ghod command area lies in a scarcity zone where rainfall is not only very erratic but is also received very late, in August-September. The main crops grown in the kharif season are jowar, bajara and groundnut. Table 4.8 clearly shows large fluctuations in the irrigated area during the kharif season. Initially the utilisation was very low but it showed some increase after the establishment of CADA for this project in 1974-75.

Maximum irrigation was recorded at 7,734 hectares in 1980-81 due to the early replenishment of the reservoir because of adequate rainfall in the month of June. The rainfall received in June at Sirur and Shrigonda was 192.0 mm and

Table 4.2 : Area Actually Irrigated During the Period from 1970-71 to 1983-84

									(Area in hectares)-
Year	Kharif irrigation	Percent share	Rabi irrigation	Percent share	Hot weather irrigation	Percent share	Perennial irrigation	Percent share	Total area under irrigation
<u>Before establishment of C.A.D.A.</u>									
1970-71	2,690	19.9	7,707	56.9	1,840	13.6	1,303	9.6	13,540 = 100
1971-72	3,423	26.9	6,144	48.2	2,047	16.1	1,120	8.8	12,734 = 100
1972-73	3,254	22.5	9,772	67.5	-	-	1,440	10.0	14,466 = 100
1973-74	1,642	15.5	6,657	63.0	1,404	13.3	872	8.2	10,575 = 100
<u>After establishment of C.A.D.A.</u>									
1974-75	3,767	28.2	6,009	45.1	2,785	20.9	777	5.8	13,338 = 100
1975-76	4,656	26.1	9,342	52.4	3,017	17.0	808	4.5	17,823 = 100
1976-77	7,499	29.5	13,372	52.5	3,177	12.5	1,409	5.5	25,457 = 100
1977-78	6,051	26.0	12,044	51.9	3,000	12.9	2,129	9.2	23,224 = 100
1978-79	7,149	29.5	11,322	46.7	4,360	18.0	1,400	5.8	24,231 = 100
1979-80	6,083	29.0	9,059	43.2	4,763	22.8	1,040	5.0	20,950 = 100
1980-81	7,734	33.3	9,949	43.0	3,944	17.0	1,560	6.7	23,187 = 100
1981-82	6,239	29.5	9,923	47.0	3,332	15.8	1,617	7.7	21,111 = 100
1982-83	4,280	23.1	10,266	55.6	2,137	11.6	1,780	9.7	18,463 = 100
1983-84	5,515	28.0	9,125	46.3	3,398	17.3	1,650	8.4	19,688 = 100

Source : Annual Administration Report of the CADA, 1983-84, Irrigation Department, Pune, Annexure XVIII.

Table 4.9 : Potential and Seasonwise Utilisation of Water on Ghod Project

Year	Kharif utilisation	Percentage utilised to potential	Rabi utilisation	Percentage utilised to potential	Hot weather utilisation	Percentage utilised to potential	Perennial utilisation	Percentage utilised to potential	(Area in hectares)-	
									Total utilisation	Percentage utilised to potential
Potential	10,000		6,800		-		2,560		24,960	
<u>Utilisation</u>										
1970-71	2,690	26.90	7,707	113.34	1,840	-	1,303	50.90	13,540	54.25
1971-72	3,423	34.23	6,144	90.35	2,047	-	1,120	43.75	12,734	51.02
1972-73	3,254	32.54	9,772	143.70	-	-	1,440	56.25	14,466	57.96
1973-74	1,642	16.42	6,657	97.90	1,404	-	872	34.06	10,575	42.37
1974-75	3,767	37.67	6,009	88.37	2,785	-	777	30.35	13,338	53.44
1975-76	4,656	46.56	9,342	137.38	3,017	-	808	31.56	17,823	71.41
1976-77	7,499	74.99	13,372	196.65	3,177	-	1,409	55.04	25,457	102.09
1977-78	6,051	60.51	12,044	177.12	3,000	-	2,129	83.16	23,224	93.04
1978-79	7,149	71.49	11,322	166.50	4,360	-	1,400	54.69	24,231	97.08
Potential	8,400		9,000		1,200		1,900		20,500	
1979-80	6,083	72.42	9,059	100.65	4,768	397.33	1,040	54.73	20,950	102.19
1980-81	7,734	92.07	9,949	110.54	3,944	328.67	1,560	82.10	23,187	113.11
1981-82	6,239	74.27	9,923	110.25	3,332	277.67	1,617	85.10	21,111	102.98
1982-83	4,280	50.95	10,266	114.07	2,137	178.08	1,780	93.68	18,463	90.06
1983-84	5,515	65.65	9,125	101.39	3,398	283.17	1,659	87.31	19,682	96.01

Source : Table compiled from the Annual Administration Report of the CADA for Ghod and Bhima Projects, Pune, 1983-84, Annexure XVIII.

214.0 mm respectively. On the other hand, the irrigated area was the lowest at 4,280 hectares during 1982-83 on account of non-availability of sufficient water for irrigation in the storage due to late monsoon. Rainfall recorded at Sirur during the months of June and July was only 31.0 mm and 20.0 mm respectively while there was no rainfall in August. (The monthly rainfall recorded at Sirur Rain-guage Station from 1970-71 is given in Appendix E.) Similarly, a considerable area (7,499 ha.) was brought under irrigation during the year 1976-77 mainly due to early rainfall in June and thereby the availability of adequate water.

The area irrigated under kharif crops remained below the area proposed for these crops in the cropping pattern. Kharif utilisation does not show any trend but it fluctuated widely from 16 per cent to 92 per cent during the period under consideration, depending upon the availability of water in the particular year.

The case of kharif utilisation in this area is very peculiar. Lack of assurance for supply of irrigation water to the kharif crops is the most important reason for non-utilisation or under-utilisation of irrigation facility in this region. This is, of course, due to very late (in August) replenishment of the reservoir. The Irrigation Department, Sirur, also informed the Author that the Ghod project is not reliable for kharif irrigation as the reservoir, on many occasions, fills up only partly or less than the sill-level

because of the erratic nature of rainfall. Therefore, supply of water for irrigation in this season can be given only if there is adequate water in the reservoir.

Further, kharif cultivation is not very popular in this area, whereas the rabi crops are grown extensively. As soils are fertile, a few showers received at the fag end of monsoon suffice for the rabi crops. Moreover, it is a common practice in this area to take rabi crops as a second crop after harvesting the summer groundnut. Cultivators keep their summer groundnut fields fallow during the kharif season for growing rabi crops. The summer groundnut crop has gained much popularity in this area. The area irrigated under this crop was 2,367 hectares in 1983-84 in the total hot weather irrigated area of 3,398 hectares.

Various measures are being taken by the CADA to improve the kharif utilisation on this project. One of the most effective measures to ensure the utilisation during the kharif season is the introduction of the block system. According to this system, sanctions are given to sugarcane with one or two non-cash crops in kharif and rabi seasons. Though the block system has been introduced to ensure the kharif utilisation, kharif utilisation has not shown much improvement during the initial years. The cultivators prefer to keep the land fallow in the kharif season for the cultivation of rabi crops, though the charges for the kharif season are included in the block rates. The cultivation of kharif crops under the block

system was made compulsory by the State Government during a special kharif campaign launched in 1974-75. But in the case of Ghod project, the compulsion of the kharif cultivation in the sugarcane block is very difficult. Firstly, replenishments are received very late due to late monsoon, and secondly, irrigation year starts from 1st July but, farmers need at least 1 or 2 waterings in the month of June.

4.8.2 Rabi Seasonals

It will be observed from Table 4.8 that the area actually irrigated under rabi seasonals appeared to be quite satisfactory throughout the period of study. This has traditionally been a rabi tract because of the nature of the rainfall pattern. Rabi irrigation showed some fluctuations during the initial years. When this project was transferred to the CADA for its administration the utilisation in this season has shown a steady increase.

Though the trend of rabi utilisation was not definite, the irrigated area in this season was more than the proposed area during the period from 1974-75 to 1983-84 excepting the year 1974-75 which was the first year of the working of CADA. Large area was brought under irrigation during three years, 1976-77, 1977-78 and 1978-79, due to the availability of additional water through the Yedgaon dam. There was no demand for irrigation on this project as the conveyance system was not ready for the distribution of water. When the command

area of the Yedgaon project got ready to receive irrigation less and less quantity of water was made available from this project and hence, the rabi irrigated area on the Ghod project registered a fall in the subsequent years. Now the rabi irrigated area has stabilised around 9,000 to 10,000 hectares.

Rabi irrigation seems to be satisfactory because of the extensive cultivation of wheat in this season where the proportion of wheat is more than 40 per cent of the total rabi irrigated area. Table 4.10 shows the distribution of the irrigated area under different rabi crops since 1979-80 to 1983-84.

Table 4.10 : Area Irrigated under Various Crops During the Rabi Season

Crop	(Area in hectares)				
	1979-80	1980-81	1981-82	1982-83	1983-84
Jowar	5,889 (65.01)	5,827 (58.60)	5,464 (55.06)	6,519 (63.50)	4,761 (52.18)
Wheat	2,718 (30.00)	3,595 (36.10)	4,066 (40.98)	2,954 (28.77)	3,926 (43.02)
Other crops	452 (4.98)	527 (5.30)	393 (3.96)	793 (7.73)	438 (4.80)
Total	9,059 (100.00)	9,949 (100.00)	9,923 (100.00)	10,266 (100.00)	9,125 (100.00)

Note : Figures in parentheses show percentage to total irrigated area.

Wheat is grown under irrigated conditions in this command area. Though wheat cropped area is less than the rabi jowar cropped area, the requirements of water of wheat crop is more compared to that of jowar. Two-three waterings are quite enough for the maturity of rabi jowar, whereas wheat requires at least 5-6 waterings during its life time.

4.8.3 Hot Weather Seasonals

As noted earlier, two seasonals received no response in this command area as the farmers are not acquainted with their cultivation. Further, there is no guarantee about the supply of water to these crops due to late monsoon in this region.

Groundnut, hybrid jowar, Baishakhi mung, sunflower, are some of the main crops grown during the hot weather season. Being a cash crop, summer groundnut is the most popular crop in this area. Table 4.11 indicates the area irrigated under groundnut and other crops.

Table 4.11 : Area Irrigated During Hot Weather Season

Crop	(Area in hectares)				
	1979-80	1980-81	1981-82	1982-83	1983-84
Groundnut	3,153 (66.13)	1,851 (46.93)	2,017 (46.83)	1,136 (53.16)	2,367 (81.00)
Other crops	1,615 (33.87)	2,093 (53.07)	2,290 (53.17)	1,001 (46.84)	555 (19.00)
Total	4,768 (100.00)	3,944 (100.00)	4,307 (100.00)	2,137 (100.00)	2,922 (100.00)

Note : Figures in parentheses indicate percentage to total irrigated area.

Hot weather irrigated area showed a constant increase during the period 1970-71 to 1979-80 excepting two years. Thereafter, it decreased in the subsequent three years and again increased in the last year. There was no irrigation during 1972-73 - a drought year when the reservoir was almost dry by April. During 1982-83, the lowest area (2,137 hectares) was irrigated since the formation of CADA, on account of limited storage. The live storage available on 1.3.1983 was 2,807 m.c.ft. as against the live storage of 3,932 m.c.ft. during the previous year. There was also a provision made for water supply to Shrigonda town. As the quantity of water available in the storage on 1.3.1984 was 4,791 m.c.ft., the area irrigated was considerable, about 3,398 hectares in the summer season of 1983-84.

