"IMPACT OF IRRIGATION ON ECONOMIC DEVELOPMENT- A STUDY OF SHRIGONDA TAHSIL, AHMEDNAGAR DISTRICT, MAHARASHTRA"

A thesis submitted to

TILAK MAHARASHTRA VIDYAPEETH, PUNE,

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October-2012

DECLARATION

I hear by declare that the thesis entitle **"Impact of Irrigation on Economic Development- A study of Shrigonda Tahsil, Ahmednagar District, Maharashtra"** completed and written by me has not previously formed the basis for the award of any Degree or other similar title of this or other University or examining body.

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Date: October 2012

CERTIFICATE

This is to certify that the thesis entitled **"Impact of Irrigation on Economic Development- A study of Shrigonda Tahsil, Ahmednagar District, Maharashtra"** which is being submitted herewith for the award of the Degree of Vidyavachaspati (Ph.D.) in the subject of **Geography** of **Tilak Maharashtra Vidyapeeth, Pune** is the result of original research work completed by **Shri. Sopan Nivrutti Dalimbe** under my supervision and guidance. To the best of my knowledge and belief the work incorporated in this thesis has not formed the basis for the award of any Degree or similar title of this or any other University or examining body.

Dr. N. M. Kadam
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Chapter.1

INTRODUCTORY

1.1: Introduction:

In India with more then 75% of the total population is in rural areas. It is imperative to develop the villages. Agricultural activity is not only a means of earning livelihood about a way of life in the Indian context. In India, agricultural sector is predominant. So obviously agricultural planning will be the core of the overall planning. The basic production unit is the individual's farm. Marion Clawson remarks that the "Considerations of physical feasibility, economic efficiency and cultural acceptability set major limits for truly comprehensive national planning for agriculture" (Marion Clawson 1963). Out of the National Income gross agricultures share is 42% (Directorate of Economics and Statistics, New Delhi 1980). Hence the level of efficiency and productivity in agriculture to a great extent determine the efficiency of Indian economy. Thus indirectly rural development is depends on the agricultural development of the nation. When once the population is self sufficient in the food grains, oil seeds, pulses etc. the surplus income generated can be used for other necessary infrastructure development (Vasudeva Rao, D. 1978), for the development of agriculture, the availability of water dependable and in sufficient quantity is a pre condition. Rural development and prosperity through irrigation has been the dominant theme is in Indian planning through five year plans.

All too often irrigation studies in India are confined to relatively narrow issues in production economics. It is obvious that, viewed as an input in rural development not merely agricultural production irrigation has other points of contact with development, economics as the irrigation in Indian rural economy begins to move from the wings towards the centre of the stage (Rao, V. M. 1976). Wide distribution of irrigation

water implies a strategy of dispersing the development thrust of irrigation it has other points of contact with development economics as the irrigation in Indian rural economy begins to move from the wings towards the center of the stage. Wide distribution of irrigation water implies a strategy of dispersing the development thrust of irrigation it has to treat irrigation as only a component in a broader design for agricultural and rural development.

Irrigation often lands to increase urban market contacts on the part of the farmers with so many objectives of linking with development. Agricultural development does not start in vacuum. This is already in operation through ages but in traditional ways. It should have a five lift and transformation.

With the progress of time the accent on the country's agricultural development has changed from problem of food scarcity to equity in distribution of benefits accruing to individual farmers. To analyze the distributive justice in development, no single study can encompass all the relevant dimensions, as these manifestations of the phenomenon are many and diverse. Even then social scientists have been paying lot of interest to the problems of agricultural development and a interknit and connect the development of agriculture to the overall economic growth. There can't be one point solution to all the evils.

Agricultural development leads to higher levels of productions of food and other farm products, higher income, better standard of living to the cultivators in particular and non-cultivators also draw the benefits with its spread effects.

Arputharaj observes that characteristics of underdeveloped countries are 1) concentrations of population in primary sector, 2) Population explosion, 3) poor efficiency in human resources, 4) unemployment 5) low per capita income, 6) low level of technology, 7)

shortage of capital for investment and 8) disparities in income (Arputharaj. 1983).

While relating agriculture sector and economic development, he observes that role of agriculture is very vital in economic development of a country. In fact development in other sectors is linked to that of agriculture unless agricultural productivity is very high; diversion of manpower for agriculture is not possible.

It agricultural productivity is very high, the savings would also be high. Supply of raw materials and food grains are very important for economic development. He suggests the following solutions for rapid rural development.

- Intersectoral balancing and linkages.
- Lessening pressure on land by increasing productivity.
- Land reforms: tenancy legislation, land ceiling, consolidation of holdings.

Johnston and Mellor suggest the following important contributions of agricultural sectors a) increased food supply, b) set of agriculture exports, c) increased transfer of labour force, d) additional capital formation, e) additional purchasing power, as a result of an increasing level of income (Johnston & Mellor, 1961).

Simon Kuznets feels the contribution of agriculture to the overall economic development by

a) Product contributions; increase the supply of food and fiber products ;
b) Market contribution ; trade contacts with other sectors ;
c) Factor contribution; release of labour force for non-farm occupation (Simon Kuznets, 1961).

Increased agricultural production provides food for the ever growing non- farm sector; initially agro based industries like processing

industries, (sugar, milk, lemon) mills, oil extraction. The higher returns to the farm houses encourage them to invest more on modern farm practices for regular and higher yields. The higher returns induce farmers to improve the intake of quality food and there by their nutritional standards. This tells on the higher level of living with more amenities and better of living with more amenities and better facilities. Higher production obviously leads to better consumption (market surplus will also be more) better hours i.e. higher labour productivity (Vasudeva Rao, D. 1975).

Mellor argues that agricultural sector can provide for capital formation, in much more strength, than ever known or felt, substantial proportion & income in rural area is in the hands of persons whose income is well above the average (Mellor, 1967).

When the improved agriculture production can release the under employed farm workers to other sectors firstly the women and children (family labour) can be spared (Shrikant, K. S. others, 1978). The children can be sent to school and their skills can be improved, whereby the overall (rural) literacy rate can go up. Those children who sharpen their skills can return to their villages as "new entrepreneurs" and can exploit the local potential non – farm opportunities. This helps to absorb the locals into employment opportunities created in their native villages.

When once the agricultural development takes place, the related agricultural infrastructure has to develop consequently to reap better and quicker results. The infrastructure includes irrigation, transport, storage, processing, power (physical), credit, marketing, extension and research (service) and agrarian reforms, co-operatives (organizational) etc. which, when work in consonance, would bring the maximum returns.

As per S.R. Sen. Development of agriculture helps economic development from stagnant to the progressive stage by i) increasing the gross national product, ii) supplying the physical surplus in the shape of

food and raw materials and iii) providing the economic surplus which constitutes the material basis for economic development (Sen, S. R. 1959).

In a note by agriculture ministry, Government of India, it is stressed that the inescapable solution is that a rapid increase in production of food in India's primary problem in achieving welfare, social justice and democracy (Ministry of Food and Agriculture, Govt. of India, 1959).

Natural priority in a plan, trying to raise the standard of living of masses, most of who reside in rural areas, is to strengthen the rural base of the economy before any large scale industrialization programmers could be undertaken. Agricultural sector has to generate the surplus, essential for the development of other sectors of the economy as it has a large number of spills over schemes, to depend on.

In Israel almost all of the increase in farmed area consists of land brought under irrigation. Irrigation is also the most important single contributor or agriculture growth in Greece between 1950-60 (USDA, 1955).

Irrigation is a vast subject and both its content and impact vary with the source on it is based. In the new planning strategy now being worked out, irrigation is being assigned a major role in rural development and employment generation (Rao, V. K. R. V. Forward of Impact of Irrigation, *Ibdi*, 1979). Not only does controlled water supply reduce fluctuations in agriculture output, it also raises crop yields. Yields on irrigated lands are much higher than those in un-irrigated lands (NCAER, 1963). Estimated that on the average, irrigation causes 30% increase in yield acre of rice and 20 % for wheat.

Lele and Mellor used the figures of 30% as representing the increment in yields to be expected from irrigated as compared to un-irrigated lands (Lele & Mellor, 1963). Water is a key factor in plant

growth and its availability in adequate amounts and at the right time is one of the basic determinants of agriculture productivity (William Donald, 1970). Panse and associates indicated an additional food grain yield of 0.5 to 0.7 tons per acre from the use of irrigation (Panse & Associates, 1964). Ford Foundation Team estimated an increase of 0.20 to 0.25 tons of again per acre on irrigated land as compared to un-irrigated land (Ford Foundation Team, 1959). National planning commission estimated productivity of irrigated land to be almost twice that of un-irrigated land (National Planning Commission, 1967).

The development of irrigation effects agriculture in several ways:

1. It makes the outcome of the crop more certain than in its absence. Instability of yields should decline with the advent of irrigation ;
2. the immediate impact is on crop pattern leading to a shift from less to more remunerative crops; and
3. Irrigation is also expected to increase the overall productivity.

A dry region previously having low yielding crops and unstable yields enjoys the privilege of a more stable and higher value of output with the introduction of irrigation (Nadkarni, M. V., Irrigation Development in Karnataka, 1979). Water more than any other production input, dictates the seasonal crop pattern and the Intensity of cropping (Weaver, 1967). With inelastic supply of land, attempts in the underdeveloped countries to increase output are directed to increasing yields per acre and cultivating each hectare as many times as possible during a year. Irrigation agriculture has great a year. Irrigation agriculture has great potentiality to absorb the modern inputs.

Irrigation reduces the risks; uncertainty associated with rain fed farming and facilitates adopting of modern inputs by farmers. Plugging land under irrigation is commonly associated with increased dependence upon the market economy, with increased use of purchased inputs, with

improved tillage practice (USDA, 1965). Irrigation, therefore, is not merely on input providing modest increase in yields, it is also an instrument of transformation of subsistence farming into modern agriculture provision of adequate and timely irrigation facilities cropping and thus increase the 'effective area' under cultivation (Rao, V. M, 1979) . Irrigation has been an important input in rural development not only to augment agricultural production but to removal lessen interregional disparities in the level of development. Irrigation helps a great deal in reducing the disparity in climate, rainfall etc. irrigation is a tool by which land is made useful in drought prone areas by providing water for land (Nanjundappa, D. M. 1981).

The concept of extensive and intensive irrigation can be practically implemented in the areas, brought under the command of the irrigation project. In case of irrigation, the first step is the availability of water in sufficient quantities and on time (dependability). Then a suitable crop pattern should be evolved depending on the soil – crop – water – requirements. This is influenced by the current expected market prices. With the assured water availability, the crop pattern with change from inferior water availability the crop pattern with change from inferior coarse grains to superior quality cereals, pulses and millets. More area would be brought under commercial crops. With changed food habits, higher productivity and more returns from commercial crops, there would be higher surplus available in the same region after the introduction of irrigation. For modern agriculture, which envisages a shift from single and traditional cropping to multiple and commercial crops, irrigation is the main source.

The other major chunk of the primary sector in the rural area is the agriculture labour. This section gets work seasonally on some of the large farms. Rest of the year would be slacks season for these people and they

have to go in for all sorts of odd jobs or migrate to the neighboring urban areas. This creates problem both economic and social to the mitigate these problems to a vary large extent. When the dry crops are turned into wet crops, more number of man-days is required (Vasudeva Rao, D. 1978). Along with it's, some agro- based processing industries with backward and forward linkages will automatically come up in the region. In some neighboring areas, non- farm activity; processing units, markets, warehouses, trade, transport etc, will develop to absorb the once "under employed" population. Thus irrigation directly to some extent and indirectly to a large extent helps to solve the under employment problems of a region. Thus in the background, irrigation holds the key for agriculture development. An irrigation project confers both direct and indirect benefits on the region *viz*, an increase in the farm production, creation of opportunities for processing activities, employment opportunities for processing activities, employment opportunities in the related by providing new investments, employment opportunities in the related secondary and tertiary sectors. Newer activities are created by providing new investments, employment, income and related benefits. The greatest and first benefit, which can't be quantified, is the sense of security in the farmers and stability of farm business.

In agriculture a small input would result in a large output *i.e.,* low input output ratio. Hence greater investment can be should be made in agriculture. Development of agriculture dose not demands foreign exchange as in the case of industry. As agricultural contribution to the national income is around 42 % developing agriculture will lead to higher per capita income.

For this study Shrigonda Tahsil is taken up, for i) irrigation has improved much, over the past three decades ii) the agricultural development through Command Area Development Authority, through

there are five such CADAs in the Tahsil, remained a bunch of un-co-ordinate schemes not bringing the expected results, iii) frequent droughts floods marred the little progress achieved if any and iv) the familiarity of the researcher with the Tahsil and the region.

In Shrigonda, net area sown is 74.18% of the total geographical areas. Out of his 27.72% is the net area irrigated (2009-10). In different Tahsil in the district, the area brought under irrigation varies. Area irrigated by canals is 13785.97 hectares of the total area irrigated. For the year 2009-10, at current prices the contribution of agriculture to the Tahsil income is 46.35% and that of the primary sector is 49.12% (Maharashtra at a glance, Bureau of Economics and Statistics. 2000-10). Such is the importance and magnitude of the agriculture sector in Shrigonda Tahsil. Hence, the starting point for development would be no other than agriculture itself.

1.2: Review of Literature:

In the present study an attempt has been done for understanding the change which has occurred due to irrigation facilities in Shrigonda Tahsil with geographical view by reading so many related literature of agricultural geography. In India, there are differences between land use and crop pattern. Many geographers, economists, agriculturists and planners studied differently about irrigation, crop pattern etc. and therefore this topic have multiple approaches.

The impact of irrigation is studied by several social scientists in the past in different parts of India. The studies are of different parts of India. The studies are of different nature (cross sectional and longitudinal) and at different levels; at macro level or at micro level i.e. at village level. The ultimate aim is to bring out the impact of irrigation on various factors or aspects of development either at the household level or village level.

The factors generally touched upon are farm economy, general economic conditions, employment etc. in come cases even the social factors are analyzed.

Gadgil, D. R. (1948) studied the affect of irrigation on economic development and he focused on the direct and indirect advantages of Pravara and Godavari Canal Irrigation Plan and studied comparatively the irrigated and non-irrigated area. He concluded that when farmers in Godavari and Pravara Canal region, change their crop pattern then their per acre productivity and total income will increased. Besides by changing the production system and transport facility the agricultural production and commerce and trade increased. Consequently the road and rail transport, market facility becoming increase in Ahmednagar district. There is more need of agricultural labours in irrigated area and alternatively employment opportunities and employment rate become increased. This increase in income is helpful for increasing economic and social status of labours. In 1958, Planning and Development Corporation, government of India had decided to create one research group by presidency of D. R. Gadgil and studied some selected direct and indirect benefits. They studied various projects like Sarala Canal (U.P), Triveni Canal (Bihar), Damodar Canal (West Bengal), Kaveri Mettur Project (Tamil Nadu), Nijamsagar Project (Andhra Pradesh) and Ganga Canal (Rajasthan).In 1954-56 Epstein selected two villages in Mandya district of Karnataka state representing the wet and dry nature of irrigation. She visited these villages again in 1971. She analyzed the caste system, class dominance etc., between these two villages over time. However the impact of irrigation is brought out as a salient feature, in the background; Irrigation has increased considerably the productivity of land and facilitated growing of cash crops, thus raising the prices of wet lands by 330 %. It raised the levels of income and standard of living. Canal

irrigation has reduced dependency of farmers of risks like uncertain and scare rainfall. On overall regional development number of wage earning people has gone up commuting (new rich class) has increased, leading to new houses, shops. When the marginal propensity to consume is high, the multiplier effect is considerable. In the wet village unlinear nature of economic growth is observed where agriculture remained the dominant economic pursuit, while the dry village developed into a kind of servicing centre for neighboring irrigated villages and its economy got diversified.

Krishna Murthy (1956) has evaluated the influence of Mattur irrigation and hydro electric project on agriculture and agro- industries in Puttukotal tahsil of Tanjore district of Tamil Nadu State. The sample covered 15 villages; with a sample of (total) 597 household; some with land and others with no land under the project and another 54 households from the non-project area to serve as control. The topics covered are area under irrigation, net cultivated area, intensity of cropping, yield rates, food supply, agriculture employment, cultivation practices, land scale and indebtedness. In all these aspects, it has been observed that the project area has an edge over the non-project area in general and wet cultivators over dry cultivators in particular.

Singh and Singh (1962) Studied and compared he rate at which and the extent to which irrigation by Bakra Dam has contributed in ameliorating the economic and social conditions of inhabitants of this tract. They have selected 8 already irrigated villages, 15 villages irrigated only through Bakra and 7 dry villages. When the water is released first during 1952- 53 and again in 1961- 62 they have compared the status of these villages. They have observed that crop pattern, pattern of cultivation, crop intensity have changed in the villages under Bakra, with more secure agriculture condition and with more returns. The standard of living of farmers has gone up. Irrigation seems to have lowered the area

under traditional crop bajra and increased the area under more profitable crops like cotton, sugarcane, rice, vegetables and gram. So far as family budget is concerned, it is observed that the total average income per family per annum (source wise) has gone up in the villages under the dam. A shift in the standard of living, as reflected by food habits, has also been observed.

Hanumantha Rao (1965) Compared yields in Telangana between partially irrigated (86) and dry (121) farmers. Among partially irrigated farmers output shows, on an average, a greater degree of response to a given percentages increase in land output than to a similar increase in labour input. The converse of it holds true among dry farmers greater the intensity of utilization of land, larger the elasticity of output that could be expected with respect to this factor.

Divakar Jha's (1967) study deals with the direct and indirect benefits of irrigation under the Tribeni canal in the Champaran district of Bihar (under the Gandak River). Study area is divided into two major parts (i) project area (P), (ii) control area (C), the farmer with 96 % irrigated area under canal as against 34% in the latter. But the percentage areas irrigated to the total cultivated area differed much 55% to 2 % (c). In each area, around 4,000 farmers are contacted. The direct benefits studied and compared between (p) and (c) are (1) land ownership (2) land utilization and crop pattern, (3) rural credit borrowings (4) farm investment, (5) farm implements (6) farm assets, (7) livestock, (8) human labour, (9) farm input, (10) farm output, I/O ratio, (11) Value of land, where as indirect benefits studied are (a) agricultural labour, (b) rural industries, (c) rural transport, (d) urban development (e) urban industries. The author categorically concluded that the irrigation has definitely brought prosperity of the project area cultivators.

Great economists named Divakar Za (1967) and Basu and Mukerjee (1963) concluded that by means of irrigation maximum land utilized for cultivation of cash crops or people's attitude turned into to obtain commercial crops production rather than food grain crops. This situation caused for developing and increasing the per acre production and income. This same situation has been seen at Ahmednagar district.

Sachidananada (1972) in his study on social dimension of agricultural development in Bihar, has observed that the caste composition, size and type of family, education, occupation, land holding size and socioeconomic status, levels of living levels of aspirations differed significantly between the two sets of block : one with IADP and other without it.

Another study by Khan and Triparhy (1972) in west Godavari district of Andhra Pradesh compared the upland (dry) and delta (wet) irrigation. The sample consists of 94 sample farms from 3 wet villages and 180 farms from 6 dry villages. In wet areas, income from cultivation and livestock enterprise is high on the average LHS. In so far as modern agriculture practices are concerned, the overall response of delta farmers has been quite good. The gross income, net returns and productivity of labour, both human and bullock, are more in wet cultivation.

In the Mizaffarnagar district of U.P. Prakasa Rao (1976) conducted a study on the "Strategy for developing an agricultural region". He considered Khadar (flood plain), and Bhanagar (interflow) tracts, covering 6 villages. It has been observed that (i) use of inputs is more intensive in small farms, (ii) yield per acre goes up with increasing 1 HS, (iii) < 5 LHS of B > 30 LHS in K are losing farms where input > output, iv) investment capacity, entrepreneurship, types of land are more reflected in higher inputs, more profit, than the high LHS, (v) with

uncertainly of inputs, prices, marketability the small farmers are cautious and calculative.

Rajpurohit (1977) who revisited the Mandya villages (earlier studies by Epistein) observed differential impact of irrigation in different socio- economic groups. The wealthiest have become considerably richer. The earlier observation that the untouchable house holds, with rural cash wage dependency, further worsened their standard of living is contested. Vokkaligas of medium land ownership are the great beneficiaries from irrigation.

Abdul Aziz (1977) observed in his native village Hunisikote in Kolar district, that before and after the introduction of well irrigation, there is a change in the occupational pattern, as reflected by emergency of plurality of occupations in the same household. There has been some occupational mobility in the village after sinking wells- shift by emphasis towards agriculture as main occupation with majority from artisans joining agriculture.

Patil R.G., Suryvanshi S.D. and Kapse P.M. (1978) studied Socio-economic survey of Girna Project in district Jalgaon and concluded that irrigation projects are not only beneficial for economic purposes but also for farmers socio-economic development. Economic development includes growth of per acre production, change in crop pattern, increase in income and agricultural production as well as farmers standard of living improves. Besides it is helpful for people's awareness regarding education, health, family planning in social point of view.

Pandey's (1979) study on impact of irrigation on rural development is a case study on command areas of Kivi– Badua – Chandan in the State of Bihar. In all 6 villages 3 each from wet and dry categories are selected. The households within the villages are selected on the basis of purposive random sampling. The criteria of selection are: size of land hold, location,

population, soil, rainfall, climate and geophysical conditions out of he total 2,033 households in the 6 villages, a sample of 610 households is selected. These villages are studied with reference to the variables like communication, population, occupation, irrigation, markets, co- operative societies; self leased cultivation, fragmentation, crop pattern, income and indebtedness. The study indicates that the overall performance of the irrigated villages is far superior to that of the un-irrigated villages.

Another study conducted by Alexander (1979) at Attabira and Rengati Block under Hirakud command area concluded that economic development and social change are closely associated. By two state random sampling, he has selected 463 persons in R and 538 persons in A Block, each covering 100 households. The study of benefited Vs control blocks brought out that (1) Introduction of canal irrigation in A, lead to intensification of agriculture through larger use of labour, various inputs, multiplication of crop pattern. (2) There is a six fold increase in A, than in R, in the production of paddy in a year. This made 75 % of farmers (belonging to 2 acres class) to be in surplus. (3) Employment in primary sector and hence in secondary and tertiary sectors has gone up (4) Though employment opportunities have gone up in A, only 53 % are workers (80 % in R) due to the withdrawal of children, adults and old women from work. (5) Level of living of a marked difference in clothing, food consumption, and housing than in R. To meet the subsistence needs, agricultural produce is sold in R due to deteriorating economic condition, while in A to meet social needs.

In this study of Bellary district in Karnataka, Misra (1979) classified the sample villages under Tunga Bhadra dam inter dry – cum – wet, perennial and wet depending on the availability of water for irrigation. He had selected ten villages from 3 talukas. On the whole he collected information (HH level) from 92 farmers and 9 landless labours.

He observed an inverse relationship between the size of the holding and the area irrigated. Allocation of area under different crops; adoption of new HYV crops are the result of irrigation. The induced effects of quick yielding change in the field of production refer to higher crop yields per acre in the sample villages, than what they were prior to canal irrigation. Despite high cost per acre, the farm business income per acre is positive in irrigated lands. So also the net income per acre. The introduction of canal irrigation has positively effected the employment of labour per person and per acre. The annual employment per person has increased significantly in all the villages, including landless labour.

Patil (1980) conducted a study in the Ghod command Area of Maharashtra about the socio- economic conditions of the farmers in the command area. Samples of 400 holdings, 40 in each cluster are randomly selected. In Karjat Tahsil 2 clusters ; in Shrigonda Tahsil 5 clusters ; from Shrigonda Tahsil 3 clusters are selected is collected on land use pattern, crop pattern, agricultural implements and crop- wise labour input. The analysis is presented per farm, and per hectare on adoption of improved agricultural practices like improved seed, cultivation practices like improved seed, cultivation practices, seed treatment, use of fertilizers and green manure. At each stage, irrigated vs. un-irrigated ways of cultivation are compared. The yield rates are compared at two points of time: (1969-70) and 1975-76) before the onset of irrigation and after. The results indicated that post- irrigation is better of over pre- irrigation in all aspect. Consumption of food grains (cereals, pluses), protective items likes milk, oil, vegetables, spices, meat, fish, egg, fruit beverage per family, per adult unit, has been observed to have improved in the irrigated area with time.

Rane (1980) in his study to assess the number of households below poverty line as a consequence of irrigation has selected two villages around Delhi. They are similar in many aspects, only the limiting factor is

irrigation in one village 91.4 % of the cultivated area is irrigated, while in another, irrigated area is negligible. At 1980 prices, the daily expenditure per head required for meeting minimum nutritional target is estimated to be Rs. 3.45. The author worked out the amount. Total annual family disposable income from agriculture, non agricultural sources is estimated from the household data. 61 percent of the population in un-irrigated village and 23 per cent in the irrigated village are observed to be "below poverty line". It is concluded that problem of un-irrigated area is very severe comprising of a very large population below poverty line. Higher Gain ratio indicates inequalities of income distribution to be more in irrigated area than in un-irrigated area, where income itself is very low.

Alexander K.C. (1982) studied comparatively the irrigated and non irrigated area in Ganganagar district of Rajasthan and concluded that agricultural development is more in that area where irrigation facilities are available on large scale. There demand of labours also increases. Farmer's uses mostly advanced technology and instruments rather than traditional tools. Use of chemical fertilizers, pesticides, high yielding seeds becomes increases. Therefore, per acre production increases and peoples attitude tends for saving money. Commercial value has been increases. This same situation has been seen at Shrigonda Tahsil in Ahmednagar district which has been studied in present research.

Patil A.V. (1983) studied socio-economic condition in Rajasthan Canal Project Area and concluded some remarks these are impact of Rajasthan Canal Project has been occurred on crop pattern, occupation, business, income and social change in that area which is under this project. After 1978-79 there crop pattern also changed by using canal irrigation system and therefore, agricultural production increased. The per hectare income increased from Rs.256 to Rs.1268. The rate of cultivators and agriculture labours in irrigated area is 59 % and 22 % respectively

whereas in dry area it is 73 % and 7 % respectively. It means most trades are developed in irrigated area.

Gadre N.A. (1983) studied the impact of economic and technological factors in changing the agricultural pattern in Vidarbha. In 1956 – 57 there was not much availability of irrigation facilities in Vidarbha. These irrigation facilities had increased in 1983 in Akola and Amravati district and therefore there irrigated and cultivated land area becomes increased. In Akola and Amravati district and therefore there irrigated and cultivated land area become increased. In Akola and Amaravati district the irrigated area was 6.3 % and 0.77 % respectively. Due to the increase in irrigation facilities in 1983, that area becomes increased as 2.88 % and 1.51 % respectively. In this district wells are mostly used for irrigation. In Akola and Amaravati district the area under well irrigation is 70 % and 90 % respectively. In rabbi season crops require more amount of irrigation. In this region because of increase in crop production economic factors are increased.

Asturkar, B.W. (1986) studied the growth of water management in Maharashtra. If we spend cost on irrigation for the crops like Jowar, Bajra, cotton these are Kharif season crops while wheat, gram, and sunflower these are rabbi season crops. Groundnut crop require less amount of water and it can grow in summer season also. All these crops require less amount of water than sugarcane crop. Therefore if we cultivate less area under sugarcane crop and more area under these all remaining crops then we can get more production and profit as well as water management also increased. Therefore in rural area employment becomes increased and consequently income will increase.

Ahirrao, D.Y. (1987) studied the impact of irrigation on agriculture and socio-economic change and case study of Ahmednagar district, Maharashtra a geographical analysis and studied the effects of irrigation

on agriculture and socio-economic condition in Ahmednagar district. In this research he tried to focus on the impact of irrigation in cropping pattern, change in agricultural technology, agricultural productivity, crop intensity, and socio-economic factors in Ahmednagar district. In his study he observed that above factors are affected on this region and therefore positive changes have been occurred in Ahmednagar district.

Mahendradev, S. (1987) studied the growth of food grain production and its uncertainty. They observed that during 1960- 61 and 1983- 84 the irrigated land area and cultivated land area in India is increased on 60 %. In India near about 70% area is depended on rainfall. If we think in state level, then during the 1983-84 periods, irrigated area increased as 11 % in Maharashtra while in Punjab it increased as 86 %. In Haryana and Uttar Pradesh irrigated area and cultivated area increased as 60 %. During 1960-61 to 1983-84, in Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan in these states the irrigated area increased at 50 %. In Punjab, Haryana and Uttar Pradesh, the canal irrigation as well as tube well irrigation has been increased.

Rao and Mishra, A.K. (1989) studied the water economy in draught prone area in Maharashtra and concluded that if irrigation used only for rabbi Jowar crops then 64 % area in Maharashtra will come under irrigation for other crops. Rabbi Jowar crop requires less amount of water than other crops. In Maharashtra, western Maharashtra, Marathwada and Vidarbha included in draught prone area. Sugarcane crop require more amount of water. In canal irrigation area sugarcane cropped area is only 10 % but this area requires more than 50 % water as compare to other crops. If we decrease the area under sugarcane crop and increased the area under rabbi crops then 30 to 60 % area will increased for irrigation area. In this way, in Maharashtra more than 34 % area will come under irrigation. If we accepted the fast growing cropping pattern than

sugarcane crop then irrigated area will increased as 50 %. But in Maharashtra, sugarcane industries are on large scale therefore they require more amount of sugarcane production. Therefore the change in cropping pattern is difficult. In above discussion Rao and Mishra explained that sugarcane crop affects on growth of irrigated area.

Mishra, A.K. (1990) studied the impact of irrigation on uncertain agriculture production in Maharashtra and he find out that in this state, on an average irrigated area under wheat, Bajara, Sugarcane, Cotton and Groundnut these crops has been increased on 100 %. Before four years ago means before 1979-80, irrigated area under Jowar crop was increased as 75%. Besides, during 1975-76 to 1979-80, irrigated area under other crops become significantly increased. It is observed that, in Maharashtra, four divisions having same condition of area under irrigation for various crops.

In Mumbai division, the area under irrigation for wheat, rice, sugarcane crops is increased during 1956-57 to 1964-65. In 1980 period, irrigated area of these crops had increased. In Pune division, during 1956-57 to 1964-65 periods, the irrigated area under Jowar and Sugarcane crops was more in this period and after 1980 the area under irrigation for sugarcane crop become increased. In Aurangabad division, during 1956-57 to 1964-65 period more irrigation has been provided for Jowar and Wheat crops. After 1980, mostly wheat cropping area comes under irrigation. In Nagpur division during 1956-57 to 1964-65 period, only rice cropped area was under irrigation. But after 1980, wheat and cotton cropped area also covered under irrigation. During the period of 1979-80, area of various crops comes under irrigation. In 1967-68 to 1975-76 period, in whole Maharashtra, food grain crops like Rice, Wheat, and Bajra these crops comes under irrigation and there area become increased for irrigation. During the period between 1967-68 to 1975-76 there was

uncertainty of production of these crops. But the area under irrigation for sugarcane crop was constant. There observed uncertainty of Cotton production also.

Gaikwad, V.R. (1992) studied streams in watershed area of Ahmednagar district and he selected Gunodi, Bhatodi, Kamargaon, Kolgaon and Visapur these five watershed areas in Ahmednagar district as a representatives and studied these regions. In these, Visapur tank is major watershed area (411.63 km), Bhatodi (80.52km). The ratio between irrigated area and storage capacity is Tankwise different. Catchment area and stream velocity both are not related with each other. As well as there is no any relationship between catchment area and water storage capacity. Sediment prediction equation is not applicable for Kolgaon and Visapur tank.

Salve, V.R. (1992) studied the substitute water distributive policy in Mula Left Canal Project of Musalwadi distributaries No.1. He studied the changes in models of various crops which are under this project. He focused on affects of water balance, irrigation management on cropping system and find out that water management positively affects on growth of crop production.

Sale D. (1992) studied that, land use, cropping pattern, and crop production changes due to watershed development programme and he selected study area for this, Tikhol in Parner Tahsil, Kharvandi in Pathardi Tahsil, Nimbhere in Rahuri Tahsil of Ahmednagar district. For this total 100 interviews has been taken from farmers in each watershed area and the data about the benefits of watershed area development, use of land, cropping pattern and crop productivity etc has been collected from this interviews. Before the development of watershed area the total area under crop was 169.06 hectare only but after the development of this

area the area was 223.82 hectare. Crop productivity also increased as like cropped area. It means the production of Jowar, Gram etc. increased as 18.06%, 11.11%, and 32.24% respectively. In this manner, due to the implementation of watershed area development programme the changes have been occurred in land use, cropping pattern and crop productivity.

Kale, Y.W. (1992) studied the water scarcity of Maharashtra and find out that the average area under wheat crop in Maharashtra has been decreased with 0.95 lakh hectare area while area under Jowar crop decreased as 5.8 lakh hectare area. As well as the area under Sugarcane crop has been decreased with 0.58 lakh hectare area. According to this data it is clear that due to the increase in irrigation area farmers mostly tend to cultivate the cash crops like Sugarcane and they least tend to cultivate foodgrain crops.

Shete, V.R. (1995) studied the various crops in Maharashtra during 1956 to 1990 and concluded that during this period in the total irrigated area of Maharashtra, the rice cropped area increased from 20.85 % to 27.42%. Wheat cropped area increased from 15.50% to 58.13%, gram cropping area from 9.19% to 16.0% and rabbi Jowar increased from 6.67% to 10.98%. The irrigated area of these all crops has been tremendously changed except Konkan region. In western Maharashtra, Vidarbha and Marathwada, the area under rice and gram crop has rapidly increased. So, it is clear that during 1956 to 1990 period, the irrigated area of various crops has been increased.

Chavan Rani (1997) studied the usefulness of Natuwadi medium scale irrigation project in Khed Tahsil of Ratnagiri district with economical view and with the help of this project he studied the positive impact of medium scale irrigation project in Konkan on cropping pattern and agriculture production. For this study he selected three beneficial villages and three non-beneficial villages in Natuwadi project beneficial

area. From these villages 25 farmers were selected by random sampling method. The data has been collected from total 75 beneficial and 75 non-beneficial farmers by surveying economic and social issues and with the help of this data the analysis has been done. This information was the economic year 1994-95. The data about cropping pattern which has been decided by irrigation department and traditional cropping pattern, collected from the above information. It has been seen that most of the area was under rice crop. The rice production from beneficial areas was 16.44 quintal per hectare and from the non-beneficial areas it was 14.66 quintal per hectare. Generally, the total production profit of beneficial farmers was 23,475 Rs. while it was only 8,942 Rs. of non-beneficial farmers. It means the income of beneficial farmers was twice as compared to income of non-beneficial farmers. Therefore, it is clear that Natuwadi medium scale irrigation project is beneficial for farmers.

Kasar, D.V. (1997) studied the divisional irrigation development and diversity in their use in Maharashtra and concluded that during the period of 1960-61 to 1996-97 the irrigated area and total irrigated area of Maharashtra has been increased as 4.50% and 6.56% respectively. This growth in irrigated area was more in 1960-61 to 1977-78 than the 1978-79 to 1995-96. Wells were used for major source of irrigation. In the Western Maharashtra the development of irrigation has been more in Marathwada and Vidarbha as compared to Konkan region. In 1995-96 the total irrigated area of western Maharashtra was 51.27%, in Marathwada 26.05%, in Vidarbha 21.08% whereas in Konkan it was 1.05% only.

Jogalekar, G.D. (1998) studied the role of major dams in the development of cities. He studied this subject by analyzing three cities namely Nashik, Ahmednagar and Aurangabad. Where the dams has been constructed at the upper reach zone of city, there these dams (Khadakwasla dam and Gangapur dam has been constructed at the upper

reach part of Pune and Nashik city respectively) mainly used for fulfills the demand of drinking water. But where this dam facility is not available there water has been lifted from another water body and this water should carry through pipeline up to the city. For e.g. Ahmednagar for Mula dam and Aurangabad for Jaykwadi dam. In this way, in the development of urban civilization the role of dams is very important.

Soman, A. (1998) presented an article on the contribution of beneficiaries in the management of irrigation. In this paper he concluded that the beneficiary's contribution is effective in the management of irrigation. For e.g. Ralegansiddhi and Adgaon project. How people can contribute in the construction of dam? For these peoples from 27 villages of Vijapur district in Karnataka established one organization and they constructed dam which has the capacity of 1000 hectare catchments area under the guidance of local engineer. Baliraja dam in Sangali district has been constructed by contribution of people. Farmers have knowledge about the management of irrigation projects. In brief, for generating the irrigation capacity and development not only irrigation projects and canal construction is enough but active contribution of beneficiaries is also necessary.

Kulkarni, S.R. (1998) studied the role of minor irrigation projects in irrigation management in agriculture. He studied very keenly the minor irrigation project of Loni and surveyed many factors like cycling crops and related area, various crop production, soils water shrinking or absorbing capacity of various crop roots in selected farms or fields, irrigation by wells, lifting irrigation by dams, beneficiaries social and economic evaluation etc. and concluded some remarks or findings. If agriculture fields constructed by advanced method then water providing capacity for crops can be increased. As irrigation water, the other things like qualitative seeds, fertilizers, pesticides are also important in growth

of production. Unless the contribution of farmers in the management of irrigation is not present till the real actively irrigation management is not possible.

Tilekar, S.N. (1998) studied comparatively cropping pattern and income of beneficial area of Mula irrigation area and non-beneficial area of this project. For this he selected 108 farmers in beneficial area and 108 farmers from non-beneficial areas and find out that there is no difference in cropping pattern of these both areas but there is more difference in area of rain fed farming and irrigated farming. An income of farmers in beneficial areas is double or triple more than non-beneficial areas.

Dhate, S. (1999) studied the various problems in lake irrigation and their remedies and find out that due to various reasons problems arises in lake irrigation these are as follows: i) mistakes or problem in doors which are used for water lifting from lake to canal, ii) the fitting of these main doors, iii) water tax collection, irrigation management and minor repairing of canals etc. For these reasons the expenditure of repairing is high and profit is low. Therefore these are some problems in lake irrigation. For solving these problems following are some remedies these are i) to use fiber doors which are made by advance techniques, ii) to plaster the front part of canals by cement concrete, iii) to collect the water tax through contract system.

Ghugarkar, K.M (1999) studied the critical study of co-operative water utility organization in Mula Right canal beneficial area of Ahmednagar district. For this he studied the co-operative water utility organization in distributaries No. 4 and 5 in Mula right canal beneficial areas and the problems arising due to the work of water utility organizations has been done. These members of such organizations are middle aged, literate and having 2 hectare field area. There find out that 45.48% member has positive attitude about co-operative water utility

organization. Because of these organizations 97% farmers regularly paid water tax on time. But due to the lack of water measurement instruments in these organizations there are problems arises in use of water, water utility, and distribution of water. In summer, farmers demands to government for more supply of water, permanent and full time water distribution. In this research it has been concluded that water utility organizations plays very vital role in water distribution, char repairing, water tax collection etc.

Galgale, H.M. (2000) studied the development of land and water resources in Pimpalgaon Ujjaini Tahsil in Ahmednagar watershed area with the help of Geographical Information System and remote sensing. In this study the objectives are to study the socio-economic condition and land-water problems in watershed area, to socio-economic information with the help of maps, to prepare policies for water resources development and land resources development etc. For this study he selected Pimpalgaon Ujjaini watershed area on Aurangabad road which is 15 km far from Ahmednagar.

In this area, out of total 3109 hectare area 59.79 hectare area is under Kharif crops, 360.34 hectare area under rabbi crops and 345.86 hectare area under dual crop. This watershed area has ten types of soil and more and more area is able for cultivable land. Maps have been prepared for doing classification as per land capacity. With the help of maps the locations which suitable for construction of check dams, Kolhapur pattern dams, these locations have been shown. Maps about development plan of land and water resources, soil in watershed area, slope of land, drainage pattern etc. has been prepared with the help of Geographical Information System and remote sensing. Besides this, it has been suggested that if the check dams, dams, Kolhapur type dams would constructed then development of watershed area can be possible.

More, D.M. (2000) studied that after the availability of irrigation facility to rain fed farming the productivity, production and income become increased. For this the aerial information of beneficiaries in Palashi irrigation projects beneficial areas on Anjana River (Sub-tributary of Purna River) has been collected. According to analysis of that information some conclusions has been made. Here due to the benefit of irrigation the production become different in two ways i) due to the increase in per hectare production and ii) due to the gaining of more than one crop production in two different season in one year. On same land area, the total production and alternatively total income become increased.

Solunke, R.S. (2000) studied impact of long term funding on irrigated area, Parbhani district. He tried to study the impact on irrigated area due to the fund supply by bank for irrigation in Parbhani district.

For this study he used primary data *i.e.* questionnaire and interviews. For selecting the samples the farmers were selected who had taken loan from bank in 1990-91 year. The actual survey of selected samples has been alone in 1997-98 year. The total farmers who had taken loan they were 563. Out of these 10% means 56 were selected for actual sample survey. Sampled farmers who had taken loan for irrigation purpose, their out of total 803 acre agriculture land only 37 acres land *i.e.* 4.6% land was under irrigation before taking loan. But after taking loan their 25.8% land came under irrigation. Therefore due to the long term funding through Maharashtra State Co-operative Agriculture and Rural Development Bank of Parbhani, the impact has been seen positively on irrigated area.

Palaskar, M.S. (2000) studied changing nature of cropping pattern under irrigation project. According to pre irrigation crop survey which crops are in the irrigation project area after providing irrigation project

has been prepared? Specifically, well irrigation farmer which crop had been taken from last many years and after the availability of irrigation to dry land farming crops which changes will occurred in cropping pattern? Then such estimation has been done and that cropping pattern has been proposed through agriculture department. Scientifically, soil type, climate, advanced crop method, irrigation facility, economics of irrigated crops, food and grass need, agriculture based industries, international market, skill approaches and knowledge of irrigation management officers about irrigated agriculture these all factors are responsible for occurring changes in crop pattern in irrigation project. For e.g. desired cropping pattern and traditional cropping pattern for Palkhed left canal has been suggested. Therefore, it is clear that changes have been occurred in cropping pattern which is under irrigation project.