On Ghod project, only 1,200 hectares could be irrigated with the available water. But the area actually irrigated during the hot season was much larger i.e. 3 to 4 times more than the projected area excepting the year 1982-83. This was possible because a substantial quantity of additional water was received from the year 1976-77 through the Yedgaon reservoir on Kukadi river. Since 1984-85, the water for irrigation from Yedgaon was no more available as the works on canal and distribution were completed.

There is no problem of under-utilisation during the hot weather season. The storage limitations, heavy evaporation

and transit losses, etc. are the principal factors which determine the utilisation in this season.

4.8.4 Perennials and Other Perennials

A slightly more than one-tenth of the total area was sanctioned under perennials in the initial cropping pattern. The proportion of these crops was kept minimum as the Ghod project was constructed mainly to eliminate the frequent scarcity conditions in this area. In the revised cropping pattern (1979) the area proposed to be irrigated under perennials has been reduced from 2,560 hectares to 1,500 hectares. Other perennials have also been proposed in the new cropping pattern which account for a total area of 400 hectares.

There was no specific trend regarding the area irrigated under perennials but the utilisation showed an upward trend in the latter period excepting the year 1983-84 when more than 85 per cent of the proposed area is irrigated under these crops. It is observed that the cultivators normally take 1-2 years to prepare their lands for the cultivation of sugarcane after the creation of the blocks. That is why the irrigated area under sugarcane appeared to be low during the years 1974-75 and 1975-76. Thereafter, it showed a considerable increase but decreased in the 5th/6th year i.e. towards the end of the contract period. After the re-creation of new blocks sometimes in 1980 there was a gradual increase in the sugarcane area. This area is likely to increase still further.

The block system was introduced on this project to ensure kharif utilisation. Under this system, water is supplied throughout a block for a period of 6 years. Kharif and rabi crops are sanctioned with sugarcane crop but the provision is that the area under sugarcane should not be more than one-fourth of the total block area. For instance, under cane blocks $1/4$ area will be under sugarcane and $3/4$ under seasonal crops. During the hot weather season only sugarcane is allowed. This system proved to be beneficial as it gives an assurance of water for a period of 6 years. Government also benefited from this system by getting permanent customers.

Other perennials (fruit trees) are grown in a very limited area. Soil in this command area is generally suitable for these crops as 35 per cent soils are medium black and well-drained. Since there is no assurance for year round supply of water due to the erratic rainfall, there is a risk of drying up of fruit trees if no irrigation is available for two-three months. Such a failure of fruit plantation costs heavy losses in terms of money and labour. Hence, the farmers are not in a position to take risk and the area under other perennials is very limited.

The above data on the area irrigated under different crops revealed that the cropping pattern particularly revised, was by and large, fully realised. Rabi and hot-weather utilisation was quite satisfactory - more than the projected area was actually under irrigation. The target of perennials

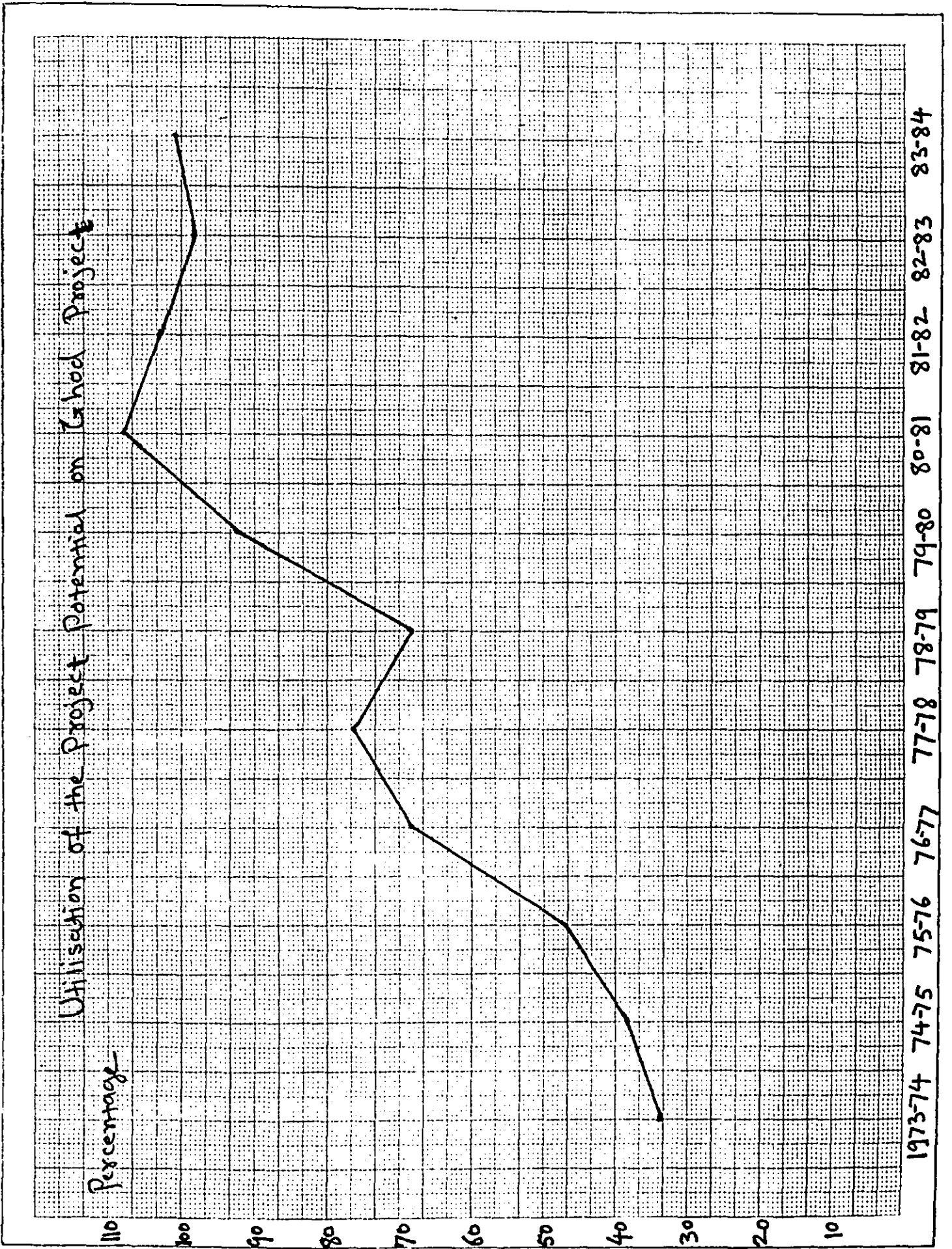
is also achieved. But the kharif utilisation is lagging behind the planned area. This data also demonstrated that there was a definite shift in the cropping pattern from subsistence rainfed farming to irrigated commercial farming. Kharif and rabi food-grains were the main crops grown in the area before the Ghod irrigation project. Besides these crops, at present, cash crops like sugarcane and summer groundnut are grown extensively in this area. This change was, undoubtedly, brought about due to the availability of irrigation facility in this region through the Ghod project.

4.9 Utilisation of the Project Potential in Terms of Base Crop Area

While finding out the extent of utilisation on this project, the physical area irrigated during the various years are converted into the base crop area (i.e. rabi seasonals) by giving the same treatment as has been followed in the case of Purna project. This data were then compared with the projected area to be irrigated in the cropping pattern obtained in terms of rabi seasonals. The details regarding the conversion of areas into the equivalent area under rabi crops are presented in Appendix I. Table 4.12 and Figures 3 and 4 give the details about the percentage utilisation of the irrigation potential of this project.

If we consider the overall utilisation on this project we find from Table 4.12 that the utilisation was very low

FIGURE 3



— Year —

FIGURE 4

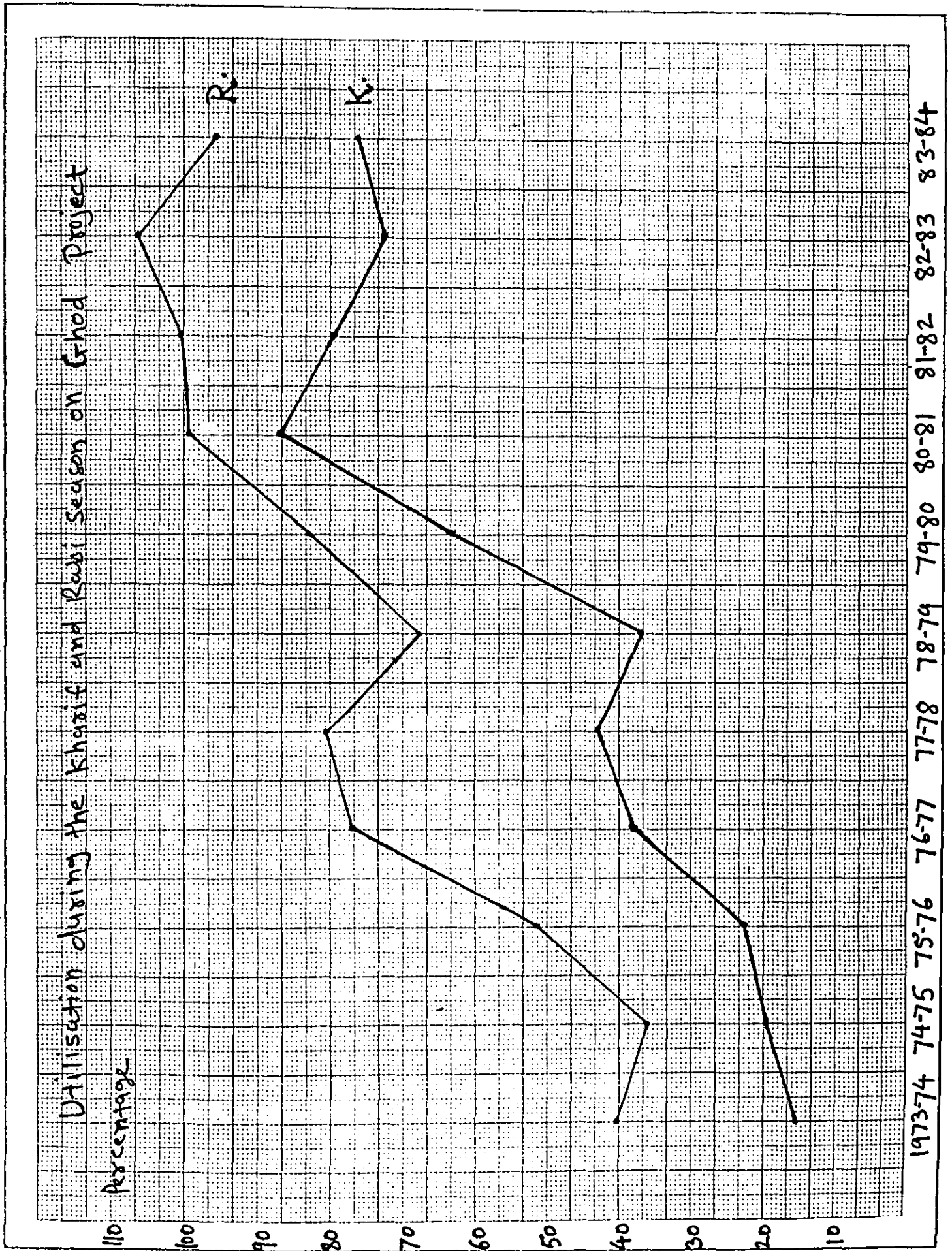


Table 4.12 : Utilisation of the Project Potential

Year	(Area in hectares)			
	Kharif	Rabi	Hot weather	Total
Base crop area to be irrigated as per proposed cropping pattern	24,044.38	22,878.92	10,756.30	57,679.60
<u>1970-71</u>				
Base crop area irrigated	5,674.41	11,616.46	9,339.38	26,630.25
Percentage utilisation	23.60	50.77	-	46.17
<u>1971-72</u>				
Base crop area irrigated	5,606.28	9,504.39	9,005.24	24,115.91
Percentage utilisation	23.32	41.54	-	41.81
<u>1972-73</u>				
Base crop area irrigated	6,455.51	14,092.51	6,050.42	26,598.44
Percentage utilisation	26.85	61.60	-	46.11
<u>1973-74</u>				
Base crop area irrigated	3,693.65	9,273.31	6,612.71	19,579.67
Percentage utilisation	15.36	40.53	-	33.94
<u>1974-75</u>				
Base crop area irrigated	4,802.86	8,340.27	9,114.09	22,257.22
Percentage utilisation	19.97	36.45	-	38.59
<u>1975-76</u>				
Base crop area irrigated	5,479.16	11,766.28	9,731.63	26,977.07
Percentage utilisation	22.79	51.43	-	46.77
<u>1976-77</u>				
Base crop area irrigated	9,147.72	17,599.50	12,592.89	39,340.11
Percentage utilisation	38.04	76.92	-	68.20

Contd...

Table 4.12 : (Continued)

Year	Kharif	Rabi	Hot weather	Total
<u>1977-78</u>				
Base crop area irrigated	10,357.91	18,431.75	15,246.34	44,036.00
Percentage utilisation	43.08	80.56	-	76.34
<u>1978-79</u>				
Base crop area irrigated	8,891.07	15,522.49	15,039.75	39,453.31
Percentage utilisation	37.00	67.35	-	68.40
Base crop area to be irrigated as per the revised cropping pattern (1979)	11,212.05	14,700.67	10,503.57	36,416.29
<u>1979-80</u>				
Base crop area irrigated	7,111.53	12,179.37	14,384.07	33,674.97
Percentage utilisation	63.42	82.85	136.94	92.47
<u>1980-81</u>				
Base crop area irrigated	9,754.96	14,629.55	14,838.29	39,222.80
Percentage utilisation	87.00	99.52	141.27	107.71
<u>1981-82</u>				
Base crop area irrigated	8,945.08	14,774.57	13,792.39	37,512.04
Percentage utilisation	79.78	100.50	131.31	103.01
<u>1982-83</u>				
Base crop area irrigated	8,148.81	15,606.63	11,967.38	35,722.82
Percentage utilisation	72.68	106.16	113.94	98.09
<u>1983-84</u>				
Base crop area irrigated	8,569.07	14,075.58	14,069.66	36,714.31
Percentage utilisation	76.43	95.75	133.95	100.82

particularly before the setting up the CADA in 1974-75 though full potential was created in 1968-69. The potential utilised in 1973-74 was only 34 per cent. A number of factors that attributed to low utilisation were:²

i) As irrigation was started for the first time in this area; farmers were not familiar with the irrigated farming.

ii) There was a tendency on the part of the farmers not to shift to the irrigated agriculture due to their traditional outlook.

iii) Lack of adequate capital and credit which is necessary for irrigated farming.

iv) Lack of or inadequate work of land preparation for irrigation like land levelling, land shaping, etc.

v) Non-maintenance of water courses and field channels, and

vi) Low and un-assured prices for the agricultural produce.

The Committee of Ministers³ (1973) on Under-utilisation of Created Irrigation Potential pointed out that the cultivators' non-use of water in kharif season was the principal reason for the lag in utilisation on this project. Further, only about two-third command area of the project was covered under the water courses. Therefore the introduction of a short duration kharif crop, planned propaganda and demonstration

in this respect were some of the measures suggested to improve the utilisation, particularly during the kharif season on this project.

A bench mark survey entitled "An Investigation into the Socio-Economic Conditions in Ghod Command Area"⁴ (1980) was undertaken by R. G. Patil and others for the period 1973-74 - 1975-76 to furnish a sound informative foundation of carefully ascertained facts which would serve as a basis for further decision and action. The survey revealed that there were a number of reasons for under-utilisation and improper utilisation of water in this project. The principal reasons were as under: defective distribution system and the necessity of lining of canal and distributaries to minimise losses and improving irrigation efficiency, need of educating the farmers on economic use of canal water, improper land levelling, farm development and drainage programmes for reclaiming water logged area, lack of infrastructure, adequate marketing facilities and lack of agro-industries. Further, late sanction for water use for crops which affects the timely sowing and proper decision making by the farmers was also mentioned as one of the main factors for under-utilisation. As the problem of non-utilisation/under-utilisation of irrigation water during kharif season was more serious, the sample farmers were also asked as to why they could not avail the irrigation facility in kharif season. The details of the reasons reported by them are presented in Table 4.13.

Table 4.13 : Reasons for Non-utilisation of Water During Kharif Season

Reason	No. of farmers
Lack of capital	25 (11.74)
Adequate rains	40 (18.78)
Using well water	23 (10.80)
Kept fallow	53 (24.88)
Land situated at the tail-end	35 (16.43)
Defective distributaries	15 (7.04)
Irregular water supply	32 (15.02)
Non-co-operation of the officials	37 (17.37)
Total	213 (100.00)

Figures in the parentheses are percentages to total.

Source : Op.cit., R. G. Patil and others, p. 146.

All the sample farmers were of the opinion that the CADA has helped in bringing about the overall development of the command area. This authority has introduced non-traditional crops and has also been helping in the spread of knowledge about improved agricultural practices.

Table 4.12 indicates a steady increase in utilisation after the project was transferred to CADA in 1974-75 for its management. The utilisation increased from about 39 per cent

in 1974-75 to 108 per cent in 1980-81 excepting the year 1979-80 in which the utilisation was 68 per cent. Again, the utilisation decreased in the following two years but increased in the last year of study i.e. 1983-84 when the utilisation was 101 per cent. In this way the utilisation on this project is quite satisfactory due to the various reasons mentioned below:⁵

i) Establishment of Command Area Development Authority was the principal factor that led to steady increase in the utilisation on this project. CADA took various effective steps like (a) ayacut development, maintenance of the field channels, free/concessional water facility, etc. (b) Land development works like land levelling, land shaping, drainage, etc.

ii) CADA formed three irrigation groups comprising Extension Officer, Agricultural Officer and Deputy Director and 30-35 Agricultural Assistants and Supervisors. These groups made a tour through the villages in the command area and gave valuable information and guidance to the cultivators on different aspects of the irrigation system and tried to solve the problems related with irrigated agriculture.

iii) The trial-cum-demonstration farm at Kasthi also demonstrated to the farmers the modern methods of cultivation, use of the improved seeds, fertilisers and pesticides. Training and short-duration courses and discussions on irrigation management and economic use of water were organised at the Kasthi farm.

iv) Introduction of the block system guaranteed the supply of water for a period of six years and ensured utilisation during the kharif season.

v) Availability of an additional irrigation water through the Yedgaon dam enabled the CADA to bring more and more area under irrigation particularly during the hot weather season.

vi) Furthermore, CADA has adopted a flexible policy regarding the cropping pattern. A more suitable cropping pattern has been suggested in 1979 in which summer groundnut has been proposed in the place of two seasonals.

vii) CADA has played an important role in solving the problem of credit with the help of the co-operative credit sector.

viii) Some special programmes were launched particularly for the weaker sections of the farm community according to which grants were provided in terms of supply of seeds, fertilisers, pesticides, etc. in kind.

ix) The Administrator, Executive Engineer, Officers and other staff members accepted the challenge and made rigorous efforts to improve the utilisation on this project. Cultivators also gave quite encouraging response as this is a scarcity area. As a result of all the above, the utilisation on the Ghod project has increased substantially.

The CADA thus played a very pivotal role in helping

to achieve the basic objective of bridging the gap between the creation and utilisation of the irrigation potential in the Ghod command area. At present, all the available water is fully consumed and the utilisation has stabilised around 100 per cent. Hence, the project was delinked from the supervision of the CADA since 1985-86 which is the best indicator about the performance of this authority.

4.10 Efficiency Achieved in Water Utilisation

Table 4.14 indicates the area to be irrigated per Mm^3 of water during different seasons in the project report.

Table 4.14 : Planned Utilisation of Water

Season	Area to be irrigated (ha) per Mm^3
Kharif	128.26
Rabi	146.42
Hot weather	49.86

Source : A Success Story of Ghod Project, Command Area Development Authority for Ghod and Bhima.

The area actually irrigated and the water utilised during the period from 1976-77 to 1983-84 is given in Tables 4.15 and 4.16 while the average utilisation over this period is presented in Table 4.17.

Table 4.15 : Seasonwise Area Irrigated and Water Utilised

Year	Kharif			Rabi			Hot weather		
	Water utili- sed (Mm ³)	Area irriga- ted (ha)	Area irriga- ted per Mm ³ (ha)	Water utili- sed (Mm ³)	Area irriga- ted (ha)	Area irriga- ted per Mm ³ (ha)	Water utili- sed (Mm ³)	Area irriga- ted (ha)	Area irriga- ted per Mm ³ (ha)
1976-77	66.17	8,908	134.62	115.98	14,781	127.44	65.52	4,586	70.00
1977-78	74.13	8,180	110.35	85.17	14,173	166.41	56.76	5,129	90.36
1978-79	74.05	8,549	115.45	99.11	12,722	128.36	91.99	5,760	62.61
1979-80	46.60	7,123	152.85	80.08	10,099	126.11	90.07	5,808	64.48
1980-81	57.11	9,294	162.74	89.20	11,509	129.02	80.51	5,504	68.36
1981-82	61.47	7,856	127.80	98.88	11,540	116.71	109.67	4,949	45.13
1982-83	58.73	6,060	103.18	102.68	12,046	117.31	63.63	3,917	61.56
1983-84	25.49	7,159	280.85	88.89	10,784	121.32	120.36	5,057	42.01

Source : 1) Success Story of Ghod Project, 1981, CADA, Pune, Annexure C.

2) Annual Administration Reports of CADA for Ghod and Bhima, 1981-82, 1982-83 and 1983-84, Pune, Annexure V.

Table 4.16 : Actual Utilisation as Percentage of Planned Water Utilisation During Different Seasons

Year	Kharif		Rabi		Hot weather	
	Actual utilisation per Mm ³	Percent utilisation	Actual utilisation per Mm ³	Percent utilisation	Actual utilisation per Mm ³	Percent utilisation
Planned utilisation per Mm ³	128.26		146.42		49.86	
1976-77	134.62	105.06	127.44	87.04	70.00	140.39
1977-78	110.35	86.04	166.41	113.65	90.36	181.23
1978-79	115.45	90.01	128.36	87.66	62.61	125.57
1979-80	152.85	119.17	126.11	86.13	64.48	129.32
1980-81	162.74	126.88	129.02	88.12	68.36	137.10
1981-82	127.80	99.64	116.71	79.71	45.13	90.51
1982-83	103.18	80.44	117.31	80.12	61.56	123.46
1983-84	280.85	218.96	121.32	82.86	42.01	84.25

Table 4.17 : Average Area Irrigated During the Period
1976-77 to 1983-84

Season	(Area in hectares)		
	Area planned to be irrigated (per Mm^3)	Average area irrigated (per Mm^3)	Per- centage
Kharif	128.26	148.48	115.76
Rabi	146.42	129.08	88.16
Hot weather	49.86	63.06	126.47

Table 4.17 shows that the efficiency in water use is more or less achieved as expected in the project report. In fact, it is more than the planned one by 16 per cent and 26.5 per cent during the kharif and hot weather season respectively, whereas in the rabi season, it is 88 per cent of the expected utilisation.