Lele, S.N. (2001) presented a three volumes report on co-operative irrigation management in Maharashtra and Maharashtra water and Irrigation Ayog -II in 1999. In this report he stand up some issues and tried to present in front of government of Maharashtra and irrigation department and watershed development and rural development department. In this report he analyzed management of total water and irrigation planning and the major contribution of peoples in this management. According to Jal Ayog, in 1938 sir Vishweshwarayya enquiry committee provided facility of water measurement to beneficiaries group as well as in 1962-63 some experiments has been done on Nira and Pravara projects but they failed due to some reasons. After that, in 1987 experiment on Mula project at Chanda, Vaghad project at Ozar and Parunde minor project were successfully done but there is no dynamic progress in programmes. To explain that why should be there necessity of co-operative irrigation management? Then Ayog

answered that irrigated area should be under co-operative water utilization organization of beneficiaries and it is the need for present time.

Ananda, V. (2001) studied development of saline land and crop cultivation in projected area and suggested some measures about marshy and saline land renovation.

Kapare, A.H. (2001) studied classification of irrigated land in irrigation projected area and its limitations, problem verifications and find out that yearly cropped area getting from irrigational classification these both are ratherly similar.

Kulkarni, P.P. (2001) studied evolutionary analysis of Musalwadi medium scale irrigation project in Ahmednagar with the help of Remote Sensing and Geographical Information System. Out of selected 907 hectare area 751.22 hectare area is under irrigation. From the study of this region near about 90% projected areas groundwater level become increasing and 10% areas this level is medium. Proper use of GIS and Remote Sensing will be helpful for water management in projected area. With the help of this data map can be made for this region. It has been find out that it is possible to change the crop condition and water management in Musalwadi Project area.

Patil, S.B. (2001) studied irrigation policies in Mula Left Canal in Mula Irrigation Project. He selected Devalali-Pravara subdivisions in Mula left canal project area. Here water distribution through distributaries of Mula left canal has been studied. Increase in water distribution of Mula left canal has been studied with the help of simulation model is very influensive.

Dagade, S.J. (2003) studied optimum use of canal water and land resources in Nazare Medium Scale Project Area with the help of Remote Sensing and Geographical Information System. He selected Nazare Project in Purandar Tahsil of Pune district. He studied land and water

resources in Nazare Project Area with the help of GIS and RS from this irrigation policies and its impact on project area also studied. For this he prepared various maps. He proved that with the help of these techniques irrigation and land use problems will be solved.

Ingale, P.M. (2003) studied on performance of difference operation schedules in canal command area of Nazare medium scale irrigation project using RS and GIS techniques. In this research he studied land use, soil, hydro geomorphology in Nazare medium scale project with the help of Remote Sensing and Geographical Information System and prepared maps for showing this information.

Varade, S.V. (2004) studied on irrigation growth and development area analysis in Maharashtra. He studied various affecting factors on irrigation growth and development and its impact on crop condition. He find out that as compared to other states the growth rate of irrigation is more in Maharashtra. In 1960-61, the irrigated area was 6% and in 2001-02 it was increased as 16.78%. Therefore, it is clear that the irrigation area growth is positive in Maharashtra.

Bamnote, D. (2006) studied on upper Vardha project in Dhamangaon Tahsil and concluded that there are main secret in organization which is made by farmers for water management of canal in upper Vardha project in Dhamangaon and this organization is beneficial for farmers.

Thus the above review indicates that many attempts have been made in the past to assess and evaluate the impact of irrigation, on the living standards of the masses. But these studies are mostly cross-sectional in nature. Though time and men are not constraints wherever follow up studies are conducted, they confined to villages or households. But in no single study an attempt has been made to compare both the micro level and macro level observations, in order to eliminate the chance

element *viz.,* at the household's level some effects may occur purely due to chance, without reliability. It an attempt can be made to compare the irrigated area (at macro level) (1) with another neighboring area which has no irrigation and (2) with the same area, before the onset of irrigation, the differences (in the variables studied) can be safely attributed as due to irrigation. This fool proof method has been adopted in this present study. Thus Shrigonda Tahsil is compared between 2001 and 2010.

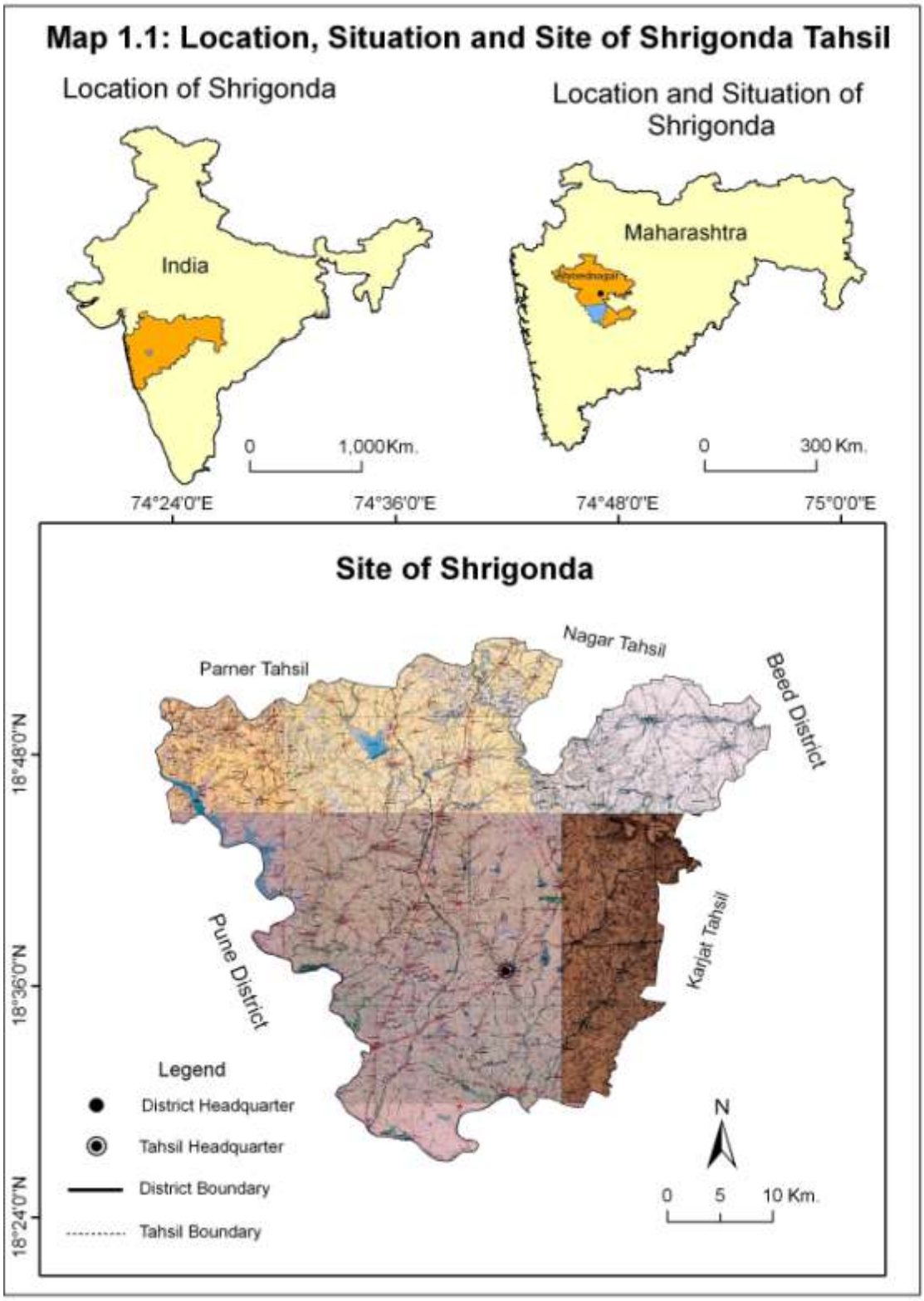
In conclusion the following observations are made:

Impact of development is observed through the maximized inputs of production. This led to unquestionably a rise in agricultural production higher income of farmer more prosperity for the people at large. Through the rise is not even in different areas, it is expected to be reflected in the levels of living and levels of aspirations. An inventory of articles of daily use in the houses is made to find out if there is any marked difference in the two IADP blocks and between them and control blocks. The difference is evident. However no perceptible impact is observed on the levels of aspirations. With a word of precaution, the study concludes. It is of course realized that ten years is a small period for large scale changes to be manifested in such on age old institution on caste system.

In short, researcher has been attempted to determine the direction for research by taking review of past literature related to subject as stated above.

1.3: Study Area:

Shrigonda Tahsil forms to the southern part of Ahmednagar District (18^0 27′ N to 18^0 51′ North latitudes and 74^0 23′ E to 74^0 52′ East longitudes). Total geographical area of the Tahsil is 1519.89 Sq. Km. and stand fourth largest Tahsil in Ahmednagar district. Shrigonda Tahsil is situated between Pune District to the southwest and Beed District to the northwest. Parner and Nagar Tahsil to north and Karjat to southwest. Agro climatologically, Shrigonda Tahsil is affected by drought prone area, and average annual rainfall is 522 mm. and the rainfall is 77% in June to September, which is reflected on cropping pattern of the Tahsil. The average maximum temperature is 38.9^{0C}. The area is characterized by plateau of Ahmednagar district and dose not shows high aptitude of relative relief and absolute relief. The offshoots of Balaghat range extended to northeast portion of Tahsil and locally known as Kolgaon Mandavgan hill range. The rest of the area shows topography throughout the area. The geographical structure of this study area is consisting of very hard basaltic rocks. The horizontal layers of sill and sheet formed in this area. The soils in the hill slope area are characterized by thin layer cover with Murum and slightly faint grey tones. Alluvial soils are found in major river basins Bhima and Sina which is highly reflected on natural vegetation acacia (Babhul) and Neem; are some of the characteristic species of semiarid climate.


Map 1.1: Location, Situation and Site of Shrigonda Tahsil
Location of Shrigonda
India
0
1,000Km.
Location and Situation of Shrigonda
Maharashtra
0
300 Km.
74°24'0"E
74°36'0"E
74°48'0"E
75°0'0"E
Site of Shrigonda
Parner Tahsil
Nagar Tahsil
Beed District
Pune District
Karjat Tahsil
18°48'0"N
18°36'0"N
18°24'0"N
Legend
District Headquarter
Tahsil Headquarter
District Boundary
Tahsil Boundary
N
0
5
10 Km.

1.4: Selection of Study area and Topic:

As per the Revised Drought Prone Reclamation Committee in 1987, it has been directed that Ahmednagar, Nandurbar, Dhule, Nashik, Pune, Satara, Sangali, Solapur, Osmanabad, Latur, Beed, Jalgaon, Aurangabad, Buldhana and Jalgaon etc. Districts and their Tahsils in Maharashtra are under drought prone area. Ahmednagar District is one of them and Shrigonda is known as drought prone Tahsil also. The soil in Shrigonda Tahsil is fertile. Its climate is also favorable for agriculture. However this area has not economically developed due to an irregularity in water supply for agriculture.

Most of the people in Shrigonda Tahsil have been migrated for bread and buffer in other developed cities like Pune and Mumbai. The rest of the people are farming with Bore Wells and Wells. Uncertain monsoon is the curse for farming in such area. The annual average rainfall in Shrigonda Tahsil is about 522mm. Out of them 77% of rainfall during the rainy season (June to September). It a effects on such crops in Tahsil regions. Once in a year there is only one crop that takes place. As a result the economical condition so not so good. Most of the amounts that they get through farming spend on family expenditure. They are unable to invest capital for farming.

Visapur Tank is built by British in 1914 to 1927 on the river Hanga. This tank is completed in 14 years. This earthen tank is 84Ft. height. The water storage capacity of the tank is 1.13 TMC. That time the water of this tank is irrigation purpose. In rainy season the mud was coming from catchment's area in this tank. Due to mud storage the water capacity of the tanks has been decreased day by day. Water supply to the farming is less than expected due to only one canal that had been constructed nearby 25 Kms. The Ghod Dam had been built in 1966 on the Ghod River on the boundary of Ahmednagar and Pune Districts. The

water storage capacity of it is 7.5TMC. It has been divided in to canals namely left bank and right bank canal. The right bank canal supplies its water for irrigation south west part of the Shrigonda Tahsil. The major part of water through left bank canal is given to Pune District.

Irrigation Department Government of Maharashtra has done allayment survey of Shrigonda Tahsil in 1952 for Kukadi Project. The distance of this project is 145Kms to 249Kms. Out of its total work of the main canal have been completed in December 1981. The main Kukadi Project canal length in Shrigonda Tahsil is 104Kms. The canal goes to the North-West to South-East direction across the Tahsil. Irrigation department built 14 distributaries from the main canal for the purpose of water supply for irrigation; but all of them go to South and West. Irrigation department merges the Visapur Tank and Ghod Dam in the Kukadi project per the necessities. The water supplies to Visapur Tank and Ghod Dam by canal in to the Kukadi project. The irrigation department spent 15 years for completing the small distributaries a bore mentioned project. After a long span Shrigonda Tahsil got water through canal on 25th December 1996.

The Kukadi project supplies its water through various small canals via South-West, South and South-East part of the Tahsil. But North and North-East parts (about 20% Areas) of Shrigonda Tahsil have been deprived from irrigation facilities till today. It is impossible to supply water, through this project to Mandavgaon and Kolgaon revenues divisions because of its geographical structure. These two revenue divisions all 30 villages are lack of irrigation facilities today. These 30 villages from these revenue divisions are under sub-branch of Mandavgaon-Kolgaon hill range of Balaghat. The irrigation department has to undertake co-operative lift-irrigation schemes for such villages.

The under crop area of Shrigonda Tahsil is 1, 41,996 hectares, and irrigated area is 39,338 hectares. It means 27.70% of land comes under irrigation. The irrigation department has to look into this matter as a serious issue. The Shrigonda Tahsil is known as agricultural land in the District. After the Kukadi project most of the land had been under irrigation. The geographical, economical, social and political surroundings are very well known to the researcher as he belongs to the same Tahsil. There has been tremendous change in socio-economic sectors. After completion of the Kukadi project, the farming sector has rapidly been developed. Therefore, the researcher has chosen this subject and Shrigonda Tahsil for the study work.

Chapter. 2

HYPOTHESIS, SCOPE, OBJECTIVES AND METHODOLOGY

2.1: Hypothesis for the Present Study:

It is difficult to make categorical statements on the development which is a multi faceted phenomenon; caused in the command areas, due to irrigation, however voluminous may be the data. An evaluation assessment on the basis of some primary and secondary information available for a short, yet acceptable, period will indicate the positive changes in the direction, and degree and quality of changes is discernible. The hypothesis taken up in this study is whether irrigation improves the standard of living of the rural masses and in turn helps the rural development. This study has the main objective of studying the impact of irrigation on rural development, through the development of agriculture (Vasudeva Rao, D. 1982). The assumed chain reaction is that irrigation leads to intensive cultivation which results in better crop pattern reflecting in higher productivity causing more employment resulting in more per capita income and more saving. The probable increase in expenditure is expected to raise the intake of quality food. Expenditure on non food items like education, health care would also go up. Thus the study aims at quantifying and linking up interwoven characteristics of development, with irrigation as the (center) starting point for around development of the study (rural) area.

2.2: Scope and Objectives:

The main objective is to study in depth, how irrigation holds the key for agricultural development and consequently rural development. The approach is a two pronged one : (i) At micro level : the cultivator

households are considered, (ii) Tahsil as a unit is taken up for macro-level study of the overall development.

2.3: Specific Objectives and Problem:

The present study can be termed as a path breaking one, in the sense that, an attempt is made here to study, understand and assess at micro level (cultivators households) the impact of irrigation under a command area canal system, in Shrigonda tahsil, as against the macro background of state level. After critical examination of different issues involved, at micro and macro levels, the study has finally selected the following eleven specific objectives to be studied at micro level.

To cross cheek and further corroborate the micro level findings, an unique attempt and novel approach is made to compare the two neighboring villages (with irrigation as the limiting factor) with respect to twenty variables between two points of time. This proceeding helped to arrive at definite conclusions as to whether irrigation has really effected or it is a fluke chance at the micro mechanism of the analysis which makes the conclusions tool proof and leaves no room for benefit of doubt.

At the farmer's (households) levels the following topics would be studies in depth to know whether irrigation has brought any change in the:

1. Work participation of own family female labour.
2. Attendance of the school going children (4-15 years) either to school or for work.
3. Area under cash crops; sugarcane, oil seeds, cotton, lemon, graps.
4. Use of inputs viz, on time and in sufficient quantities, thus minimizing the wastage.
5. Optimum (own / hired) labour usage (habit)
6. Intake of quality foods (milk, meat, ghee, etc.)

7. Proportion of (per capita consumption unit) expenditure on non-food items in the total expenditure
8. Per capita income: overall and source wise.
9. Indebtedness and its impact on agricultural production.
10. Housing conditions and availability of amenities / facilities
11. Position of people with reference to poverty line.

At macro level, Shrigonda tahsil would be compared (over time and extent of benefit derived) with the neighboring dry tahsil Karjat. The secondary information will be collected on important variables that can be quantified like changes in literacy, population, employment, land use, crop pattern, agricultural implements, social infrastructure, communication, connectivity etc. this will be supplemented by personal observation too.

2.4: Relevance of the Study:

The overall development in the command area can be well brought out at micro level, by studying one fairly big and representative village as most of the characteristics the problems faced, the benefits enjoyed, soil type, crop pattern, Ecological sociological and economic conditions are unbiasedly represented by the sample villages. However generalization cannot be extended too far. It is also remembered that ten years time is not that big to manifest radical changes in the traditionally backward areas like the study region. An attempt is made to know the directions of change. The ideal way of studying and understanding the impact of irrigation on the all round development of the village would have been by comparing the pre- irrigation data for the same villages. But this is time consuming and can't be done single handedly. Hence the next best alternative is to compare two neighboring villages, which are similar in

all respects and ascepcts, except irrigation. The differences if any can be safely attributed to irrigation (Alexander, K. C. 1980).

With an eye on change in the crop pattern, crop rotation judicious use of water and other essential inputs, the maximum yields can be achieved which in turn would give rise to a shift in emphasis from growth of per capita income to eradication of poverty, reduction in income inequalities, expansion of employment opportunities, rise in literacy levels, better standard of living.

2.5: Limitations:

i. Study is not following up but cross sectional in nature, due to lack of manpower, time and money. Wherever possible some figures from the bench mark survey report are referred to.

ii. Memory basis of the respondent: as the data for a full agricultural year is collected in one to two sittings, during 2000-01 to 2010-11 for the each agricultural year.

iii. Generally the tendency is to overestimate the expenditure and underestimate the income and production.

iv. Only one year reference period (through rainfall is normal and not a drought year) It is not safe to generalize from the results obtained and conclusions arrived at, on the basis of only one year's inquiry, though the year of inquiry coincided with adequate rainfall in selected villages. To the extent the differences in output between 22 villages, which might have been noticeable, in an otherwise drought year, is mitigated. There are dangers in generalization, dangers of extrapolation and its is sometimes forgotten that any number of traverses do not add up to triangulation- this warning is well kept in mind by the researcher, in this study (Spate, O. H. K. in Introductions to T. S. Episten's Book of 1973).

This is overcome to a great extent by cross checking the village level data and agriculture department employees, (checklist) and personal observation.

2.6: Study Region Canal Irrigation Sources:

1. Visapur Dam:

In Shrigonda Tahsil irrigation facility provided by British Visapur Dam was dedicated to the Nation by the British on 1927. The earthern dam is 84 ft. in height. The water storage capacity of this dam is 0.92 TMC for irrigation and other purpose. There is only one canal on the left bank with a length of 25 Kms. It irrigates mainly villages from Shrigonda Tahsil.

2. Ghod Dam:

This is earthen dam with 10900 ft. embankment and 97 ft. height. The water from dam is let into canal with Ghod left and right banks. It was completed in 1966 and irrigated the area of Shrigonda and Karjat tahsil, some villages. It also facilitates the area of Shirur tahsil of Pune district. Water storage capacity of this dam is 7.5 TMC.

3. Kukadi Project:

In 1903 to 1910 Mr. Ben, an Executive Engineer, has don a research study of the river Ghod, Kukadi and Meena for using their water for the droughted tahsils areas in the district of Ahmednagar like Parner, Shrigonda, Karjat and Karmala of Solapur district. In addition to this, he also studied the various optional plans previously studied water resources for farming. Having studied the Kukadi canal project, he submitted the project report to the Maharashtra Government; in 1965.

The Kukadi Project Report was studied the Irrigation Department of the government and sanctioned the project on 30/04/1965 vide letter No. PIM / 3465 / 12050- P

Under the Kukadi project in Pune district hearly about five dams were constructed such as Yedgaon (1977), Manikdoh (1994) on Kukadi River, Wadaj (1983) on Mina River, this river is tributary of Kukadi, Dimbhe (1995) on Ghod River, Pimplgaon Joga (2000) on Arr River; this river is tributary of Kukadi River also. Total five dams were constructed under this project.

Through Kukadi left Bank Canal 50 % land irrigated in Shrigonda tahsil. The Kukadi canal project plays vital role in the development of agricultural field.

Some Particulars:

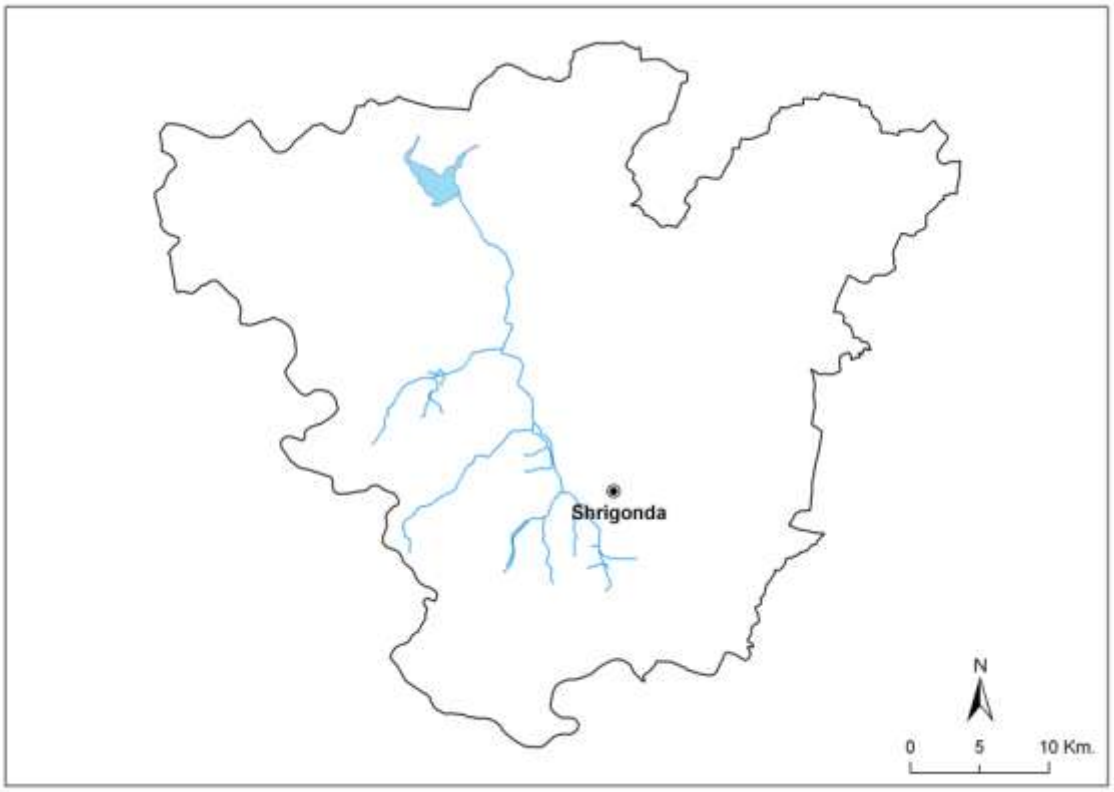
Visapur Dam (Left canal) - 25 Km length – Irrigates 3164.51 hectares in Shrigonda Tahsil.

Ghod Dam (Left Canal) - 64 Km length – Irrigates 9238.92 hectares in ShrigondaTahsil.

Kukadi Canal Project - 104 Km. length – Irrigates 30616 hectares in Shrigonda Tahsil.

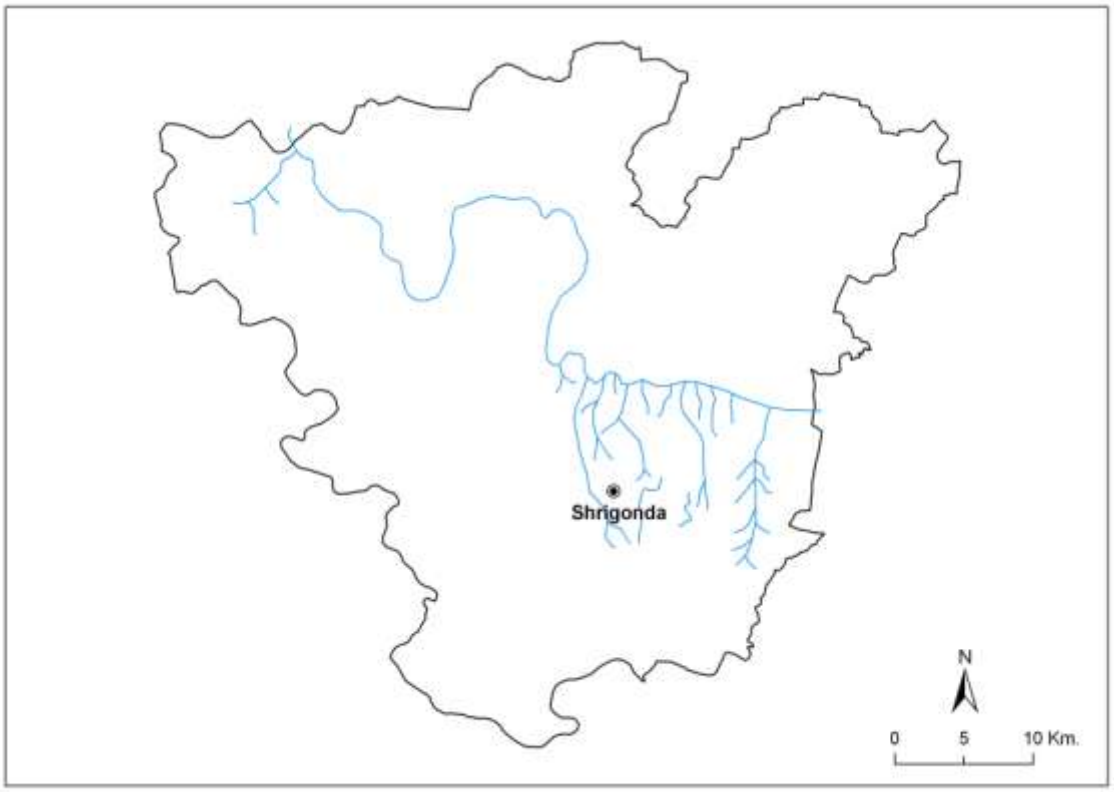
Above all three projects benefited irrigation facilities as follows (Table 2.1)

Map 2.1: Visapur Dam with Canal



Map 2.2: Ghod Dam with Left Bank Canal

Map 2.3: Kukadi Irrigation Project with Left Bank Canal



Map 2.4: Canals, Dams and Bandharas of Study area

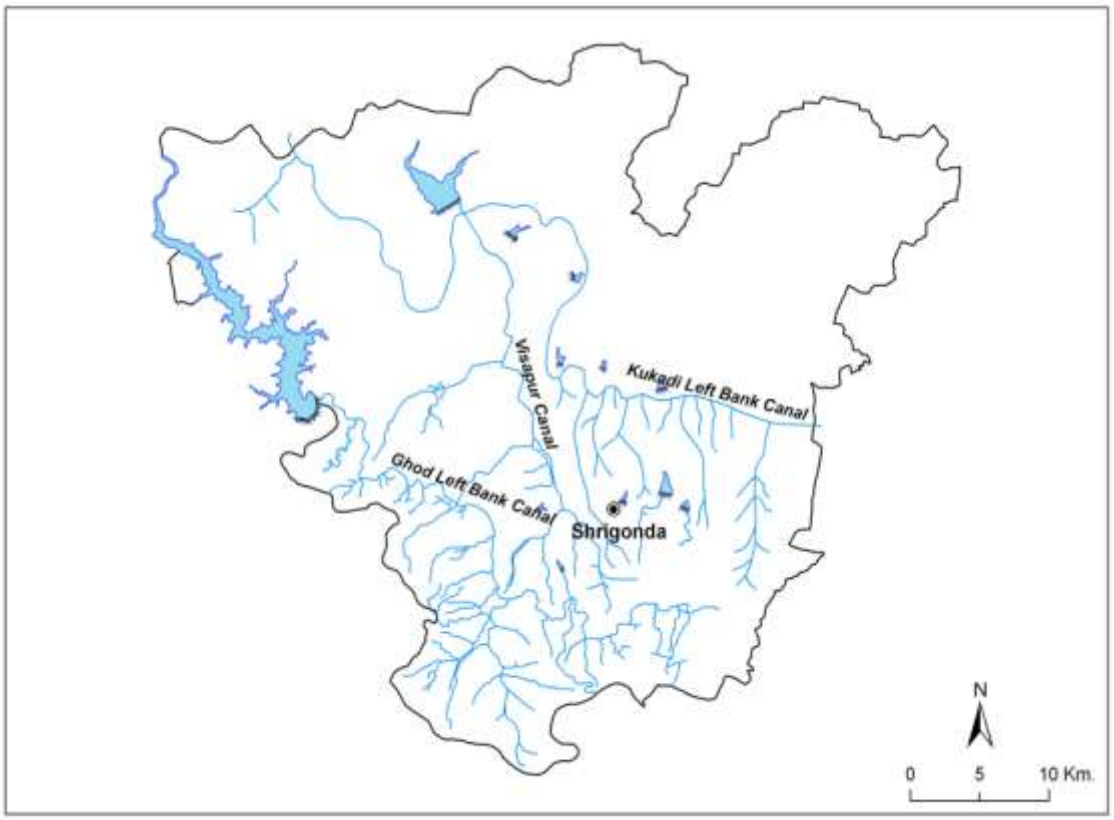


Table- 2.1

Distinguishing Features of Kukadi Project

Sr.No.	Details	Unit	Yedgaon	Manikdoh	Pimpalgaon Joge	Dimbhe	Wadaj	Total
1.	Sight of Dam	---	---	---	---	---	---	---
2.	Latitude	---	$19^0 10' N$	$19^0 12' N$	$19^0 18' N$	$19^0 05' N$	$19^0 08' N$	---
	Longitude	---	$17^0 01' E$	$74^0 50' E$	$73^0 52' E$	$73^0 44' E$	$73^0 52' E$	---
	Village	---	Yedgaon	Manikdoh	Pimpalgaon Joge	Dimbhe	Wadaj	---
	Tahsil	---	Junnar	Junnar	Junnar	Amegaon	Junnar	---
	District	---	Pune	Pune	Pune	Pune	Pune	---
	River	---	Kukadi	Kukadi	Arr	Ghod	Mina	---
3.	Type of Dam	---	Mixed	Earthen	Mixed	Earthen	Mixed	---
4.	Catchments Area	Sq. Km	461	129	96	298	155	1139
		Sq. Mile	178	50	37	115	60	440
5.	75% Protected Water	Quebec Mts.	188	311	166	415	126	1206
		Quebec Feet.	6618	10986	5879	14666	4457	42607
6.	Main River Valley	---	Krushna	Krushna	Krushna	Krushna	Krushna	---
7.	Sub-river Valley	---	Bhima	Bhima	Bhima	Bhima	Bhima	---
8.	Rainfall	Inch	25 to 37	150 to 273	134 to 137	150 to 158	131 to 151	---
9.	**Water Storage Capacity**							
	a)Total Capacity	Quebec Mts.	93.43	308.06	235.33	382.52	36.00	1037.62
		Quebec Feet.	3300	10880	3310	13500	1271	36647

	b) Useful Capacity	Quebec Mts.	79.27	288.07	110.16	353.91	33.20	847.17
		Quebec Feet.	2800	10147	3890	12500	1171	29920
	c) Dedstock	Quebec Mts.	14.15	19.99	125.20	28.31	2.80	190.45
		Quebec Feet.	500	706	4421	1000	100	6727
	d) Water For Use	Quebec Mts.	610.02	53.97	123.85	239.24	73.56	1100.69
		Quebec Feet.	21543	1907	4374	8449	2598	38871
10.	Length of Dam	Meters	4470	930	1492.75	852	1830	---
11.	Height of Dam from River Bottom	Meters	23.60	51.80	27.57	72.10	26.42	---
12.	Project Affected Villages	Totally	03	03	03	11	05	25
		Partly	01	15	03	13	05	37
		Total	04	18	06	24	10	62
13.	Submerge Area	Hectares	1500	1995	2540	2203	588	8825
14.	Year Starting the Work	---	1970	1975	1992	1977	1977	---
15.	Year Completed the Work	---	1977	1984	2000	1995	1983	---

Source: Government of Maharashtra, Irrigation Department, Kukadi Irrigation Project Vol. II page: 21-22

Dig. 2.1: Distinguishing features of Kukadi Project

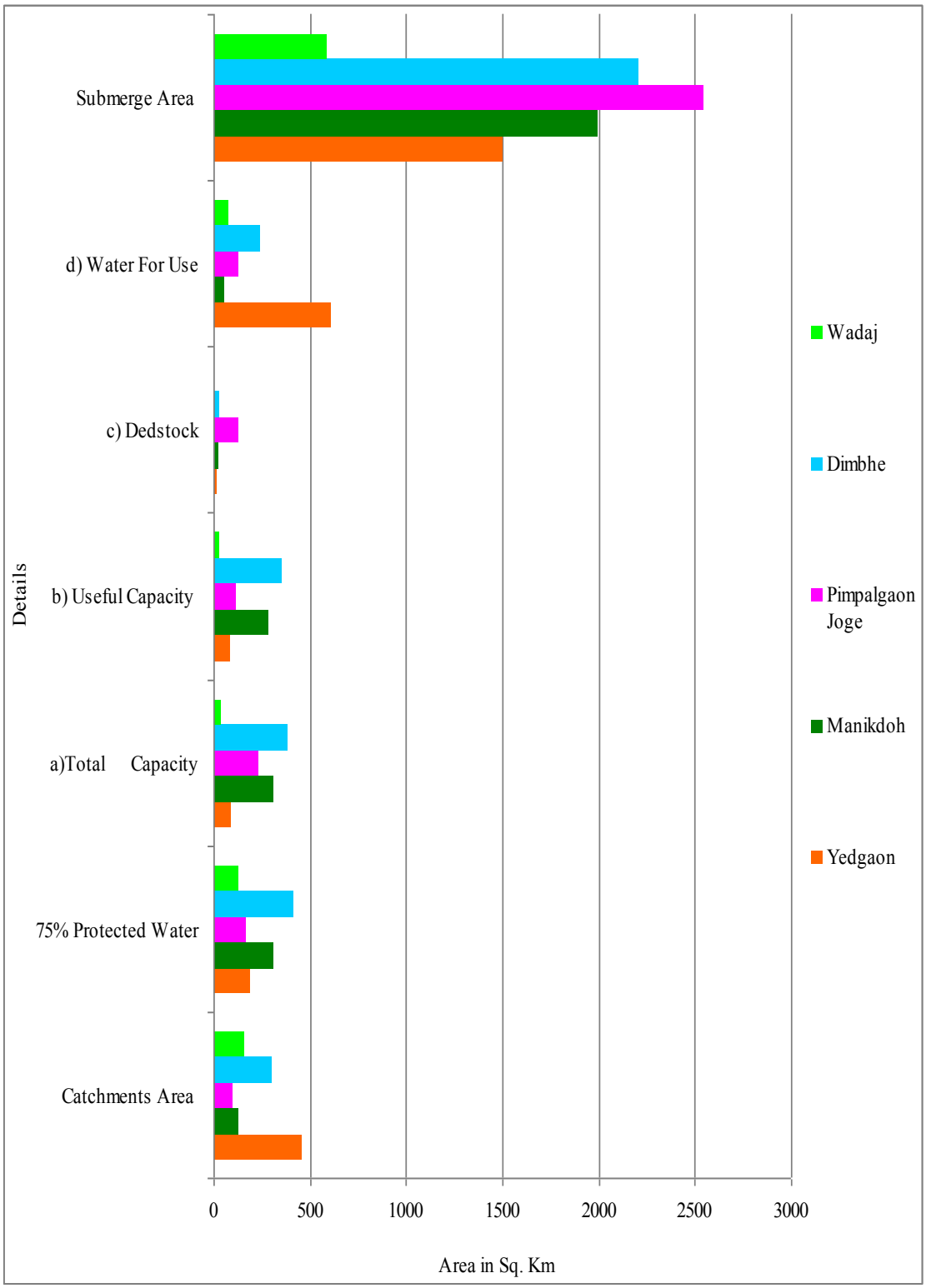


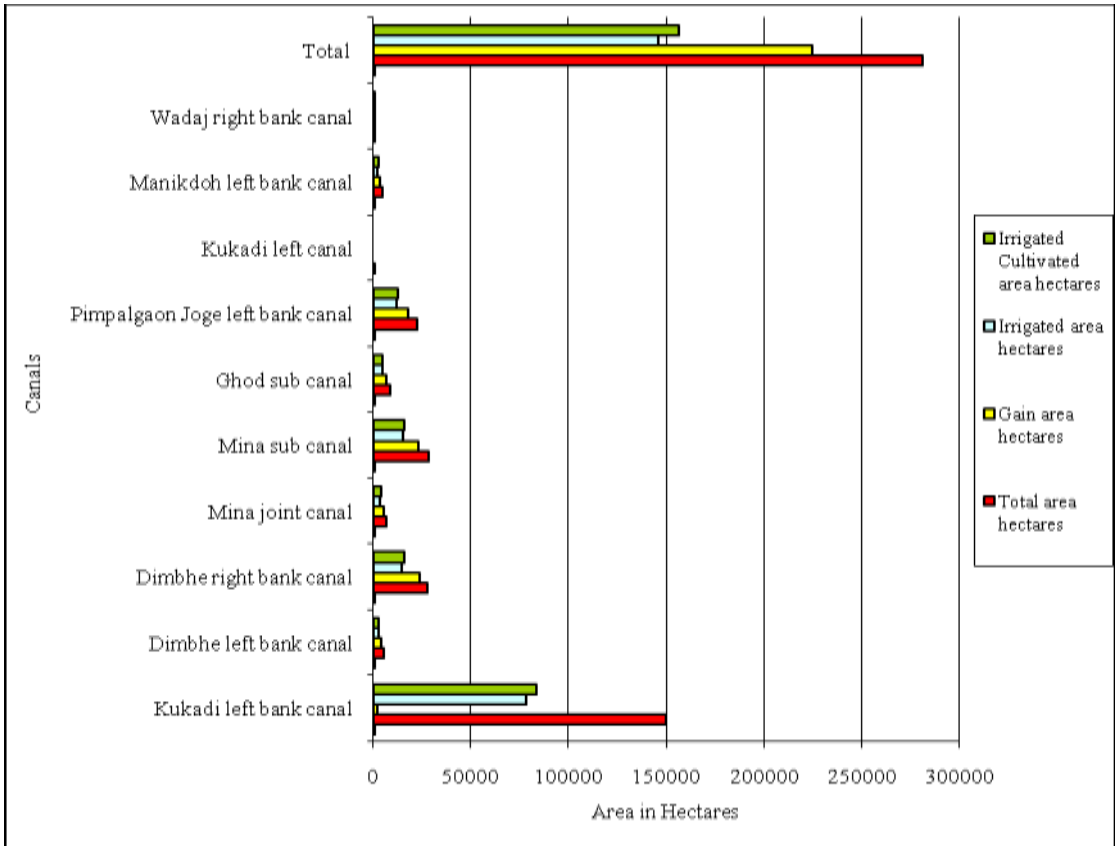
Table- 2.2

Canals under Kukadi Project

Sr. No.	Canal Name	Total Length of Canal Km	Total area hectares	Gain area hectares	Irrigated area hectares	Irrigated Cultivated area hectares
1.	Kukadi left bank canal	149	149893	1999.15	77944	83400
2.	Dimbhe left bank canal	55	5060	4048	2631	2815
3.	Dimbhe right bank canal	103	27789	23382	14549	15568
4.	Mina joint canal	14	6856	5485	3565	3815
5.	Mina sub canal	40	28273	23098	15014	16065
6.	Ghod sub canal	12	8327	6662	4330	4633
7.	Pimpalgaon Joge left bank canal	71	22134	17708	11510	12316
8.	Kukadi left canal a) Sina left canal b) Sina right canal	19 29	23356 ---	18685 ---	12145 ---	12995 ---
9.	Manikdoh left bank canal	27	4356	3485	2265	2424
10	Wadaj right bank canal	10	692	554	360	385
	Total	**685**	**280871**	**224699**	**146056**	**156278**

Source: Government of Maharashtra, Irrigation Department, Kukadi Irrigation Project Vol. II page: 23-24

Dig. 2.2: Canals under Kukadi Project



(Table 2.1 and 2.2) shows the all area of Dams under Kukadi project was in Pune district. But more benefited area in Ahmednagar district. To take for granted water storage capacity of all five Dams are 75% and 42.09 Quebec feet water use for Kukadi project. Water availability for Pushapatvati dam is 0.5 Quebec feet and for Ghod canal 0.2 Quebec feet form Kukadi project. In 1970-71 water demand of benefited farmers under Kukadi project is increased than Government relies more water by Visapur and Ghod Dams.