4.11 Transit Losses on the Ghod Project

As we know the losses in transit are very heavy especially from the distributaries, water courses and field channels due to the large scale seepages and leakages. Defective construction of the canal structure, poor maintenance of field channels, careless handling of water supply and in many cases rat holes are chiefly responsible for the high proportion of the seepages and leakages and thereby, the heavy transit losses.

The transit losses which are generally heavy on various projects, necessarily reduce the discharge in the channels reducing the area irrigated in the command. It will be interesting to study the position of the Ghod project in this regard because this project is located in the scarcity area. First of all, we shall consider a broad assessment of this loss made by the National Commission on Agriculture in October 1972 during its visit to the project. The figures for the year 1970-71 are given in Table 4.18.

It can be seen from Table 4.18 that out of the total quantity of water let in at the canal head in 1970-71, the estimated quantity available at the field head was only 34 per cent and 31.6 per cent on the left and the right bank canals respectively while it was 33.5 per cent on the entire project. It was further observed that in 1971-72, the water released from the reservoir was 145 m.cu.m. of which only 39 per cent (56 m.cu.m.) reached the fields while 61 per cent (89 m.cu.m.) was lost in transit.

The transit losses during the rabi and the hot weather seasons on this project for the period from 1980-81 to 1983-84 are indicated in Tables 4.19 and 4.20.

It is estimated that of the total water released at the canal head during the rabi season about 48 per cent was utilised in the field and the rest i.e. 52 per cent was lost in transit and in hot weather season 65 per cent of the water

Table 4.18 : Transit Losses on the Ghod Project : 1970-71

Particulars	(m.cu.m.)		
	Left bank canal	Right bank canal	Total
Amount of water let in at canal head	120	41	161
Loss in the main canal and branches	50	20	70
Amount of water at distributary head	70	21	91
Lost in the distribution system at 30% of water let in the distributary head	21	6	27
Amount of water available at outlets	49	15	64
Lost in water courses and field channels at 16% (assumed) of water available at outlets	8	2	10
Water available at field head	41	13	54

Source : National Commission on Agriculture : Interim Report on Modernising Irrigation System and Integrated Development of Commanded Areas, 1973, p. 34.

Table 4.19 : Transit Losses During the Rabi Season

Particulars	(Quantity in Mm ³)			
	1980-81	1981-82	1982-83	1983-84
Contents on 15/10	216.31	216.31	216.31	216.31
Quantity utilised at canal head	102.80	99.00	102.79	88.98
Quantity utilised at distributary head	76.41	72.17	72.28	68.35
Quantity of water lost in the main canal and branches	26.39	26.83	30.51	20.63
Percentage of water lost in the canal and branches	25.68	27.10	29.68	23.18
Lost in the distribution system at 25% of water let in the distributary head	19.10	18.04	18.07	17.09
Quantity of water available at outlets	57.31	54.13	54.21	51.26
Lost in water courses and field channels at 16% (assumed) of water available at outlets	9.17	8.66	8.67	8.20
Quantity of water available at field head	48.14	45.47	45.54	43.06
Percentage of transit losses	53.17	54.07	55.70	51.61

Source : Water Account Register, Command Area Development Authority, Pune.

Table 4.20 : Transit Losses During the Hot Weather Season

Particulars	(Quantity in Mw ³)			
	1980-81	1981-82	1982-83	1983-84
Contents on 1/3	156.31	172.84	141.01	197.18
Quantity utilised at canal head	83.22	109.79	63.69	120.54
Quantity utilised at distributary head	56.83	73.72	40.04	82.37
Lost in the main canal and branches	26.39	36.07	23.65	38.17
Percentage of water lost in the canal and branches	31.71	32.85	37.13	31.66
Lost in the distribution system at 33.33% of water let in the distributary head	18.94	24.57	13.34	27.45
Quantity of water available at outlets	37.89	49.15	26.70	54.92
Lost in water sources and field channels at 20% (assumed) of water available at outlets	7.58	9.83	5.34	10.98
Quantity available at field head	30.31	39.32	21.36	43.94
Percentage of transit losses	63.58	64.19	66.46	63.55

Source : Water Account Register, CADA, Pune.

released at the canal head was lost in transit and only 35 per cent used in the field. Thus, the transit losses on this project are very heavy as the canal passes through strata having high permeability.

The quantity of water lost through percolation and seepage, undoubtedly, serves to augment ground water in the command area and is, therefore, not altogether a total loss. It was observed that the area irrigated under well irrigation in the command area had substantially increased due to the project. For instance, during the period from 1961 to 1971, the area irrigated under sugarcane from wells in the canal command increased from 75 hectares to 426 hectares and that under seasonal crops, from 460 hectares to 1360 hectares.⁶ Further, the loss of water increase the re-generated flow in the Bhima river, but this water cannot be utilised in the Ghod command area.

4.12 Problem of Water-Logging

Since the transit losses on Ghod project are heavy, the problem of water-logging and salinity has become a serious matter of concern as was observed in the case of Purna project. Water-logged and salt affected area in the command of Ghod project is given below.

(Area in hectares)				
Area irrigated (1981-82)	Area water logged	Area salt affected	Total	Percentage to the irrigated area
21,111	1,419	1,602	3,021	14.31

Source : Annual Administration Report 1981-82, CADA, Pune, Annexure XVI.

Like Purna project here also certain steps are urgently needed to eliminate the losses in transit and also to reclaim the area affected by water-logging and salinity. If these losses are reduced it will be possible to bring more area under irrigation on this project.

References

1. Interim Report of the National Commission on Agriculture on Modernising Irrigation Systems and Integrated Development of Commanded Areas, Ministry of Agriculture, Government of India, New Delhi, 1973, pp. 33-35.
2. Administrator, A Success Story of Ghod Project, Command Area Development Authority for Ghod and Bhima, Pune, 1981 (in Marathi).
3. Report of the Committee of Ministers on Under-utilisation of Created Irrigation Potential, Government of India, New Delhi, 1973, p. 114.

4. R. G. Patil, S. D. Suryawanshi and P. M. Kapase, An Investigation into the Socio-Economic Conditions in Ghod Command Area, MPKV, Rahuri, 1980, p. 13.
5. Op.cit., A Success Story of Ghod Project, 1981.
6. Op.cit., National Commission on Agriculture, p.34.

CHAPTER V

SUMMARY AND CONCLUSIONS

Indian economy is predominantly agricultural and irrigation has to play a very critical role in its development. Expansion of irrigation facilities has been thought of as an important means for rural transformation as rainfall in the country is not only confined to just four monsoon months, but is uncertain and unevenly distributed in respect of time, space and quantum. For instance, in all 260 districts in the 14 states and union territories and about 150 million people and 113 million cattle heads were affected by a widespread drought in 1985-86. About 326 talukas in 8 states or 16 per cent of the area is drought prone. The ultimate irrigation potential of the country from all sources is estimated to be 113.5 mha. In other words, about 60.6 per cent of the gross cropped area, or slightly more than 63 per cent of the net cropped area in the country, can be irrigated.¹

Recognising the need for irrigation development, irrigation has been accorded a high priority during the five year plans. With a total investment of Rs. 9,318 crores, about 67.9 million hectares of irrigation potential has been created and the corresponding utilisation stood at 62.7

million hectares by 1984-85. Thus, the gap between potential created and utilised was 5.2 million hectares. This gap may be much larger as the figures of utilisation as reported by different states are not reliable due to the different methods and assumptions adopted in compiling statistical data regarding potential and utilisation. The irrigation projects, particularly major and medium have failed to yield satisfactory financial and economic returns due to various reasons like huge amount of investment, long gestation period, delay in completion and cost escalation, heavy transit losses and poor utilisation of the potential created. Some of the projects started before fifth plan are still under construction and some of them are expected to be completed only during the Eighth Plan. A recent study shows that the cost of 156 major irrigation projects has risen from the original estimated cost of Rs. 2,156 crores to Rs. 14,000 crores. And the cost of creating one hectare of irrigation potential increased from Rs. 1,200 to Rs. 26,874 during the period from first plan to the seventh plan.²

It is, therefore, quite necessary to reduce the gap between the potential created and utilised. For this purpose, CAD authorities have been set up for the major and medium irrigation projects in the country.

Maharashtra is one of the least irrigated states in India. At present, the area under irrigation is hardly 13 per cent whereas the corresponding proportion is 32 per cent,

for the country as a whole. The rainfall is erratic, uncertain and deficient for the growth of crops in about 33 per cent of the area in the state. The area under multiple cropping is limited due to the meagre irrigation facilities. Therefore, irrigation development in the state is the sine qua non for not only the development of rural areas but also for the overall economic development of the state.

Even if the ultimate irrigation potential is created, it would be possible to irrigate only 1/3 of the total cropped area. The cumulative potential created by the end of Sixth Plan was 22.7 lakh hectares and the potential utilised was about 49 per cent. It means that Maharashtra is lagging behind not only in respect of creation of irrigation potential but, also in utilisation of the potential created. There are several factors like defective construction, lack of land development works, inadequate maintenance of the distribution system, financial constraints, lack of credit and infrastructural facilities, traditional outlook of the farmers, managerial problems, etc. that lead to under-utilisation.

As there is a substantial gap between the potential created and its utilisation in Maharashtra, it was felt necessary to undertake a study of some of the irrigation projects situated in different regions of the state in order to understand the extent of utilisation and the problems of under-utilisation on these projects. For this purpose, two

irrigation projects - Purna and the Ghod were selected from Marathwada and Western Maharashtra respectively. This study is primarily based on the secondary data and the required data and information have been collected from the concerned Command Area Development Authorities and Irrigation Department by personally visiting their offices.

Main Findings of the Study

The summary of the main findings is given as under:

1) In the case of Purna project, the data on the area irrigated during the period from 1968-69 to 1983-84 reveals that the proposed cropping pattern is not fully realised. As the cultivation of perennials is restricted to the pre-determined or x-limits, farmers are growing these crops extensively on their own wells. Sugarcane is grown in the upper reaches while banana is grown in lower reaches. There is inadequate demand for other perennials. Kharif irrigation is quite below the proposed area as there is no need of providing irrigation water to these crops due to assured and well-distributed rainfall. Rabi irrigation is better due to the extensive cultivation of wheat. L. S. cotton and other two seasonals received inadequate response on the canal irrigation but these crops, particularly L. S. cotton, are grown to a considerable extent on well irrigation. Hot weather irrigated area is much larger than the area proposed in the cropping pattern.

2) Even though the ultimate irrigation potential on this project was created in 1968-69 the potential actually

utilised is less than 40 per cent. The highest utilisation at 59.5 per cent was achieved in 1975-76 because of special concessions offered by the CADA, but thereafter, it fluctuated widely.

3) Excepting the year 1972-73, an year of severe drought, the kharif utilisation has been quite low. Only in 1975-76 it was as high as 79 per cent due to the facility of free water. Since then the utilisation in this season showed a constant decrease, excepting the year 1980-81. The lowest utilisation at nearly 9 per cent was observed in 1983-84 due to very heavy rainfall.

4) Though the position of the rabi utilisation is better than the kharif utilisation, it is not satisfactory. Before the establishment of the CADA in 1974-75, the utilisation in this season remained below 37 per cent. Maximum utilisation at 55 per cent was achieved in 1975-76 but thereafter, it decreased considerably in the subsequent years. In 1983-84, the potential utilised was only 31 per cent.

5) In the hot weather season, the utilisation showed an increasing trend for the initial four years but large fluctuations were observed in rest of the period. Utilisation was lowest in 1982-83 while it was highest at 72.5 per cent in 1983-84. Hot weather utilisation is relatively satisfactory because of the cultivation of summer groundnut.