Today irrigation department has including under Kukadi project. But in 1976 Government (irrigation Department) publish new report and following beneficial changes including in the report.

1. Kukadi left bank canal expansion up to Sina river valley and an attempt to more 12,145 hectares area under irrigation.
2. An attempt to more 11,510 hectares area under irrigation to Pimpalgaon Joge left bank canal.
3. Increasing irrigated area (3,565 hectares) with the help of Wadaj left bank canal.
4. With the help of newly constructed Manikdoh left canal 2,265 hectares area under irrigation.

Social and Economic Condition under Kukadi Canal Project Area:

Kukadi canal project mainly the advantage of to drought prone area of Pune, Ahmednagar and Solapur district. In this districts total 5, 38,760 hectares area irrigated by this project. This project helps improvement in employment and industries in this area particularly.

Competence of Irrigation by Kukadi Project:

Dams including under Kukadi project are 1) Manikdoh 2) Dimbhe 3) Yedgaon 4) Wadaj and 5) Pimpalgaon Joge. The planning of irrigation formed by government are, fist collect the four Dams water in Yedgaon Dam and then relies the water form Kukadi left bank canal for irrigation purpose.

All five Dams under Kukadi project providing water for irrigation of Kharif and Rabbi Seasons, but not for summer season. The total capacity of irrigation by Kukadi project was 1, 56,278 hectares. Out of that 1, 14,271 hectares area covered up to June 2004.

This project provided the irrigation facilities for Pune district (Ambegaon, Junnar and Shirur tahsils), Ahmednagar district (Parner, Shrigonda and Karjat tahsils) and Solapur distict (Karmala tahsil) mainly.

According to 75% water storage capacity of these five Dams are 42,600 Quebec feet. After completion the all work the water storage capacity was increased up to 37,256 Quebec feet. The following planning of water use estimating by irrigation department.

1. Total water storage:	37,256 Quebec feet
2. Water for Yedgaon Dam:	15,439 Quebec feet
3. Water for irrigation:	33,595 Quebec feet
4. Loss of evaporation:	4,631 Quebec feet
5. Loss of carrying expenditure:	1,145 Quebec feet
6. Total water use: (3+5)	39,371 Quebec feet
7. Reserve water for Puspavati canal:	500 Quebec feet
8. **Planning of total water use:**	**38,871 Quebec feet**

Dig. 2.3: Water Use Estimate by Irrigation Department

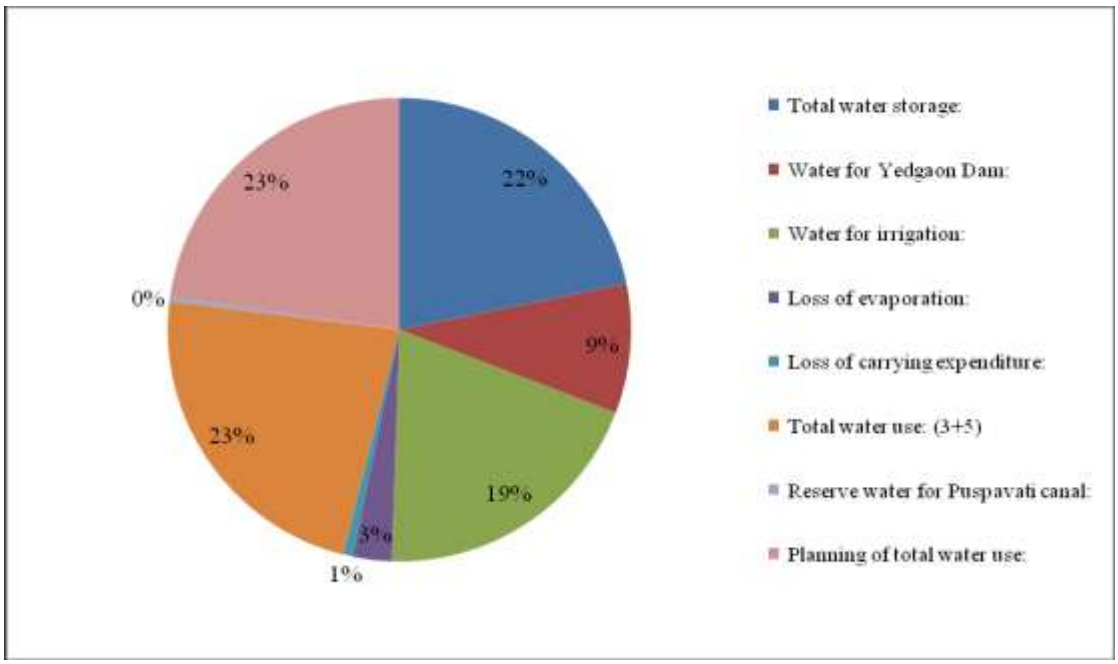


Table- 2.3

Water use of Five Dams (33,871 Quebec Feet)

Sr. No.	Details	Dimbhe	Wadaj	Manikdoh	Pimpalgaon Joge	Yedgaon	Total
1.	Total water storage	13500	1270	10880	8310	3300	37256
2.	Water for Yedgaon Dam	6217	556	8566	110	---	15439
3.	Water for irrigation	7010	2296	521	3047	20721	33595
4.	Evaporation	806	246	935	1822	880	4631
5.	Carrying expenditure	633	56	451	05	---	1145
6.	Total (3+5)	8449	2598	1907	4374	21543	38871
7.	Total with Yedgaon Dam	14666	3154	10463	4484	21543	42600

Source: Irrigation Department, Kukadi Irrigation Project No. I, Narayagaon page No. 3

Overall capacity of Kukadi project is 1, 56,278 hectares. Out of that planning for irrigation Kharif season 52% (75,946 hectares) and in Rabbi season 55% (80,332) area under irrigation.

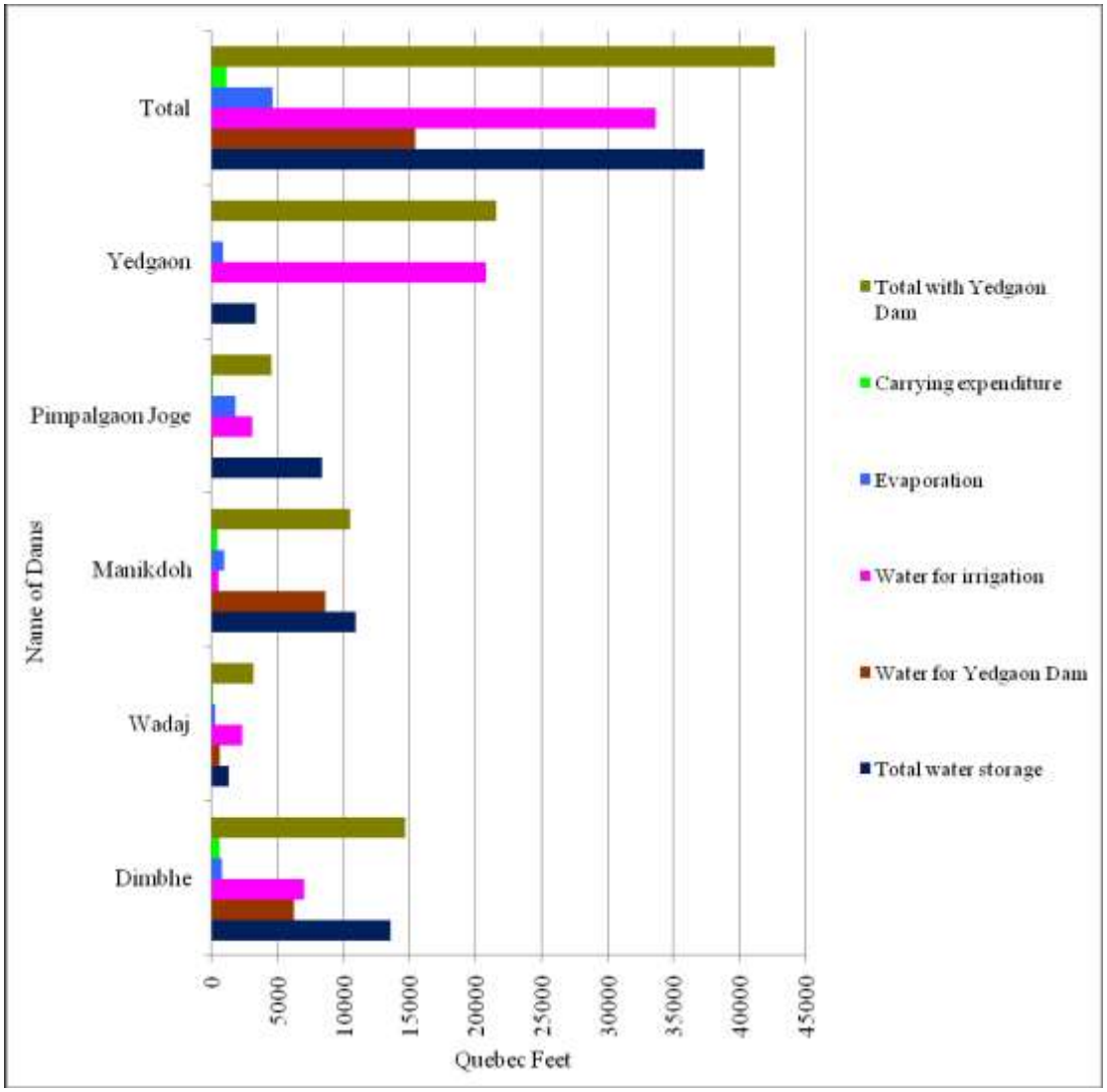
Table- 2.4

Irrigation Capacity: Five Dams under Kukadi Project

Sr. No.	Name of Dam	Kharif Season hectares	Rabbi Season hectares	Total hectares
1.	Yedgaon	46846	49550	96396
2.	Manikdoh	1178	1246	2424
3.	Wadaj	9848	2159	12007
4.	Pimpalgaon Joge	6890	7287	14177
5.	Dimbhe	11184	20090	31274
	Total	**75946**	**80332**	**156278**

Source: Irrigation Department, Kukadi Canal Project, No.1, Nrayangaon, page No.3

Dig. 2.4: Water Use by Five Dams



Dig. 2.5: Irrigation Capacity: Five Dams Under Kukadi Project

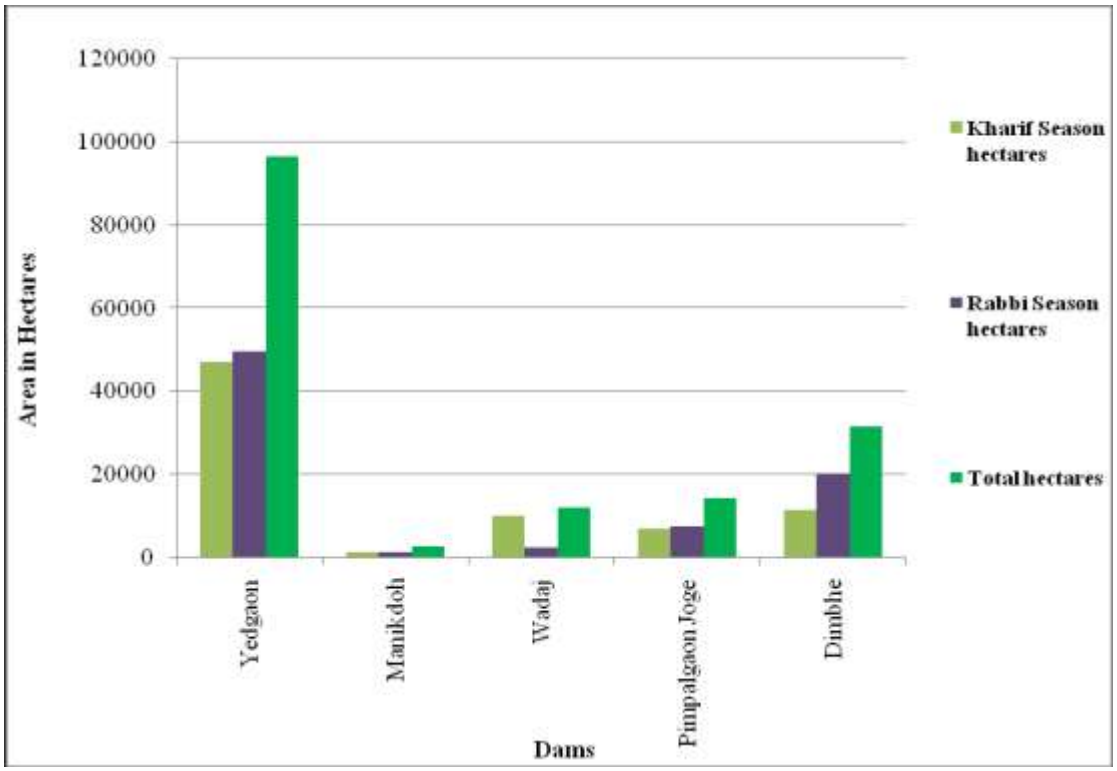


Table- 2.5

Dam wise Irrigation Capacity, Including Canals and Season wise Irrigation Capacity

Sr. No.	Name of Dam	Name of Canal	Kharif Season hectares	Rabbi Season hectares
1.	Yedgaon	Kukadi left bank canal	46846	49550
2.	Manikdoh	Manikdoh left bank canal	1178	1246
3.	Wadaj	Mina canal	1854	1961
		Mina sub canal	7807	---
		Wadaj right bank canal	187	198
		Total	**57872**	**52955**
4.	Pimpalgaon Joge	Pimpalgaon Joge left bank canal	5985	6330
		Pushpavati canal	905	954
5.	Dimbhe	Dimbhe left bank canal	1368	1447
		Dimbhe right bank canal	7565	8033
		Ghod division canal	2221	2382
		Mina division canal	---	8258
		Total	**11184**	**20090**
	Total	**---**	**75946**	**80332**

Source: Irrigation Department, Kukadi Canal Project, No.1, Nrayangaon, page No.4

Irrigation department planning is release the water from left bank canal of Yedgaon Dam and irrigate 96,396 hectares more area under irrigation. Expected of water for irrigation purpose is 20,721 Quebec feet. Bu tat present in Yedgaon Dam only 2,800 Quebec feet water is available, therefore remaining four Dams under Kukadi project are share the water in Yedgaon Dam for irrigation to Kharif and Rabbi seasons.

Dig. 2.6: Canals and Season wise Irrigation Capacity

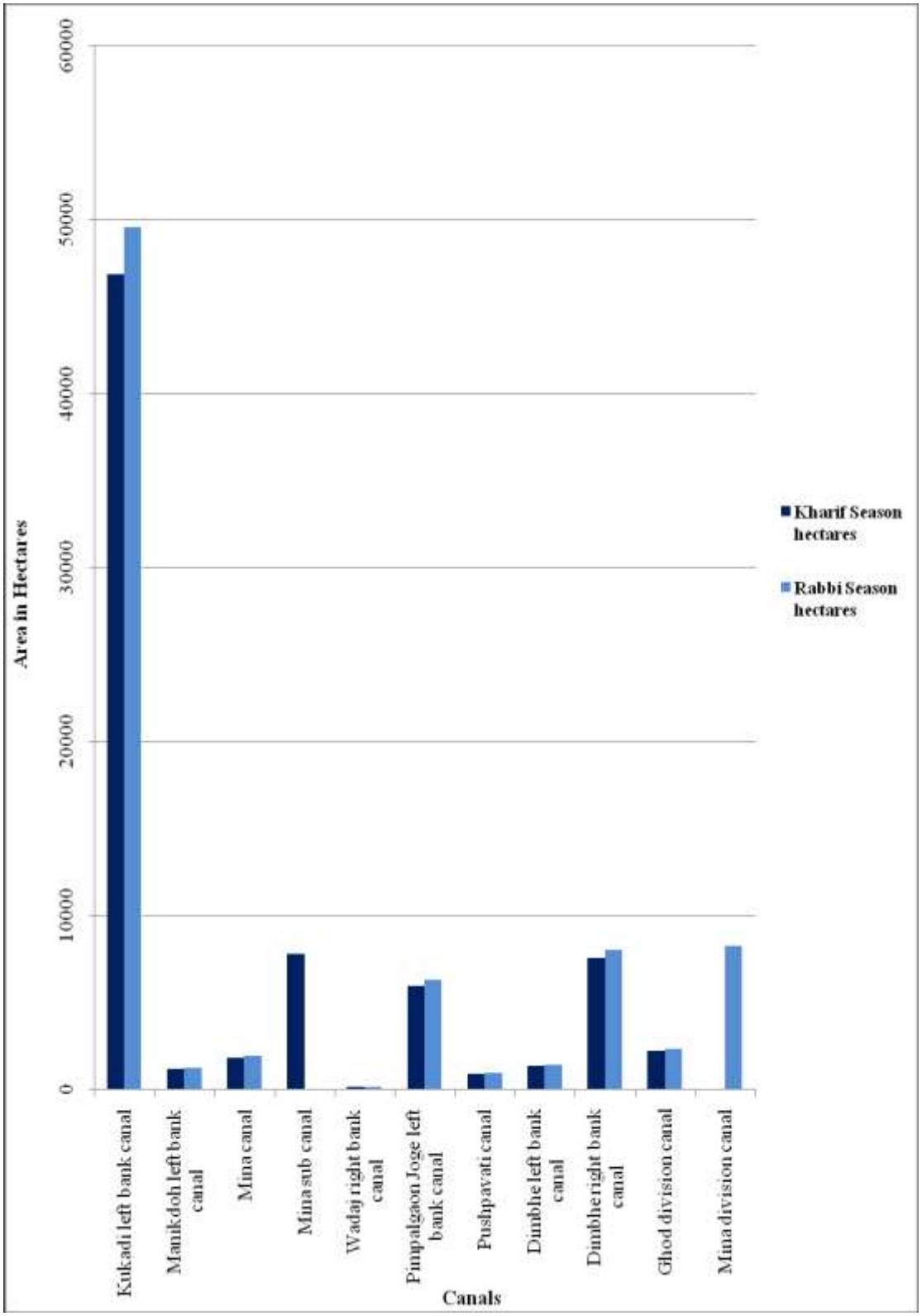


Table- 2.6

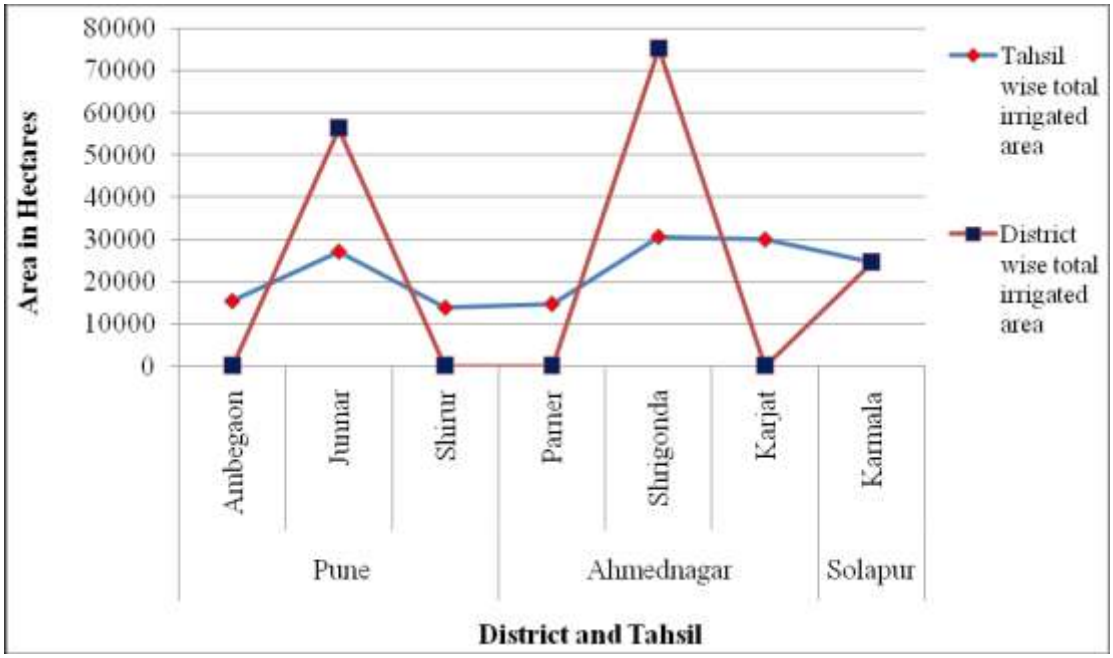
Canals under Kukadi Project and Their Tahsil wise Irrigation Capacity (Area in Hectares)

Sr. No	Name of Canal	Pune			Ahmednagar			Solapur	Tatal
		Ambegaon	Junnar	Shirur	Parner	Shrigonda	Karjat	Karmala	
1.	Kukadi left bank	---	1678	---	9550	30616	29990	24562	96396
2.	Dimbhe left bank	2124	691	---	---	---	---	---	2815
3.	Dimbhe right bank	8661	---	6907	---	---	---	---	15568
4.	Mina canal	---	3815	---	---	---	---	---	3815
5.	Mina division	---	9135	6930	---	---	---	---	16065
6.	Ghod division	4633	---	---	---	---	---	---	4633
7.	Pimpalgaon Joge left bank	---	7125	---	5190	---	---	---	12315
8.	Manikdoh left bank	---	2424	---	---	---	---	---	2424
9.	Wadaj left bank	---	385	---	---	---	---	---	385
10.	Pusphavati	---	1862	---	---	---	---	---	1862
11.	**Tahsil wise total irrigated area**	**15418**	**27115**	**13837**	**14740**	**30616**	**29990**	**24562**	**156278**
12.	**District wise total irrigated area**	**56370**			**75343**			**24562**	**156278**

Source: Government of Maharashtra, Irrigation Department, Kukadi Irrigation Project Vol. II page.10-11

According to (Table 2.6) Pune Ahmednagar and Solapur districts are beneficiary for irrigation by Kukadi project. But Shrigonda Tahsil is the most beneficiated Tahsil in the command area. Shrigonda Tahsil irrigates 30,616 hectares land by Kukadi project.

Dig. 2.7: Canals under Kukadi Project and their Irrigation Capacity (Tahsil and District wise)



District wise irrigation capacity of Kukadi Project:

Kukadi project irrigation potential is 1,56,278 hectares. Pune, Ahmednagar and Solapur districts are including in this project. Table No. 2.7 shows district wise irrigation capacity of Kukadi project.

Table- 2.7

District wise irrigation capacity of Kukadi Project (Area in Hectares)

Sr. No.	District	Projected Irrigation capacity	Actual Irrigation capacity
1.	Pune	56370	35201
2.	Ahmednagar	75346	74188
3.	Solapur	24562	4882
	Total	**156278**	**114271**

Source: Kukadi Irrigation Project: Divisional No. I, Narayangaon, Vol. I, page-10

Table- 2.8

Tahsil wise Irrigation Potential- under Divisional Irrigation office Narayangaon

Sr. No.	Name of canal	Pune			Ahmednagar			Tatal
		Ambegaon	Junnar	Shirur	Parner	Shrigonda	Karjat	
1.	Kukadi left bank canal	---	1678	---	9550	15003	---	26231
2.	Dimbhe left bank canal	224	691	---	---	---	---	2815
3.	Dimbhe right bank canal	8661	---	6907	---	---	---	15568
4.	Mina canal	---	3815	---	---	---	---	3815
5.	Mina sub canal	---	9135	6930	---	---	---	16065
6.	Ghod sub canal	4633	---	---	---	---	---	4633
7.	Pimpalgaon Joge left bank canal	---	7125	---	5190	---	---	12315
8.	Manikdoh left bank canal	---	2424	---	---	---	---	2424
9.	Wadaj right bank canal	---	385	---	---	---	---	385
10.	Pusphavati canal	---	1862	---	---	---	---	1862
11.	Total irrigation area in Tahsil	15418	27115	13837	14740	15003	---	86113
12.	**Total irrigation area in District**	**56370**			**29743**			**86113**

Source: Kukadi Irrigation Department, Division No. 1, Narayangaon Project, Vol. I, page-11.

Table- 2.9

Crop Pattern- under Kukadi Irrigation Project Area

(Area in Hectares)

Sr. No.	Crops under Project	Crop Pattern %	Area in Hectares
1.	**Kharif Season**		
	a) Jowar hybrid	20	29211
	b) Bajra	10	14605
	c) Rice	12	2921
	d) Groundnuts	15	21908
	e) Chilli	02	2921
	f) Vegetables	02	4382
	Total	**52**	**75948**
2.	**Rabbi Season**		
	a) Wheat	16	23368
	b) Jowar local	15	21908
	c) Jowar hybrid	12	17520
	d) Jwoar khodwa	02	2921
	e) Gram	05	7303
	f) Vegatables	02	2921
	g) Other	03	4383
	Total	55	80330
	Grand Total	**107**	**156278**

Source: Crop Pattern of Kukadi Project, Kukadi Irrigation Project Division No. I, Nrayangaon, page. 29

World Bank published letter (Dated- 20/01/1980) for Kukadi project. In this letter the World Bank put the eight month crop pattern and put the irrigation potential of 107%

Kukadi Irrigation Project in Shrigonda Tahsil:

In Shrigonda Tahsil Kukadi irrigation division No. 2 was working. Under this division Ghod Project, Kukadi left bank canal Km. 114 to Km. 178 area was consider for irrigation. Visapur medium project, Small irrigation projects in Pune district, five Kolhapur type dams, Kolhapur type dam at Kapsewadi in Ahmednagar district and other eight small irrigation dams was under this division.

Ghod dam was constructed brtween the village Chinchni, Tal: Shirur, Dist: Pune and village Wadgaon, Tal: Shrigonda, Dist: Ahmednagar. The total water storage capacity of Ghod dam is 216.31 Quebec meters. Out of that 154.80 Quebec meters water available for irrigation. This project irrigates 14310 hectares area in Ahmednagar district is and 6190 hectares area in Pune district.

Under the Ghod project on Ghod River there are five Kolhapur type dams are constructed by irrigation department, and all that five dams' store 441 Quebec feet water. By this water 3321 hectares area was irrigated in Shrigonda Tahsil. Near Kolgaon Dolas there is another small irrigation dam under this project and the water storage capacity of this dam is 3775 Quebec feet. This dam irrigates 134 hectares area in Shrigonda Tahsil.

From Ahmednagar and a Solapur districts Kukadi left bank canal up to 114 Km. irrigates 52838 and 24562 hectares area consequently. Today PWD handover up to 178 Km. canal for irrigation purpose and this canal irrigates more area in Shrigonda and Karjat Tahsils. Canal provided the water up to 178 Km. for drinking purpose and filling the small dams for other purpose by the direction of District Collector Ahmednagar.

Newly constructed Visapur medium project was included in Kukadi project. Water storage capacity of Visapur medium project was 26.10 Quebec meters (922 Quebec feet) and this project irrigates 5388

hectares area of Ahmednagar district. From Shrigonda Tahsil 5 and Karjat Tahsil 3 small dams under Kukadi project and water storage capacity of the eight dams are 16.45 Quebec feet (581 Quebec feet). These eight dams irrigate 3288 hectares area in Shrigonda and Karjat Tahsils in Ahmednagar district. At Kapsewadi in Shrigonda Tahsil there are another one Kolhapur type dam is constructed and this dam are also under this division. This dam provided more 267 hectares area facility of irrigation. Water storage capacity of this dam is 1.38 Quebec meters (49 Quebec feet).

Rabbi Season and Summer Season of Year 2005-06:

Rabbi Season: For rabbi season 2005-06 three times water relies from the canal and this decision taken by the Canal Committee. Ghod project, Visapur medium project and all dams under Kukadi project was fully storage by water up to 15/10/2005.

Area Irrigates in Rabbi Season- 2005-06:

1. Ghod Project:	11606 hectares
2. Kukadi Project:	24722 hectares
3. Visapur Medium Project:	3956 hectares
4. Small Irrigation Dams	1028 hectares
5. Kolhapur type Dams	1402 hectares
Total:	**39714 hectares**

Summer Season: In summer season the design taken from canal adversary committee is two times release the water for irrigation. This design depends upon availability of water in Ghod and Kukadi project. Finally release the water successfully by the design.

Area irrigated in summer season:

1. Ghod Project	4797.45 hectares
2. Kukadi Project	5768.30 hectares
3. Visapur Medium Project	2850.00 hectares
4. Small Irrigation project	651.00 hectares
5. Kolhapur type Dams	1000.00 hectares
Total:	**15060.00 hectares**

Today's water storage capacity: Following table 2.10 shows the availability of water in Kukadi project, Visapur medium project, Ghod project and Small irrigation projects up to 08/09/2006.

Table- 2.10

Today's Water Storage Capacity of Kukadi Project

Sr. No.	Name of the Dam	Capacity of the Dam		Total water storage in the Dam		Useful water storage in the Dam		
		Total capacity in Mts	Today's capacity in Mts	Total water storage m^3	Today's water storage m^3	Total water storage m^3	Today's water storage m^3	% of useful water
1.	Yedgaon, Tal: Junner, Dist: Pune	641.00	640.90	93.40	92.40	79.20	78.30	98.70
2.	Manikdoh, Tal: Junner, Dist: Pune	711.20	711.20	307.90	308.00	288.10	288.10	100.00
3.	Wadaj, Tal: Junner, Dist: Pune	717.50	719.50	35.90	36.02	33.10	33.20	100.00
4.	Dimbhe, Tal: Ambegaon, Dist: Pune	719.10	719.10	382.00	381.80	353.70	352.50	99.90
5.	Pimpalgaon Joge, Tal: Ambegaon, Dist: Pune	686.80	686.80	217.90	235.50	92.60	110.30	100.00
6.	Ghod, Tal: Shirur, Dist: Pune	548.60	548.50	216.60	213.90	154.80	152.40	98.50
7.	Visapur, Tal: Shrigonda, Dist: Ahmednagar	607.20	607.20	26.10	25.61	26.10	25.61	100.00
	Total	**---**	**---**	**----**	**904.60**	**---**	**904.60**	**---**

Source: Kukadi Irrigation Deparement No.2, Shrigonda, Dated 09/09/2006, Committee observation notes.

Dig. 2.8: Today's Water Storage Capacity of Kukadi Project

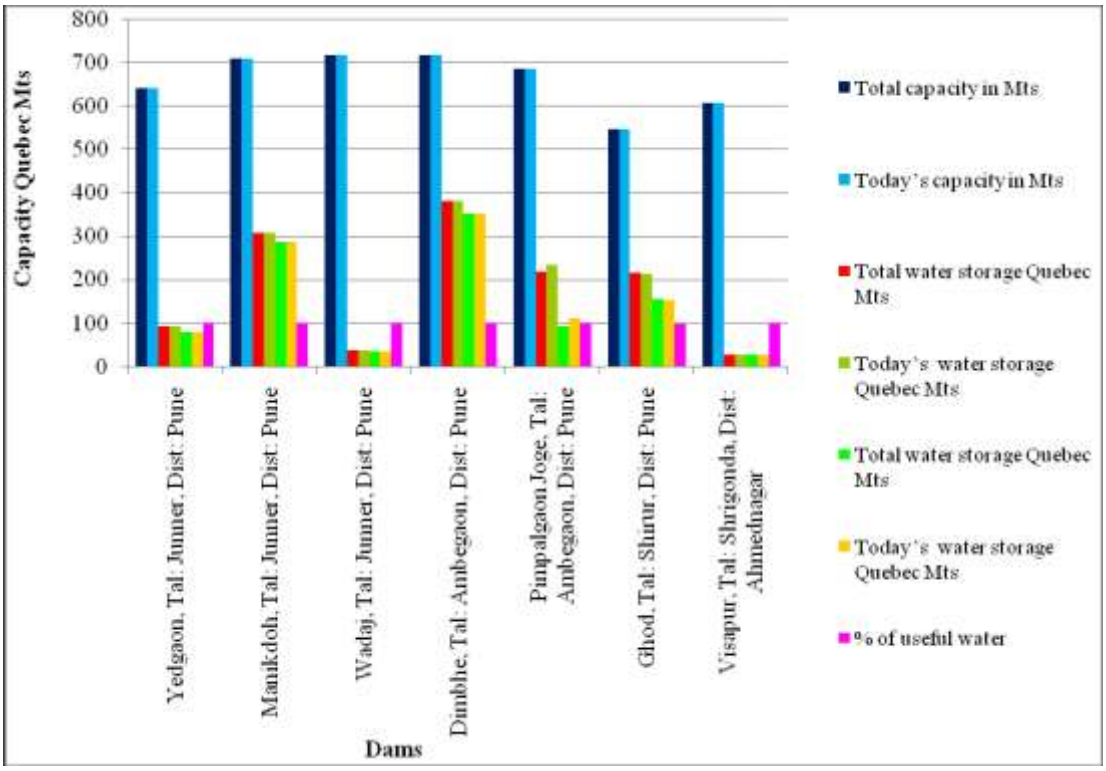


Table- 2.11

Projects Benefited Irrigation Facilities

Project	District	Benefited Tahsils	Potential (Hectares)
Visapur Dam	Ahmednagar	01	1364.51
Ghod Dam	Ahmednagar	02	14310.00
	Pune	01	5257.00
Kukadi Project	Ahmednagar	03	75343.00
	Pune	03	56370.00
	Solapur	01	24563.00
	Total	**11**	**177207.51**

2.7: Methodology:

Under Kukadi Canal project, command area in all, seven Tahsils get the benefit of irrigation; three tahsil from Ahmednagar district, three tahsils from Pune district and one tahsil from Solapur district. The water is provided three times in an agricultural year (July to June) in a protective fashion *i.e.,* under Kharif, Rabi and 2 seasonal in the ratio of 40:40:20 respectively. Ghod Dam has got 20% area under 2 seasonal crops which is not so under Visapur Dam command area selection of the sample Tahsil.

In Ahmednagar district of the three tahsils, Shrigonda tahsil gets maximum irrigation from Kukadi canal project. In terms of acreage and as well as number of villages. 83 villages get the benefit to some extent or the other. Shrigonda tahsil, both in absolute figures and percentage, stands first in terms of area actually brought under irrigation and percentage, stands first, in terms of area actually brought under irrigation and as a ratio of the targeted area (in all the 3 seasons). For the year 2005-06 (the latest available, at the beginning of this study) Shrigonda tahsil data is given below (Table 2.12)

Table- 2.12
Area actually brought under irrigation and as a ratio of the targeted area (In all the 3 seasons)

Sr. No.		Kharif	Two Seasons	Rabi	All Seasons
1.	Targeted for irrigation (acres)	9527	8940	12149	30616
2.	Actually irrigated (acres)	6670	7416	10250	24336
3.	% of (2) to (1)	70.01	82.92	84.36	79.48
4.	Overall Kukadi command (%)	12.54	31.76	15.23	27.77

Thus season wise and overall, Shrigonda tahsils figures are higher than the command area's figures. As a matter of fact, the area under this command, till the project was constructed, has been cultivated during Rabi season only (October onwards) as it is the only rainy season. It will be redundant to use irrigation water, when rainwater is abundantly available during Rabi season. If only rains fail, the farmer looks forward for canal water. Kharif is a new concept in these newly irrigated areas. The farmers are yet to get used, to the suage of canal water during Kharif. Thus Shrigonda tahsil is selected for this study due to large area under canal irrigation.

2.8: Sample Village Selection:

The next stage is to select villages for the intensive study of the farm household to assess the impact of irrigation, from out of the 114 villages, of the Shrigonda tahsil. The study area is beyond imagination to the side villages. The numbers of villages are more; therefore the Tahsil will divide in to 11 divisions. In each division to villages are selected by random sampling method. 20 farmers will be selected in each division respectively. They will be divided in four categories such as Marginal, small, medium and big farmers (According to land holding capacity). Five sample of each category will be considered in terms of interview for study.

Map 2.5: Villages of Shrigonda Tahsil

Table- 2.13

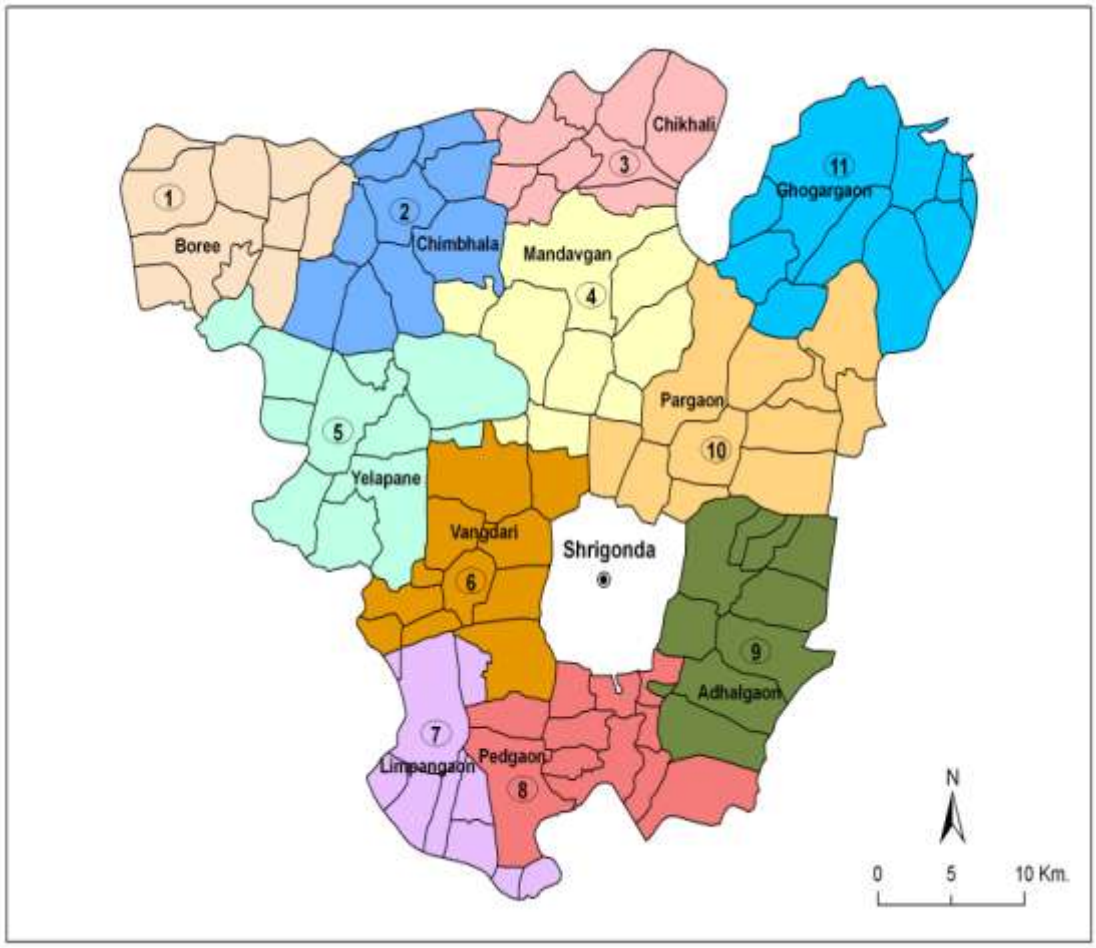
Selected Villages % of Irrigated area to total area

Sr, No.	Village	Total Area of the village (hectares)	Irrigated area (hectares)	% (2/1)
1.	Cikhali	2237.39	583.35	26.07
2.	Mungusgaon	654.40	23.50	3.59
3.	Pargaon	1116.46	390.00	34.93
4.	Khartwadi	30.00	30.00	100.00
5.	Walghud	1476.18	25.70	1.75
6.	Thite sangavi	598.81	50.00	8.34
7.	Takali – Lonar	1368.73	119.94	8.76
8.	Deulgaon	1613.12	151.65	9.40
9.	Boree	1203.84	364.37	3.26
10.	Wangdari	948.53	504.00	53.13
11.	Rajaur	2445.19	260.00	10.63
12.	Wadgaon – Shindodi	860.11	45.68	5.31
13.	Yewati	1382.55	258.22	18.67
14.	Nimbavi	1592.00s	21.09	1.32
15.	Arvi	373.57	120.00	32.12
16.	Mundhekarwadi	1154.16	962.56	83.39
17.	Sangavi Dumala	568.52	370.00	65.08
18.	Gar	736.79	119.61	16.23
19.	Ghodegaon	1177.25	214.45	18.21
20.	Wadali	1248.00	72.00	5.76
21.	Kansewadi	436.55	315.07	72.17
22.	Velu	776.57	27.50	3.54

Source: Ahmednagar District Census Handbook 2001

Thus the inevitable choice has fallen on 22 villages (Table 2.13) for detailed and in-depth study of the impact of irrigation on economic development. For comparison purpose. The villages spread all over the tahsil. But they are too small population wise, and also they get full irrigation after 2000-01 by Kukadi Canal Project. Hence the availability of dry farmers is ruled out (Administration report for 1979-80, Chairman and Administrator, CADA, MP&G Projects, Ahmednagar).

Map 2.6: Shrigonda Tahsil- Divisions for Study Purpose



Map 2.7: Villages Selected for Sampling in Study area

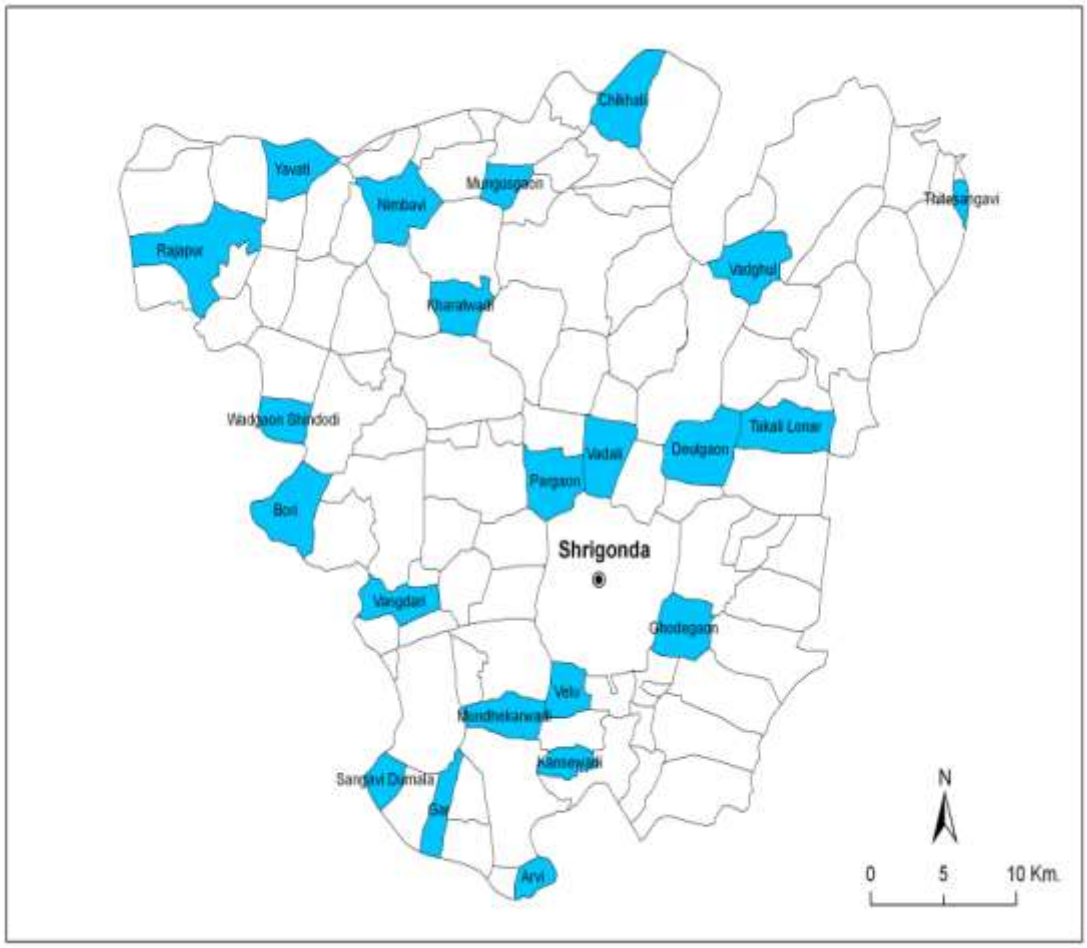


Table- 2.14

Selected Villages Population and Households

Sr. No.	Village	Population	Households
1.	Cikhali	2256	378
2.	Mungusgaon	923	172
3.	Pargaon	3478	630
4.	Kharatwadi	1554	265
5.	Walghud	769	124
6.	Thite sangavi	1051	205
7.	Takali – Lonar	2004	372
8.	Deulgaon	2059	346
9.	Boree	846	157
10.	Wangdari	1935	336
11.	Rajaur	1864	311
12.	Wadgaon – Shindodi	543	92
13.	Yewati	1324	240
14.	Nimbavi	1638	339
15.	Arvi	737	64
16.	Mundhekarwadi	2657	460
17.	Sangavi Dumala	1637	307
18.	Gar	966	148
19.	Ghodegaon	1271	215
20.	Wadali	1338	234
21.	Kansewadi	890	146
22.	Velu	779	132

Source: Ahmednagar District Census Handbook-2001

On the Eastern side, Takali Lonar village is very big village, and very low (8.76%) area under irrigation. On the south weastern side. Mundhekarwadi village is another big village and areas irrigated by all sources are 83.39%. This village has got a total geographical area are of 1154.16 hectares out of which 962.56 hectares are irrigated. Kharatwadi is near to Visapur Dam. This Village has got 30.00 hectares geographical area and all 30.00 hectares are irrigated mines 100% of irrigation in this village. Mungusgaon is only 5 kilometers away from Visapur Dam and this village has got a total geographical area of 654.40 hectares out of which 23.50 (3.59%) hectares area irrigated by canal. Cikhal is the big village on the north – eastern side of the tahsils. Populations of this village are 2,346 and total area of the village is 2,237.39 hectares out of this area only 583.35 hectares (26.07%) area is irrigated. The only difference between these villages is irrigation from Kukadi canal project. Moreover both Sellected villages have the same characteristics in terms of climate, rainfall, temperature, soil structure, sociological factors, farm practices etc. thus this study can be termed as an ex- post assessment of the benefits of irrigation. Since it is not possible to obtain data prior to the construction of the dam canal, comparing the agriculture input output in two areas similar in all respects, except the availability of the irrigation in one and the absence of it in another village, similar in all respects like climate, rainfall, soil, sociological factors, farm practices and other essential factors required to farm business, would indirectly to farm business, would indirectly bring out the impact of irrigation, if any.

Naturally the results of this study would be based on the intensive households to household's surveyor of cultivator's households. Every sample farmer would be personally contacted and interrogated in detail, with the help of a questionnaire specially designed for this purpose, covering all the conceivable aspects of his social and farming life.

The samples are drawn on he lines of probability proportional sampling method, taking the land holding size as the major control. In the experimental irrigated (wet) villages 1105 sample house holds and in the control (dry) villages 175 sample households are contacted for micro level study **(**Table 2.16).

2.9: Methods of data collection:

Questionnaire method is adopted by contacting each head of the sample household, besides the field observation and macro level (secondary) data collection. The data is collected for the single agricultural year; July 2008 June 2009. For cross checking the reliability of the data, the village level worker, agricultural assistants, engineers (PWD) and some elite leaders of the villages are interviewed individually. Their views opinions are also recorded, on cretin relevant and important issues, to serve as guidelines cross checks.

The strong point of the study is that the data has been collected by the researcher himself and subsequently the tabulate on and analysis is done by him. This approach, it is felt, enables the researcher to develop insight in the field situation which helped a lot to enrich the subject treatment in the analysis part

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2.10: Size and Type of Samples:

The cultivators list has been prepared from the up-dated Khata book of all villages, available with the Talathi (Village accountant) revenue official at the village level. The list, thus recorded is exhaustive and latest. Those farmers, who are having land in the sample villages but staying outside the village, are however not considered for this study.

The Khata book thus recorded has been regrouped into four land holding size (Villiam G. Cochran, 1972, Sampling techniques, pp. 282-

299), to capture the conditions of farmers, belonging to various levels (small, medium, marginal, big, etc.)

Farmer categories:

1. < 1.5 hectares – Small farmers
2. 1.6 to 3 hectares – Medium farmers
3. 3.1 to 7 hectares – Marginal farmers
4. > 7 hectares – Big farmers.

The percentages are worked out LHS wise to the total. The samples are drawn by adopting the "probability proportional sampling" method (Narayan, B. K. and Vasudeva Rao, D. Farm, Economy 1978 of MP and GP, CASU, ISEC). The average land holding size, per household, is observed to be around 5 to 6 hectares in the sample villages- which is true for the study region. Hence care is taken to include "samples of less than 1.5 hectares" as they might represent weaker sections and small farmers, who need special attention for their share in he process of development. In the total sample representation for each size class is maintained in the same households are selected for intensive study. (Table 2.15) so far as the control villages is concerned; the dry farmers from the villages are selected by the same method. Though 18 villages gets the benefit of irrigation from canal, yet 70 % of cultivated farmers (due to there location, higher altitude, and the alignment of the canal) pursuer the cultivation on dry / rain fed methods. From among the 05 villages listed under each land holding size, the dry farmers are identified and selected for the study of the 'control' (rain fed) conditions of 18 villages. In all 1285 cultivators are selected from 22 villages. Irrigation is the principal factor of agriculture development where rainfall is inadequate and is unevenly spread in time and space (Arun S. Patel, 1981).

The selected households are distributed equally in each of the selected villages, such that the varying geo-agricultural and social configuration of the project may well be represented in the sample (Table 2.16)

Table- 2.15

Sample Frame Work – Probability Proportional Method

Sr. No.	LHS	Total No. of Cultivators	%	Sample Cultivators	%
1.	< 1.5 hectares	1596	28.10	320	25.00
2.	1.6 to 3 hectares	1468	25.90	320	25.00
3.	3.1 to 7 hectares	1389	24.50	320	25.00
4.	> 7 hectares	1220	21.50	320	25.00
	Total	**5670**	**100.00**	**1280**	**100.00**

Table- 2.16

Distribution of Sample Farms out of the Total Villages

Sr. No.	Village	Total Cultivators	Sample	%
1.	Cikhli	378	75	5.85
2.	Mungusgaon	172	35	2.73
3.	Pargaon	630	120	9.37
4.	Kharatwadi	265	55	4.29
5.	Walghud	124	25	1.95
6.	Thitesangavi	1051	40	3.12
7.	Takali-Lonar	2004	70	5.46
8.	Deulgaon	2059	70	5.46
9.	Boree	846	35	2.73
10.	Wangdari	1935	70	5.46
11.	Rajapur	1864	150	11.71
12.	Wadgaon-Shindodi	543	25	1.95
13.	Yewati	1324	50	3.90
14.	Nimbavi	1638	50	3.90
15.	Arvi	737	35	2.73
16.	Mundhekarwadi	2657	95	7.42
17.	Sangavi-Dumala	1637	80	6.25
18.	Gar	966	40	3.12
19.	Ghodegaon	1271	50	3.90
20.	Wadali	1338	50	3.90
21.	Kansewadi	890	30	2.34
22.	Velu	779	30	2.34
	Total	**25108**	**1280**	**100.00**

Source: Ahmednagar District Census Handbook-2001

Chapter. 3

PHYSICAL AND CULTURAL SETTING

3. A: Physical Setting

3. A.1: Introduction:

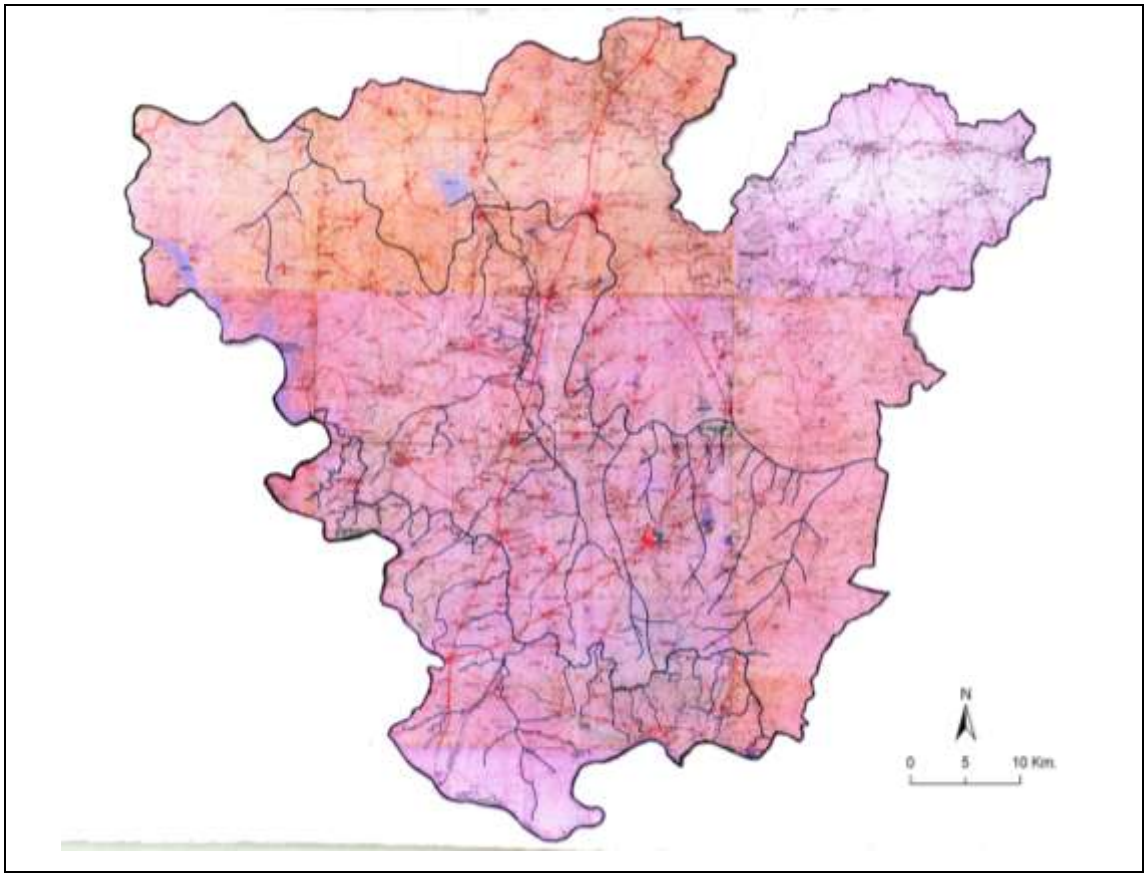
Land is the basic resource of human society. Its utilization shows a reciprocal relationship between ecological conditions of a region and man. Visher (1932) has rightly put forward the theory that a specific field of geography concerns itself with the study of the influence of natural environment on the nature and distribution of men's activities.

The varied nature namely soil, water, climate provides different area with variety of possibilities of development Hettnerr (1947). It is therefore, necessary to evaluate the agricultural land use of the study region, needs to unfold the nature of ecology of the Shrigonda Tahsil of Ahmednagar District. This chapter covers the profile of physical background of the Tahsil, i.e. Climate, Rainfall, Temperature, Humidity, Cloudiness, Winds, Drainage, Soils, Vegetation, Geology, Rocks, Ground Water and Sunshine.

3. A.2: Location, Situation and Site:

Shrigonda Tahsil is lying between 18^0 27′ N to 18^0 51′ North latitudes and 74^0 23′ E to 74^0 52′ East longitudes. Total geographical area of the Tahsil is 1519.89 Sq. Km. and stand fourth largest Tahsil in Ahmednagar district. Shrigonda Tahsil is situated between Pune district to the southwest and Beed district to the northeast. Parner and Nagar Tahsil to north and Karjat to southwest.

Map 3.1: Study area



3. A.3: Climate:

Agro climatologically, Shrigonda Tahsil is affected by drought prone area and average annual rainfall is 522 mm. And the rainfall is 77% in June to September, which is reflected on cropping pattern of the tahsil. The average maximum temperature is 38.9^0c. The area is characterized by plateau of Ahmednagar district and dose not shows high aptitude of relative relief and absolute relief. The offshoots of Balaghat range extended to northeast portion of tahsil and locally known as Kolgaon Mandavgan hill range. The rest of the area shows topography throughout the area. The geographical structure of this study area is consisting of very hard basaltic rocks. The horizontal layers of sill and sheet formed in this area. The soils in the hill slope area are characterized by thin layer cover with Murum and slightly faint grey river basins Bhima and Sina which is highly reflected on natural vegetation acacia (Babhul) and Neem; are some of the characteristic species of semiarid climate.

The climate of Tahsil Shrigonda is characterized by a hot summer and general dryness during major part of the year except during south-west monsoon season. The cold season in the tahsil is commences from December and ends in the month of February. The period from March to the first week of June is the hot season. It is followed by the south-west monsoon season which lasts till the end of September, October and November constitute the post- monsoon on the retreating south-west monsoon season.

3. A.4: Rainfall:

Records of rainfall in the Shrigonda tahsil are available for three rains guage stations for periods extending from 10 years. The average extending from 10 years. The average annual rainfall in the tahsil is 522 mm. The tahsil mostly in rain shadow region, to the east of Western

Ghats. Near the western border of the tahsil the rainfall decreases rapidly as one proceeds towards east. But from a line roughly north-south in the central parts of the tahsil, the rainfall gradually increases towards the east. About 77% of the annual rainfall in the tahsil is received during the south – west monsoon season, September being the rainiest month. The variation in rainfall from year to year is found. The highest annual rainfall amounting to 159% of the normal occurred in 1916, while 1920 was the year with the lowest annual rainfall which was 51 % of normal. In the fifty years period from 1950 to 2000 the annual rainfall in the tahsil than 80% of the normal in 10 years with the consecutive years of such rainfall occurring once and two consecutive years thrice. Considering the annual rainfall at the individual stations two and three consecutive years of rainfall less than 80 % of the normal is common at many stations. Even four consecutive years of such low rainfall occurred once each at two of the stations. On the average there are 35 rainy days (i.e. days with rainfall of 2.5 mm, - 10 per cent or more) in a year in the tahsil. This number varies from 23 at Kolgaon and Belwandi to 31 at Kasti. The heaviest rainfall in 24 hours recorded in the tahsil was 280 mm at Wangdari on 15th October 2003.Agriculture in the tahsil is depends mainly on the rainfall from south-west monsoon. The distribution of rainfall is most uneven in the tahsil. The major part of precipitation is experienced in weastern portion of tahsil, whereas rains in southern part of the tahsil lies in the zone of low rainfall ranging from 508 mm. to 635 mm. annually. The tahsil can divided into two zone according to rainfall at tahsil headquarters, wiz; the northern part comprising Mandavgan division with a rainfall of about 500 mm. or less, the second zone comprising the remaining tahsil with rainfall between start in the second week of June and last till the end of September. The intensity of rainfall is the heights in July. Sometimes thunder showers in March and April are recorded. In

the plain areas of the tahsil the rains are erratic and mostly from the north-east monsoon.

3. A.5: Temperature:

There is a meteorological observatory in the district at Ahmednagar functioning from 1891. The records of this observatory many be taken as representing of the metrological conditions prevailing over the district. The cold weather starts by about the middle of November and continues till the end of February and continues till the end of February. December is the coldest month of the year with the mean daily maximum temperature at 28.5^0c and the mean daily minimum at 11.7^0c. During the cold season the tahsil is sometimes affected by cold waves in association with passage of western disturbances across north India, causing drop of minimum temperature to 2^0c to 3^0c. From March to the break of south-west monsoon, the day temperatures increase progressively and the nights remaining comparatively cool. In the hot season, the sweltering heat of the afternoons is sometimes relieved by thunder-storms. May is the hottest month of the year with the mean daily maximum temperature at 38.9^0c and the mean daily minimum at 22.4^0c. On individual says during the hot weather period temperature occasionally goes u to 43^0c to 44^0c. With the onset of south-west monsoon in the tahsil there is an appreciable drop in temperature and weather becomes pleasant. With the withdrawal of the monsoon by about the first week of October. However the night temperatures decrease steadily after the withdrawal of the monsoon.

The highest maximum temperature recorded at Shrigonda was 43.7^0c on 10^{th} May 2004 and the lowest minimum 6.4^0c on 7^{th} January 2010.

3. A.6: Humidity:

The air is generally dry during the months from February to May and particularly in the afternoons when the humidity is, about 20% on an average. The relative humidity during south-west monsoon period is between 60 and 80%. Thereafter they decrease rapidly.

3. A.7: Cloudiness:

Skies are generally heavily clouded to overcast during monsoon months. In the post-monsoon months the cloudiness decreases. In the rest of the year the skies are clear or lightly clouded.

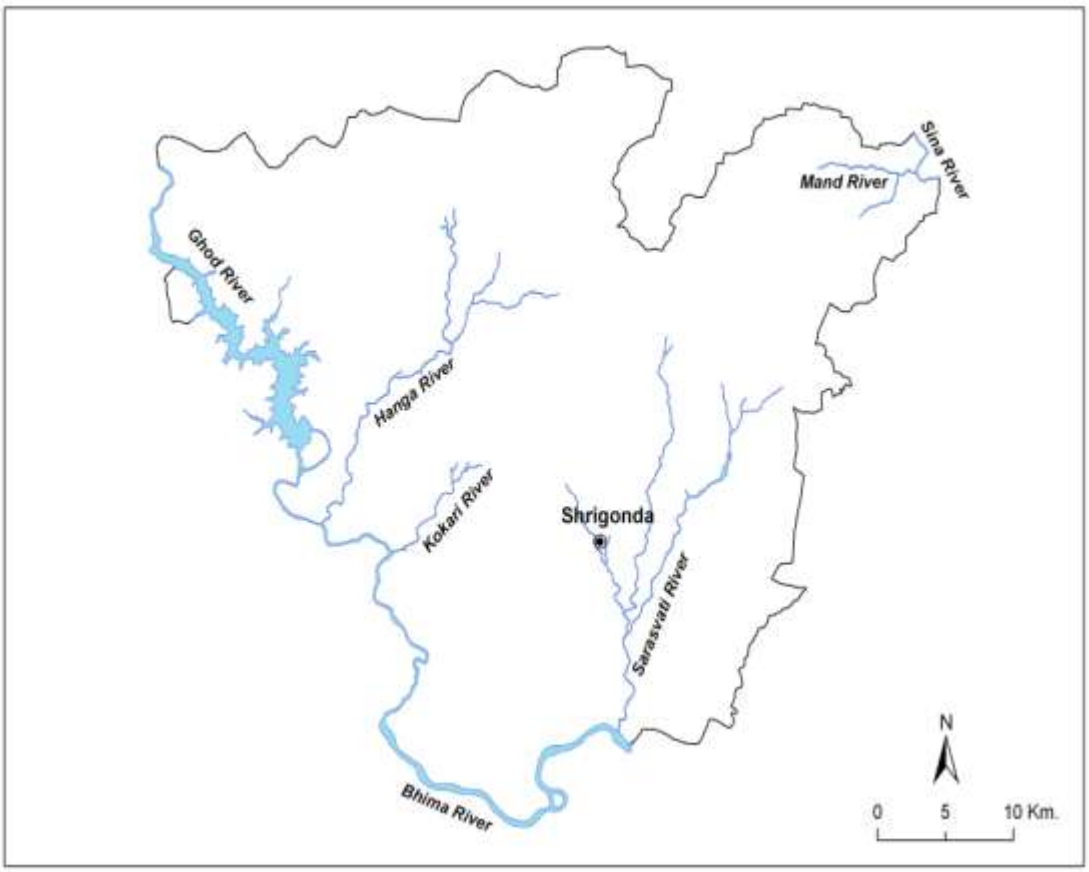
3. A.8: Winds:

Winds are generally light to moderate with some strengthening in the south-west monsoon season. In the south-west monsoon season. In the south-west monsoon season winds are from direction between south-west. In the post-monsoon season winds from the north-west and north are common in the mornings while in the afternoons the winds blow from directions between north and east. In the cold season winds variable in directions. Winds between north-west being more common. In the summer season northerly to north-westerly winds are more common, but by May westerly also being to blow in the afternoons.

3. A.9: Natural Drainage:

The drainage of Shrigonda Tahsil belong two major river systems of Maharashtra, the Bhima in the south and the Ghod in the west. These two main rivers which flow on the southern and western boundaries of the Tahsil, major tributaries of these two rivers in the Tahsil drain the area of the Tahsil in general north-southwards.

Map 3.2: Shrigonda Tahsil- Natural Drainage



Bhima River: The Bhima River drains the southern part of the Shrigonda Tahsil. It inters into the Tahsil near the village Sangavi Dumala and 60Kms. continuous part forms the boundary between Ahmednagar and Pune districts. The river receives on the left bank, waters of the Ghod River and further east it is joined by the Saraswati, Lohkara and the Nani Nadi. In Tahsil Shrigonda the course of the Bhima is continuously to the south-east. It passes along the western boundary of Sholapur, lower downstream before emptying into the River Krishna. The banks of the river are generally low. The river bed is sandy and there by rocky barriers. There are many deep pools but during hot months the stream dwindles down to an insignificant stream. In the Tahsil main tributaries of the Bhima are the Ghoa and the Hanga rivers.

Ghod River: The Ghod River is the main left-bank tributary of the Bhima, rise on the slopes of the Sahyadry in Junner Tahsil of Pune district. River flows is south-easterly direction for 80Kms. forms part of the western boundary of the Shrigonda Tahsil and Pune district. The Ghod River is remains at cantonment township of Shirur, on left bank of the Kukadi Nadi and further the water volume is increased due to the water of the Hanga and the Pathal Nadi. The streams which drain into it the waters of Shrigonda Tahsil on the right bank are few on account of the proximity of the water-shed which makes the drain small. The banks of the tributaries are low and its beds are generally rocky. In the dry months, the streams are fordable, but during rainy season the river basin are fully watered and cannot be crossed without boats. The Ghod falls into the Bhima near the village Sangavi Dumala in Shrigonda Tahsil.

Hanga River: The Hanga River rises on the slope of the eastern hills of the Parner Tahsil headquarter and it flows north to south, during the Parner Tahsil and it enters into the Shrigonda Tahsil near the village Chambhurdi. The bank of the Hanga is low and its bed is sandy. After heavy rains, its flow is somewhat rapid, as is shown by the directness of its course. During the summer season the river becomes practically dry. The length of Hanga River is about 72Kms. in the Tahsil Shrigonda. It flows in a north-weasterly direction for over 30Kms. and it joins the Ghod River at the village of Hangewadi in the Tahsil.

Saraswati River: The Saraswati River is rises on the southern slop of the Kolgaon Mandavgan hill range. It flows in a north to south direction for over 65Kms. Headquarter of Shrigonda Tahsil is on the left bank of the river. After heavy rains its flow is somewhat rapid. During summer season the river becomes practically dry. The Saraswati fall is into the Bhima River near the village Anandwadi in Shrigonda Tahsil.

Mand River: The Mand River is rises on the eastern slope of the Kolgaon Mandavgan hill rang near the village Wadghul. It flows west-easterly about 27Kms. and joins into the Sina River near the village Thitesangavi in the Tahsil Shrigonda.

Dev River: The Dev River is rises in the eastern parts of Shrigonda Tahsil on the slopes of the Koseghavan peaks. It flows for 34Kms. in an south direction and joins in to the Saraswati near the village Chorachiwadi in the Tahsil Shrigonda.

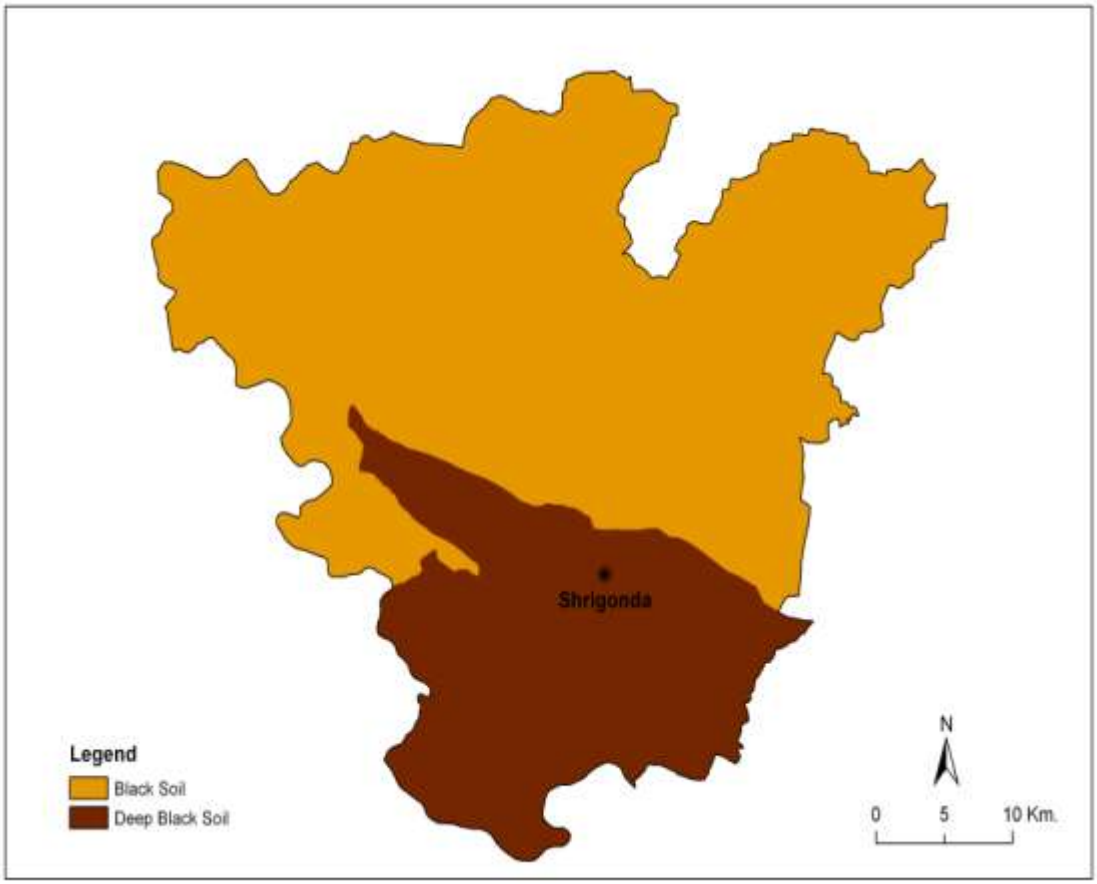
Sina River: The Sina River has two chief sources; one is near Jamgaon sbout 20Kms. west from the Ahmednagar and the other near Jeur about

16Kms. from the Ahmednagar to its north-east. The River goes near through the village Chavarsangavi into the Shrigonda Tahsil and forms 12Kms. continuous part of the boundary between Ahmednagar and Beed district. The banks of the Sina River are low and its bed is sandy. After heavy rains, its flow is somewhat rapid as shown by the direction of its course. During summer the river becomes practically dry.

3. A.10: Soils:

The soils in the Tahsil can generally be classified into three groups, *wiz;* Black or Kali, Red or Tambat, and Laterite and the Gray of inferior quality locally known as Bharad including white or Pandhari of these, bharad soils are very poor in fertility. The plains in west and south part of the Tahsil have comparatively a good depth of soil. Near the Bhima and Ghod Rivers white tracts of deep rich land is found. Specially two barren tracts be noticed, one on the border of Karjat and Shrigonda Tahsil's and the other north of a line drawn east to west through Chikhali village, ten miles to the north of Nagar, and as far north as the slopes down to the Hanga River. The second waste of great extent and is mostly un-arable being little better than bare basalt, unusable for anything except sheep-grazing. Near the range of the hill that runs south-east down the center of the Shrigonda and Karjat Tahsils, the land is very poor with occasional patches of good light soil near Adhalgaon, Ghodegaon, Takali Kadevalit, Shedgaon and other places. In the hilly areas to the North-east of Tahsil red soil is found. The major area of the Tahsil comes under scarcity zone. The types of soil of this zone are given in the following map.

Map 3.3: Shrigonda Tahsil- Soil



3. A.11: Vegetation:

The forest in the Tahsil falls in the "Southern tropical dry deciduous" type and is mostly spread over the parts of Tahsil. The commercially important species found in the forest are *Teak, Jamubhul, Mango, Neem, Babul, Sissoo, Sandalwood* etc. Other species as *Khair, Hiwar, Herkal, Apta, Ber* etc. are also found in the forest. There are two types of forest are in the Tahsil *i.e.* (I) Reserved forest and (II) Protected forest. The major portion of the area is in under the charge of the Forest Department and the rest in under the charge of the revenue Department.

The growth is stunted and slow due to poor soils and lack of adequate humus. Vast stretches of grass-lands are also found. The species of grass commonly found are *Kusal, Dongari-Gavat, Pavanya and Marvel*. Among the shrubs the following are found: - *Phusmysorensis (Amoni), Cae Salpinia, Sepiaria (Chilar), Lantana Camara (Tantani), Gymnosporia Montana (Henkal), Cassia Auriculata (Tarwad)* etc. The grass is *Sheda, Gondal, Chirka, Marval, Kusal, Kunda* and *Rosha*. The forest in tahsil produces small quantity of teak poles, charcoal, firewood, grass and myrobalans.

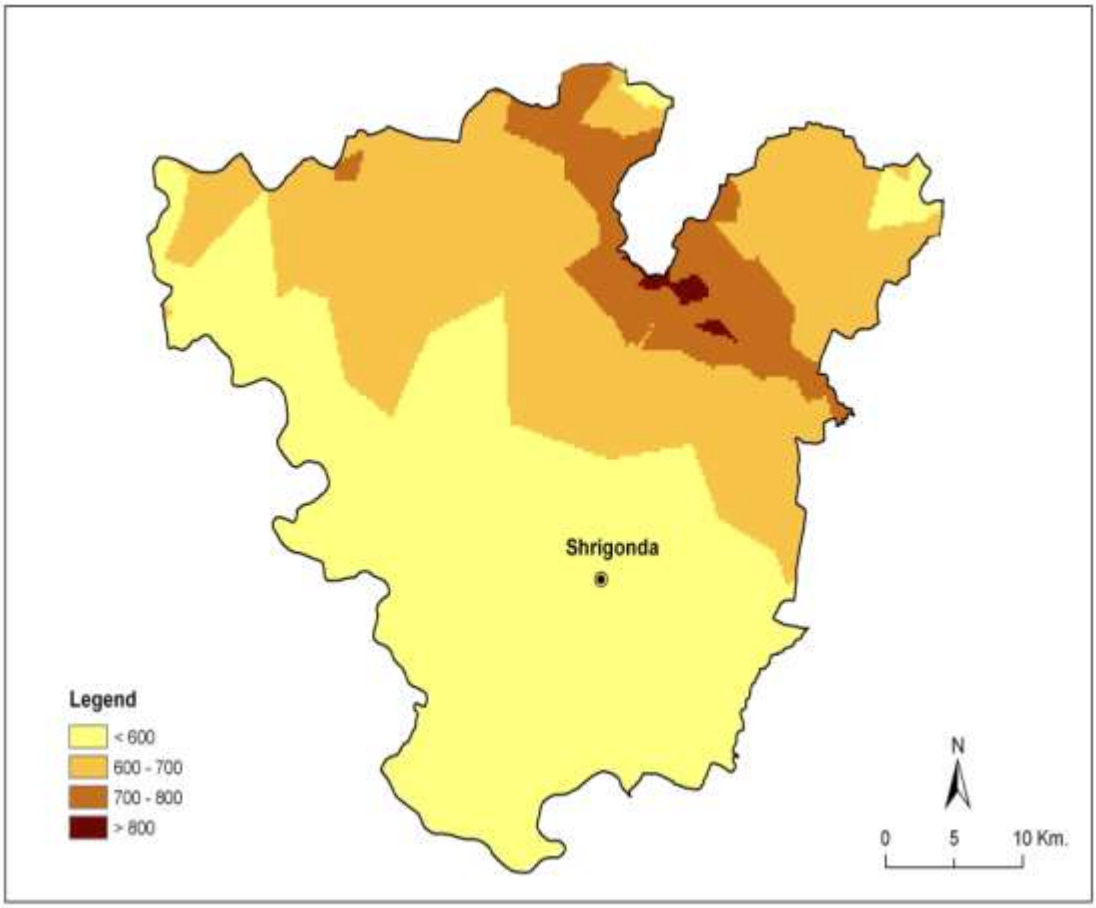
3. A.12: Geology:

There is no systematic geological map of the Tahsil has yet been drawn up by the Geological Survey of India. The Geological information is available only in the reports submitted by the officers of the Geological Survey of India.

The entire Tahsil is occupied by basaltic lava-flows erupted in the Cretaceous-Eocene age, which are popularly known as Deccan traps. These lava-flows are sometimes associated with inter trapping beads such as limestone, sandstone, clay shale's and red bole beads. The black cotton soil is found almost everywhere in the Tahsil. The river alluvium, sands,

gravel, clays and silts represent recent deposits in the Tahsil. Calcareous concretions and concentrated in the vicinity of the stream-courses. Stratigraphic sequence: - The stratigraphic sequence of the rocks in the Tahsil is as below.

Map 3.4: Physical Map of Study area



Black cotton soil, river alluvium sands, gravels, silts and calcareous kankar.	Recent
Intrusive basic dykes, basalt lava flows belonging to the Deccan trap volcanic episode, associated with inter-trappean beads, red whole beads, porous ash and scoriaceous matter etc.	Cretaceous-Eocene

3. A.13: Rocks:

I) Basalts:

Every flow of the basalt is generally composed of two different units: (a) the lower and middle parts are hard and compact, dark grey to greenish grey or black in colour and almost non-vesicular or very minutely vesicular. They are traversed by numerous joints and fractures and on weathering at the surface given rise to spheroidal blocks with inter-spaces between the spheroids filled with soft weathered material. (b) The upper parts of the flow are comparatively soft and vesicular. They have reddish pink to purplish colour and the vesicles almost everywhere filled up by zeolites and at place by other secondary minerals like calcite, greenish chlorophaeite, quartz, or ferruginous material.

For want of geological mapping in the area, flow pattern and fabric of basalts exposed in the Tahsil are not known. The thickness of the flows range from 3 meters to as much as 40 meters, the average thickness being around 15 meters.

The basalt is composed of plagioclase feldspars and clinopyroxenes, usually agate or pigeonite, with iron area and other minor constituents. They exhibit porphyritic texture wherein thin laths of plagioclase and feldspars are set between the plates of agate.

II) Red Beds:

These are thin reddish horizons occurring in between the successive flows of basalt and are exposed in discontinuous patches. They are very well along the hill-sides.

III) Intrusive Dykes:

No details available regarding true dykes in the Tahsil. Two trap dykes are reported to occur near Visapur Dam site. One is about 1.2 meters thick and runs in the middle of the Hanga River for about 100 meters. The other is large dyke about 9 meters thick and is seen on the left bank of the Hanga River.

IV) Calcareous Kankar:

These are either associated with soil or occurring as small nodules or concretions either associated with soil as infillings cracks, fissure and joints in rocks seen in the cliff at the bank of Bhima River near Pedgaon.

V) Soil and Alluvium:

Black cotton soil is the alluvium product of decomposition and weathering of basalt. This is highly absorbent and cracks and crumbles after a period long drought. Recent alluvium and consolidated gravels have attained a thickness of 24 to 30 meters on the left bank of the Ghod River near Bori and Bhingan villages.

3. A.14: Ground Water:

The geological setting of the Shrigonda Tahsil has a decisive role in determining the ground water possibilities in different parts if the Tahsil. The Tahsil is mainly occupied by basaltic lava flows and alluvium

of the Ghod and Hanga Rivers. Ground water occurs under water table conditions in different units of basaltic flows and the Hanga alluvium. The massive trap units being less permeable as compared to the vesicular units are likely to act as confining beds for the underlying vesicular zones and hence possibility of confined aquifers at depth cannot be ruled out.

Aquifer performance tests on wells tapping vesicular and massive traps indicate that the farmer has comparatively much higher yields than the latter. The yields in the farmer case are of the order of 1000 to 3000 Kilo litter per day (Klpd) for a depression of 1 to 4 meters, while in the case of massive traps it is of the order of 100 to 1000 Klpd. for a depression of 2 to 6 meters. In the case of alluvium, the safe yields are of the order of 700 to 2000 Klpd. for 1 to 1.5 meters of depression.

As regards the confined aquifers at depths, lack of adequate and reliable data prevents from giving any firm opinion on their true or apparent potential at this stage. Certain areas have been demarcated for exploratory drilling in parts of Shrigonda Tahsil based upon recent studies carried out by the Geological Survey of India. However, presence of successful tub-wells in the adjoining areas of Tahsil leaves scope for cautious optimum.

Data on the surface flow of Ghod and Bhima Rivers indicates that there is high discharge even in peak summer months. This is naturally attributable to the ground-water leakage (run-off) from the water table aquifer feeding these rivers. The leakage has, therefore to be effectively checked and adequately utilized. This can be construction of surface and sub-surface check weirs in stream beds at suitable places selected on the basis of detailed geo-hydrological studies. Contour banding would also be an important measure in addition to this to check the surface run-off. The

water thus impounded would considerably increase the recharge to the ground-water body.

3. A.15: Sunshine:

Seasonal variation in temperature is quite large. From March onwards is a period of continuous increase in day temperature, the nights remaining comparatively cool. May is the hottest month of the year with the mean daily maximum temperature at 38.9^{0C}. On individual days temperature occasionally rise to 43^{0C} or 44^{0C}. With the onset of the south-west monsoons there is an appreciable drop in temperatures increase but night temperatures progressively decrease. From about the middle of November both day and night temperatures decrease rapidly. December is the coldest month of the year with the mean daily minimum temperatures at 11.7^{0C}. In association with the passage of western disturbances across north India during winter season, the minimum temperature in the Tahsil sometimes drops to 2^{0C} or 3^{0C}.

Special Weather Phenomena:

Thunder – storms occur during the months from March to June and in September and October. Dust- storms are very rare in the Tahsil. The Tahsil experiences cloudy to overcast skies with wide – spread heavy rain in association with the monsoon depressions that forms in Bay of Bengal and move across central parts of the country.

3. B: Cultural Setting

3. B.1: Introduction:

After studying the background of physical setting of the study region including relief structure, climate, soil and geology, it would be

relevant to understand the role of cultural aspects in shaping agricultural land use pattern in area under study. Both the physical and cultural variables show their impact on agriculture practice and its production. The traditional system of agriculture and decision making have their bearing on the regional variations in agricultural land use in Shrigonda Tahsil. This has been elaborated and discussed in the section. Jasbir Singh and S. Dhillon (1987) have rightly stressed the necessity of the evolution of socio-economic variables in terms of inputs involved in agriculture sector that have been ultimately forming land use pattern and yield per hectare. The present study, therefore, is significant in this respect.

The objectives of this section is to highlight the cultural background of the study region or Tahsil, namely, population, irrigation, general land use, cropping pattern, literacy, workers, industries and their impact on cultural setting of the area under study.

The data of population of Shrigonda Tahsil from 2001 to 2010 have been collected from Ahmednagar Census Handbook, Ahmednagar. The data of occupational structure have been collected from the socio-economic abstract of Ahmednagar district, while the data of irrigation, general land use, cropping pattern, literacy, and industries collected from Ahmednagar District Gazetteer and socio-economic handbook of Ahmednagar district. The methods are used to depict the density of population, irrigation, literacy etc. of the Tahsil.

3. B.2: Population:

According to the 2001 census the total population of Shrigonda Tahsil is 2, 35,706 having 1, 20,914 males and 1, 14,792 females. The Shrigonda Tahsil has 4.27% of district population over 5.54% of its area.