6) Although the CADA was set up for this project in 1974-75, still there is a glaring gap between the potential

created and utilised; more than 60 per cent potential remains unused. CADA made efforts to improve the utilisation on this project by adopting various measures but the agro-climatic conditions in this area are not favourable. As this area lies in the assured rainfall zone, the kharif utilisation is low and due to the late return monsoon and fertile soil even in the rabi season the demand is limited.

7) In the case of Ghod project, the proposed cropping pattern (1979) is by and large realised. The area irrigated under rabi crops and perennials is more than the planned area to be irrigated. Hot weather irrigated area is much larger than the projected area. Only kharif irrigation is below the proposed area and also there is very limited area irrigated under other perennials.

8) The overall utilisation on this project is appreciable. It was quite low during the initial years but after the transformation of this project to the CADA for its administration, it increased steadily. For instance, the potential utilised was 34 per cent in 1973-74 while it was 101 per cent in 1983-84.

9) For the first four years, the kharif utilisation was low, less than 30 per cent. With the formation of the CADA in 1974-75, the utilisation substantially increased from 20 per cent to 76 per cent during the period from 1974-75 to 1983-84. Maximum utilisation at 87 per cent was achieved in 1980-81. Although the kharif cultivation is not

very popular in this area as the rainfall is either very erratic or is received late the utilisation in this season is satisfactory because of the efforts taken by the CADA like the introduction of the block system.

10) The trend observed in the case of rabi utilisation was uneven for the first four years. Thereafter, the utilisation increased from 36 per cent in 1974-75 to 106 per cent in 1982-83 which was maximum ever achieved during that season. As this is a rabi tract and rabi crops like wheat, jowar require irrigation water in this area, the rabi utilisation is satisfactory.

11) There is no demand for two seasonal crops like L.S. cotton but there is a heavy demand for hot weather cash crops like groundnut. The utilisation was always more than 100 per cent due to the additional water received through the Yedgaon dam. The highest utilisation at 141 per cent was recorded in 1980-81.

12) CADA has played a very dynamic role in increasing the utilisation on this project. For this purpose, a number of effective measure like the introduction of the block system, land development works, proper maintenance of the distribution system, introduction of the HYVs, trial-cum-demonstration farm and the training and guidance to the farmers, etc. were adopted. The ultimate objective for which the CAD Authorities were set up for the medium and major

irrigation projects in the country has been satisfactorily achieved in the command area of this project.

13) On this project, the efficiency in the water use i.e. the area irrigated per Mm^3 of water, is generally achieved. This efficiency is more than the planned one in the project during the kharif and the hot weather season but in case of the rabi season, it is somewhat less than 12 per cent.

Comparison between Purna and Ghod

Table 5.1 : Comparison between Purna and the Ghod Projects

Particulars	Purna	Ghod
Type of project	Multi-purpose project	Irrigation project
Zone	Assured rainfall zone	Scarcity zone
Irrigation potential	61,540 ha.	24,960 ha.
Irrigation potential created by	1968-69	1968-69
Potential utilised by 1983-84 (%)	38.64	100.82
a) Kharif	8.67	76.43
b) Rabi	30.73	95.75
c) Hot weather	72.53	133.95
Estimated transit losses (%)	<u>1980-81</u>	<u>1983-84</u>
a) Rabi	44.02	51.61
b) Hot weather	57.69	63.55

A comparison between the Purna and the Ghod projects with respect to cropping pattern, utilisation, problems of utilisation and other aspects reveals some interesting conclusions as under:

1) The proposed cropping pattern in Ghod command area is by and large, realised but in the case of Purna project, the cropping pattern is not developed according to the planned one. In both the cases, farmers are switching on from the subsistence farming to the commercial agriculture and cash crops like sugarcane, banana and summer groundnut are grown in a large area.

2) Kharif utilisation is very low on Purna project due to assured and well distributed rainfall. In the case of Ghod project, kharif utilisation is problematic because the storage is not reliable for the kharif irrigation as replenishments are received late.

3) In the case of Purna project, due to the late return monsoon and fertile soils, there is no need of supplying water to the rabi crops except wheat. Area irrigated under rabi jowar is limited but that under wheat, is large. On Ghod, rabi utilisation is satisfactory. Wheat and rabi jowar are grown extensively.

4) The demand for perennials is heavy on both the projects. However, their cultivation is restricted in the command area due to their high water requirements. Banana

is also equally popular crop amongst the cultivators in the Purna command area but grown mainly on well irrigation.

5) Hot weather utilisation is appreciable in both the cases. Groundnut is the major cash crops grown in this season.

6) There is no demand for L.S. cotton and other two seasonals in the Ghod command area, whereby these crops, particularly L.S. cotton is one of the major cash crops in the Purna command area and cultivated extensively on private wells.

7) The transit losses during the rabi and hot weather seasons are higher compared to the Purna project because the canal of the Ghod project goes through strata which have high permeability.

To sum up the project potential of the Ghod project is fully utilised whereas the utilisation on Purna project is below 40 per cent. If we consider Wade's suggestion that about 90 per cent utilisation can be considered good enough,³ we find that the utilisation on the Purna project is far from satisfactory. The reason is that Ghod is primarily an irrigation project undertaken in a scarcity area where the rainfall is inadequate and erratic. Surface irrigation on a large scale was introduced in western Maharashtra 9 to 10 decades ago. The cultivators in western Maharashtra are familiar with the irrigated agriculture and the benefits of irrigation. Moreover, CADA did quite well to improve the

utilisation on this project. On the contrary, Purna command area is an assured rainfall zone and there is no need for supplying water to the kharif and rabi crops. Cultivators are not acquainted with irrigated farming. As a matter of fact, Purna project is a multi-purpose project and constructed for the generation of power and irrigation is not its only purpose.

Finally, it may be concluded that selection of proper site for the dam is the most important issue as the problem of utilisation is directly related with this. If irrigation project is taken up in an assured rainfall zone, then the utilisation of irrigation water during the kharif and rabi season would be low as we observed in the case of Purna project. Hence, it is quite necessary to consider the factors like need for irrigation, agro-climatic conditions, irrigation possibilities and also suitability of soil while constructing a major irrigation project.

Case of Jayakwadi Project

Let us take the case of Jayakwadi project. This project on Godavari river near Paithan town is the biggest major irrigation project in Maharashtra. There are two canals - Paithan Left and Right Bank Canals - to irrigate a total area of 1,83,300 hectares. The actual work on dam construction commenced in 1965 and was completed in 1974. The work on left bank canal and right bank canal was started in 1966 and 1972 respectively. But even by 1986 the work is not completed. Although full storage has been created in

1974-75, considerable part of the command area is still not ready to receive irrigation water. The work on the project has been delayed and this has resulted in cost escalation. Irrigation commenced in 1974-75 but the potential created by 1983-84 was 69,429 hectares only and the area actually irrigated in 1982-83 was 42,873 hectares. The full potential is not utilised as the work of main canal, distributary, minors, fixing of outlets and land development works are still under construction. As this command area comes partly under the assured rainfall zone and partly adequate rainfall zone, there is not much need of supplying water for kharif and rabi crops. A different cropping pattern from that proposed in the project is developing. Sugarcane and hot weather seasonals have already crossed the limit of the area planned to be irrigated. The problem of water-logging and salinity have already become a matter of concern. This project is not unique; there are a number of major projects lingering for 15-20 years. The returns on these projects, in terms of yield and investment have been quite unsatisfactory and in addition, the problem of under-utilisation of the potential created remains serious.

Thus one of the major problems facing the country in the field of irrigation development is that of inordinate delays in the completion of the projects, particularly the major irrigation projects. A large number of projects launched in the earlier plans are still under various stages of

construction. Construction of major dams has involved long delay, massive cost-escalation and under-utilisation due to the lag in the completion of distribution network even though the reservoir is ready. In addition serious problems are created due to displacement of large number of families and ecological imbalance due to inundation of extensive areas.

It is therefore important to consider various alternatives before taking decision regarding the choice of irrigation project. Smaller projects should be given prior consideration as these projects have relatively shorter gestation period, and distribution of water over larger area can be ensured it is possible to create a chain of small dams.

Conclusion

The Problem of Correct Assessment of Under-utilisation

It will be clear from the foregoing discussion that in considering the problem of under-utilisation variety of issues are involved. Firstly, there is the problem of measurement. Irrigation utilisation is generally estimated by comparing the area actually irrigated with the potential created. This figure of utilisation in gross terms cannot give the correct picture of the actual utilisation due to the unrealistic/unrealised cropping pattern, less availability of water than the estimated one in a given year and

the declaration of the irrigation potential created even without the construction of a proper distribution system. While discussing utilisation, it is necessary to consider the proposed cropping pattern and the cropping pattern actually developed, the quantity of water available in the particular year and the quantity actually utilised, transit losses and other factors like completion of canal and distribution system, ayacut development, land preparation, maintenance of field channels and water courses, extension and other infra-structural facilities.

When correct assessment of the extent of under-utilisation is made by relating the quantity of water available in a year to the water actually used in each particular season, the exact nature of the problem of under-utilisation becomes clear. As we noted in the case of Purna project the utilisation of irrigation potential during the kharif and rabi season is low mainly due to the assured rainfall and fertile soils. Although CADA introduced a number of measures to improve the kharif as well as rabi utilisation, the utilisation has not shown much improvement. Though Purna project is a multi-purpose project, the under-utilisation of created irrigation facility during the kharif and rabi season is a matter of concern. It is thus clear that while taking up an irrigation project in the assured rainfall zone like Purna command area, Government should consider various factors like rainfall, soil type, crops grown and to be grown after the

availability of irrigation facility and should design cropping pattern accordingly. In assured rainfall tracts there is demand for water mainly during summer. However, this is the season during which heavy percolation and evaporation losses are involved. Unless the method of conveyance is changed the transit losses cannot be reduced, and summer irrigation cannot be enhanced. In view of the above problems it is advisable to give relatively low priority to major irrigation projects in the assured rainfall tract in the present state of crop culture and methods of storage and conveyance.

Efficiency in Water Utilisation

In the low rainfall tract the problem of under-utilisation does not arise when the work of reservoir, distribution system and land development is properly executed. The problem in this tract is of proper utilisation of the scarce water resource. Particularly in Maharashtra the water resources are quite limited and hence, their efficient use is quite essential in order to extend the benefits of irrigation to as a large number of cultivators as possible. The Seventh Plan (1985-90) also gave the highest priority to the utilisation of the existing irrigation potential by constructing field channels, land levelling and shaping, field drains and introduction of Warabandi system of irrigation.⁴ There are different methods of irrigation by which efficiency in the utilisation of water can be achieved.

1) Shejpali System - The present system of irrigation which is known as shejpali system is a traditional one and is followed on most of the irrigation projects in the State. Under this system, sanctions for water supply are made on area basis for different seasons every year in October. In practice, this system is never enforced rigidly and consequently it lead to unauthorised irrigation, wastage of water and various malpractices.

ii) Supply of Water on Volumetric Basis - The alternative to the shejpali system is to supply of water on volumetric basis. This system is being followed by the Maharashtra State Farming Corporation on its large farms. The main difficulty in the adoption of this system is that the supply of water on volumetric basis to each individual cultivator is practically very difficult.

iii) Rotational Water Supply System - Rotational Water Supply (RWS) system is another alternative to the traditional system of irrigation. This system has been adopted in the command area of the Girna and the Mula projects. In this system water is measured indirectly at the outlet. Specific time for supply of water is allocated to each irrigator which is fixed on the basis of area sanctioned and the nature of the crop. This method of irrigation is strongly recommended by the High Power Committee (1981) on all the irrigation projects in the State without any further delay as it possesses all the merits of good irrigation system like reliability,

efficiency, equity, timely supply of water and active involvement of farmers, etc.

Eight Monthly Irrigation

Here reference may be made to the much debated issue of introduction of eight monthly irrigation in Maharashtra. Dandekar Committee (1978) i.e. the Committee to study the introduction of eight monthly supply of water on the irrigation projects in Maharashtra has recommended the introduction of eight monthly irrigation on the irrigation projects in the State.

The 3D Committee⁵ (Dandekar, Deshmukh and Deuskar) observed in their report that sugarcane is not the most profitable crop to grow under canal water if the net values of produce per acre-inch of water of different irrigated crops are compared. The Committee, therefore, suggested the system of eight monthly supply of water. While designing new projects in water scarcity basin, it is recommended that one third of the total utilisable water may be used in kharif and the remaining two-third in rabi and summer.⁶ The rationale of this policy as stated by the Committee is the "denial of water to perennial crops such as sugarcane and adopting extensive irrigation confined to kharif and rabi seasonals not only help a wider dispersal and in equitable distribution of benefits of irrigation but also increase the total benefits."⁷ Further, the Committee pointed out that in water

scarcity basins in the State surface irrigation should be provided only for other crops and perennial crops may be grown on groundwater.⁸

It must be noted here that if we examine the designed crop pattern in various major projects the distribution between seasons is not much different than what is suggested by the 3D Committee. We can take the example of Purna and Ghod projects.

Season	(Percent share)					
	Purna project		Ghod project		Mula project*	
	Proposed	Actual (1979-84)	Proposed	Actual (1979-84)	Proposed	Actual (1976-80)
Kharif	33	19	42	32	39	32
Rabi	43	45	45	47	47	46
Summer	24	36	13	21	14	22
Total	100	100	100	100	100	100

* Ashok K. Mitra, "Underutilisation Revisited : Surface Irrigation in Drought Prone Areas of Western Maharashtra", Economic and Political Weekly, Vol. XXI (17), April 26, 1986, pp. 753-54.

The problem is of enforcement of distribution according to the desirable pattern. Here one comes up with the problem dichotomy between private gains and public interest. If the return per unit of water is considered sugarcane does not top the list. However, in Maharashtra

it gives highest return per unit of land; it is a crop easy to manage and the returns are assured. If the return per unit of water is to be the determining criterion in the use of irrigation water, a number of policy changes e.g. policy regarding relative pricing and stable prices of agricultural crops and rationalisation of irrigation water charges etc. will have to be introduced.

On-Field Application Methods

Lastly, the problem of wastage of water needs immediate attention. This is one of the major factors that would help increase the water available for irrigation and also check spread of water logged areas. The loss in the distribution system can be checked through proper maintenance of the distribution system. Lining of the canals effects large savings but entails heavy costs and unless the lining is properly maintained it might mean waste of scarce resources. There is a considerable scope of controlling wastage through improved on-field application methods. The usually accepted and recommended method is to switch to sprinkler or drip system. Both are however very capital intensive and the scope for their application is therefore quite limited. Improved application methods like graded border strip that makes use of land shaping techniques to create border strips along the prepared gradients that follow the natural gradients is found to be effective. Water is

applied at the ridge end of the strip and flows down the strip to the valley end of the strip. By proper adjustment of quantum flow of water it can be ensured that there is little percolation below the root zone. However to be fully effective farmers need to plan their waterings in consultation with each other and do the land shaping work in cooperation.

Thus, for optimal water use policy to be successful, it is necessary that water is considered as a social resource, and the farmers cooperative to build the necessary material infrastructure and its maintenance and accept control on water distribution and accept crop planning so as to optimise the return to unit of water applied. The problem of proper utilisation of the irrigation water resource therefore needs to be approached both from the technical-managerial aspects in which CADA can play a very valuable role and also from the social organisational aspects in which unity of interest among farmers and their mutual cooperation are of crucial importance.

References

1. N. Rath and A. K. Mitra. "Economics of Utilisation of Canal Water in Dry Agricultural Regions," Indian Journal of Agricultural Economics, Vol. XLI (2), Bombay, April-June, 1986, p. 131.
2. Surekha Sule. "Minor Irrigation Deserves Top Priority," The Economic Times, Bombay, February 5, 1986, p. 8.

3. Wade Roberts. "Performance of Irrigation Project," Economic and Political Weekly, Vol.XI, No.3, January 17, 1976, p. 63.
4. Seventh Five Year Plan 1985-90, Planning Commission, Government of India, New Delhi, p. 74.
5. // Interim Report of the Committee to Study the Introduction Eight Monthly Supply of Water on Irrigation Projects in Maharashtra, Department of Irrigation, Government of Maharashtra, Bombay, 1979, p. 32.
6. Ibid., p. 70.
7. Ibid., pp. 30-31.
8. Ibid., p. 71.

Appendix A : Rainfall at Basmathnagar Rainauge Station for the Period from 1968 to 1983

Month	Normal rainfall	(Rainfall in mm.)															
		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
January	-	44.4	-	10.0	-	-	-	-	-	-	24.0	-	-	49.0	-	-	
February	-	0.3	-	-	-	-	-	-	11.0	-	-	34.0	72.0	-	-	-	
March	-	58.0	-	-	-	-	-	-	-	-	3.0	6.0	-	-	3.0	-	
April	-	-	-	-	-	-	17.0	-	-	-	-	6.0	-	-	-	-	
May	4.7	-	5.3	60.2	-	-	-	2.7	56.0	-	-	-	28.0	-	14.0	N.A.	N.A.
June	134.5	162.3	58.4	336.2	51.2	180.0	126.4	117.1	82.0	127.0	40.0	149.0	207.0	171.0	86.0	86.0	208.0
July	303.9	301.2	343.1	115.2	33.5	149.0	166.8	84.9	461.0	355.0	130.0	266.0	194.0	207.0	200.0	206.2	387.0
August	335.3	51.0	243.3	475.3	313.1	72.6	510.8	222.0	185.0	285.0	265.0	101.0	158.0	314.0	255.0	100.4	788.6
September	145.3	225.3	456.4	190.3	136.7	59.8	90.2	111.0	486.0	46.0	120.0	36.0	118.0	105.0	324.0	200.2	399.4
October	80.8	41.5	32.2	6.2	63.2	3.3	59.0	142.0	160.0	-	67.0	101.0	-	-	54.0	48.0	117.0
November	7.5	-	12.0	-	-	32.0	-	-	-	22.0	112.0	21.0	24.0	-	-	19.0	-
December	5.7	-	-	-	-	5.2	-	-	-	-	2.0	-	6.0	19.0	5.0	-	-
Total	1,018.7	884.0	1,150.7	1,193.4	597.7	501.9	970.2	679.7	1,441.0	835.0	739.0	744.0	807.0	816.0	990.0	659.8	1,900.0

Source : 1) Socio-Economic Review and District Statistical Abstract of Parbhani District, Directorate of Economics and Statistics, Government of Maharashtra, Bombay, Various Issues from 1968-69 to 1981-82.

2) Rainfall Data Register, Parbhani District, CADA, Nanded.

Appendix B : Seasonal Duties Currently Adopted on Purna Project

Crop	(Area in hectares)		
	Kharif	Rabi	Hot weather
Sugarcane and banana	32.38	28.33	20.23
Other perennials	48.56	42.49	30.35
Kharif seasonals	157.83	-	-
Kharif rice	32.38	-	-
L.S. cotton	169.97	84.99	60.70
Other two seasonals	48.56	56.66	-
Rabi seasonals	-	72.85	-
H.W. seasonals	-	-	40.47
Hybrid crops in H.W.	-	-	24.28

Appendix C : Conversion of the Area under Various Crops
in the Approved Cropping Pattern of the Purna
Project into the Base Crop Area

Crop	Area (ha)	Duty	Base crop area (ha)
<u>Kharif</u>			
Sugarcane and banana	6,478	32.38	14,574.50
Other perennials	3,036	48.56	4,554.63
Kharif seasonals	4,453	157.83	2,055.38
Kharif rice	6,154	32.38	13,845.55
L.S. cotton	11,338	169.97	4,859.52
Other two seasonals	4,048	48.56	6,072.83
Total			45,962.41
<u>Rabi</u>			
Sugarcane and banana	6,478	28.33	16,658.04
Other perennials	3,036	42.49	5,205.29
L.S. cotton	11,338	84.99	9,718.48
Other two seasonals	4,048	56.66	5,204.67
Rabi seasonals	21,255	72.85	21,255.00
Total			58,041.48
<u>Hot weather</u>			
Sugarcane and banana	6,478	20.23	23,327.84
Other perennials	3,036	30.35	7,287.40
L.S. cotton	11,338	60.70	13,607.47
Hot weather seasonals	3,644	40.47	6,559.56
Hybrid crops in H.W.	1,134	24.28	3,402.47
Total			54,184.74
Total			1,58,188.63

Appendix D : Conversion of the Area Irrigated under Various Crops into the Base Crop Area : 1968-69 to 1983-84

Crop	Duty	1968-69			1969-70			1970-71		
		Area ir- rigated (ha)	Base crop (ha)	Percen- tage uti- lisation	Area ir- rigated (ha)	Base crop (ha)	Percen- tage uti- lisation	Area ir- rigated (ha)	Base crop (ha)	Percen- tage uti- lisation
<u>Kharif</u>										
Sugarcane and banana	32.38	1,448.18	3,258.18		1,939.27	4,363.06		1,972.06	4,436.83	
Other perennials	48.56	184.21	276.35		164.77	247.19		207.69	311.58	
Kharif seasonals	157.83	384.21	177.34		393.93	181.83		21.05	9.72	
Kharif rice	32.38	418.62	941.83		887.45	1,996.63		259.52	583.88	
L.S. cotton	169.97	600.81	257.51		250.20	107.24		621.46	266.36	
Other two seasonals	48.56	733.20	1,099.95		997.16	1,495.95		1,417.00	2,125.79	
Total			6,011.16	13.08		8,391.90	18.26		7,734.16	16.83
<u>Rabi</u>										
Sugarcane and banana	28.33	1,448.18	3,723.96		1,939.27	4,986.79		1,972.06	5,071.11	
Other perennials	42.49	184.21	315.83		164.77	282.50		207.69	356.09	
L.S. cotton	84.99	600.81	514.99		250.20	214.46		621.46	532.69	
Other two seasonals	56.66	733.20	942.70		997.16	1,282.09		1,417.00	1,821.89	
Rabi seasonals	72.85	7,246.96	7,246.96		4,621.06	4,621.06		6,577.33	6,577.33	
Total			12,744.44	21.96		11,386.90	19.62		14,359.11	24.74
<u>Hot weather</u>										
Sugarcane and banana	20.23	1,448.18	5,215.02		1,939.27	6,983.48		1,972.06	7,101.56	
Other perennials	30.35	184.21	442.16		164.77	395.50		207.69	498.52	
L.S. cotton	60.70	600.81	721.07		250.20	300.28		621.46	745.85	
Hot weather seasonals	40.47	449.80	809.68		667.21	1,201.04		2,191.90	3,945.63	
Hybrid crops in H.W.	24.28	Nil	-		Nil	-		Nil	-	
Total			7,187.93	13.27		8,880.30	16.39		12,291.51	22.68
Total			25,943.53	16.40		28,659.10	18.12		34,384.83	21.74

Contd...