Out of the total population of the Tahsil 2, 14,060 persons (90.81%) are residing in rural areas and remaining 21,646 persons (9.18%) are residing in urban areas. In Ahmednagar district 15.82% of the total population is urban whereas in Shrigonda Tahsil only 9.18% the total population is urban. The average number of towns per hundred inhabited villages is often considered as an index of urbanization. In Shrigonda Tahsil, there are 0.84% towns for every hundred inhabited villages. Shrigonda Tahsil is one of the less urbanized Tahsil in the district. Out of 114 total villages are inhabited. The rural population is thus distributed among 114 inhabited villages in the Tahsil. Shrigonda Tahsil is most populous town and Kasti, Belwandi, Mandvgan and Kolgaaon are other populous towns. There are no town in the Tahsil which has more than 5, 000 population. The average size of an urban centre of the Tahsil works out to 10, 000 persons.

3. B.3: Population Growth:

During 1981-91 Shrigonda Tahsil registered a growth rate of 29.92% added with an addition of 54,288 souls. However, the growth rate in the Tahsil was more than that of the district (24.35%). Among the 13 Tahsils of the district, Shrigonda Tahsil stands at second in average growth rate. During the decade 1911-21, the Tahsil registered the negative growth rate of 22.32% as against during 1921-31, the highest growth rate was recorded as 34.77% and subsequently during 1931-41, it has been significantly decline to 15.87%. In the earlier decade, during 1971-81 it was 19.32% which is increased by about the five points during 1981-91. Of the 13 Tahsils in the district nagar Tahsil registered the highest growth rate of 31.95% while Shrirampur has the lowest growth rate of 15.03%. The growth rate of Shrigonda is above the district average (29.92%) and the growth rates of remaining 5 Tahsils are below the

district average. The growth rates for the district and Tahsils in total, rural and urban areas and percentage of urban population to total population.

The average growth rates for the rural and urban areas in the district are 20.26% and 51.83% respectively. Shrigonda Tahsil average growth rate for the rural areas are 17.99% and Tahsil do not have urban areas. The highest urban growth rate is recorded in Rahuri Tahsil (95.84%) followed by Kopargaon Tahsil (87.54%). Sangamner Tahsil registered the lowest urban growth rate 22.38%. During 1951-91, the urban growth rate recorded at the 1951 census was the highest both in the district (80.95) and in the State (62.81%). The decade 1951-61 witnessed a decline (-12.81%) in district urban population and in the state the growth rate came down to 21.32%. During 1961-71 the urban growth rate in the district and the state rate to 34.27% and 40.75% respectively. During 1981-91 census an urban growth rate of (39.17%) and 39.99% recorded for the state respectively. In 2001 an urban growth rate rose to 51.83% in the district and for state it has come down to 38.87%.

3. B.4: Density:

Shrigonda Tahsil has an average density of 1123 persons per sq. km. This is lower than the district average density of 198 persons per sq. km. Among the 13 Tahsils of the district; Shrigonda held at sixth place. Within the district Shrirampur is the mostly thickly populated Tahsil with density of 393 persons per sq. km. On the other hand Parner Tahsil has a density of barely 114 persons per sq.km of area. Other Tahsils in the district where density of population exceeds the district average are Kopargaon (312), Nagar (307), Rahuri (247), Nevasa (212) and Sangamner (210).

3. B.5: Sex Ratio:

In Ahmednagar district as a whole there are 949 females for every thousand males. Shrigonda Tahsil indicates the same sex ratio as of the district (949) and remaining Tahsils are above the district average. When the districts are arranged in the descending order of sex ratio, Ahmednagar occupies the 14th place in the state. Within the district, the ratio varies from 1017 in Parner Tahsil to 912 in Nagar Tahsil. The sex ratio in six Tahsils is below district average. In all Tahsils except Nagar Tahsil, the sex ratios are lower than that in 1991. Generally rural areas have higher sex ratios than the urban areas but Shrirampur and Kopargaon Tahsils shown lower sex ratio figures for rural areas than urban areas. The sex ratio figures for rural and urban areas of the district are 956 as compared to the state average of 972 and 875 respectively. In urban areas, sex ratio in five Tahsils is above the district average and remaining two are below the district average.

It is observed that the rural sex ratio in 10 Tahsils is below the district average of 956 and the sex ratio of 3 Tahsils is above the district average. The highest sex ratio is seen in Parner Tahsil (1017) and lowest in Shrirampur Tahsil (937).

3. B.6: Literacy:

A person who can both read and write with understanding in any language is to be taken as literate by the Indian census. A person who a merely read but cannot write, is not literate. It is not necessary that a person who is literate should have received any formal education or should have passed any minimum educational standard. In addition to this for 1991 census, all children of age 6 years or less are treated as illiterate even though they may be going to school and can read and write a few odd words. In earlier census, this limitation was up to the age of 4. It has

also been decided to use only effective literacy rates for the 1991 census i.e., the ratio of literates and population excluding the age group of 0-6.

Through the population of Ahmednagar during 1961-91, almost doubled, the jump in literates is almost 4 times which in itself a significant achievement. In 1991, Shrigonda Tahsil reported 11,847 persons as literates, and it constitutes 58.25% of the total population (excluding) 0-6 age group) of the Tahsil. The literacy rate of Shrigonda Tahsil in 1991 census was 50.87% of the total population (excluding 0-6 age group). The literacy rate for Shrigonda Tahsil is below the district average of 58.89% and when the Tahsil are arranged in the descending order of literacy rates, Shrigonda occupies the 6th place in the district.

Rural and urban Literacy:

For the Tahsil as a hole, the literacy rate for male is much higher than the females. As much as 72.27% of the males are literates while females account for only 43.47%. The Tahsil-wise break-up shows that Nagar Tahsil with 73.74% literates tops the list and Akola with only 49.66% stands at bottom in the district. It is observed that in most of the cases, the Tahsils having urban components have literacy rates higher than the district average confirming the fact that urban centers and surrounding areas have better infrastructure as far as the educational facilities are concerned.

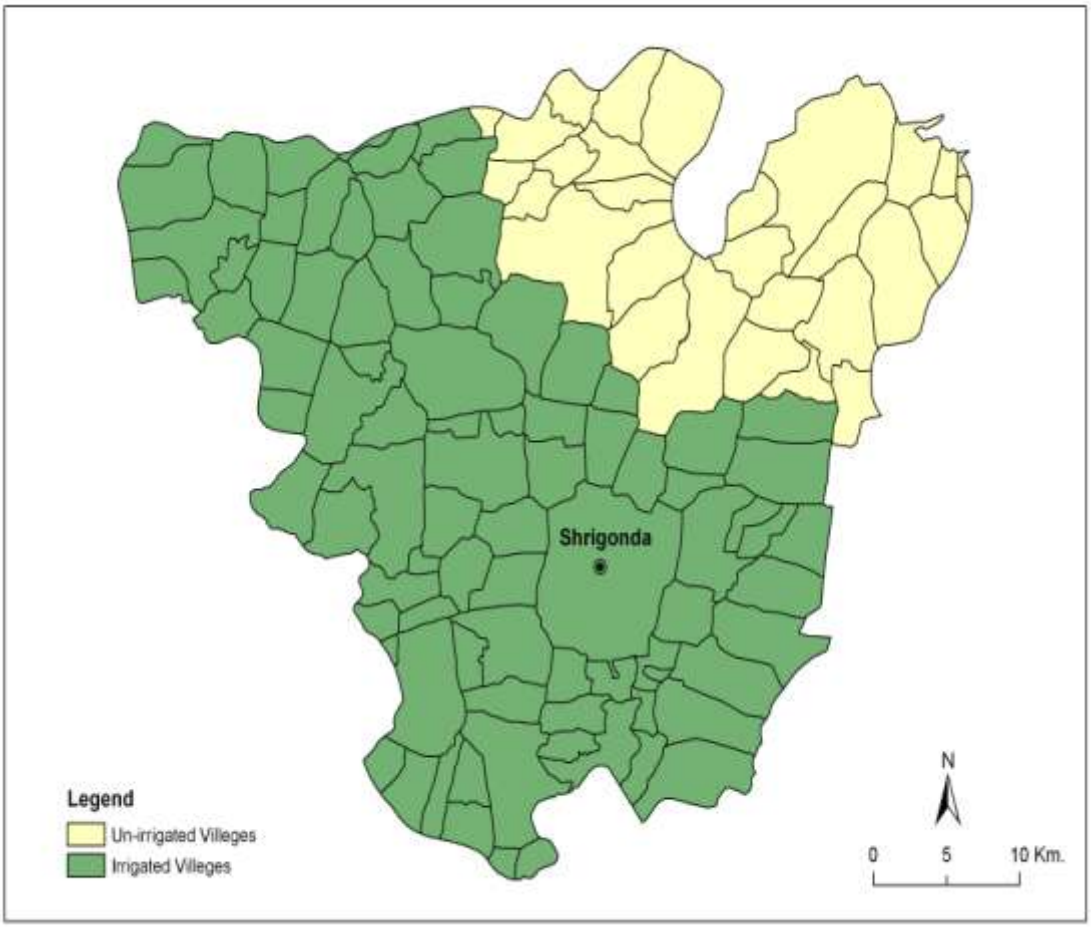
3. B.7: Irrigation:

The multiplicity is mostly interrelated to physio-socio-economic factors, and having considerable impact on irrigation. But all of them are not equally affecting on the aerial variations and temporal development of agricultural phenomenon in an area. To avoid dissipating one's efforts, it is desirable to choose the primary, decisive factors that may be of major

importance in causing spatial and temporal variations. Water is one of the important and scarce inputs besides fertilizers, insecticides, high yielding seeds and modern technology for agricultural development.

Thus irrigation is the main axis around which the whole agricultural activity revolves. Under this situation of low rainfall and its high variation in nature, the development of artificial means of moisture supply is very essential. The supply of water is depending upon availability of water resources. Ecological environment may limit the range of crops but the human factors determine which of the feasible crops. The farmers will choose and the input intensity with which his farms. Irrigation increases the range and the choice of ecological feasible crops on the farm and raises the practicability and profitability levels of inputs. Shrigonda Tahsil has very limited water resources. The source of water is surface and ground water. The surface and ground water resources are harnessed by constructing major, medium and minor irrigation schemes across rivers and streams of the Tahsil.

Map 3.5: Irrigated and Un-irrigated Villages of Study area



Surface Water:

Surface water is provided by the flowing rivers or from the still water of tank, ponds and artificial reservoirs. Irrigation from rivers is mainly through canals, drawn from dams constructed across the rivers. When the dam is high enough to from a large reservoir, the water is available throughout the year. The possibilities of developing the normal flows of rivers into irrigation canals. Tanks are mostly rain fed. They depend for their replenishment on the surrounding drainage area and watersheds.

Ground Water:

Ground water is tapped by digging or drilling wells. In this case the lifting of water is necessary before it is used for irrigation. What the development of irrigation technology, never and more efficient methods are employed for water source. Tub well irrigation makes intensive cultivation wherever water is available in required quantities whenever desired depending upon the regularity of energy sources. Particularly it has proved admirably suited to sub-marginal, marginal and small operational holdings.

Period to 1884, irrigational facilities in the Tahsil mainly included well-watering or *motsthal* and small channel-watering or *patasthal*. The area of neither class was large. At the same time the want of a large enough supply of water and of land at a suitable level made the area of channel-watered land much less than the area if well-watered land. Most of the dams or bandharas were built of mud and had to be repaired every year after the rains. Such bandharas were found throughout in the Tahsil, built across the many small early-dry streams which seam the country. Even now this practice is in vogue. Besides, wells were also used for irrigating all over the Tahsil. They were the property of individuals, but

the small dams or bandharas belonged to all who used to share in its building or in its repairing. A *sluice-man* or *patkari*, whose business was to keep the channel in order, used to arrange the share of water according to the areas of land held by each sharer and for this he was paid by a grant of land or by a small share of the produce of the watered land. Some wells use in watering fields and gardens were square with a flight of steps but most were round. Generally, they were eight feet deep and built with brick or stone and mortar or dry cut stone, often only on the side or which the bucket or mot was worked.

3. B.8: General Land Use:

The topography of the Tahsil presents three main zones. The first zone is North-eastern part of the Tahsil (Mandavgan revenue circle) is most scarcity area. This zone grows mainly Kharif crops. The second zone (Shrigonda revenue circle) is mostly scarcity area. This area receives low rainfall but has better soils and canal irrigation. The third zone (Belwandi revenue circle) generally gets an assured rainfall and comparatively fertile land. Besides, these two revenue circles are expected to be immensely benefited by the Kukadi, Visapur and Ghod irrigation projects. Mandavgan revenue circle however have poor lighter soils and irrigation by wells and tub-wells. However all over the three natural zones agriculture is the main component in the land utilization in the Tahsil. Following table gives the decadal variation in land utilization of the Tahsil from 1991-92 to 2004-05. Shrigonda Tahsil general land use (Table-3.1): 2000-2011 (Area in hectares)

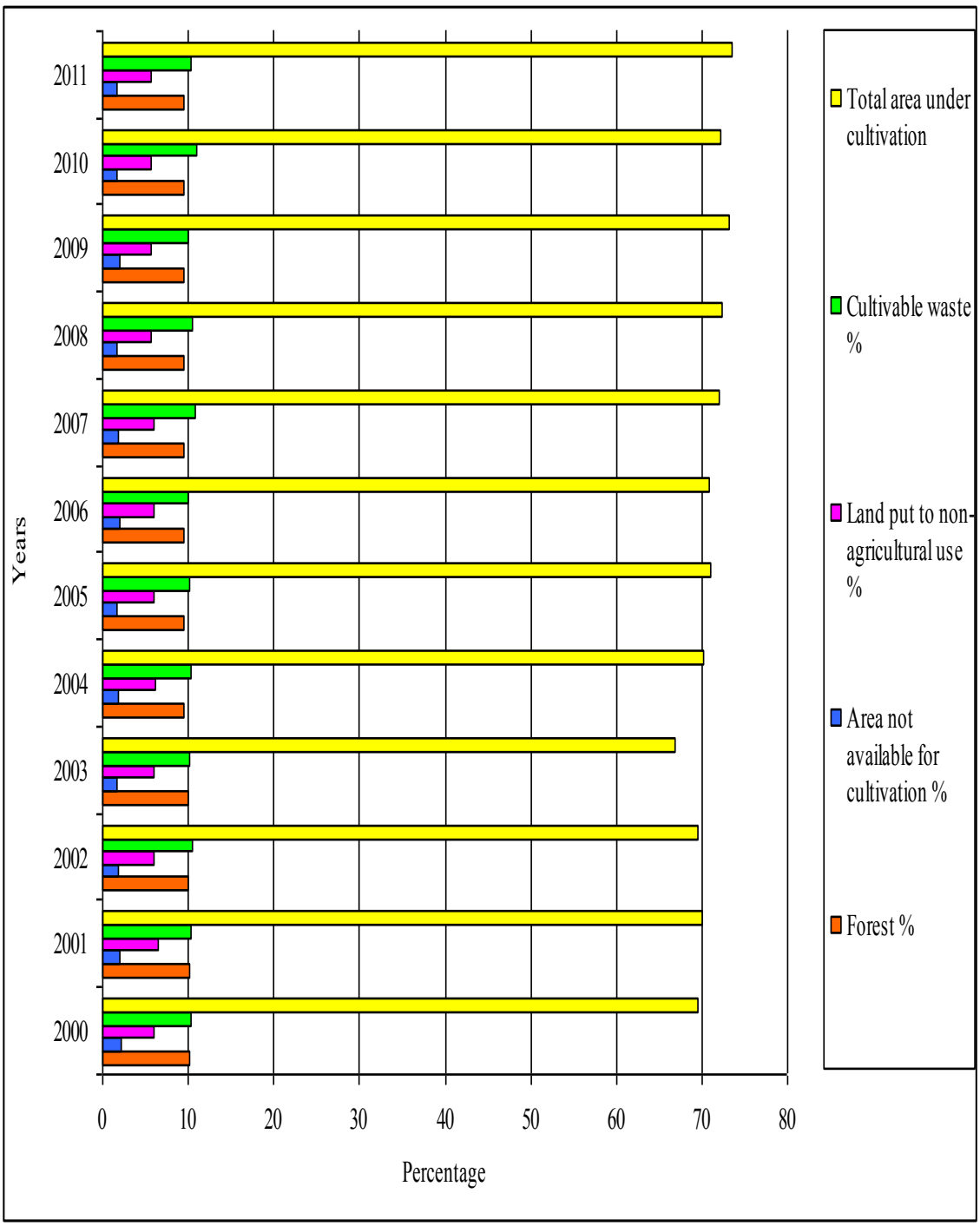
Table- 3.1

Shrigonda Tahsil general land use

Sr. No.	Year	Total Geographical area	Forest %	Area not available for cultivation %	Land put to non-agricultural use %	Cultivable waste %	Total area under cultivation
1.	2000	160481	10.10	02.10	06.02	10.38	69.44
2.	2001	160481	10.08	01.99	06.42	10.29	70.05
3.	2002	160481	10.04	01.82	06.00	10.44	69.55
4.	2003	160481	10.01	01.72	06.03	10.09	66.79
5.	2004	160481	09.47	01.88	06.14	10.28	70.11
6.	2005	160481	09.47	01.63	06.00	10.12	71.03
7.	2006	160481	09.47	02.00	05.99	10.02	70.90
8.	2007	160481	09.47	01.91	05.98	10.73	71.96
9.	2008	160481	09.47	01.69	05.64	10.48	72.34
10.	2009	160481	09.47	02.04	05.65	10.01	73.16
11.	2010	160481	09.47	01.69	05.65	10.94	72.23
12.	2011	160481	09.47	01.68	05.65	10.24	73.55

Source: - Tahsil Agricultural Office, Shrigonda.

Dig. 3.1 Shrigonda Tahsil General Land Use (2000 to 2011)



3. B.9: Cropping Pattern:

Jowar is the most important crop of the entire Tahsil. Bajra also occupies a significant proportion increasing in important in the lighter soils to the south and east. Pulses are much less significant in the basin in Shrigonda plateau and are raised only as cover crops. Cash crops on the other hand are much more significant than on the plateau and of them, sugarcane is the most important. Next in important are groundnut and other oilseeds.

3. B.10: Workers:

Work may be defined as participation in any economically productive activity, such participation may be physical or mental in nature "work" involves not only actual work but also effective supervision and direction of work. It also includes unpaid work on farm or in family enterprise." The main workers of 1991 are distributed in nine industrial categories of economic activities. Nature of one's activity and extent of participation in economically productive work are the decisive factor for such a classification. Levels of economic development of different regions within the Tahsil, availability of opportunities besides willingness to work especially among women initiative and entrepreneurship evinced by the men folk in general etc. are the important factors that influence the distribution of population under these three categories i.e. main workers, marginal workers and non-workers. Table No. 9 below shows the distribution of main workers, marginal workers and non-workers for total, rural and urban areas.

The workers participation rate for total workers is defined as the percentage of total workers to total population. In a similar way it is defined for main and marginal workers. 1991 census recorded 44.22% of the Tahsil population as main workers, 5.29% as marginal workers and

the remaining 50.48% as non-workers. The corresponding figures for the district are 42.47%, 3.48% and 54.05% respectively. The ratio of persons engaged in economically productive activity to total population for the Tahsil in 1991 is slightly more than that for the district. Shrigonda Tahsil holds the 7th rank when the 13 Tahsils are arranged in descending order of the proportion of main workers.

Among the main workers, male participation rate in the Tahsil is 52.41% while that of females is 35.60% as per 1991 census. The sex wise break up shows those among males and females 0.44% and 10.40% of the population are marginal in the Tahsil. Of the rural population of the Tahsil returned in 1991 census it is seen that 44.98% are main workers, 5.79% are marginal workers and the remaining 49.23% are non-workers the corresponding proportion for district is 44.48%, 4.01% and 51.51% respectively. The comparison of main workers between the Tahsil and the district shows that the work participation rate in the rural near about equal. The work participation rate has slightly high 44.98% in 19991 43.12%.

Among the main workers, male participation rate in rural areas of the Tahsil is 52.70%, while that of female is 36.86% as per 1991 census. Marginal male and female workers account for 0.47% and 11.38% respectively of the total rural population of the Tahsil. The proportion of female marginal workers is higher than that of male because the females besides attending the household duties also perform one or more economic activities to supplement the family income. The disparity between the proportions of main workers among males and females is comparatively less in rural areas of the Tahsil.

Workers by industrial categories:

The distribution of total male and female workers by nine industrial categories of economic activities for the Tahsil and district.

The relative importance of the main spheres of economic activities may be gauged from the pattern of distribution of main workers according to the broad four-fold classification namely, cultivation, agricultural labour, household industry and other economic activities. The economic activity of the district is primarily dependent on agriculture which is supported by the fact that the cultivators (55.99%) and agricultural labours (28.54%) together constitute 84.53% of the total main workers of the Tahsil as against the district average of 73.94%. The agricultural sector has absorbed about three-fourth of the total main workers, this is so because there is no alternative employment available in the Tahsil. It may be seen that only one-fourth of the workers are engaged in the work other than agriculture. Among them the major categories manufacturing, processing, servicing and repairs in other than household industry (3.42%) trade and commerce (2.51%) and other services (4.67%) in the Tahsil.

3. B.11: Industries:

Shrigonda Tahsil is not industrial Tahsil in the district sense of the term. Being traditionally a famine-stricken Tahsil agricultural resources could not provide the necessary encouragement for industrialization. Under-development in agriculture in the past was probably the principal reason for lack of industrial growth. The Tahsil is also not endowed with minerals, forest resources or adequate water-supply which is essential for resource-based industries. The necessary infrastructure for industrialization is hardly available in the Tahsil.

The growth of sugarcane cultivation which was made possible only after the availability of irrigation facilities of the eastern part of the Tahsil however encouraged the growth of sugar and *gul* industries has brought about conditions of prosperity to a section of the population in Tahsil.

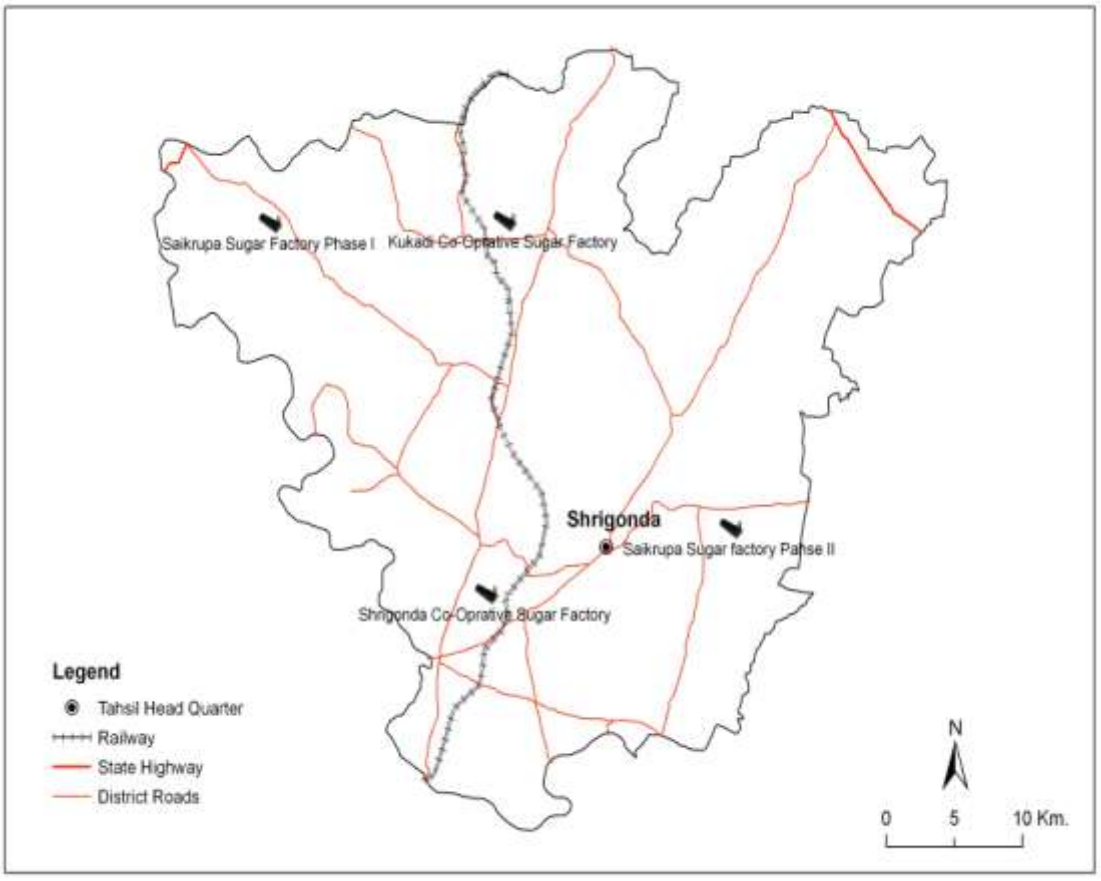
The Tahsil is not rich with minerals or forest resources. There are two co-operative and one private sugar factories and other some small scale industries in the Tahsil.

The most important small scale industries in the Tahsil are milk and *gul* processing having a good demand in the market. Other registered units are sugar mills, *gul* making, weaving mills, pottery, brickmaking, carpentry, tanning, oil mills, leather working, basket making and engineering units. Shrigonda Tahsil is one of the forefronts of sugar production. Small scale industries such as *Bidi* making and *Ghaypat rope* making are also in Shrigonda Tahsil. Through Shrigonda Tahsil is under developed in the district.

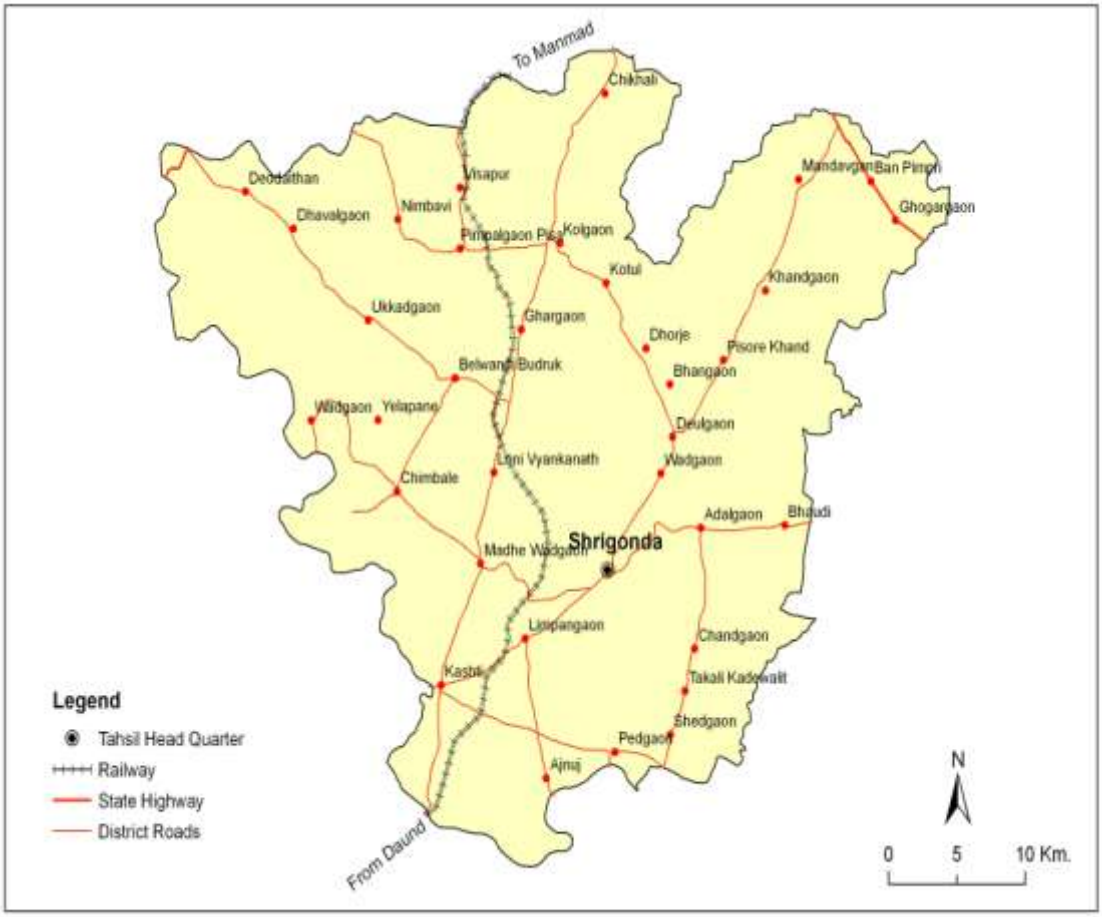
Workers in Trade and Commerce:

As per 2001 census the number of persons engaged in trade and commerce in the Tahsil are 5,566 which constitute the proportion of 5.05% of the main workers. About 28 banking institutions were functioning in the Tahsil in 2000-01. Out of these 76.51% are working in rural areas and 23.49% were in urban areas in the Tahsil. The banking facility was available to 14 villages and most of the towns in the Tahsil. Shrigonda town being the important trade center have five of the total number of banking institutions in the Tahsil. The State Bank of India works as the treasuring for the Tahsil.

Map 3.6: Location of Sugar Factories in Study area



Map 3.7: Transportation in Shrigonda Tahsil



Chapter.4

ANALYSIS AND RESULTS

4.1: Caste Composition of the Sample Villages:

It is but natural that land use, crop composition and pattern, crop intensity, use of scientific farming, package practices, etc., vary with the class, reflecting indirectly the caste community in a village. In Shrigonda tahsil Maratha and Mali castes is dominant the largest and major castes associated with the class (Narayan, B. K, Vasudeva Rao, D. 1978). This is followed by Mahar and Koli, Mang and Muslims castes from minority communities.

In all sample villages (Table 4.1) Maratha from the majority (27.26%) followed by Mali (24.48%) and Mahar (8.59%) Mang (6.48%) Koli (8.04%) Among non- Hindus, Muslims represent 25.46 percent of the total sample. Maratha and Mali appear predominantly in each land size class also. The other minor castes in the sample are Kumbhar, Chambhar, Bhill, Jain, Nhavi, Brahmin, Wadar, Kaikadi, Gondhali and Gurav.

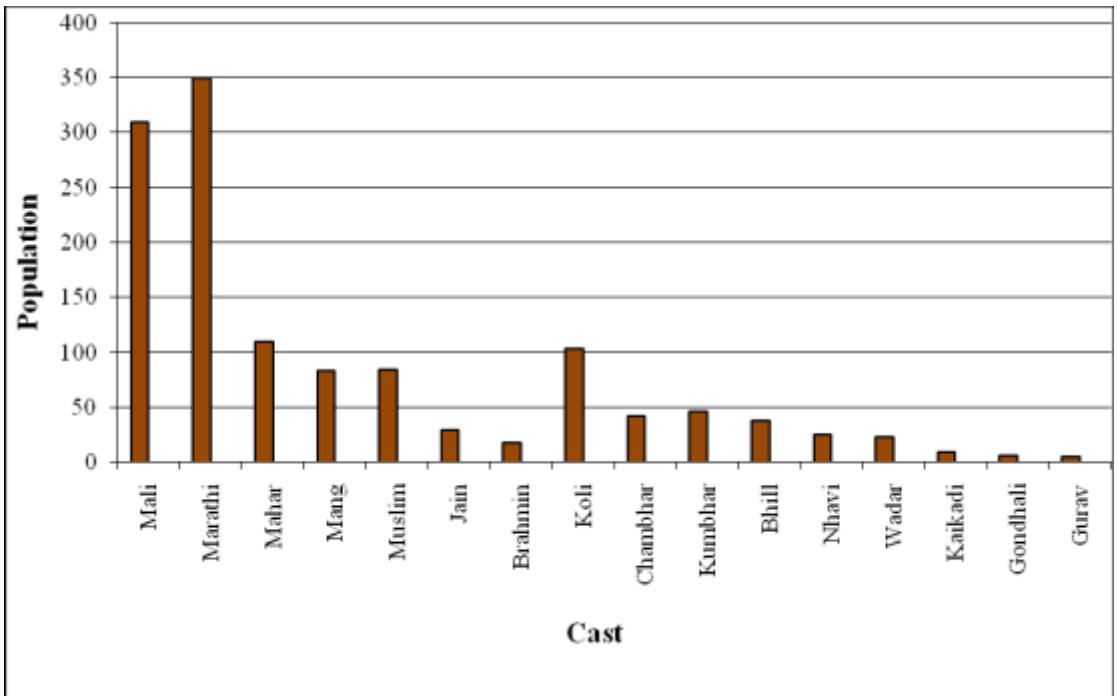
In the dry villages also Maratha dominated the scene to the extent of Mali. While Mahar the next place with 8.59% and Mang 6.48% In Wangdari Koli castes are dominated all castes because location of this village. This can be explained by the little interest of the farmers towards cultivation as it is risky under rain fed conditions, non- remunerative, time consuming and need for working capital. Thus it is evident that poor and minor castes have not ventured into cultivation but preferred other jobs for livelihood in rain fed tract.

Table- 4.1
Cast Composition in Sample Villages – LHS-wise

Sr. No.	Village Name	N	Mali	Marathi	Mahar	Mang	Muslim	Jain	Brahmin	Koli	Chambhar	Kumbhar	Bhill	Nhavi	Wadar	Kaikadi	Gondhali	Gurav
1.	Cikhali	75	13	18	7	5	6	-	2	5	4	6	2	2	4	1	-	-
2.	Mungusgaon	35	6	7	2	1	3	1	1	1	3	1	-	3	3	1	2	-
3.	Pargaon	120	24	60	3	11	5	3	3	-	6	2	1	3	-	-	-	-
4.	Kharatwadi	55	12	17	5	4	3	4	-	1	2	2	2	2	-	1	-	-
5.	Walghud	25	10	9	2	2	1	-	-	-	1	-	-	-	-	-	-	-
6.	Thitesangavi	40	14	13	2	2	2	1	-	-	2	1	2	1	-	-	-	-
7.	Takli- Lonar	70	26	22	8	6	3	2	-	-	1	-	2	1	-	-	-	-
8.	Deulgaon	70	19	16	10	3	9	2	-	2	3	1	2	1	-	1	-	1
9.	Boree	35	6	9	3	1	2	1	-	6	2	2	3	-	-	-	-	-
10	Wangdari	70	3	12	4	3	-	-	-	34	-	-	1	3	6	1	2	1
11	Rajapur	150	32	16	8	10	9	6	3	20	7	25	6	2	2	2	1	1
12	Wadgaon-shindodi	25	13	7	2	2	1	-	-	-	-	-	-	-	-	-	-	-
13	Yewati	50	11	12	7	3	5	2	-	-	2	1	-	2	3	1	2	-
14	Nimbavi	50	17	13	6	6	3	1	2	-	2	-	-	-	-	-	-	-
15	Arvi	35	10	09	3	-	4	-	3	3	-	-	2	-	1	-	-	-
16	Mundhekarwadi	95	33	19	9	4	12	6	1	5	1	2	3	-	-	-	-	-
17	Sangavi – Dumala	80	10	24	8	8	7	2	2	6	1	1	4	2	3	-	-	-
18	Gav	40	7	9	2	1	3	-	-	10	2	-	6	-	-	-	-	-
19	Ghodegaon	50	13	22	6	3	2	-	-	1	2	-	-	-	-	-	-	-
20	Wadali	50	16	10	8	5	3	-	1	1	-	2	1	1	2	-	-	-
21	Kansewadi	30	8	15	2	-	-	-	-	3	-	-	-	1	-	1	-	-
22	Velu	30	6	10	3	1	1	-	-	5	1	1	1	1	-	-	-	-
	Total	**1280**	**309 24.14%**	**349 27.26%**	**110 8.59%**	**83 6.84%**	**84 6.56%**	**30**	**18**	**103 8.04%**	**42**	**46**	**38**	**25**	**23**	**9**	**6**	**5**

N= Samples

Dig. 4.1: Cast Composition of Sample Villages



4.2: Demographic Features of the Sample Villages:

Sample households of all villages consist of 17,019 males and 15,518 females. The sex ratio is 814 female 1000 male as against that of the district 949 and the tahsil 992 (2001 census). In the control village, the sex ratio is 32,609 with 17,019 males and 15,518 females (2001 provisional census figures).

In sample village, age and sex wise distribution of total population (Table 4.2) shows some interesting results, children (0.14 years) constituted 29% of the total, while older people (56 + years) constituted only 7 % thus leaving a major portion (64%) in the working age group of 15-55 years. In comparison with other villages have more adults in the working age group: 73% in (15-55 years), while there are relatively lesser children (18%) However older people are (9 %). The common feature for both villages is, within children, feature for both villages is, within children, girls are more (34% G, 28% B, in sample villages: 26% G, 24 % B, in remaining villages) in the other age group, males outnumbered. Females: 67 % males against 60% females in 15-55 years age group of sample villages, as against 78% males and 66 % females in tahsil. This shows the males dominance in the working age group in sample villages (Table 4.3).

Table- 4.2
Population (Age- Group) of the Sample village

Sr. No.	Village Name	Sex	Age Group										Total
			0-4	5-10	11-14	15-20	21-30	31-40	41-50	51-55	56-60	60+	
1.	Cikhali	Male	74	80	73	93	242	316	148	66	57	12	1211
		Female	88	89	62	96	234	309	139	62	43	13	1135
2.	Mungusgaon	Male	42	32	30	44	75	89	66	51	44	10	483
		Female	40	39	40	41	62	73	52	45	40	08	440
3.	Pargaon	Male	205	184	172	256	305	293	159	90	87	55	1806
		Female	184	178	160	221	292	270	148	83	79	57	1672
4.	Kharatwadi	Male	38	81	77	85	97	145	132	63	51	44	813
		Female	40	73	76	80	88	131	125	57	39	32	741
5.	Walghud	Male	33	41	37	42	59	63	49	37	28	07	396
		Female	46	55	32	38	47	57	36	28	25	09	373
6.	Thitesangavi	Male	14	16	24	31	69	144	123	86	47	27	581
		Female	16	33	28	34	55	82	109	58	33	22	470
7.	Takali – Lonar	Male	22	37	29	35	147	203	260	131	92	81	1037
		Female	50	47	52	54	132	185	185	109	81	62	967
8.	Deulgaon	Male	13	18	26	24	108	211	230	204	145	117	1096
		Female	38	34	55	31	88	137	192	183	122	103	963
9.	Boree	Male	14	15	12	22	65	72	83	87	61	44	476
		Female	17	14	13	17	41	54	69	62	53	30	370
10.	Wangdari	Male	36	55	127	133	123	139	127	95	96	66	997
		Female	40	64	119	126	132	125	103	83	89	57	938
11.	Rajapur	Male	54	67	115	132	117	126	99	103	104	48	965
		Female	52	59	87	106	132	118	106	91	92	56	899
12.	Wadgaon Shindodi	Male	15	10	13	21	29	56	57	43	31	14	289
		Female	19	10	16	19	18	46	45	40	29	12	254

13.	Yewati	Male	58	58	56	89	129	133	86	73	60	45	707
		Female	36	29	42	70	103	99	72	64	63	39	617
14.	Nimbavi	Male	43	63	54	63	143	136	128	93	96	61	880
		Female	35	51	52	59	120	117	113	76	81	54	758
15.	Arvi	Male	17	13	12	32	57	68	71	68	43	24	758
		Female	11	12	11	18	49	42	65	70	38	19	335
16.	Mundhekarwadi	Male	93	105	103	112	186	270	313	114	123	109	1346
		Female	53	73	98	115	157	230	246	126	98	115	1311
17.	Sangavi – Dumala	Male	38	32	38	47	109	167	146	121	98	51	848
		Female	35	40	45	52	102	141	123	112	90	49	789
18.	Gar	Male	36	32	49	46	55	63	88	62	37	25	493
		Female	45	55	56	50	47	44	60	47	47	22	473
19.	Ghodegaon	Male	50	48	44	58	62	102	95	89	52	72	672
		Female	52	50	49	48	51	100	78	72	41	58	599
20.	Wadali	Male	49	47	67	85	152	96	48	56	53	46	699
		Female	35	40	52	76	129	90	57	53	58	49	639
21.	Kansewadi	Male	41	47	67	43	55	51	69	52	42	38	485
		Female	20	28	38	51	49	46	66	50	38	19	405
22.	Velu	Male	29	30	41	44	37	49	55	39	32	53	409
		Female	40	26	33	40	35	38	49	37	29	43	370

Dig. 4.2: Population of the Sample Villages

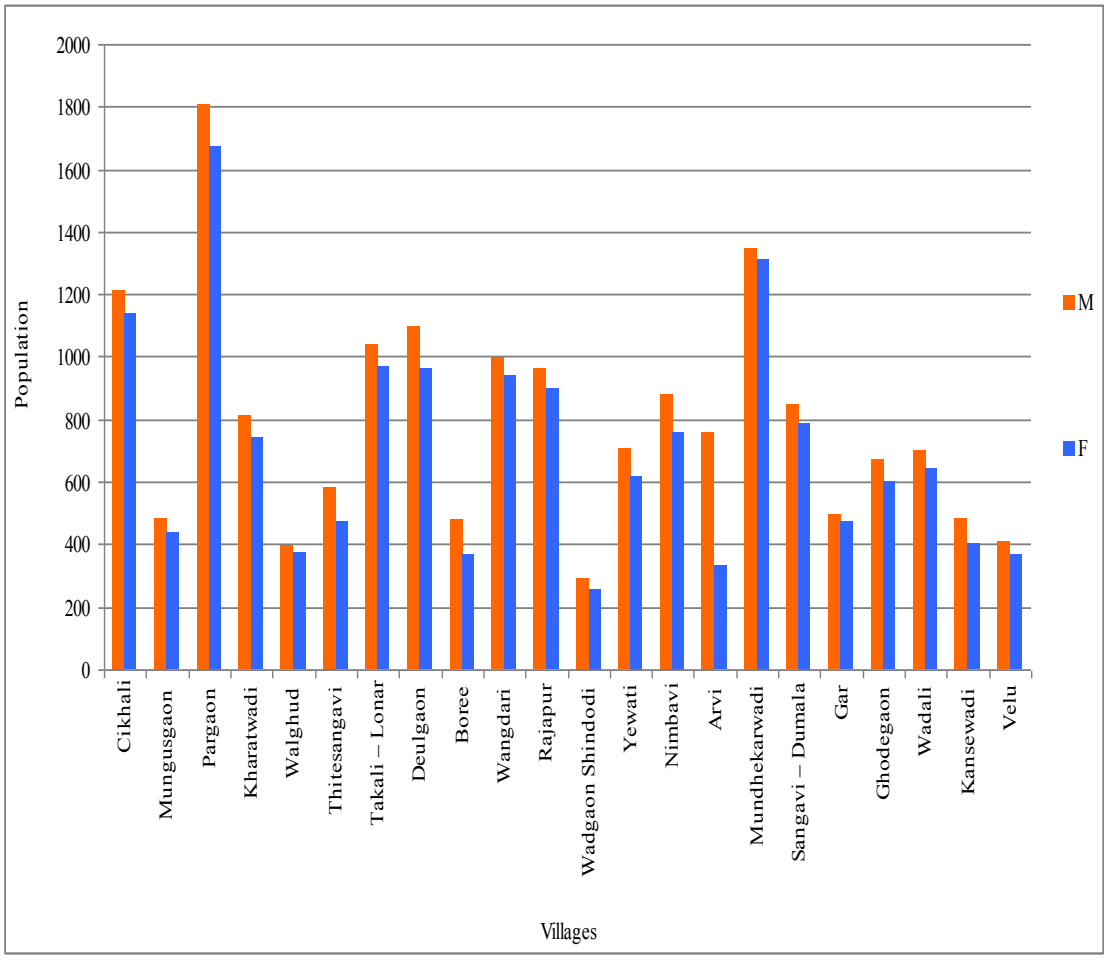
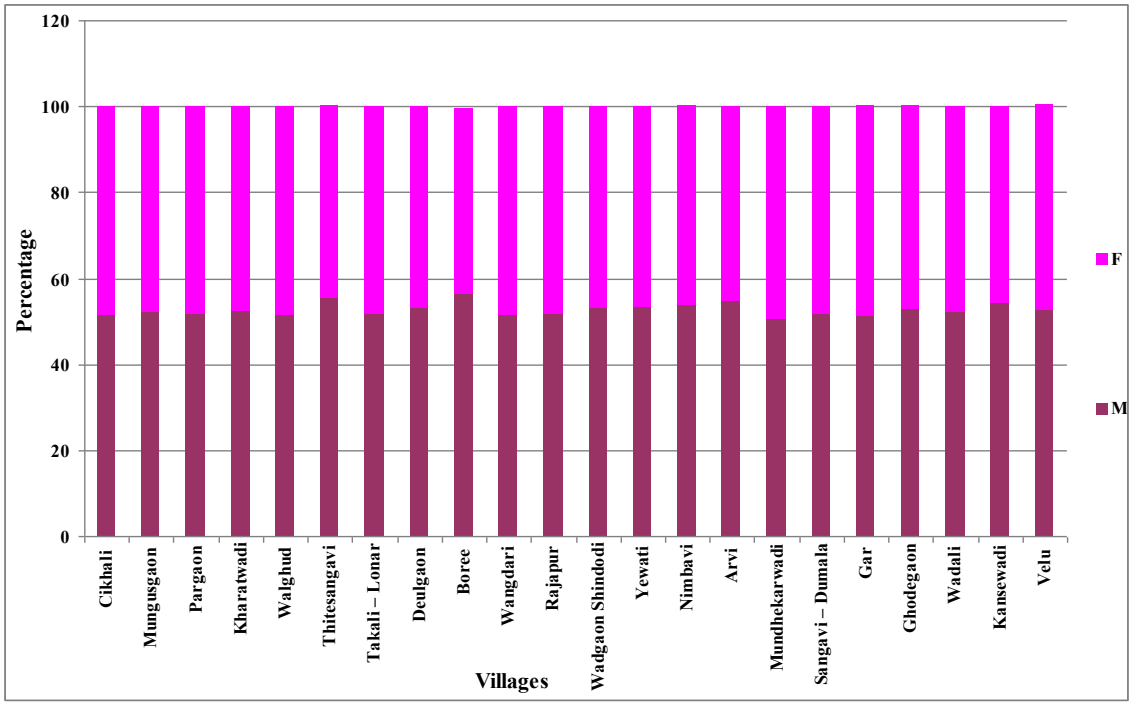


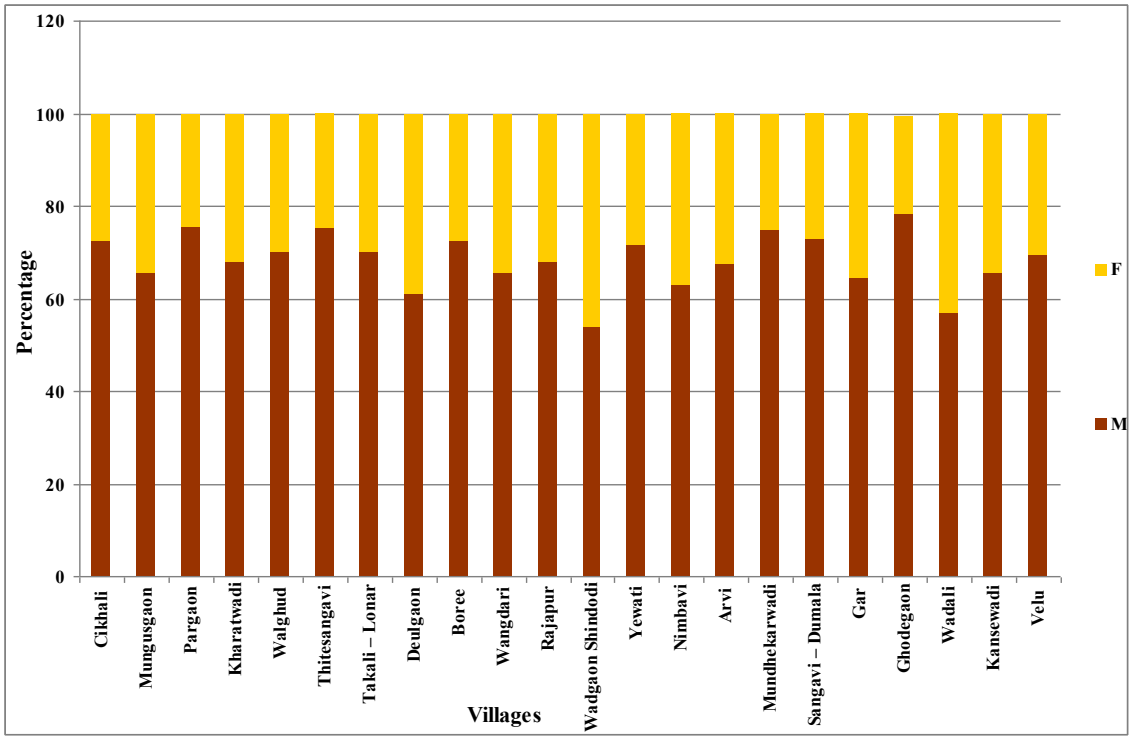
Table- 4.3
Demographic Particulars of the Sample Villages

Sr. No.	Village Name	Total					Earners					Literates				
		Male	Female	M %	F %	M +F	Male	Female	M %	F %	M +F	Male	Female	M %	F %	M +F
1.	Cikhali	1211	1135	51.61	48.38	2346	603	230	72.38	27.61	833	416	54	88.51	11.48	470
2.	Mungusgaon	483	440	52.27	47.67	923	196	103	65.55	34.44	299	156	36	81.25	18.75	192
3.	Pargaon	1806	1672	51.92	48.07	3478	842	272	75.58	24.41	1114	605	113	84.26	15.73	718
4.	Kharatwadi	813	741	52.31	47.68	1554	361	169	68.11	31.88	530	172	44	79.62	20.37	216
5.	Walghud	396	373	51.49	48.50	769	195	83	70.14	29.85	278	116	38	75.32	24.67	154
6.	Thitesangavi	581	470	55.28	44.71	1051	320	105	75.29	24.70	425	168	57	77.66	22.34	225
7.	Takli- Lonar	1037	967	51.74	48.25	2004	490	209	70.10	29.89	699	210	41	83.66	16.33	251
8.	Deulgaon	1096	963	53.22	46.77	2059	473	300	61.19	38.80	773	233	50	82.33	17.66	283
9.	Boree	476	370	56.26	43.23	846	250	95	72.46	27.53	345	166	29	85.12	14.87	195
10.	Wangdari	997	938	51.52	48.47	1935	461	241	65.66	34.33	702	209	37	84.95	15.04	246
11.	Rajapur	965	899	51.77	48.22	1864	451	212	68.02	31.97	663	261	72	78.37	21.62	333
12.	Wadgaon-shindodi	289	254	53.22	46.77	543	130	88	53.92	46.07	191	88	27	76.92	23.47	115
13.	Yewati	707	617	53.39	46.60	1324	360	142	71.71	28.28	502	146	32	82.02	17.97	178
14.	Nimbavi	880	758	53.72	46.27	1638	378	224	62.79	37.20	602	182	61	74.89	25.10	243
15.	Arvi	402	335	54.54	45.45	737	190	92	67.37	32.62	282	89	19	82.40	17.59	108
16.	Mundhekarwadi	1346	1311	50.65	49.34	2657	640	216	74.76	25.23	856	257	68	79.07	20.92	325
17.	Sangavi – Dumala	848	789	51.80	48.19	1637	388	145	72.79	27.20	533	263	58	81.93	18.06	321
18.	Gav	493	473	51.03	48.96	966	203	113	64.24	35.75	316	116	39	74.83	25.16	155
19.	Ghodegaon	672	599	52.87	47.12	1271	313	226	58.00	42.00	539	94	27	77.68	22.31	121
20.	Wadali	699	639	52.24	47.75	1338	310	235	56.88	43.11	545	163	45	78.36	21.63	208
21.	Kansewadi	485	405	54.49	45.50	890	196	103	65.55	34.44	299	103	22	82.40	17.60	125
22.	Velu	409	370	52.50	47.88	779	178	78	69.53	30.46	256	85	19	81.73	18.26	104
	Total	**17091**	**15518**	**52.41**	**47.58**	**32609**	**7928**	**3681**	**68.29**	**31.70**	**11609**	**4298**	**988**	**81.30**	**18.69**	**5286**

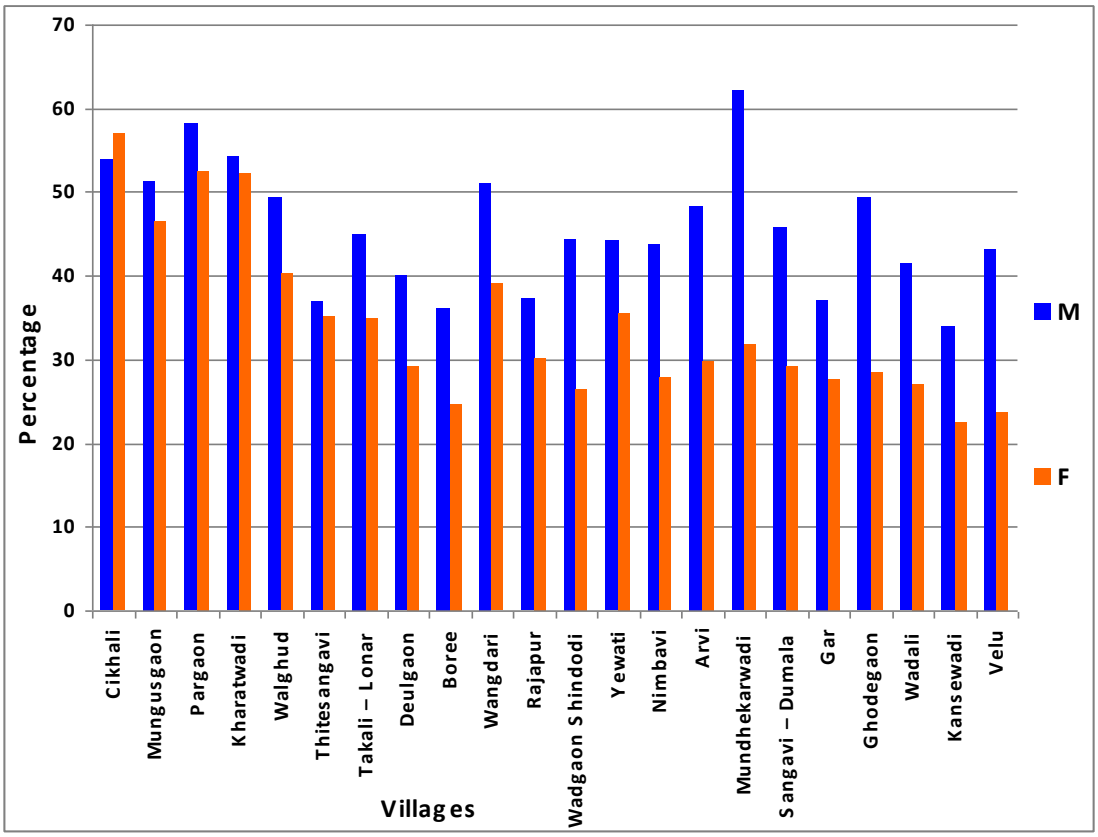
Dig. 4.3: Demographic Particulars of the Sample Villages (Total %)



Dig. 4.4: Demographic Particulars of Sample Villages (Earners %)



Dig. 4.5: Demographic Particulars of Sample Villages (Literates %)



Earners:

When the earners are analyzed sex-wise, some more interesting results are observed (Earner: who spends eight hours a day in a remunerative occupation- either on their farm or outside farm). Overall earners position is relatively less is sample villages (44%) (Alexander, K. C., 1979; *Ibid*). Male earners, out of the total male members (of all age groups) are same (68.29%) in all the villages. The female work participation ratio is observed to be less in the sample villages (31.70%) in all sample villages. The child labour is also observed to be more in irrigated villages (13%) then in un-irrigated villages. The real work force (13-55 years) is almost equal in both the villages (60% each) as well as people working in the older age (35%).

Male earners are compared between the two types of villages irrigated and un- irrigated villages. Overall being the same (58%) for both the villages working boys are reported to be more in irrigated villages (11%) than in un-irrigated villages (7%). But un- irrigated villages having more working men (15-55 years) (78%), than irrigated villages (66%). In the other older age group (+56 years) both the villages have almost equal percentage of earners (50% each).

Among female earners, age breakup analysis showed that an un-irrigated village has more female workers in all age groups (than irrigated villages).

More of female participation indicates the poor economic conditions existing in a village. The dry cultivation being what it is not remunerative. Hence more number of people goes in for work to other's farm or to some non- agricultural jobs during the slack season. This is further corroborated by more of child labour in irrigated villages in both sexes. In order to keep the wolf away from the door to maintain the subsistence levels, all the able bodied people, irrespective of their age and sex, are going to work in irrigated villages (Shrikant, K. S., et al. 1978 and Demographic study M. P. and G. P.). What little child and female labour is observed in un- irrigated villages, they are mostly working on their own farms. Otherwise they are working for other as exchange labour as it happens in small land holding size male earners of paragon village (15-55 ages) are more (75.58%) than their counterparts for other nearest villages. This fact indicates the demand and need for able bodied men as the newly introduced irrigation, with its new crop pattern and higher intensity of cropping, requires more labour (Vasudeva Rao, D. 1982). The same reason holds good, for large number of older (male) earners in un-irrigated villages. Most of these men, work on their own fields in

managerial and supervisory capacity. This is the case with larger land holding sizes.

LHS Wise:

Percentage of family labour participation is maximum (62%) in the lowest LHS (1 hectare and less) of un- irrigated villages. This figure has gradually come down to 50% in the 4th land holding size. Further, in the later holding sizes, it has come down to 30%. This shows the reduction in family labour participation, with increasing land holding size. The family female labour participation is observed to be maximum in '1 hectare and less' group (52%). From 4th LHS on wards the figure become single digited. With increasing farm size and affluence, the affordability increases: as such the family women belonging to higher class going for work becomes a social taboo.

In irrigated villages for almost all the LHS (Except the largest one), the work participation by sex and age is uniform. This shown the compelling reasons for more number of people in a family to go in for work (Shrikant, K. S., Narayan, B. K, Vasudeva Rao, D. 1978). All members working in dry village for subsistence is due to their meagre incomes followed by not so guaranteed employment throughout the year and hence diversification of activities is a must for 'some' income, as agriculture cannot be depended upon throughout the year under uncertain dry farming conditions (Episten, T. S., 1973).

$$\text{WPR (Work Participation Ratio, Sex Specifics)} = \frac{\text{No. of workers in the age group}}{\text{Total No. of persons in that age group}} \times 100$$

Literacy:

The overall literates are 49.99%, while that of tahsil and district are 57.87% and 60.64% (2001). Sex-wise male literates are in sample villages (81.30%), while female literates seem to be less in sample villages (18.69%). In irrigated villages for 3rd LHS, the overall literacy rate is quite high 69% as against 49% of un-irrigated villages (Table 4.4). Similar is the case with 4th LHS where irrigated villages figures dominated over the un- irrigated villages figures. In the 1st, 2nd, 3rd LHS, it is other way *i.e.,* unirrigated villages figures are more.

Table- 4.4

Ahmednagar District and Shrigonda Tahsil Literacy %

Provisional (2000)	Ahmednagar District	Shrigonda Tahsil
Rural Total	60.64	57.87
Literate % Male	75.30	72.27
Female	45.99	43.47

Literates in (15-55) years of sample village and Shrigonda tahsil have shown that they are almost the same (52% each). In the older age group (56+ years), there are more literates in tahsil (14%) than in sample villages (9%). But the age- wise analysis has shown that in the real school going age sample villages has certainly an upper hand over Shrigonda Tahsil (Table 4.5).

Sex- wise also the same trend is observed. This shows that the present generation is being too spared to school in sample villages.

Table- 4.5
Age Group and Literates of the Sample Villages

Sr. No.	Village Name	Sex	Age Group										Total
			0-4	5-10	11-14	15-20	21-30	31-40	41-50	51-55	56-60	60+	
1.	Cikhali	Male	-	93.75	90.41	71.40	70.16	58.25	55.67	42.19	35.60	20.00	53.74
		Female	-	83.88	93.54	70.72	65.61	60.19	49.10	32.93	27.30	17.43	57.07
2.	Mungusgaon	Male	-	84.37	83.33	67.13	65.24	58.13	52.51	48.17	34.71	19.19	51.27
		Female	-	82.05	77.50	61.08	57.30	51.50	48.30	41.19	30.72	16.06	46.57
3.	Pargaon	Male	-	96.66	93.60	86.42	80.43	76.10	67.40	35.17	31.82	13.88	58.14
		Female	-	85.39	82.35	82.19	77.41	70.25	60.18	30.45	24.13	12.60	52.49
4.	Kharatwadi	Male	-	92.59	88.13	84.22	80.35	71.63	52.17	29.67	27.06	21.43	54.19
		Female	-	93.15	88.13	83.30	73.18	70.44	51.09	28.41	19.71	16.16	52.35
5.	Walghud	Male	-	92.68	87.33	80.41	71.03	67.03	51.45	19.60	13.63	9.8	49.29
		Female	-	90.90	79.60	67.61	61.27	36.74	32.16	16.13	12.12	6.4	40.29
6.	Thitesangavi	Male	-	62.50	60.43	58.15	60.16	52.40	35.03	19.19	13.16	8.5	36.92
		Female	-	72.72	70.16	56.31	43.41	38.16	31.73	20.00	11.16	7.1	35.07
7.	Takali – Lonar	Male	-	81.08	79.03	71.62	68.19	53.04	42.68	31.63	19.45	3.4	45.04
		Female	-	68.08	62.90	58.40	43.46	40.41	32.63	28.35	12.60	2.9	34.93
8.	Deulgaon	Male	-	78.10	61.23	54.69	45.60	41.22	53.18	36.92	21.06	9.72	40.12
		Female	-	66.42	52.61	40.19	38.03	26.64	22.41	20.21	18.56	6.23	29.13
9.	Boree	Male	-	71.42	68.05	54.23	46.59	41.01	37.77	28.81	22.09	11.54	36.15
		Female	-	63.54	42.62	38.40	30.46	24.12	18.93	13.06	9.40	5.33	24.58
10.	Wangdari	Male	-	84.83	81.92	76.21	70.17	66.41	56.50	38.48	23.05	13.33	51.09
		Female	-	72.80	60.50	57.21	51.49	48.81	37.71	31.55	21.79	9.10	39.04
11.	Rajapur	Male	-	69.66	62.21	56.09	48.35	41.39	32.06	30.36	21.01	10.76	37.18
		Female	-	54.41	51.61	49.19	35.41	30.73	28.88	24.19	19.63	7.71	30.17
12.	Wadgaon Shindodi	Male	-	71.73	65.74	61.23	55.05	48.23	42.75	36.64	20.91	11.49	44.37
		Female	-	59.92	53.63	39.03	36.54	30.41	21.63	12.56	7.09	3.55	26.43

13.	Yewati	Male	-	72.69	70.41	63.21	60.70	52.40	46.11	38.15	21.03	16.22	44.09
		Female	-	68.76	60.69	51.41	46.15	40.61	35.66	28.42	17.51	6.26	35.54
14.	Nimbavi	Male	-	74.40	70.15	66.52	60.44	52.19	49.59	35.63	19.61	9.93	43.84
		Female	-	68.52	44.50	37.18	35.40	27.72	22.54	20.80	13.66	7.5	27.78
15.	Arvi	Male	-	82.32	77.46	68.29	63.30	58.69	51.06	41.65	20.17	19.64	48.25
		Female	-	63.18	56.60	40.44	36.41	30.38	27.19	21.24	12.74	10.25	29.84
16.	Mundhekarwadi	Male	-	85.62	83.33	80.16	75.40	70.19	68.41	63.19	55.06	40.30	62.16
		Female	-	66.45	47.08	39.03	35.50	30.10	29.11	27.45	22.32	20.25	31.72
17.	Sangavi – Dumala	Male	-	73.29	70.16	66.26	63.05	55.46	50.40	35.06	27.90	16.19	45.77
		Female	-	63.45	59.18	40.61	32.04	29.64	23.61	20.73	13.33	9.61	29.22
18.	Gar	Male	-	72.06	67.09	62.38	40.49	37.16	30.04	25.57	19.60	16.16	37.05
		Female	-	65.54	55.50	38.83	32.25	29.06	20.41	17.05	10.06	6.50	27.52
19.	Ghodegaon	Male	-	82.09	80.06	72.54	66.16	60.03	58.85	41.51	19.60	12.77	49.36
		Female	-	69.05	55.65	40.04	36.54	30.92	24.47	13.06	10.54	3.61	28.48
20.	Wadali	Male	-	79.25	75.19	67.29	50.54	45.09	38.41	27.74	20.10	10.20	41.38
		Female	-	63.44	40.49	36.60	34.54	33.15	22.55	20.16	13.54	6.66	27.11
21.	Kansewadi	Male	-	69.66	40.94	47.19	40.12	38.09	35.63	30.41	28.41	9.63	34.00
		Female	-	56.29	45.50	33.05	32.16	30.23	10.10	8.45	7.11	2.10	22.49
22.	Velu	Male	-	70.45	68.11	62.10	58.26	55.55	40.93	38.83	20.45	18.06	43.27
		Female	-	63.61	47.66	30.41	25.18	20.74	18.04	13.27	9.55	8.06	23.65

Table- 4.6

Overall literacy rates

Age (Yrs)	Sample Village	Shrigonda Tahsil	Ahmednagar District
05-10	88.81	87.42	76.19
11-14	89.08	85.16	74.13
15-20	71.06	73.42	65.89

Though Tahsil and district figures are less they are not discouraging. Affluence being the background in sample villages, more and more children (even girls) of the present generation is being sent to school. Thus the high literacy levels of the real school going age children show that they are able to go to school because of the affluence and awareness of their parents, while these parents could not go to school due to their bad economic position. This fact reveals the impact of irrigation on the literacy levels between the sample villages, generation wise (Table4.6).

4.3: Distribution of Cultivators: LHS - wise and Area Cultivated:

The relation between land holding size and area cultivated, in each group LHS class, has shown that number of cultivators have come down with increasing LHS. But conversely, area cultivated is reported to be increasing in absolute terms as well as per cultivator household. The average size of land holding in sample villages is 5.23 hectares (Narayan, B. K., Vasudeva Rao, D. 1978 Farm Economy of M. P. and G. P.).

Table- 4.7

Distribution of Cultivated Area – LHS and Mean Area

Sr. No.	LHS	N	%	Area hectares aggregate	%	Mean Size
1.	< 1.5 hectares	320	23.73	392.04	20.33	10.41
2.	1.6 to 3 hectares	320	24.98	422.65	21.19	12.47
3.	3.1 to 7 hectares	320	25.05	669.77	34.73	36.27
4.	> 7 hectares	320	26.23	443.75	23.03	18.50
	Total	**1280**	**100**	**1928.21**	**100**	**77.65**

t = 77.65 = 36.44 Sign at 0.1 % LS.

In Shrigonda tahsil the average size of the farm is 2.5 hectares. The statistical significance between farm sizes of sample villages is found to be greater than that of tahsil. The small farmers are swelling in number due to technical partition, inheritance and land reforms, Hence the average LHS is declining in sample villages. But small is beautiful, in the sense that they have higher productivity (Table 4.7).

Crop Pattern: LHS – wise:

The crop pattern indicates area under different crops as sown cultivated by farmers. The optimum crop pattern is that one which yields maximum net farm returns within its agro climate, resource endowment and infrastructure (Table 4.8).

Table- 4.8

Percentage Area Irrigated Percentage Villages

Sr. No.	LHS	-25	-50	-75	76+	Exactly 100	Overall
1.	320	91	76	69	42	27	61.00
2.	320	66	75	58	74	64	67.40
3.	320	70	77	94	59	52	70.40
4.	320	61	66	52	36	35	50.00
Total	**1280**	**288**	**294**	**273**	**247**	**178**	**284.80**

r (LHS, % Irrigation) : – 0.898

And also $X^2 = 2.94$ SIG at 10% L.S.

Table- 4.9

Percentage of Area under Crops Season wise

Season	LHS Classes				
	I	II	III	IV	Overall
Rabbi Field crops	36 (67)	19(44)	45(54)	33(40)	25(65)
+ Mixed	17(23)	22(35)	15(20)	30(35)	25(70)
Kharif crops	18(18)	15(17)	10(15)	15(17)	25(80)
Sugarcane	19(23)	28(30)	17(20)	10(15)	15(55)
Sugarcane + Mixed	10(15)	16(20)	13(15)	12(16)	10(50)
Total plots	**100(146)**	**100(146)**	**100(124)**	**100(123)**	**100(320)**

Table- 4.10

Sample Villages Crop Pattern: Area under different Crops

LHS- wise

	I	II	III	IV
R Jowar	63.75 (32)	59.15(28)	36.13 (25)	11.75(10)
R Bajra	34.70(71)	27.27 (12)	47.88 (40)	11.27(11)
R. Wheat	37.62(18)	32.22 (15)	29.06(31)	9.44(12)
(1) Sub Total	**136.07 (121)**	**118.64(55)**	**113.07 (96)**	**32.46 (33)**
J + Sugarcane	77.40 (125)	131.62(81)	28.90 (66)	10.06(12)
J + Vegetables	68.28 (133)	90.50(78)	32.43(35)	8.44(10)
B + Oilseeds	43.13 (36)	58.50 (28)	17.35 (22)	7.25(12)
B+ Lemon	25.15 (17)	34.05 (27)	12.48(13)	8.30 (13)
J + Lemon	18.93(32)	14.14(11)	18.19 (20)	15.27 (18)
W + Sugarcane	87. 63 (40)	74.06 (39)	46.55 (55)	19.92 (30)
(2) Sub Total	**320.52 (363)**	**441.87 (264)**	**155.90 (211)**	**96.24(95)**
K Wheat	131.62 (340)	96.40 (90)	44.30(50)	26.15 (30)
K Sugarcane	112.04 (277)	85.52 (88)	35.71 (47)	25.20 (35)
K Cotton	96.12 (201)	60.15 (75)	32.58(42)	19.36 (32)
(3) Sub Total	**339.81 (818)**	**242.07 (253)**	**112.59 (139)**	**70.71(97)**
Sugarcane (4)	213.46 (250)	176.40 (203)	153.21 (175)	88.47 (105)
S + Jowar	315.11 (270)	132.29 (219)	96.45(189)	76.44(123)
S + Bajra	230.06 (239)	127.92 (147)	87.71 (132)	68.81 (145)
S + Wheat	244.72(275)	109.16 (227)	123.40(180)	77.63(179)
(4) Sub Total	**1003.35 (1034)**	**545.77 (796)**	**460.77 (676)**	**311.35(552)**

(1) Vegetables: 9 = 20

(2) Oilseeds: 11= 12

(3) Pulses: 8 =13

(4) Sunflowers: 7 = 9

(5) Gram: 18 = 21

Table- 4.11

Area under different Crops LHS- wise

Crops	Overall	%
Jowar	532 (96)	23.87
Bajra	276(211)	12.38
Wheat	350(126)	15.70
Sugarcane	690(357)	30.96
Cotton	104(79)	4.66
Lemon	74 (58)	3.32
Vegetable	51 (57)	2.28
Oilseed	60 (52)	2.69
Pulses	44(164)	1.97
Sunflower	23 (38)	1.03
Gram	24(42	1.07
Sub Total	**2228(1280)**	**100**

The crops have been broadly classified as rabbi field crops, mixed or relay crops, Kharif two seasonal crops and related mixed or relay crops (Table- 4.9). The mixed crops are mainly vegetables, oilseeds, pulses, sunflower and Gram along with the principal crops (Table 4.10).

At it happens in any developing economy, maximum area has been observed to be under 3 field crops: (Jowar, wheat and Bajra). Sharing among themselves 70% of the (last col.) total cropped area. The share of each crop within the total area is: 23.87% area under Jowar, 12.38 % under Bajra, 15.70% under wheat and 30.96% area under sugarcane (Table 4.11).

`In a traditionally rabbi oriented area, which is hitherto under dry conditions, thanks to irrigation, only a small beginning (6% of area) is made in raising crops during Kharif season. The “two seasonal” crop-

sugarcane has picked up very well. Its improtantance in terms of area (30.96%) of the total cropped area) and popularity (357 plots), keeps it next only to cereals as a single major crop. Another 10 plots (covering 3 % area) are also under sugarcane with mixed crop. Thus the two season crop covers 16% of the total cropped area against the expected to carry water sufficient for 40% area under kharif, 40% during rabbi and 20 % for 2 season crop). This crop is very remunerative due to higher market price.

Among the mixed crops (lemon food grain) combination seems to be most popular (area and plot wise) as yield is maximum and returns are encouraging. Next in importance is (wheat + onion); (wheat + vegetables) occupy third position. Thus pulses and oilseeds in combination have occupied an important position which is the need of the hour.

Land size-wise, area under food grains seems to be maximum under the smaller land size (<1.5 hectares) i.e. 95 % of the total cultivated area, during rabbi and remaining 5% during Kharif.

Gradually, with increase in land size, a declining trend in the area under food crops is observed (till 4^{th} land holding size). The break even point can be observed to be 5 hectares where from the area under sugarcane started rising. Hence it can be presumed that 5 hectares is the economically variable unit, in the present study for sample villages.

Sugarcane is an important commercial crop. Sugarcane is raised as a single crop and also as a mixed crop. Thus area under sugarcane (single or mixed) has touched the target 30.96% in 1^{st} to 4^{th} LHS and achieved the optimum. The highest land size (+12 hectares) has not evinced the amount of interest expected of them in growing sugarcane. It is equally difficult to manage and to get labour throughout on hire, on time, to look after. This may be the problem which might be hindering many big landlords from growing sugarcane extensively.

Crop pattern in sample villages is altogether different from that of Tahsil, with no Kharif crops at all and with minimum number of crops and with minimum number of crops and combinations. Sugarcane is grown as a single crop but not as a mixed crop. The area under principal food crops (jowar, bajra, wheat) is only 51.95%, while mixed crops have a better role and importance in sample villages (36%) as against (8%) in un-irrigated villages. Sugarcane seems to have got the same treatment in both the villages. Thus the diversity of mixed crop system shows the importance for short duration and highly remunerative sub- crops like grams and sunflower. Combined cropping system seems to be the favourite with dry farmers. The reason being: for the same labour, time and investment they get home requirements, and if there is any surplus, they can get cash also. Moreover, if one crop fails, they can get at least their investment (however meagre it is) through the other crop.

Thus the crop pattern, being different in both the villages, has its own diversifications to suit the needs of the farmers. There can be no tailor made or blanket crop pattern, for the entire command area, as the crop pattern differs from village to village, depending on the circumstances. Within the given framework, farmer is the better judge to decide and grow the remunerative crops and combinations during each season.

4.4: Profits as a Ration of NR/ Input:

The overall values show that, for one rupee invested in wheat cultivation, 1.20 is the return in sample villages, as against 0.12 in un-irrigated villages, it is slightly better in irrigated villages. This is also an artifact because of the very high ratio in the lowest land holding size (<1.5 hectare) so far as sugarcane is concerned, the returns are very high

and encouraging in sample villages with 2.66 while it is 0.66 for un-irrigated villages.

Table- 4.12

Sample Villages: Ratio of Returns to Investment- Crop wise

Sr. No.	Village Name	Wheat	Jowar	Bajra	Sugarcane
1.	Cikhali	1.38	0.52	0.32	1.77
2.	Mungusgon	1.42	0.39	0.42	2.21
3.	Pargaon	1.37	1.45	1.15	3.42
4.	Kharatwadi	1.68	0.39	0.62	2.98
5.	Walghud	1.78	0.65	0.41	1.62
6.	Thitesangavi	1.42	0.32	0.35	1.55
7.	Takali- Lonar	1.76	1.30	0.49	1.89
8.	Deulgaon	1.88	1.32	1.03	2.30
9.	Boree	1.35	0.46	0.41	2.21
10.	Wandari	1.89	1.51	1.23	3.40
11.	Rajapur	1.32	0.32	0.41	3.33
12.	Wadgaon Shindodi	1.44	0.47	0.39	2.29
13.	Yewati	1.23	0.46	0.33	1.60
14.	Nimbavi	1.36	0.49	0.32	1.62
15.	Arvi	1.49	0.38	0.29	2.21
16.	Mundhekarwadi	1.85	1.35	136	3.40
17.	Sangavi – Dumala	1.66	1.27	1.32	3.13
18.	Gar	1.45	0.45	0.37	3.40
19.	Ghodegaon	1.88	1.29	1.30	3.41
20.	Wadali	1.72	1.32	1.29	3.40
21.	Kansewadi	1.61	1.09	1.26	3.42
22.	Velu	1.57	0.43	0.37	2.37
	Overall	**1.56**	**0.80**	**0.70**	**2.58**

Soource: Ahmednagar District Census Handbook 2001

Within sample villages Sugarcane stands first with 2.58 followed by Wheat (1.56), Jowar (0.80) and Bajra with the least value (0.70). In all villages sugarcane the exception is some land sizes. Otherwise for all the two crops (Jowar and Bajra) grown under dry conditions, the ratio is less than unity i.e. returns are less than investment. Thus the dry cultivation in

absolute terms as well as ratio wise is not remunerative when compared to wet cultivation. Is once again proved by this analysis (Table 4.12).

4.5: Fixed Cost for different Crops - LHS wise:

In the Indian agriculture scene small and poor farmer tries to get maximum out of his profession by minimizing out of pocket expenses (OPE). He tries to substitute wherever possible, resources of his own, to avoid expenditure in cash (Table-4.13)

Table- 4.13

Fixed Cost for different Crops - LHS wise

LHS	A2 (1)	C-A2 (2)	C (3)	G.R. (4)	3/1 %	Ratio 4/1	4/2	Ratio 0/1
I	177	411	588	709	30	4.00	4.00	1.20
II	238	430	668	695	36	2.92	2.92	1.04
III	317	413	730	842	43	2.65	265	1.15
IV	304	452	756	1015	40	3.34	3.34	1.34
Total	**259**	**427**	**686**	**815**	**37**			

Col 1 = Cost A2 = Out of pocket expenses

Col 2 = Cost B = Imputed cost (C-A2)

Col 3 = Cost C = Total cost

Col 4 = G.R. = Gross Returns

In sample villages, total input cost is expressed as the ratio between out of pocket expenses (OPE) and imputed costs. They are in the ratio of (47.53) for all sample villages. In sample villages OPE is observed to be the least in the lowest land holding size (30%) indicating higher own (imputed) component. With increase in farm size, OPE has gone up to 43 %. In 4th land holding sizes, OPE has come down to 40 % with the onset of irrigation, some extra activities *i.e.,* ploughing every year, land

preparation, water management, more of weeding, more time to harvest etc., will compell the farmer to send more money even though some of these activities, to some extent can be done by family labour. This would be more so, when the farm size is big.

The ratio (output / input) is attempted to know [col. (4) (1)] the value added. The ratio is very high for the lowest LHS (4.0), when only OPE is considered. It has come down [col. (4) (3)] to 1.20 when imputed values are also added to total cost of cultivation. The ratio is 2.92 for 2nd LHS, but the same is reduced to 1.04 for the total cost. Thus the imputed costs (cost c) have narrowed down the profit and or value added. Though it is inevitable for academic exercise (to include the imputed costs) farmers do not calculate for their accounting purposes. Moreover there are some crops like jowar, which are to be grown without taxing into account the loss profit but for survival.

Thus out of pocket expenses seem to be more, both in absolute terms and percent for sample villages, as the intensive and extensive nature of cultivation in the irrigated tract demands more of cash expenditure. This indirectly suggests the new employment created in the irrigated zones. Thus irrigated zone not only improves the might of the local farmers but also creates new vistas for employment which absorbs the once under employed masses in the newly irrigated areas.

4.6: Gross Revenue and Costs / Hectare:

Gross output is a measure of farm level efficiency. If it is compared with total input cost, the difference gives a rough estimate of profit in farm business.

Gross Return = Total physical output, expressed in monetary terms, at farm harvest prices.

Net Return = GR- all expenditures incurred – (OPE + Imputed)

Returns to Family Labour and Management = Remaining money got by the farm family, after all expenses (except imputed cost) are deducted.

Farm Business Income = Gross revenue – OPE

FBI is highly relevant, in farm level decision making and seems to be the returns which farmers attempt to maximize. This also helps to compare the efficiency of different land holding sizes.

The GR (Rs. Per hectare) is given in (Table 4.14) for different LHS, in sample villages. The general impression is that GR increases with LHS. The gross revenue for sample villages is (on an average) Rs. 841 and the total Cost (c) = Rs. 841 and the total cost (c) = Rs. 724 i.e., rate of profit is 16%. The corresponding values are Rs. 377, Rs. 336 for the villages, with 12 % profit.

In the lower and higher land holding size, GR is high (Rs. 700 per hectare). But still a higher value is observed in 4^{th} land holding size (Rs. 1015). The same dips and peaks are observed in the costs also *i.e.* wherever may be the GR; correspondingly costs are also maintaining constant distance. This observation is valid for Shrigonda tahsil too.

Table- 4.14

Gross Revenue and Costs per Hectare (Rs.)

LHS	G.R.	Cost C
I	709	588
II	695	668
III	842	730
IV	1015	756
Overall	**815**	**686**

G.R: Gross value of output (main + by – products) at farm harvest prices 315,

Differences of total output (sample villages) per hectare: t = 10.45 1% Ls

Total Cost (sample villages) 686 t = 14.82 1% Ls

Sample villages 815 / 686 = 18% profit

The ratio of G.R. to total cost is worked out (Table 4.15). The overall value for sample villages is higher than of tahsil (1.17 Vs 1.13). Also for almost all land holding sizes. These ratios give a crude estimate of how profits are arrived in sample villages and for each LHS.

The NR value in all villages behaved almost the same way. In sample villages, it starts with a high value then falls and rises to a maximum of (Rs. 259) and touches a minimum of (Rs. 4) in the highest LHS (Table 4.14). In a village for higher land holding size, negative returns are observed (Vasudeva Rao, D. 1981). Thus in both the villages the behaviour of NR can be stated to be erratic.

FBI seems to decline with the increasing farm size. It picked up at 4^{th} LHS and starts declining. In tahsil other villages, FBI reaches minimum in 3^{rd} LHS. Then onwards it picks up in next LHS only to results in a fall in 4^{th} LHS (229). 't' test is done to know whether the FBI values of sample villages and other villages in the tahsil are different.

They are found to be statistically different, at 1 % LS (Sample villages < Tahsil) (Table 4.16).

4.7: Labour Utilization:

The ratios of FBI and RFLM to NR may be treated as approximate measure of efficiency, the usage of family labour and own money. The interpretation follows is that a low (FBI / NR) indicates productive use of both family labour and owned capital; while low (RFLM / NR) indicates proper use of owned capital invested in land. If the low value (mode) is considered to be around '4' in sample villages, wastage of resources is observed for 2nd and 4th LHS (Table 4.17) other LHS do not go very much off form the 'mode'. For other tahsil villages ratios are not worked out for the highest LHS which has negative returns. For other villages in the tahsil farmers of 1st, 3rd and 4th LHS seem to be extravagant as far as the family labour and owned capital are concerned, as the ratios are very high and far away from the mode value.