Appendix D : (Continued)

Crop	1971-72			1972-73			1973-74		
	Area ir- rigated (ha)	Base crop (ha)	Percen- tage uti- lisation	Area ir- rigated (ha)	Base crop (ha)	Percen- tage uti- lisation	Area ir- rigated (ha)	Base crop (ha)	Percen- tage uti- lisation
<u>Kharif</u>									
Sugarcane and banana	3,162.34	7,114.78		2,321.00	5,221.89		1,762.00	3,964.23	
Other perennials	58.71	88.08		31.00	46.51		39.00	58.51	
Kharif seasonals	1,937.65	894.37		1,542.00	711.74		403.00	186.01	
Kharif rice	3,069.23	6,905.29		6,196.00	13,940.04		1,420.00	3,194.78	
L.S. cotton	2,243.73	961.67		473.00	202.73		1,060.00	454.32	
Other two seasonals	1,534.41	2,301.93		913.00	1,369.69		891.00	1,336.68	
Total		18,266.12	39.74		21,492.60	46.76		9,194.53	20.00
<u>Rabi</u>									
Sugarcane and banana	3,162.34	8,131.89		2,321.00	5,968.40		1,762.00	4,530.95	
Other perennials	58.71	100.66		31.00	53.15		39.00	66.87	
L.S. cotton	2,243.73	1,923.23		473.00	405.44		1,060.00	908.59	
Other two seasonals	1,534.41	1,972.85		913.00	1,173.88		891.00	1,145.59	
Rabi seasonals	9,078.14	9,078.14		12,339.00	12,339.00		9,419.00	9,419.00	
Total		21,206.77	36.54		19,939.87	34.35		16,071.00	27.69
<u>Hot weather</u>									
Sugarcane and banana	3,162.34	11,387.86		No irrigation due to reservoir limitations in H.W.			1,762.00	6,345.12	
Other perennials	58.71	140.92					39.00	93.61	
L.S. cotton	2,243.73	2,692.85					1,060.00	1,272.17	
Hot weather seasonals	4,544.13	8,179.88					5,205.00	9,369.51	
Hybrid crops in H.W.	Nil	-					52.00	156.02	
Total		22,401.51	41.34					17,236.43	31.81
Total		61,874.40	39.11		41,432.47	39.84		42,501.96	26.87

Contd...

Appendix D : (Continued)

Crop	1974-75			1975-76			Duty	1976-77			1977-78		
	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation		Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation
Khharif													
Sugarcane and banana	1,719	3,867.52		2,424	5,453.63								
Other perennials	18	27.00		101	151.52		40.47	3,944	7,099.59		4,505	8,109.44	
Khharif seasonals	467	215.55		6,012	2,274.97		157.83	1,168	541.97		905	417.72	
Khharif rice	2,214	4,981.16		10,083	22,685.19		32.38	11,753	26,442.43		6,367	14,324.77	
L.S. cotton	1,627	697.34		4,111	1,762.00		169.97	501	214.73		359	153.87	
Other two seasonals	551	826.61		2,409	3,614.00		48.56	427	640.59		456	684.09	
Total		10,615.18	23.10		36,441.31	79.29			34,939.31	76.02		23,689.89	51.54
Rabi													
Sugarcane and banana	1,719	4,420.37		2,424	6,233.27								
Other perennials	18	30.86		101	173.17		35.41	3,944	8,114.10		4,505	9,268.26	
L.S. cotton	1,627	1,394.60		4,111	3,523.78		84.99	501	429.44		359	368.09	
Other two seasonals	551	708.44		2,409	3,097.35		56.66	427	549.01		456	586.30	
Rabi seasonals	11,412	11,412.00		19,055	19,055.00		72.85	20,485	20,485.00		15,962	15,962.00	
Total		17,966.27	30.95		32,082.57	55.28			29,577.55	50.96		26,184.65	45.11
Hot weather													
Sugarcane and banana	1,719	6,190.27		2,424	8,729.04								
Other perennials	18	43.21		101	242.43		25.29	3,944	11,361.02		4,505	12,977.03	
L.S. cotton	1,627	1,952.67		4,111	4,933.88		60.70	501	601.28		359	430.86	
Hot weather seasonals	4,711	8,480.27		5,607	10,093.15		40.47	4,945	8,901.49		7,892	14,206.38	
Hybrid crops in H.W.	1	3.00		553	1,659.23		24.28	8	24.00				
Total		16,669.42	30.76		25,657.73	47.35			20,887.79	38.55		27,614.27	50.96
Total		45,250.87	28.61		94,181.61	59.54			85,404.65	53.99		77,488.81	48.98

Contd...

Appendix D : (Continued)

Crop	1978-79			1979-80			1980-81			1981-82		
	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation
Khariif												
Perennials	3,518	6,332.75		2,680	4,824.26		3,054	5,497.50		3,824	6,883.58	
Khariif seasonals	506	233.55		936	432.03		685	316.18		313	144.47	
Khariif rice	3,591	8,079.19		3,100	6,974.52		4,021	9,046.63		2,440	5,489.62	
L.S. cotton	296	126.87		901	386.17		864	370.31		297	127.29	
Other two seasonals	510	765.10		1,153	1,729.74		530	795.11		286	429.06	
Total		15,537.46	33.80		14,346.72	31.21		16,025.73	34.87		13,074.02	28.44
Rabi												
Perennials	3,518	7,237.68		2,680	5,513.64		3,054	6,283.08		3,824	7,867.22	
L.S. cotton	296	253.72		901	772.30		864	740.58		297	254.58	
Other two seasonals	510	655.73		1,153	1,482.46		530	681.44		286	367.72	
Rabi seasonals	11,980	11,980.00		13,678	13,678.00		11,697	11,697.00		12,781	12,781.00	
Total		20,127.13	34.68		21,446.40	36.95		19,402.10	33.48		21,270.52	36.65
Hot weather												
Perennials	3,518	10,133.90		2,680	7,719.97		3,054	8,797.31		3,824	11,015.36	
L.S. cotton	296	355.25		901	1,081.35		864	1,036.94		297	356.45	
Hot weather seasonals	8,100	14,580.80		10,387	18,697.63		15,716	28,290.35		3,174	5,713.51	
Hybrid crops in H.W.	-	-		-	-		9	27.00		-	-	
Total		25,069.95	46.27		27,498.95	50.75		38,151.60	70.41		17,085.32	31.53
Total		60,734.54	38.39		63,292.07	40.01		73,579.43	46.51		51,429.86	32.51

Contd...

Appendix D : (Continued)

Crop	1982-83			1983-84		
	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation
<u>Kharif</u>						
Perennials	2,919	5,254.49		2,050	3,690.20	
Kharif seasons	446	205.86		Nil	-	
Kharif rice	2,062	4,639.18		Nil	-	
Two seasonals	536	357.38		445	296.71	
Total		10,456.91	22.75		3,986.91	8.67
<u>Rabi</u>						
Perennials	2,919	6,005.34		2,050	4,217.52	
Two seasonals	536	551.36		445	457.75	
Rabi seasonals	8,242	8,242.00		13,160	13,160.00	
Total		14,798.70	25.50		17,835.27	30.73
<u>Hot weather</u>						
Perennials	2,919	2,921.88		2,050	5,905.20	
H.W. seasonals	Nil	Nil		18,516	33,330.63	
Hybrid crops in H.W.	Nil	Nil		21	63.01	
Total		2,921.88	5.39		39,298.84	72.53
<u>Total</u>		28,177.49	17.81		61,121.02	38.64

Appendix E : Rainfall at Sirur Rainguage Station for the Period from 1970 to 1983

Month	Normal rainfall	(Rainfall in mm.)													
		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981*	1982*	1983*
January	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
February	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
March	2.0	-	-	-	-	-	-	-	-	-	-	2	-	-	-
April	7.0	35.7	-	-	-	-	-	-	-	35	-	3	-	-	-
May	18.0	26.5	66.0	29.	2.0	70.0	2	-	18	32	22	7	-	33.5	-
June	107.0	72.9	26.0	67	157.3	48.4	100	239	128	80	69	192	52.8	31.1	8.0
July	24.0	27.0	9.0	9	170.2	66.4	65	33	97	17	70	33	39.4	20.0	161.0
August	43.0	103.0	164.0	-	75.9	65.2	105	47	24	21	104	125	11.2	-	60.0
September	143.0	82.0	193.0	5	19.0	302.5	268	28	105	149	315	178	366.0	188.1	262.0
October	62.0	61.0	35.2	142	196.7	247.6	122	4	73	36	41	-	107.0	49.8	90.0
November	33.0	-	-	-	3.1	-	-	50	116	67	66	68	2.6	57.0	-
December	7.0	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Total	460.0	408.1	493.2	252	624.2	800.1	662	401	561	437	687	609	579.0	379.5	581.0

* Rainfall at Chinchani

Source : 1) Socio-Economic Review and District Statistical Abstract of Pune District, Directorate of Economics and Statistics, Government of Maharashtra, Bombay, Various Issues.

2) Register of Ghod Dam regarding rainfall at Chinchani, Irrigation Department, Sirur, Pune.

Appendix F : Seasonal Duties Adopted on Ghod Project

Crop	(Area in hectares)		
	Kharif	Rabi	Hot weather
Cane	28.33	28.33	20.23
Kharif seasonals	129.55	-	-
Two seasonals	48.56	56.68	-
Rabi seasonals	-	85.00	-
Hot weather seasonals	-	-	40.47

Appendix G : Conversion of the Area under Various Crops in
the Approved Cropping Pattern of the Project
into the Base Crop Area

Crops	Area (ha)	Duty	Base crop area (ha)
<u>Khharif</u>			
Perennials	2,560	28.33	7,680.90
Seasonals	10,000	129.55	6,561.17
Two seasonals	5,600	48.56	9,802.31
			<u>24,044.38</u>
<u>Rabi</u>			
Perennials	2,560	28.33	7,680.90
Two seasonals	5,600	56.68	8,398.02
Seasonals	6,800	85.00	-6,800.00
			<u>22,878.92</u>
<u>Hot weather</u>			
Perennials	2,560	20.23	10,756.30
			<u>57,679.60</u>
Total			57,679.60

Appendix H : Conversion of the Area under Various Crops in the Revised Cropping Pattern (1979) of the Ghod Project into the Base Crop Area

Crops	Area (ha)	Duty	Base crop area (ha)
<u>Kharif</u>			
Perennials	1,900	28.33	5,700.67
Seasonals	8,400	129.55	5,511.38
			<u>11,212.05</u>
<u>Rabi</u>			
Perennials	1,900	28.33	5,700.67
Seasonals	9,000	85.00	9,000.00
			<u>14,700.67</u>
<u>Hot weather</u>			
Perennials	1,900	20.23	7,983.19
Seasonals	1,200	40.47	2,520.38
			<u>10,503.57</u>
<u>Total</u>			<u>36,416.29</u>

Appendix I : Conversion of the Area Irrigated under Various Crops into the Base Crop Area

Crop	Duty	1970-71			1971-72			1972-73		
		Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation
<u>Kharif</u>										
Perennials	28.33	1,303	3,909.46		1,120	3,360.39		1,440	4,320.51	
Seasonals	129.55	2,690	1,764.95		3,423	2,245.89		3,254	2,135.00	
			<u>5,674.41</u>	23.60		<u>5,606.28</u>	23.32		<u>6,455.51</u>	26.85
<u>Rabi</u>										
Perennials	28.33	1,303	3,909.46		1,120	3,360.39		1,440	4,320.51	
Seasonals	85.00	7,707	7,707.00		6,144	6,144.00		9,772	9,772.00	
			<u>11,616.46</u>	50.77		<u>9,504.39</u>	41.54		<u>14,092.51</u>	61.60
<u>Hot weather</u>										
Perennials	20.23	1,303	5,474.79		1,120	4,705.88		1,440	6,050.42	
Seasonals	40.47	1,840	3,864.59		2,047	4,299.36		-	-	
			<u>9,339.38</u>	-		<u>9,005.24</u>	-		<u>6,050.42</u>	-
Total			26,630.25	46.17		24,115.91	41.81		26,598.44	46.11

Contd...