The foregoing discussion shows that the use of family labour is considerably productive in sample villages only to some extent in other villages in the tahsil (Narayan, B. K., Vasudeva Rao, D. 1978). To have a close picture of labour productivity, results of another detailed analysis are given in (Table 4.18). The overall labour productivity seems to be higher in sample villages: the values are 20.33 (sample villages) and 19.30 (tahsil). The values are consistently above 20, but for the higher LHS in sample villages. Thus in the higher LHS, the productivity of labour is very less i.e. wastage is more. Similarly for tahsil in the extreme LHS, productivity is not satisfactory while performance is better in 4th LHS.

Table- 4.15

Ratio of Gross Returns to Total Cost (Rs)

LHS	Returns
< 1.5 hectares	1.20
1.6 to 3 hectares	1.04
3.1 to 7 hectares	1.15
> 7 hectares	1.34
Overall	**1.18**

Table- 4.16

Returns per Hectares (Rs.)

LHS	Per Hectare		
	FBI	**RFLM**	**NR**
< 1.5 hectare	532	298	121
1.6 to 3 hectare	458	265	28
3.1 to 7 hectare	494	428	104
> 7 hectare	372	323	4
Overall	**464**	**1314**	**257**

't' FBI = 10.46 1 % LS

Farm Business Income = Gross value of output cost A2.

Returns to family labour Management = Gross value of output – cost tahsil

Net Returns = Gross value of output – Cost C.

Table- 4.17

Ratio of FBI and RFLM to NR

LHS	FBI / NR	RFLM / NR
< 1.5 hectare	4.39	2.46
1.6 to 3 hectare	16.35	9.46
3.1 to 7 hectare	4.75	4.11
> 7 hectare	93.00	80.75

1. Low value indicates productive use of both family labour and owned capital.
2. Low value indicates rational use of owned capital invested in land.

Costs of other input variables per man equivalent day of labour are also correspondingly increasing with increase in farm size. Thus the two indices are related and show an increase with increase in farm size.

Size Correlation Sample villages.

r (A, B) = 0.52

r (LHS A) = −0.12

FBI= Farm Business Income.

NR= Net Returns.

RFLM= Returns to Family Labour and Management.

Table- 4.18

Productivity of Labour on Farm

LHS	Sample Villages	
	A	B
< 1.5 hectare	18.76	4.46
1.6 to 3 hectare	20.39	5.62
3.1 to 7 hectare	19.59	4.89
> 7 hectare	15.72	4.11
Overall	**18.61**	**4.77**

A = Productivity per unit man – equivalent day of labour (Rs.)

B = Cost (Rs.) of other variable inputs

(Cost A) per men – equivalent day of labour.

4.8: Area Cultivated by Bullock Pair- A Comparison:

Farmers of all size classes are making use of owned animal labour is evident from index average area cultivated by bullocks (Table 4.19). Land holding size and village wise, the index is on increase with farm size. In each land holding size, the value is more for sample villages than tahsil villages. The overall values (area cultivated by bullock pair in hectares) between sample villages (7.25) and tahsil villages (4.21) villages are found to be statistically significant. More area commanded by pair of bullocks in sample villages means more area being brought under cultivation and more operations where bullocks are needed and also the intensity of cropping or cultivation. The land cultivated by a pair of bullocks has sharply increased from 3.1 hectares to 7 hectares and than to more than 7 hectares in sample villages, in different land holding sizes. Whereas such drastic leaps are not observed in tahsil the jump is from 3.1 to 7 hectares and then to more than 7 hectares (Table 4.20).

Table- 4.19

Bullock Pair Labour Days (Own) per Hectares: Crop wise (%)

LHS	Jowar	Bajra	Wheat
< 1.5 hectare	50	45	42
1.6 to 3 hectare	39	62	39
3.1 to 7 hectare	61	81	50
> 7 hectare	43	97	58

Table- 4.20

Average Cultivated Area by Bullock Pair (Hectares)

LHS	Sample Villages	Tahsil
1.5 hectare	1.73	2.32
1.6 to 3 hectare	2.81	2.67
3.1 to 7 hectare	4.00	2.56
> 7 hectare	4.46	2.37
Overall	**3.25**	**2.84**

't' value = 8.4 Sig. at 1 % L.S.

(Sample Village > Tahsil)

4.9: Live stock Particulars- Per Farm:

Live stock plays on important role, in rural country side. It would be imperative to study, the livestock possession (per farm) in the villages. The data is presented in (Table 4.21) LHS- wise.

The bullock power per farm seems to be on increase with farm size: from a meagre 0.38 per farm in the lower LHS to 2.37 in the higher LHS a six fold increased. Cows the Buffaloes appear significantly in all LHS and increased with farm size. These are the main sources of milk and dung. They also help to rise own draught power in the farm of calves.

Milk is a source of income, when sold. Otherwise improves the intake of animal when used for domestic consumption. With increase protein in number of cows she buffaloes, calves have also increased, with farm size. Presence of sheep and goat is seen predominantly in the highest LHS. This is due to the caste restrictions as Dhangars only rear sheep and goats. Non Dhangars go in for sheep for milk and meat purposes. Same is the case with poultry. General observation is that the livestock position has improved with increasing L.H.S.

In Shrigonda Tahsil, agriculture is not predominant as a main occupation and moreover investment (to purchase and maintain) being high, cultivator, hesitate to own livestock. Numbers of bullocks owned by tahsil villages have come down, with increasing farm size. There are no he- buff aloes at all. The milch animals also appear to be more in lower LHS than in higher LHS. The reason could be that higher LHS people have kept animals sufficient for their household (milk) a source of income (sale of milk, dung and calves). Poultry and goats are also rounding to be very less. Sheep are owned by the first 3 LHS cultivators. Per farm figures are quite high for 4^{th} LHS. Thus the livestock position is good in sample villages, but not so in tahsil. The purpose behind rearing livestock is different in villages. They help the asset formation in sample villages whereas they help to improve income condition in tahsil.

4.10: Per Farm Assets- Comparative Study:

Assets per farm are compared between sample villages and Tahsil (Table 4.21**)**. The average asset value per house hold in irrigated sample village is observed be Rs. 13,285 as against Rs. 6,878 for un- irrigated villages. Overall LHS, the share of land in the total asset is 93% in irrigated villages while for un- irrigated villages while for un- irrigated villages is 89 %. Livestock (as an asset) seems to be not that important in

irrigated villages (4%), while it is 8 % in un- irrigated villages. The share importance of agricultural implements in asset formations seems to be equal (each 3 %) for both the villages.

As the number of farms is not the same in sample villages, the ideal index *i.e.* per hectare asset value, is calculated for a more meangful comparison. The total fixed assets, per hectare, in irrigated villages are observed to be Rs. 5,733 as against Rs. 2668 for un- irrigated villages. The average land value in irrigated villages (because they are developed and irrigated) is Rs. 4, 00,000 per hectare whereas the land value (dry and rain fed cultivation) in un-irrigated villages is reported to be only Rs. 1,00,000 per hectare. The livestock value, as a fixed asset (per hectare) is observed to be more in un- irrigated villages (Rs. 434) as against (Rs. 330) for irrigated villages. Thus cultivators of un- irrigated villages seem to invest more on livestock (both working and milck animals) which is a source of income. This income is regular and assured coupled with lesser risk. So far as agricultural implements are concerned, the figures are almost the same for both the villages. Thus the overall figure seems to be deceptive, but for the land value differentials.

If the share of each component is studied separately, livestock and agricultural implements have more importance (16%, 5% respectively) in un- irrigated villages than in irrigated villages (6%, 2%). Thus depending on the methods of cultivation, sources of assets also vary.

Land holding size wise, the lowest LHS (< 1.5 hectare) in both the villages appear to be depending on livestock to a greater extent, as much as 2nd and 3rd LHS in un-irrigated villages. This shown the dependency of dry farmers on livestock, as the second major.

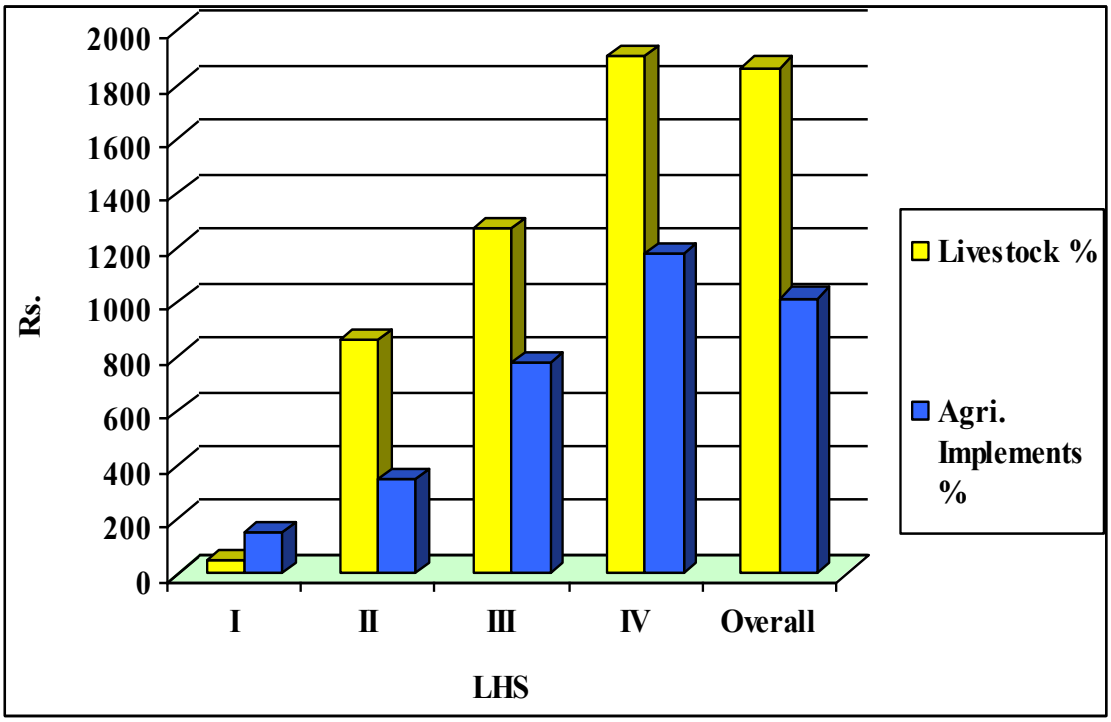
Table- 4.21
Fixed Assets Position (Rs.) Composition LHS wise
Irrigated Villages

LHS	Per farm land %	Live Stock %	Agri. Implements %	Total	Per hectare Land	Livestock %	Agri. Implements %	Total
I	3070 83	50 13	154 4	3274	400000	771 12	238 4	401009
II	8850 88	860 9	349 3	10059	380000	448 8	102 2	380550
III	17770 90	1268 6	777 4	19815	390000	313 6	107 2	390420
IV	23450 89	1908 7	1178 4	26536	410000	304 6	130 2	410434
Overall	**41510 93**	**1862 4**	**1014 3**	**44386**	**400000**	**330 6**	**119 2**	**395603**

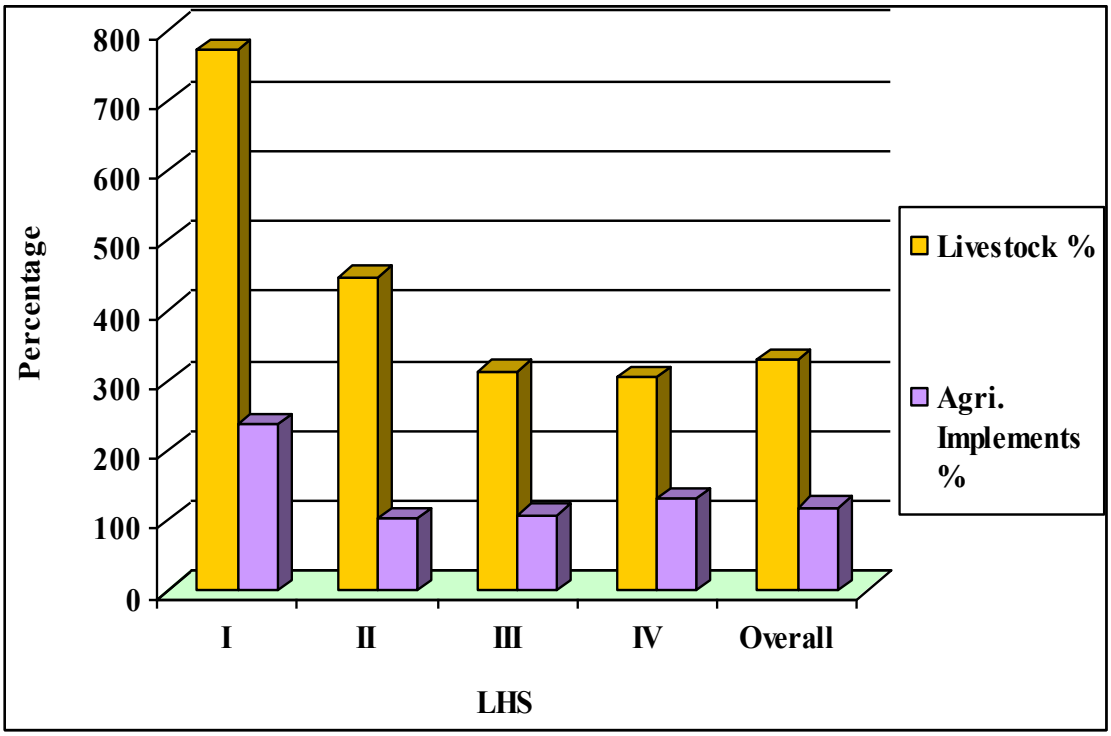
Un- Irrigated Villages

LHS	Per farm land %	Live Stock %	Agri. Implements %	Total	Per hectare Land	Livestock %	Agri. Implements %	Total
I	1890 79	478 20	35 1	2403	80000	528 20	39 1	80567
II	3957 73	1279 24	167 3	5403	90000	650 23	85 3	90735
III	7583 80	1525 16	341 4	9449	100000	552 21	123 5	100675
IV	14080 84	1948 12	738 4	16766	110000	483 17	183 6	110666
Overall	**21618 89**	**1898 8**	**662 3**	**24178**	**100000**	**398 15**	**145 6**	**95661**

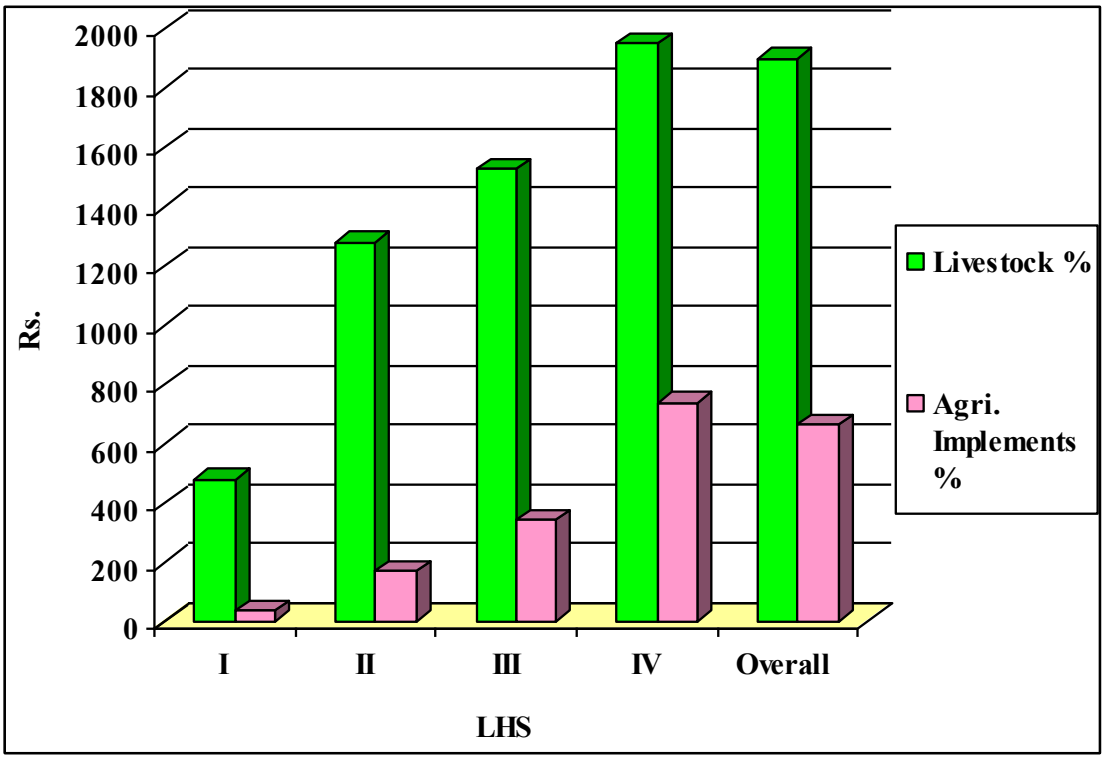
Dig. 4.6: Fixed Assets Position (Rs.) Composition- LHS wise, Irrigated Villages, Per Farm Land %



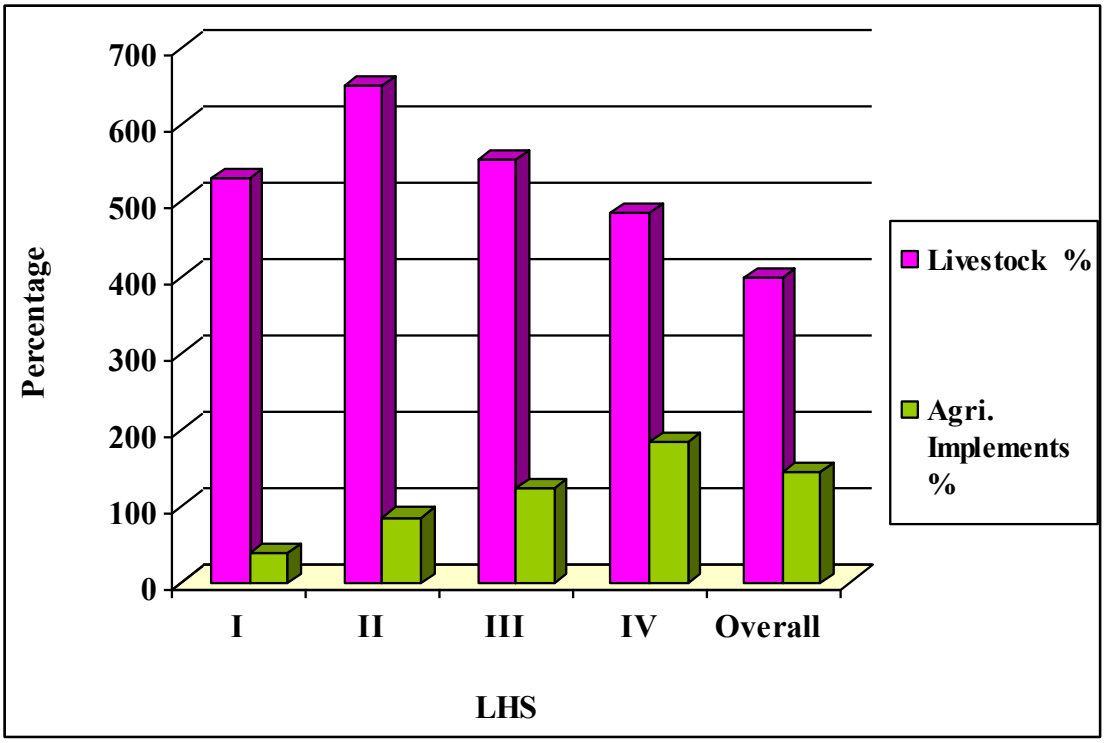
Dig. 4.7: Fixed Assets Position (Rs.) Composition- LHS wise, Irrigated Villages, Per Hectare Land %



Dig. 4.8: Fixed Assets Position (Rs.) Composition- LHS wise Un-irrigated Villages, Per Farm Land %



Dig. 4.9: Fixed Assets Position (Rs.) Composition LHS wise, Un-irrigated Villages, Per Hectare Land %



4.11: Debt Position and Assets:

Credit is a very important input in Indian agriculture. This helps to purchase other inputs, to pay labour: human and animal and as working capital and is used wherever "out of pocket expenses" are needed.

In the lowest LHS, only 38 % of the farmers are debtors. (Table 4.22). The percentage has gone up (exception being the 4th LHS) with LHS and touched 74%. The main purpose for many farmers to go in for loan is agriculture; followed by private reasons like religious and social functions. Similarly the source popular is co-operative society followed by bank, and private agencies. For agricultural purpose (inputs, well digging etc) 87% farmers borrowed money, while 13% took money for private to be the most popular agency as 55% of the cultivators took loans from the society. The private lender seems to be equally important.

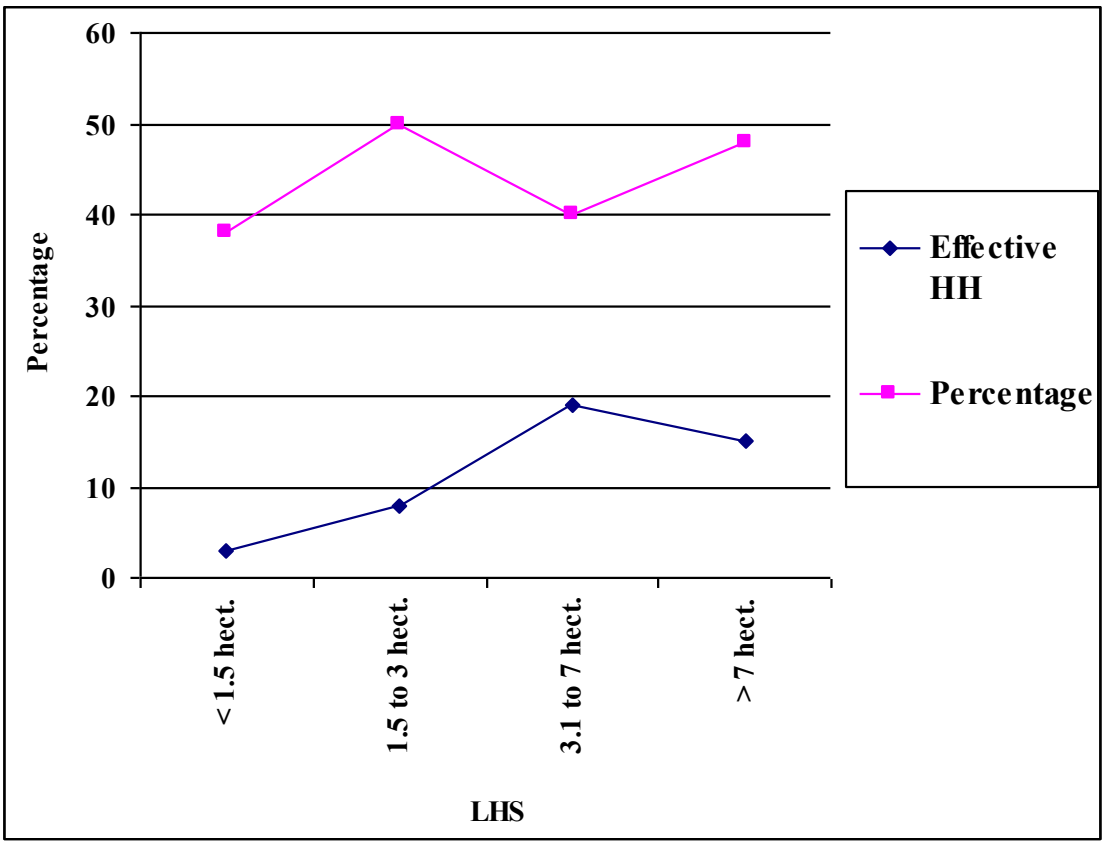
The role of private money lender seems to be more LHS, both in number and amount borrowed, though average amount borrowed (per farm) is minimum in the lowest LHS. It is on increase with land size. The range is Rs. 629 to Rs. 3406 (average of Rs. 2126). For agricultural purposes 19 farmers reported to have approached private parties. Out of the 21 cultivators approached private parties, 42 % are for agricultural purpose only. This figure shows the distressing situation still prevailing in the rural side in spite of a nationalized bank present in the sample villages.

Table- 4.22

Debt Position and Assets

LHS	Effective HH	Percentage	Purpose (n)	Source (n)	Amount borrowed (Rs.)	Assets (Rs.)	Ratio (D/A)
< 1.5 hect.	03	38	Agl (3)	Society (3)	629	3727	(0.17)
1.5 to 3 hect.	08	50	Pvt (4) Agl (4)	Pvt (4) Bk / Society (2)	420 3075	10058	(0.35)
3.1 to 7 hect.	19	40	Pvt. (3) Agl. (16)	Pvt (3) Society (13) Bk (3)	600 949	19814	(0.08)
> 7 hect.	15	48	Pvt (2) Agl (13)	Pvt (2) Bk (1) Society (7) Pvt (5)	875 868	26336	(0.06)

Dig 4.10: Debt Position and Assets



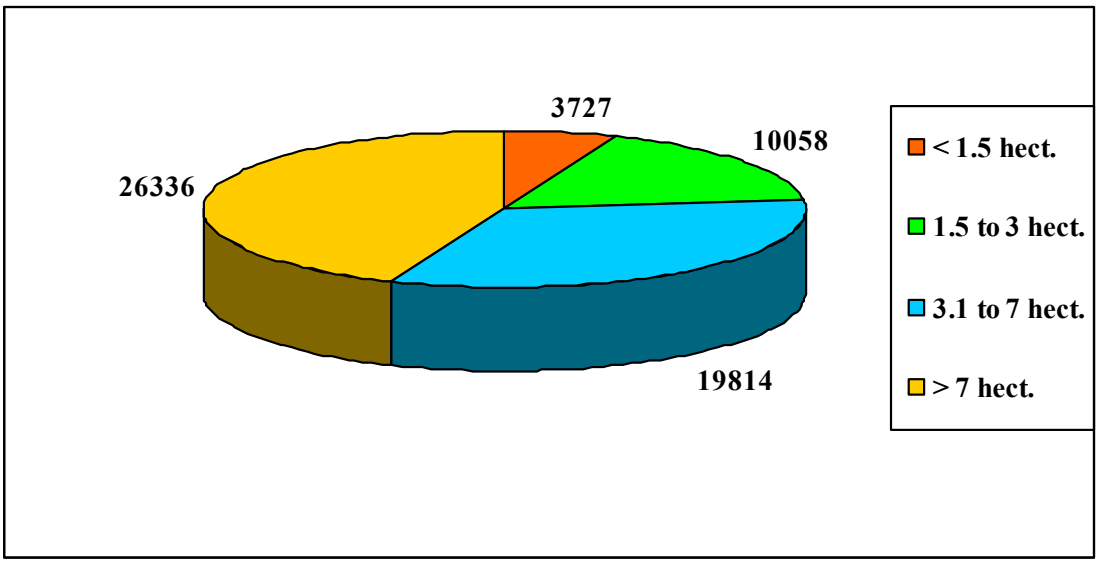
The ratio of debts to assets, for each LHS has given the nature extent of indebtedness for each land size. It is maximum (0.17) in the lowest land size. The irony is even though the effective borrowers are 38 % of the total, the ratio is high. This artifact is due to the low asset value, but not due to large money borrowed. In 2nd land size also the ratio is observed to be very high (0.35). But then onwards the value has decreased to 0.08 and 0.03. This shows that "per farm debt" is not much in irrigated villages, as they have got more assets.

In un- irrigated villages, effective number of farmers, who borrowed money for various purposes, is more (59%) than in irrigated villages (43%). The purpose is for agriculture and crop (agricultural purpose covers land leveling, farm house construction, repair, bullock cart etc.). No private purpose is reported as a reason for borrowing. The

source is mainly co- operative society (92%) followed by an insignificant role by bank (8%). Though private lender is completely absent, bank's role is also equally discouraging. The technical repayment by farmers every year and again raising loans from the society show how poor the farmers are and the extent to which they depend on borrowings to cultivate their lands. On an average per farm borrowings are observed to be Rs. 4096 as against Rs. 2126 from irrigated villages. The per farm debt is thus more in un- irrigated villages. As they have relatively lesser assets, the ratio of "debt asset" is blown up, in each land size. In comparison to that of irrigated villages, the ratios are as high as 0.83 in the lowest land size. It came down to 0.07 and 0.05 in the higher land holding size, (through 0.61, 0.42, and 0.24). This is mainly due to higher borrowing and lesser assets.

Thus it can be concluded that the debt positions is similar in both the study villages but it differed in magnitude i.e. more in un- irrigated villages. But the lower LHS to a very great extent. As the assets are very low in un- irrigated villages, however small the loans may be the ratio is blown out of proportion.

Dig 4.10(a): Debt Position Assets (Rs.)



4.12: Household Income Composition:

So far the assets a position is discussed, LHS wise for both the villages. The average household income, for each village is calculated and compared. It is found to be higher in irrigated villages (Rs. 3790) than in un- irrigated villages (Rs. 2052) (Table 4.23). The household income is observed to be on increase with increasing farm size. It would also be interesting to know the composition of income i.e., the source of income, contribute to the total income, in each LHS. The major source identified is 1. Agriculture, 2. Livestock, 3. Agriculture or non-agricultural labour, 4. Hiring out of cart and or bullock, 5. Hiring out of cart and / or bullock, 6. Hiring out of cart and or bullock, 7. Trade, 8 Cash receipts (Sometime kind receipts in lieu of cash payments in agricultural labour).

Table- 4.23
Source of Income – LHS wise per Farm Income, Per Hectare Income (Rs.)
Irrigated Villages

LHS	Agriculture %	Live Stock %	AL %	Cart	Trade %	Cash receipts %	Total
I 29	2174 (54)	911 (23)	891 (22)	64 (2)	-	-	4040
II 34	2361 (52)	1137 (26)	658 (14)	232 (5)	-	153 (3)	4577
III 24	2539 (59)	800 (18)	304 (7)	106 (2)	167 (4)	407 (9)	4323
IV 19	2005 (40.4)	1450 (29)	316 (10)	417 (95)	363 (7.3)	163 (3.2)	4968

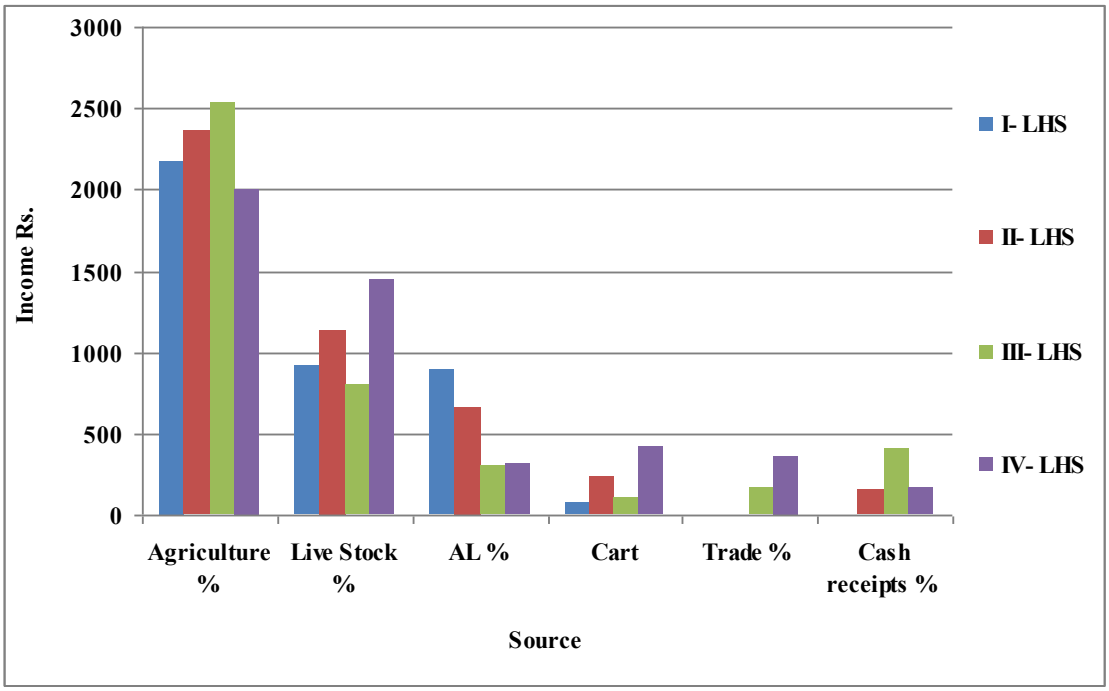
Un -Irrigated Villages

LHS	Agriculture %	Live Stock %	AL %	Cart	Trade %	Cash receipts %	Total
I	501 (27)	552 (30)	755 (41)	50	-	-	1858
II	778 (28)	790 (28)	900 (32)	192	83	67 (2)	2810
III	1467 (37)	608 (15)	583 (15)	1000 (26)	267	-	3926
IV	-79(4)	600 (41)	433 (30)	300 (21)	-	200 (14)	1454

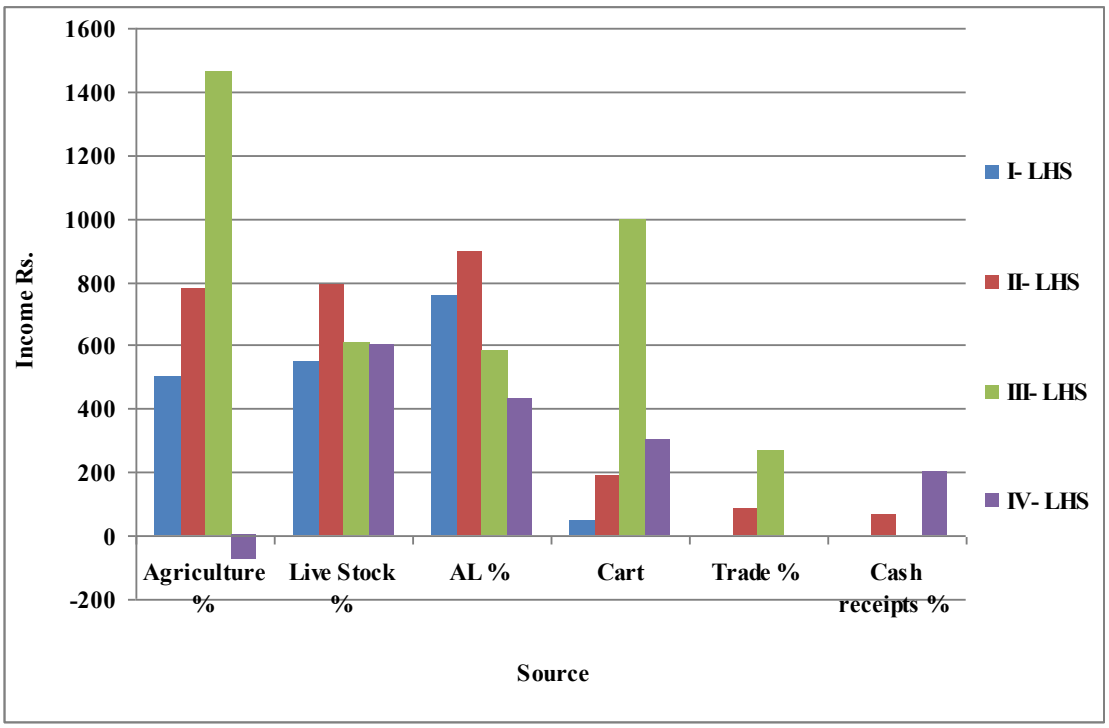
Irrigated Villages
Overall: 7, 92,158
Per farm 209: 3790
Per hectare 2,239: 354

Un- irrigated villages
Overall: 2, 01,134
Per farm 98: 2,052
Per hectare 687: 293

Dig. 4.11: Source of Income LHS wise Irrigated Villages



Dig. 4.12: Source of Income LHS wise Un-irrigated Villages



Irrigated Villages:

For the lowest LHS (< 1.5 hectare) per household income per annum is observed to be very small viz., Rs. 1,442; and for highest LHS (> 7 hectare) Rs. 4,968.

In the lowest LHS, maximum income (per farm) is coming from agricultural labour (80%), whereas agriculture and livestock contributes as small as (9%) and (7%) to the total income.

From 1st LHS onwards, the share of livestock in the total income appears to be increasing and it is more than that of agriculture labour the latter being reduced to a minimum of 7 % in 4th LHS. Here agriculture contributes a maximum of 59 %, followed by livestock (18%). Hiring out cart bullocks, trade and cash receipts also contribute to total household income to some extent in 4th LHS.

The combined contribution of agriculture and livestock has risen from as low as 16 % in the lowest LHS to 78%. In irrigated villages agriculture seems to be the single largest source of income from the 1st land holding size onwards. This proves the point that the small farmers, even in irrigated tracts due to uneconomical holding, lesser investment capacity, with more area under traditional staple crops, depend more on agriculture labour and livestock as the main source of reliable income throughout the year.

For un- irrigated villages the household income has increased with increasing farm size. Contribution from (non) agricultural labour is high in the lowest land holding size (80%) and it came down to 55% in 2nd LHS; In 3rd land size, the share of livestock has increased and that of (non) agricultural labour has decreased. In 4th LHS agriculture labours, contribution has gone up and income from non-agricultural labour has come down. In the higher LHS, income from agriculture is actually

negative; they have to depend on livestock and to some extent (none) agricultural labour also.

Thus in irrigated and un- irrigated villages the average values of the household income (per annum) not only differed in magnitude but also in composition. In dry cultivation, agricultural labour dose not play a predominant role as it dose under irrigation. The villages show the pursuit by the dry farmers of different occupations for their livelihood survival.

When the data is expressed as an index "per hectare" the result showed that per hectare income (average) is more in irrigated villages (Rs. 354) as against un-irrigated villages (Rs. 293).

4.13: Household Expenditure:

So far the discussions are around the income, asset, and debt aspect of the cultivators belonging to the 22 sample villages. To measure the standard of living at the house holds level. There is no other variable, more relevant than the expenditure, per capita or per household. The expenditure is further divided as on food and non- food items. The food items, on which data is collected are; jowar, bajra, wheat, rice, pulses, oil, vegetables, egg, meat, milk, ghee, butter, condiments, tea, sugar, gur. The important and common non- food items covered are; clothing, doctor, medicines, education, entertainment, post, religious functions and travel. It is felt that the per capita index is sometimes deceptive as consumption by adults and children would not be the same. Sex difference and nature of activity also bring in varied levels of consumption. Hence all the members of household are converted into "consumption units" (Gopalan., N. I. N., I. C. M. R.., Hyderabad. 1960) expressed in terms of male adult unit (unity). This conversion helps to express the consumption in terms of "per consumption unit" villages and LHS wise. One more index of per household' is also calculated for comparison purposes. Data on intake of

cereal, oil, pulses, vegetable and fruits are collected per week; as the farmers purchase these items once in a week in the shandy, supplemented by their own produce. The other items are purchased once in a month. Expenditure on the non- food items are reported to have been incurred once in six months, one year depending on the item. Thus all the items are finally brought to "annual consumption", (by suitable multiplication factors). For comparison purpose, all items are converted to the common deflator money (rupee).

The overall expenditure pattern shows the expenditure per consumption unit per annum is increasing with farm size: ($r = 0.88$ at 1 % LS). The important observation in this context would be the composition (of food and non- food) in the total expenditure, for each land holding size.

Intake of the protein rich food, and pulses, is low in the fist two LHS. It is on increase, with farm size, till 4th LHS, from then onwards low pulse intake is recorded. Edible Oil intake has shown improvement with increasing LHS.

Intake of vegetables and fruits has also recorded an increase with land holding size. Meat and egg intake could not record a considerable increase, due to caste composition as majority of he sample households are Maratha and Mali who are strict vegetarians. For the first LHS (< 1.5 hectare), all the three important quality foods. Egg. Meat, milk and ghee are absent. Condiments and beverages (mainly tea) are almost the same in all household as its intake cannot go beyond a level. Intake of sugar seems to have increased with LHS (till 4th LHS). But gur continues to enjoy the same to position, from 1st LHS onwards. This is due to non availability of sugar in the control market and its prohibitive price in the open market.

The expenditure (per capita, per year) showed a constant behaviour in 3rd and 4th land size. The values are high and almost the same for 4th land holding size. This shows the affordability of big farmers to spend on some of the quality foods, over and above the basic cereals and other food items. Among non- food items, major share is taken by clothing and religious functions. Next in priority comes fuel. There is an increase in expenditure on medical care with land size. This shows the awareness and capability of the big farmers to reduce morbidity. Expenditure on education is free, the expenditure on education shows that the children are sent for higher education. Entertainment and travel have an important role in higher LHS. Travel includes the trips made to tahsil headquarters for meeting official and to fetch inputs or to sell the produce and calling on relatives.

Thus the overall picture shows that big farmers have enough to spend and spare, whereas in the lower LHS, it is just hand to mouth existence (Table 4.24).