Appendix I : (Continued)

Crop	1973-74			1974-75			1975-76			1976-77		
	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion
<u>Khariif</u>												
Perennials	872	2,616.31		777	2,331.27		808	2,424.28		1,409	4,227.50	
Seasonals	1,642	1,077.34		3,767	2,471.59		4,656	3,054.88		7,499	4,920.22	
		<u>3,693.65</u>	15.36		<u>4,802.86</u>	19.97		<u>5,479.16</u>	22.79		<u>9,147.72</u>	38.04
<u>Rabi</u>												
Perennials	872	2,616.31		777	2,331.27		808	2,424.28		1,409	4,227.50	
Seasonals	6,657	6,657.00		6,009	6,009.00		9,342	9,342.00		13,372	13,372.00	
		<u>9,273.31</u>	40.53		<u>8,340.27</u>	36.45		<u>11,766.28</u>	51.43		<u>17,599.50</u>	76.92
<u>Hot weather</u>												
Perennials	872	3,663.86		777	3,264.70		808	3,394.96		1,409	5,920.17	
Seasonals	1,404	2,948.85		2,785	5,849.39		3,017	6,336.67		3,177	6,672.72	
		<u>6,612.71</u>	-		<u>9,114.09</u>	-		<u>9,731.63</u>	-		<u>12,592.89</u>	-
Total		19,579.67	33.94		22,257.22	38.59		26,977.07	46.77		39,340.11	68.20

Contd...

Appendix I : (Continued)

Crop	1977-78			1978-79			1979-80			1980-81		
	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion	Area ir- rigated (ha)	Base crop area (ha)	Percentage utilisa- tion
<u>Kharif</u>												
Perennials	2,129	6,387.75		1,400	4,200.49		1,040	3,120.37		1,560	4,680.55	
Seasonals	6,051	3,970.16		7,149	4,690.58		6,083	3,991.16		7,734	5,074.41	
		<u>10,357.91</u>	43.08		<u>8,891.07</u>	37.00		<u>7,111.53</u>	63.42		<u>9,754.96</u>	87.00
<u>Rabi</u>												
Perennials	2,129	6,387.75		1,400	4,200.49		1,040	3,120.37		1,560	4,680.55	
Seasonals	12,044	12,044.00		11,322	11,322.00		9,059	9,059.00		9,949	9,949.00	
		<u>18,431.75</u>	80.56		<u>15,522.49</u>	67.85		<u>12,179.37</u>	82.85		<u>14,629.55</u>	99.52
<u>Hot weather</u>												
Perennials	2,129	8,945.38		1,400	5,882.35		1,040	4,369.74		1,560	6,554.62	
Seasonals	3,000	6,300.96		4,360	9,157.40		4,768	10,014.33		3,944	8,283.67	
		<u>15,246.34</u>	-		<u>15,039.75</u>	-		<u>14,384.07</u>	136.94		<u>14,838.29</u>	141.27
Total		44,036.00	76.34		39,453.31	68.40		33,674.97	92.47		39,222.80	107.71

Contd...

Appendix I : (Continued)

Crop	1981-82			1982-83			1983-84		
	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation	Area irrigated (ha)	Base crop area (ha)	Percentage utilisation
<u>Kharif</u>									
Perennials	1,617	4,851.57		1,780	5,340.63		1,650	4,950.58	
Seasonals	6,239	4,093.51		4,280	2,808.18		5,515	3,618.49	
		<u>8,945.08</u>	79.78		<u>8,148.81</u>	72.68		<u>8,569.07</u>	76.43
<u>Rabi</u>									
Perennials	1,617	4,851.57		1,780	5,340.63		1,650	4,950.58	
Seasonals	9,923	9,923.00		10,266	10,266.00		9,125	9,125.00	
		<u>14,774.57</u>	100.50		<u>15,606.63</u>	106.16		<u>14,075.58</u>	95.75
<u>Hot weather</u>									
Perennials	1,617	6,794.12		1,780	7,478.99		1,650	6,932.77	
Seasonals	3,332	6,998.27		2,137	4,488.39		3,398	7,136.89	
		<u>13,792.39</u>	131.31		<u>11,967.38</u>	113.94		<u>14,069.66</u>	133.95
Total		37,512.04	103.01		35,722.82	98.09		36,714.31	100.82

BIBLIOGRAPHY

Books

- Ambegaonkar, L. W. A Study of the Utilisation of Irrigation Potential of the Purna Irrigation Project, A Ph.D. thesis submitted to the University of Poona, 1979 (Unpublished).
- Borkar, V. V., and Padhye, M. D. Purna River Valley Project, Aurangabad, Marathwada University, 1972.
- Clark, Colin and Carruthers, I. The Economics of Irrigation (3rd edition), Liverpool, The English Language Book Society and Liverpool University Press, 1983.
- Giriappa, S. Water Use Efficiency in Agriculture, Bangalore, Institute for Social and Economic Change, 1981.
- Government of India, Planning Commission. Evaluation of Major Irrigation Projects - Some Case Studies, New Delhi, 1965.
- Government of Maharashtra, Department of Agriculture. Ghod Project, Poona, 1970.
- _____. Purna Project, Poona, 1970.
- _____. Water Requirements of Crops in Different Agro-climatic Zones, (Agricultural Bulletin No.574), Pune, 1975.

Government of Maharashtra, Directorate of Economics and Statistics, Socio-Economic Review and District Statistical Abstract of Pune District, Bombay, Various Issues since 1970-71.

_____. Socio-Economic Review and District Statistical Abstract of Parbhani District, Bombay, Various Issues from 1968-69 to 1981-82.

Patil, R. G., Suryavanshi, S. D. and Kapase, P.M. An Investigation into the Socio-Economic Conditions in Ghod Command Area, Rahuri, Mahatma Phule Agricultural University, 1980.

Satpathy, T. Irrigation and Economic Development, New Delhi, Ashish Publishing House, 1984.

Administrator. A Success Story of Ghod Project, Pune, Command Area Development Authority, (in Marathi), 1981.

Reports

Government of India. Report of the Indian Irrigation Commission 1901-03, Calcutta, Office of the Superintendent of Government Printing, India, 1903.

_____. Ministry of Agriculture, Interim Report of the National Commission on Agriculture on Modernising Irrigation System and Integrated Development of Commanded Areas, New Delhi, 1973.

Government of India. Ministry of Agriculture and Cooperation, Annual Report 1984-85, New Delhi.

_____. Ministry of Agriculture and Irrigation, Report of the National Commission on Agriculture, Part V, New Delhi, 1976.

_____. Ministry of Finance, Report of the Seventh Finance Commission, New Delhi, 1978.

_____. Ministry of Finance, Report of the Eighth Finance Commission, New Delhi, 1984.

_____. Ministry of Irrigation and Power, Annual Report, 1984-85, New Delhi.

_____. Ministry of Irrigation and Power, Report of the Irrigation Commission, Vol.I, New Delhi, 1972.

_____. Ministry of Irrigation and Power, Report of the Committee of Ministers on Underutilisation of Created Irrigation Potential, New Delhi, 1973.

_____. Planning Commission, Annual Plan 1984-85, New Delhi.

_____. Planning Commission, Seventh Five Year Plan 1985-90, New Delhi.

_____. Planning Commission, Sixth Five Year Plan 1980-85, New Delhi.

Government of Maharashtra. Report of the Maharashtra State Irrigation Commission, 1962.

_____. Irrigation Department, Annual Administration Reports of the Command Area Development Authority 1981-82 to 1983-84, Pune.

- Government of Maharashtra. Irrigation Department, Annual Administration Report of CADA 1983-84, Nanded.
- _____. Irrigation Department, Report of the High Power Committee, Bombay, 1981.
- _____. Irrigation and Power Department, Report of the Soil Survey of the Areas Commanded by Purna Left Bank Canal in the Marathwada Areas of Maharashtra State, Vol.I, Bombay, 1964.
- _____. Irrigation and Power Department, Revised Administrative Approval for Ghod Project, Bombay.
- _____. Planning Department, Annual Plan 1980-81, Bombay.
- _____. Planning Department, Annual Plan 1984-85, Bombay.
- _____. Planning Department, Sixth Five Year Plan 1980-85 and Annual Plan 1981-82, Bombay.
- _____. Planning Department, Seventh Five Year Plan 1985-90 and Annual Plan 1985-86, Part I, Bombay.
- _____. Planning Department, Report of the Fact Finding Committee on Regional Imbalance in Maharashtra, Bombay, 1984.
- _____. Report of the Committee of Official and Non-official Members to Find Out the Causes of Underutilisation of Irrigation Potential of Purna Project (in Marathi), Bombay, 1972.
- _____. Report of the Fact Finding Committee for Survey of Scarcity Areas of Maharashtra State, Vol.I, Bombay, 1973.

Government of Maharashtra. Interim Report of the Committee to Study the Introduction of Eight Monthly Supply of Water on Irrigation Projects in Maharashtra (Mimeograph), 1979.

Articles

- Deshmukh, Shivajirao. "Development of Irrigation in Maharashtra," Lokrajya, Vol.41, February 16, 1986.
- Koshy, Stephen. "Foodgrain Production in India during the Sixth Plan and Irrigation Programme," Bhagirath, Vol. XXXI (2), April, 1984.
- Mitra, A. K. "Underutilisation Revisited Surface Irrigation in Drought Prone Areas of Western Maharashtra," Economic and Political Weekly, Vol. XXI, No.17, April 26, 1986.
- Pandya, G. S. "Water Logging Causes and Measures for its Prevention in Chambal Command of Madhya Pradesh," Symposium on Waterlogging - Causes and Measures for its Prevention, Vol. II (Publication No. 118), New Delhi, Central Board of Irrigation and Power, 1972.
- Pawar, J. R. and Kadam, C. S. "Underutilisation of Canal Water," The Economic Times, Bombay, 10th September, 1975.
- Rath, N. and Mitra, A. K. "Economics of Utilisation of Canal Water in Dry Agricultural Regions Characterised by Potential Shortage of Water," IWSA Seminar, New Delhi, May 4, 1986.

Solanke, D. A., Sangle, G. K. and Chole, R. R. "Factors Associated with Underutilisation of Canal Irrigation," Behavioural Sciences and Rural Development, January, 1979.

Sule, Surekha. "Minor Irrigation Deserves Top Priority," The Economic Times, Bombay, February 5, 1986.

Wade, Roberts. "Performance of Irrigation Project," Economic and Political Weekly, Vol.XI, No.3, January 17, 1976.

Government of India. Ministry of Irrigation, Bhagirath, Vol. XXX, New Delhi, Central Water Commission, October, 1983.

Indian Express, Bombay, April 29, 1986.

Records

Government of Maharashtra. Irrigation Department, Register of Ghod Dam Regarding Rainfall, Sirur, Pune.

_____. Irrigation Department, Rainfall Data Register for Parbhani District, CADA, Nanded.

_____. Irrigation Department, Water Account Register, Command Area Development Authority, Nanded.

_____. Irrigation Department, Water Account Register, Command Area Development Authority, Pune.