Table- 4.24

Per Consumption Unit Expenditure on Food and Non – Food Items (LHS – wise)

Irrigated Villages (per HH value)

LHS	No. Farms	No. Heads	C. Units	Gross area Culti.	2.00* J.Kg	2.50 B.Kg	2.50 W.Kg	2.50 R. Kg	5.00 Ful. Kg	15.00 Oil Kg.	Veg. Fruits
								1	**2**	**3**	**4**
I	**29**	**178**	**160.2**	**229.95**	**809**	**156**	**49**	**58**	**32**	**33**	**235**
			1.0cu		5.0	1.0	0.3	0.4	0.20	0.24	1.5
		29	per HH		27.9	5.4	17	2.0	1.1	1.3	8.1
II	**34**	**221**	**199.0**	**350.50**	**929**	**169**	**180**	**65**	**190**	**44**	**549**
			1.0cu		4.7	3.9	0.8	0.3	1.0	0.22	2.8
		34	2.0Per HH		27.3	22.6	5.0	1.9	5.6	1.3	16.1
III	**24**	**173**	**164.4**	**302.63**	**667**	**530**	**144**	**94**	**59**	**34**	**440**
			1.0Cu	4.1	0.9	0.8	0.6	0.4	0.21	0.3	2.7
		24	Per HH		27.8	24.2	6.0	3.9	2.5	1.4	18.3
IV	**19**	**124**	**112.8**	**352.50**	**500**	**497**	**71**	**38**	**29**	**30**	**322**
			1.0Cu		4.4	3.5	0.9	0.6	0.3	0.3	2.9
		19	Per HH		26.3	21.9	5.1	3.7	2.0	1.6	16.9

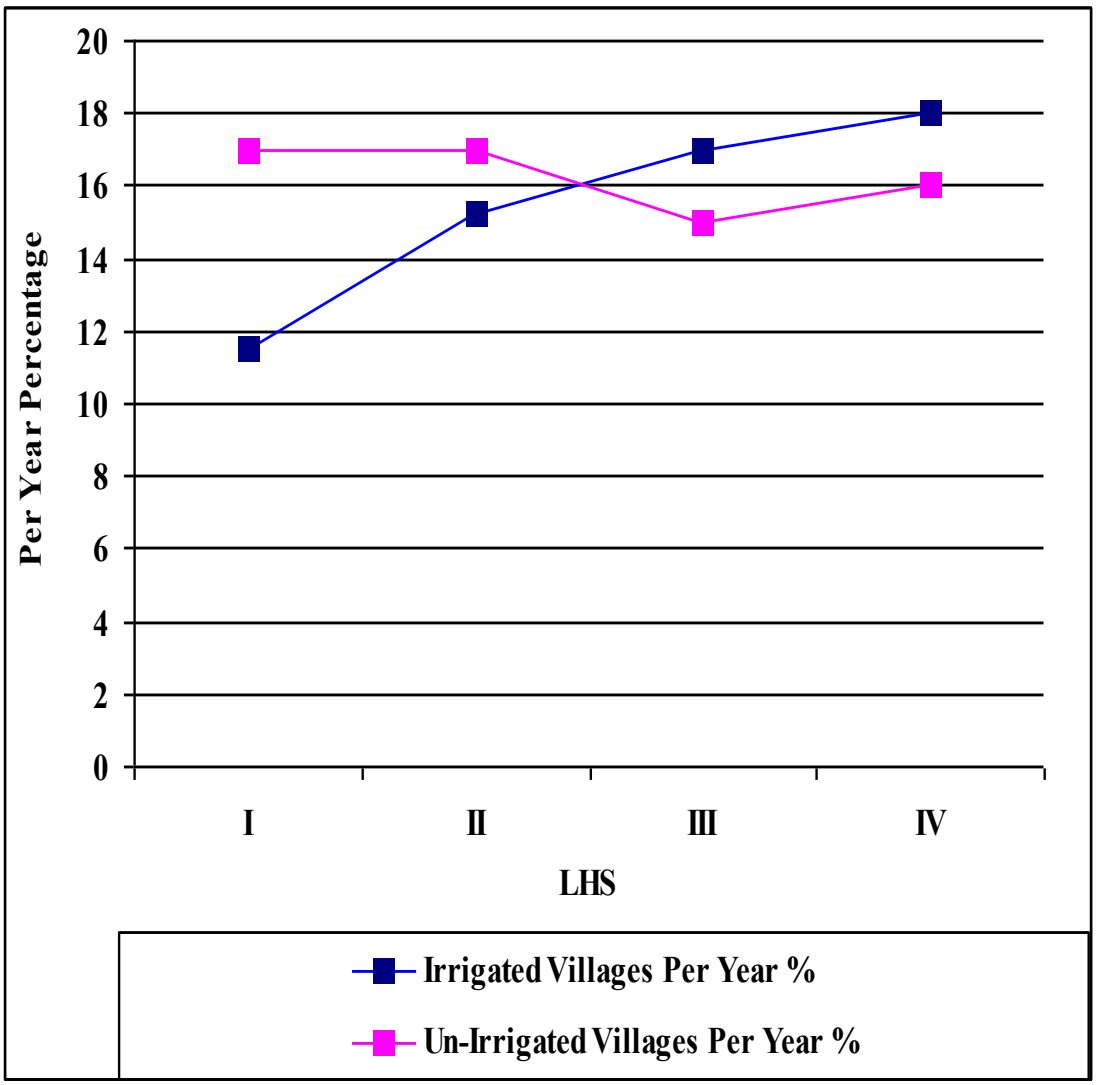
* Kg values are given for each item.

LHS	Egg meat Rs.	Per Week		Condi Rs.	(Gms) Bever	Sugar Kg.	Gur Kg.	Per week on Food items	For year
		Milk Rs.	Ghee Rs.						
I	32 0.2 1.1	380 2.4 13.1	79 0.5 2.7	51 0.32 1.80	4800 0.03 166	42 0.26 1.4	52 0.30 1.8	 26.57 146.2	 1382 (7601)
II	163 0.8 4.8	316 1.6 9.3	96 0.5 2.8	333 1.7 9.8	6500 0.03 191	56 0.28 1.6	83 0.42 2.4	 32.01 186.0	 1664 (9670)
III	95 0.6 4.0	534 3.2 22.2	64 0.4 2.7	375 2.3 15.6	5525 0.03 230	40 0.24 1.6	58 0.35 2.4	 29.93 201.20	 1556 (10465)
IV	40 0.3 2.1	482 4.3 25.3	120 1.06 6.3	62 0.5 3.3	4400 0.39 231	28 0.25 1.5	51 0.40 2.6	 31.64 187.6	 1645 (9756)

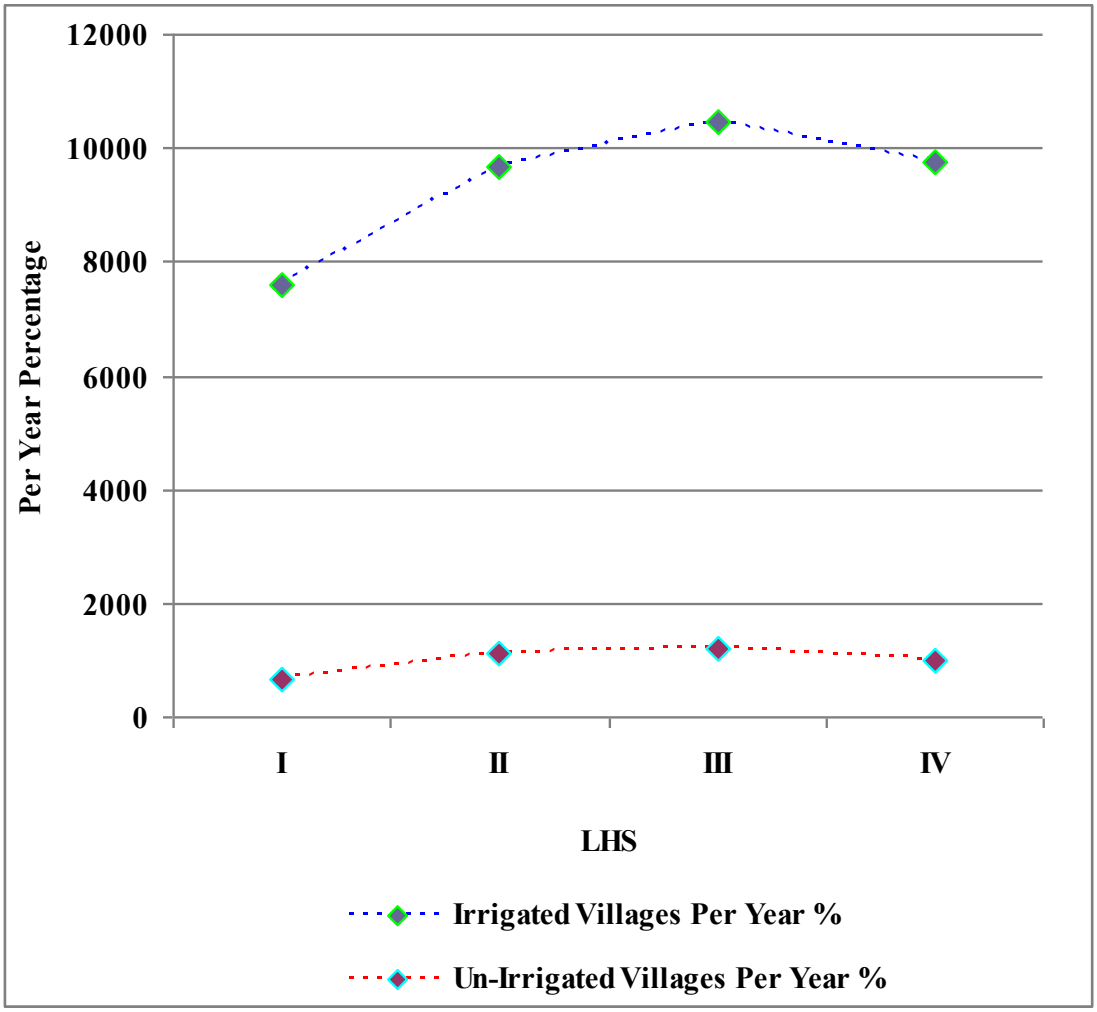
Irrigated Villages On Non – Food Item

LHS	Clothing	Dr. Medical	Educ.	Fuel	Entr.	P and T	Rel.	Travel	Per Yr. NF Total	Per Yr %	Per Yr. F + NF
I	17590 110 606	1910 11.9 66	100 0.6 3.4	2105 13.1 73	305 1.9 10.5	14 0.1 0.5	5715 36 197	1040 6.5 36	180.1 (992)	(11.5)	1561 (8593)
II	31200 157 918	5300 26.6 156	930 4.7 27	5000 25.1 147	995 5.0 29	44 0.2 1.4	12170 61 358	3800 19.1 112	298.7 (1748)	(15.2)	1963 (11418)
III	29260 178 1219	2945 17.9 123	1135 6.9 47	6088 37 254	2105 12.8 88	549 3.3 23	7690 46.8 320	2390 17.8 120	320.5 (2194)	(17.0)	1876 (12659)
IV	20100 178 1058	2555 22.7 134	2490 22 131	4690 41 245	670 5.9 35	240 2.1 13	6440 57 339	3480 30.9 183	359.6 (2140)	(18.0)	2005 (11896)

Dig. 4.13: Expenditure on Non-Food Item, Per Year



Dig. 4.14: Expenditure on Food Item, Per Year



Un- irrigated villages expenditure pattern differs from that of irrigated villages in that respect that proportion of expenditure on non - food items is more. But in absolute terms, the values are less. The ratio is big because the expenditure on food items is relatively less and expenditure on non- food items is minimum. When NF expenditure is expressed as a proportion of the total expenditure it is boosted up, out of proportion. The overall (averages) value of per consumption unit expenditure, per annum is Rs. 1121 (932 on food items and the remaining 189 on non-food items) in un-irrigated villages, while the corresponding figure of irrigated villages is Rs. 1716 (Rs. 1476 + Rs. 240 NF). Wheat replaces jowar to some extent in irrigated villages, that too in higher LHS. Intake of pulses is low and intake of egg, ghee, condiments is conspicuously absent in un-irrigated villages. Tea intake appears to be more in un- irrigated villages. Sugar and jaggery intake seems to be almost same in both the villages. Expenditure on clothing seems to be a bit on higher side in un- irrigated villages (Table 4.25).

Table- 4.25
Per Consumption Unit Expenditure on Food and Non – Food Items (LHS – wise)

Un-Irrigated Villages (per HH value)

LHS	No. farms	No. heads	C. Units	Gross area culti.	2.00* J.Kg	2.50 B.Kg	2.50 W.kg	2.50 R. Kg	5.00 Pul. Kg	15.00 Oil kg.	Veg Fruits
I	10	54	49.8 1.0cu Per HH	43.50	127 2.9 7.6	120 2.1 6.3	42 0.84 2.9	16 0.32 -	17 0.34 1.7	08 0.16 2.0	72 1.4 1.7
II	12	75	70.4 1.0cu per HH	97.95	224 3.2 9.1	200 3.0 8.4	70 1.0 3.2	42 0.6 -	30 0.4 2.0	12.25 0.17 2.1	108 1.5 6.3
III	06	39	35.3 1.0 cu Per HH	74.43	108 3.06 15.1	98 2.9 4.4	32 0.9 4.4	06 0.2 3.5	17 0.5 2.9	05 0.13 1.8	45 1.3 7.7
IV	03	23	21.9 1.0cu Per HH	7340	47 2.15 16.3	45 2.10 13.4	28 1.3 5.4	07 0.3 1.7	10 0.46 2.0	03 0.10 1.1	31 1.1 8.1

* Kg values are given for each item

LHS	Egg meat Rs.	Per week		Condi Rs.	(Gms) Bever	Sugar Kg.	Gur Kg.	Per week on food items	For year
		Milk Rs.	Ghee Rs.						
I	- -	14 0.28	- -	- -	3.82 0.03	34 0.28	30 0.25	13.02 -	- 677
II	9 0.1	34 0.5	5 -	4 -	2.02 0.02	20 0.28	25 0.36	21.33 -	- 1109
III	- 0.3	30 0.8	19 0.5	4 -	1.75 0.05	18 0.52	16 0.45	22.87 -	- 1189
IV	0 0.0	7 0.3	- -	- -	0.85 0.03	10 0.46	9 0.41	- 19.53	- 1016

Un-Irrigated Villages On Non- Food Item

LHS	Clothing	Dr. Medical	Edu.	Fuel.	Entr.	P and T	Rel.	Travel	Per Yr. NF Total	Per Yr. %	Per Yr. F + NF
I	6200 124	652 13.1	300 6	540 11	270 5	61 2	850 17.1	590 12.0	189	(17)	1103
II	10250 145	1147 16.3	1056 15	720 10	408 6	148 02	1592 22.6	950 13	230	(17)	1139
III	4000 113	597 16.9	300 8	900 25	308 9	94 3	840 23.8	600 17	216	(15)	1405
IV	2300 105	390 17.8	- -	150 7	300 14	60 3	530 24.2	580 26	197	(16)	1213

4.14: Living Conditions- Sample Villages:

The housing conditions of the cultivators show the living standards in sample villages. All the farmers are said to be living in their own houses, mostly inherited. Data has been collected on the number of rooms (Sheds, shops, including the space with a cover used for livestock) and whether there is provision for separate kitchen and both room (Lakshminarayan, K. 1981).The data has been tabulated with the household size as a major control, as the living accommodation is directly related to the number of people living in the house.

a. Irrigated Villages:

Data revealed that maximum number of families have two rooms (36%), closely followed by three rooms (35%) tenements. These houses include one living room. None of the houses have got latrine. All of them go out to the fields to attend to the natural calls as there are no public latrines constructed by panchayats. There are also 9 % of the sample households with single room. It can be better called as a hall, covering kitchen and living room. For bath, they go to either river or canal. Average number of rooms (overall) available, for each family (of different sizes) has been worked and presented herein (Table 4.26).

Table- 4.26

Housing Conditions – Irrigated Villages

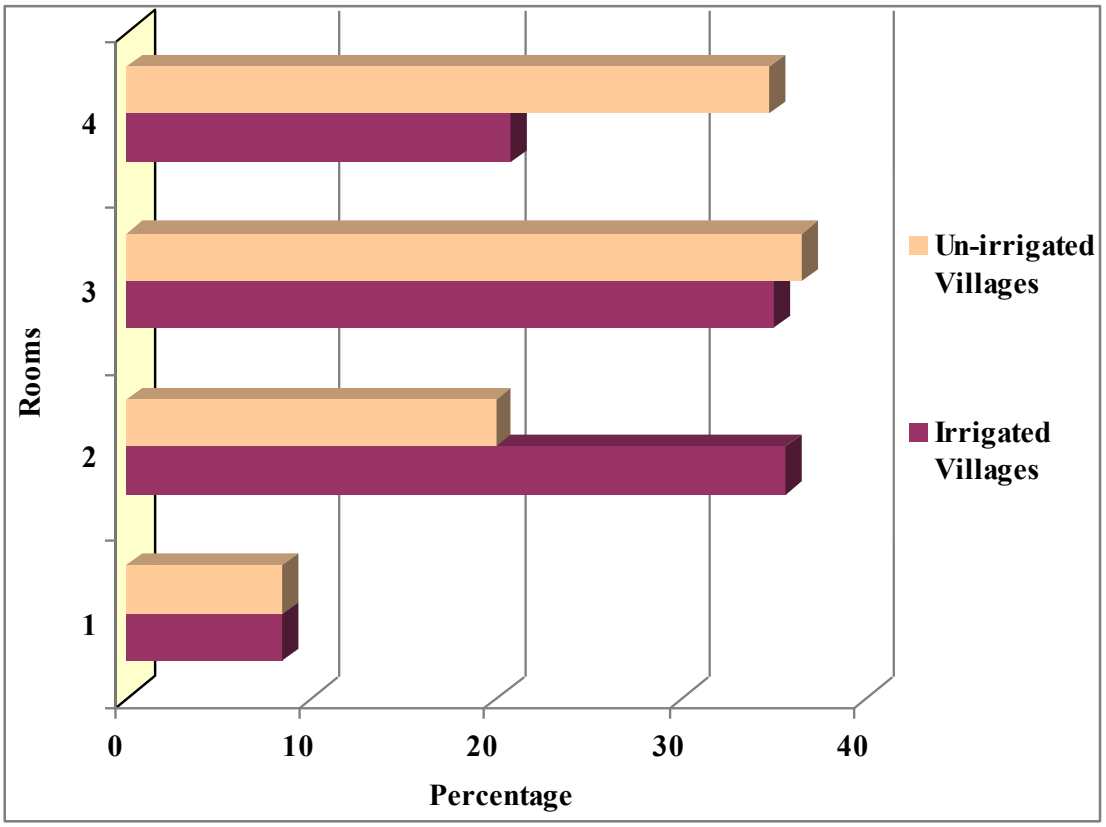
HH Size	Rooms				Roof					Floor				Wall			
	1	2	3	4	Mud	Stone	Wood	Tile	Sheet	Mud	Stone	Brick	Cement	Mud	Stone	Brick	Cement
02	39	17	14	09	30	17	32	24	38	45	32	29	19	49	41	34	21
04	23	56	26	18	42	34	51	38	29	29	47	58	42	77	68	38	19
06	32	44	58	57	34	40	29	27	42	65	19	41	37	82	80	24	24
08	-	84	149	43	22	67	48	61	41	72	68	35	22	74	89	37	28
10	-	94	83	72	31	17	52	29	58	94	39	88	20	49	42	42	20
12	-	102	57	31	16	21	37	39	59	81	41	43	39	61	64	29	13
Total	**94**	**394**	**387**	**230**	**175**	**196**	**249**	**218**	**267**	**386**	**246**	**294**	**179**	**392**	**384**	**204**	**125**
1105 %	**8.50**	**35.65**	**35.02**	**20.81**	**15.83**	**17.73**	**22.53**	**19.25**	**24.16**	**34.93**	**22.26**	**26.60**	**16.19**	**35.75**	**34.75**	**18.46**	**11.31**

Table- 4.27

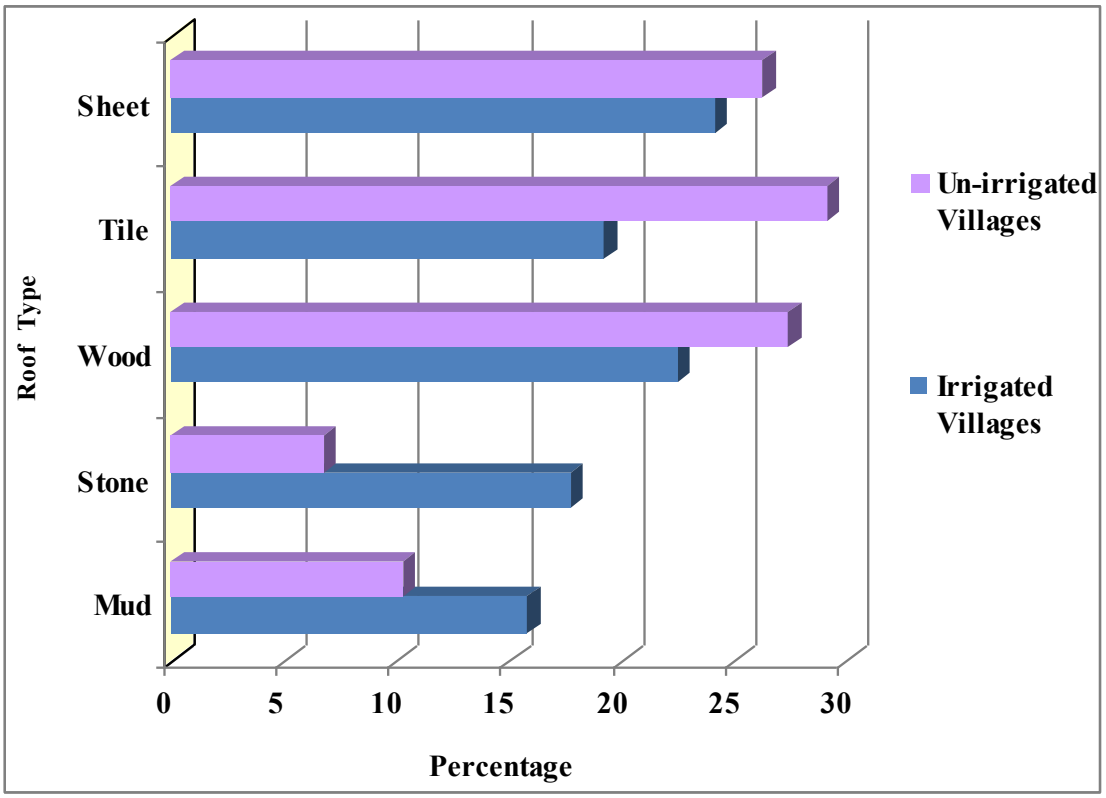
Housing Conditions – Un- Irrigated Villages

HH Size	Rooms				Roof					Floor				Wall			
	1	2	3	4	Mud	Stone	Wood	Tile	Sheet	Mud	Stone	Brick	Cement	Mud	Stone	Brick	Cement
02	06	04	-	-	03	01	03	08	06	19	13	03	04	07	18	04	-
04	09	08	05	-	03	01	04	08	09	09	06	04	03	09	07	03	19
06	-	07	12	-	02	05	09	07	16	12	07	05	02	25	13	04	02
08	-	05	26	19	02	03	25	19	10	16	09	02	02	33	08	05	01
10	-	04	14	28	05	02	06	05	03	20	05	06	05	10	03	02	02
12	-	07	07	14	03	-	03	04	02	08	06	02	10	06	02	02	13
Total	**15**	**35**	**64**	**61**	**18**	**12**	**48**	**51**	**46**	**84**	**49**	**22**	**20**	**94**	**55**	**17**	**09**
1105 %	**8.5**	**20.0**	**36.57**	**34.85**	**10.28**	**6.8**	**27.42**	**29.14**	**26.28**	**48.0**	**28.0**	**12.57**	**11.42**	**53.71**	**31.42**	**9.71**	**5.14**

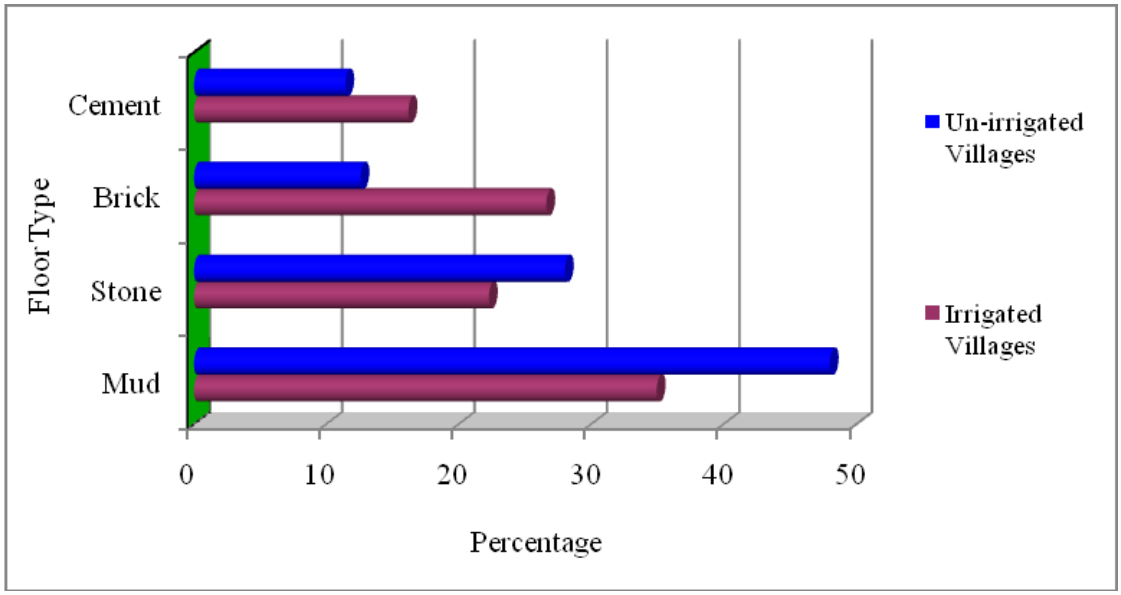
Dig. 4.15 Housing Conditions (Rooms)



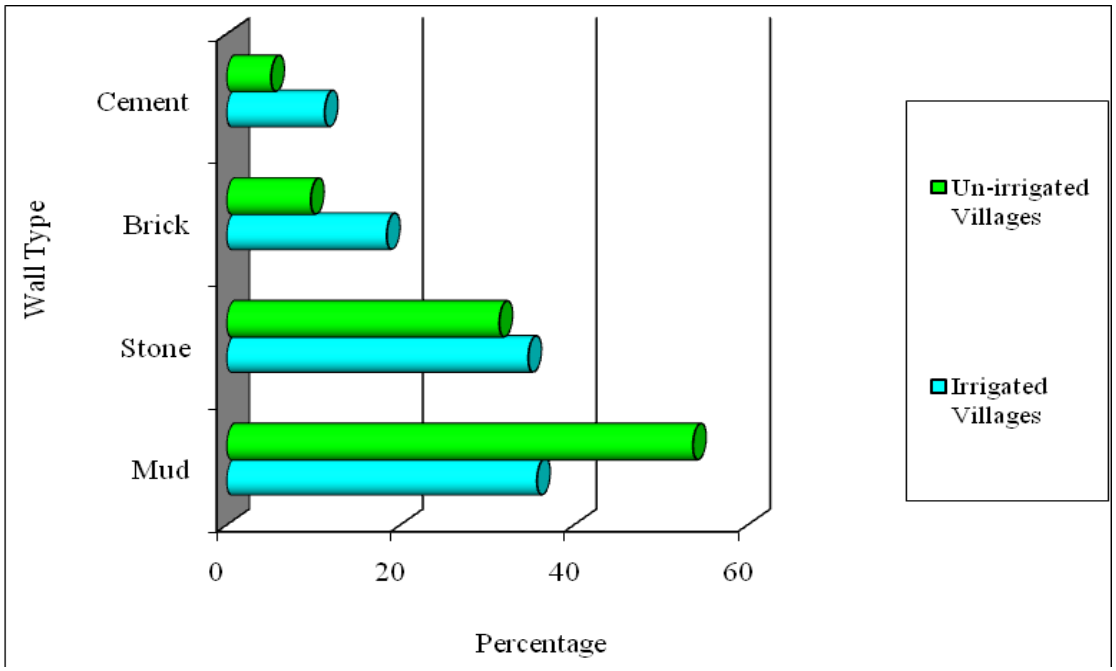
Dig. 4.16: Housing Conditions (Roof)



Dig. 4.17: Housing Conditions (Floor)



Dig. 4.18: Housing Conditions (Wall)



Average is 2.40 rooms per family (irrespective of the size of the family). It can be observed that households with a family size of 'up to 4' are having just the average values. Thus the line of demarcation is drawn between families with 8 and above 8 members, for having the average (2.40) number of rooms of living accommodation.

So far as the material used for constructing of roof of the houses, majority of the houses (16%) have used mud. Flooring is also done for majority of houses (35%) with mud. The walls, for majority of houses, are constructed by mud as they are strong and the maintenance cost is low.

18% households have reported wooden furniture like chairs, tables and benches. Another 195 of households have reported to have steel furniture: mostly steel almirahs or steel chairs. Kerosene stove seems to be still a luxury for majority of the houses. The reasons could be non-availability of kerosene and abundantly available fire wood. Sill people use the traditional (mud or copper) utensils for cooking. Jowar roties are made on iron pans (tava) or directly on fire itself.

Cycle is used as the readily available, flexible, cheap conveyance in the village during all seasons on all sorts of roads either to move to fields or to the neighboring places. The privilege is available with only 16% of the houses who own cycles. Though there is electricity in the villages, due to low cost, T.V. are used by the villagers (36.38%). D.T.H. set's are also of the luxurious items like Refrigerator, Washing machine, sewing machine, iron (to press clothes) are available in some of the sample houses, but their number is very few (Table 4.28).

Table- 4.28

Housing Conditions – Amenities (Irrigated villages)

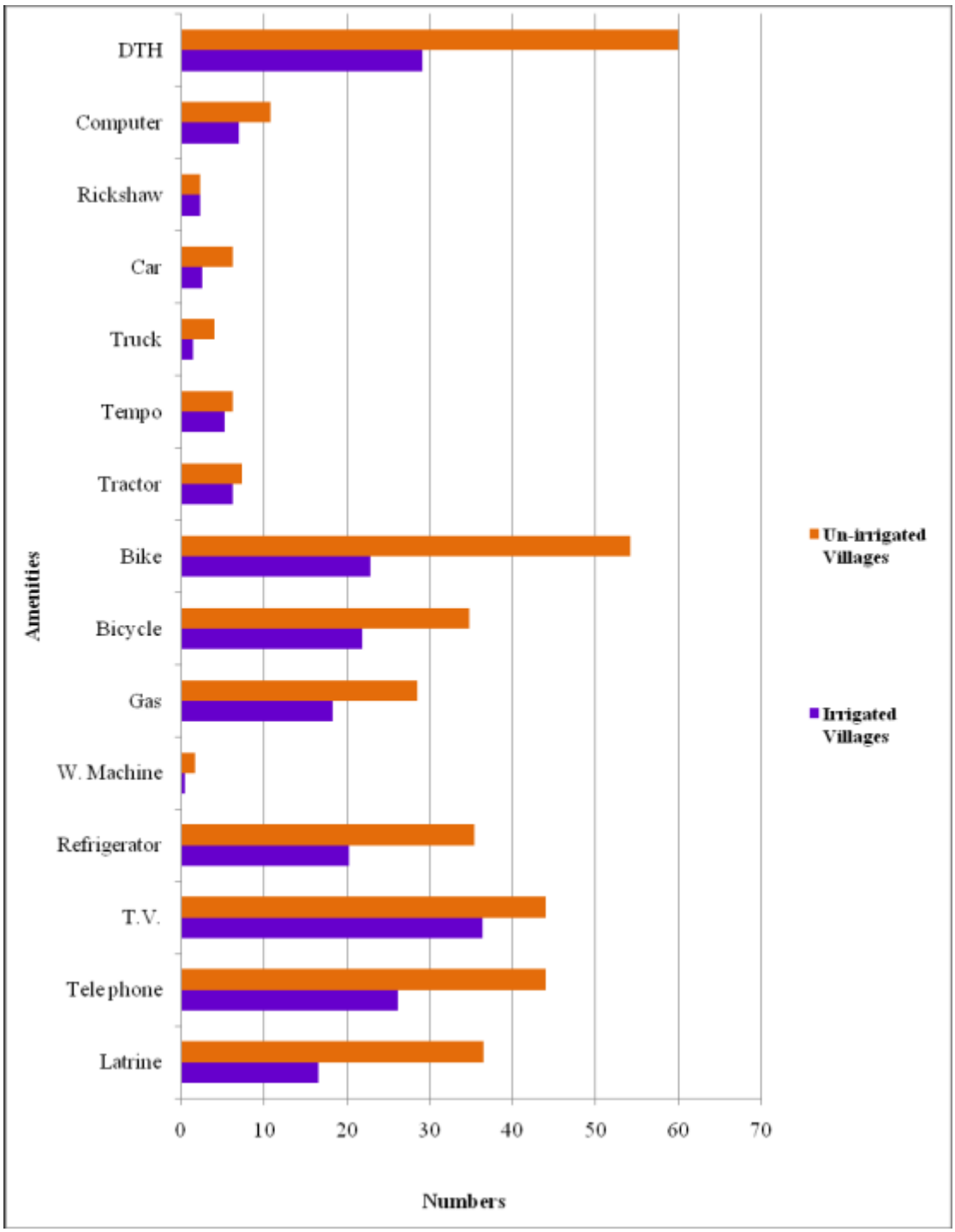
HH Size	Electricity	Latrine	Bathroom	Tele phone	Mobile	T.V	Refrig-erator	W. Machine	Gas	Bicycle	Bike	Tractor	Tempo	Truck	Car	Rickshaw	Computer	DTH
02	96	09	55	26	103	44	07	-	07	33	12	-	01	-	01	01	03	35
04	145	23	102	45	96	76	28	-	38	45	58	07	04	02	03	02	21	103
06	66	18	42	13	50	49	30	02	09	40	32	15	09	02	05	05	15	60
08	58	35	30	48	48	37	32	01	29	52	40	09	13	07	08	04	06	40
10	145	62	109	91	127	109	75	03	68	32	66	19	20	03	07	09	13	35
12	98	37	30	66	80	87	52	-	52	40	45	20	12	02	05	05	19	49
Total	**609**	**184**	**368**	**289**	**504**	**402**	**224**	**06**	**203**	**242**	**253**	**70**	**59**	**16**	**29**	**26**	**77**	**322**
1105 %	**55.02**	**16.65**	**33.30**	**26.15**	**45.61**	**36.38**	**20.27**	**0.54**	**18.37**	**21.90**	**22.89**	**6.33**	**5.33**	**1.45**	**2.62**	**2.35**	**6.96**	**29.14**

Table- 4.29

Housing Conditions – Amenities (Un-Irrigated villages)

HH Size	Electricity	Latrine	Bathroom	Tele phone	Mobile	T.V	Refrig-erator	W. Machine	Gas	Bicycle	Bike	Tractor	Tempo	Truck	Car	Rickshaw	Computer	DTH
02	23	03	07	09	19	07	01	-	02	03	10	-	-	-	01	-	02	13
04	40	13	19	24	32	18	21	-	09	12	19	03	01	-	02	-	01	12
06	32	10	28	17	29	12	09	-	12	19	22	02	02	01	-	-	05	40
08	12	06	09	03	10	06	06	-	03	06	07	01	03	02	-	03	07	06
10	30	17	21	15	25	19	12	02	14	10	12	03	03	04	06	-	-	15
12	22	15	18	09	20	15	13	01	10	11	25	04	02	-	02	01	04	19
Total	**159**	**64**	**102**	**77**	**135**	**77**	**62**	**03**	**50**	**61**	**95**	**13**	**11**	**07**	**11**	**04**	**19**	**105**
175 %	**90.85**	**36.57**	**58.28**	**44.0**	**77.14**	**44.0**	**35.42**	**1.71**	**28.57**	**34.85**	**54.28**	**7.42**	**6.28**	**4.00**	**6.28**	**2.28**	**10.85**	**60.0**

Dig. 4.19: Housing Conditions- Amenities



Thus the overall review indicates basically the traditional way of living in majority of the households. However indications of the households. However indications of the modern age are also not totally absent. But they are yet to take their place of pride. However the living conditions are not far from satisfactory in irrigated villages ; as the age old practices can't change within ten years of time (since commissioning of irrigation).

B. Un- irrigated Villages:

In un- irrigated villages the three room tenements dominates the three room tenements dominates the scene (37%) closely followed by three room tenements (35%). Every fifth house seems to have 4 or more rooms. Those houses with one living room have combined kitchen and bath room. Few of the households have latrines. They go out to the fields. The overall position of number of rooms available i.e. 2.5 (irrespective of the household size). Those families with less than four members are having lesser accommodation. But beyond "5 members" families are having above average accommodation. Unlike in irrigated villages, the number of rooms available, in un-irrigated villages have wide gap between the extreme classes. This shows the poor living conditions (congestion) in un- irrigated villages.

So far as the material used for roof, 27.42% of houses have got wooden planks, as the roof while mud (10.28%) and stone (6.8%) houses are also present. Tractor, truck, tempo, car are the amenities available, that too in a very few houses. Basic amenities also appear to be not available is sample houses. Thus difference in living conditions between villages is more than evident (Table 4.27).

Number of rooms, materials used for the construction of wall, roof and floor is another indication, about the status of the cultivators. Though

use of modern material is not that popular in irrigated villages, still indications are there. So also the amenities available. Un-irrigated villages still seems to reel under poverty, ignorance and lack of initiative (Table 4.29).

4.15: Relative Position of Sample Cultivators with reference to Poverty line in the Study Villages:

The discussions so far the sources of income and pattern of expenditure for each household (per capita and per consumption unit wise) in irrigated and un-irrigated villages. It is observed that income per household is different between these villages within the comparable land holding size. Irrespective of the income, each household must have a bare minimum (subsistence) expenditure satisfying the minimum nutritional requirements o food items, divides the population into two classes i.e., below and above poverty line. The earlier works by (Dandekar and Rath, N.1971) Vaidyanathan have thrown much light on this aspect, in determining and quantifying poverty in terms of "per capita, per month expenditure on food items" (Vaidyanathan, A., 1974).

Satyapriya had worked out for Karnataka, (Rural and urban separately) and projected the figures for future i.e., up to 80 – 81 (Satyapriya, V. S., 1978), (Ahluwali, M. S., 1979), (Pravin Visaria, 1981) of World Bank has also done substantial work on this topic.

Government of India, Fifth Five year plan document has given Rs. 46.60 (per capita, per month expenditure) as the minimum expenditure and those below that are called "below poverty line" (Planning Commission, G. O. I. Draft Five Year Plain 1978-83).

Rane had compared two villages around Delhi one with 91% of irrigation and other will nil negligible irrigation for fixing the percent of population below poverty line (Rane, A. A., 1981). At 1980 prices, he had arrived at a figure of Rs. 1600 as the total minimum nutritious target. Out of which Rs. 1259 on food and Rs. 341 on non-food. This figure works out to be Rs. 3.45 per head per day.

Of all the estimates, discussed so far, the figures given by Rane seems to be latest and more realistic to the present day situation, as

inflation has made earlier estimates projections poor and less meaningful, more to because the data, of the present study is related to 2010. Thus a more realistic comparison would bring out, the actual situation as to how many households are placed w.r. to poverty line, in both the villages. Thus the impact of irrigation can also be assessed indirectly through the "well being" of farmers.

Information on food consumption expenditure, is analyzed for both the villages separately, while identity of major control (land holding size) is maintained through out. Data related to consumption of cereals (jowar, bajra, wheat) oil, pulses, vegetables, beverages (tea), pan, tobacco, and sugar and gur. The prices are retail prices, as existing in the villages, at the time of data collection. Excepting some portion of cereals, vegetables, eggs and milk, all other items are purchased. Even the homegrown or produced items are imputed to estimate the real expenditure on food.

4.16: Poverty Line Analysis:

For each individual household, expenditure on food items is retail calculated, at prevailing local market prices. Data is collected, for a week as the purchases are made mostly during shandy which is conducted once a week. To arrive at the monthly value, the weekly values are multiplied by four i.e., the observed expenditure per month is arrived by multiplying the number of members in each household with (Rs. 1259), which gives theoretically how much each household would have spent, to maintain reach the minimum nutritious reach the minimum nutritious standards. Thus the straight comparison between (observed) O and E (Expected) gives, the number of families above the poverty line (wherever O >E). In addition, one more exercise is also attempted. There are some border line cases, in each LHS of both the villages, where observed value is neither exactly equal not more than the expected value, but some where near. To

cover such cases, an allowance of + 20% is considered for the expected values, so that the border line case of observed value can also be considered for the analysis. At the outside in irrigated villages. 18.70% of the HH and in un-irrigated villages only 17.42% of the HH are observed to be above poverty line. When the + 20% is considered 25.65% more HH are found to be above poverty line in irrigated villages, overall LHS Barring i, ii land holding sizes, in all other LHS the newly added households villages in irrigated are more than 20% (Table-4.30). There is peak of 31.30 % in the 3rd LHS: and 21 % in the last LHS. From among the remaining LHS which were earlier below the poverty line 20% allowance has helped to trace some more houses. Thus the two classifications put together, have pushed the HHS to above poverty line to the extent of 44.355 in irrigated villages. *viz.,* almost two in every 3 HHS of irrigated villages have the expenditure that matches with the minimum nutritional standards. Represented as a curve it is progressively on increase. The curve started with 37.5% in the last LHS and ended up with as high as 31.60 % in the higher LHS the average being 44.35% un-irrigated villages: There are altogether 120 HHS that are above the poverty line: constituting (17.4%) of the total. There are 110 HHS in the lower three land holding size and 10 HHS in the 4th LHS. In this situation, the allowance of "20% of E" is helpful to pull some more HHS to above poverty line. Some more (92) hhs are added to the list, thus bringing the combined list to 212 (30.4%) as against 176 hhs (44%) of irrigated villages ; which means that every two houses out of 3 hhs are above poverty line in irrigated villages but in un-irrigated villages every fifty hhs is above the poverty line in spite of 20% allowance. The two values are statistically different (at 5 % L.S.).

Table- 4.30

Poverty Line Analysis- Irrigated villages.

LHS	PL n1	Z1 %	80% Ex n2	Z2 %	Total hhs N	Total % z3 Z1+Z2
< 1.5 hect.	42	27.03	32	37.50	394	64.53
1.6 to 3 hect.	37	25.00	24	12.50	387	37.50
3.1 to 7 hect.	15	12.50	09	31.30	230	43.80
< 7 hect.	10	10.30	07	21.30	94	31.60
Total	**104**	**18.70**	**72**	**25.65**	**1105**	**44.35**

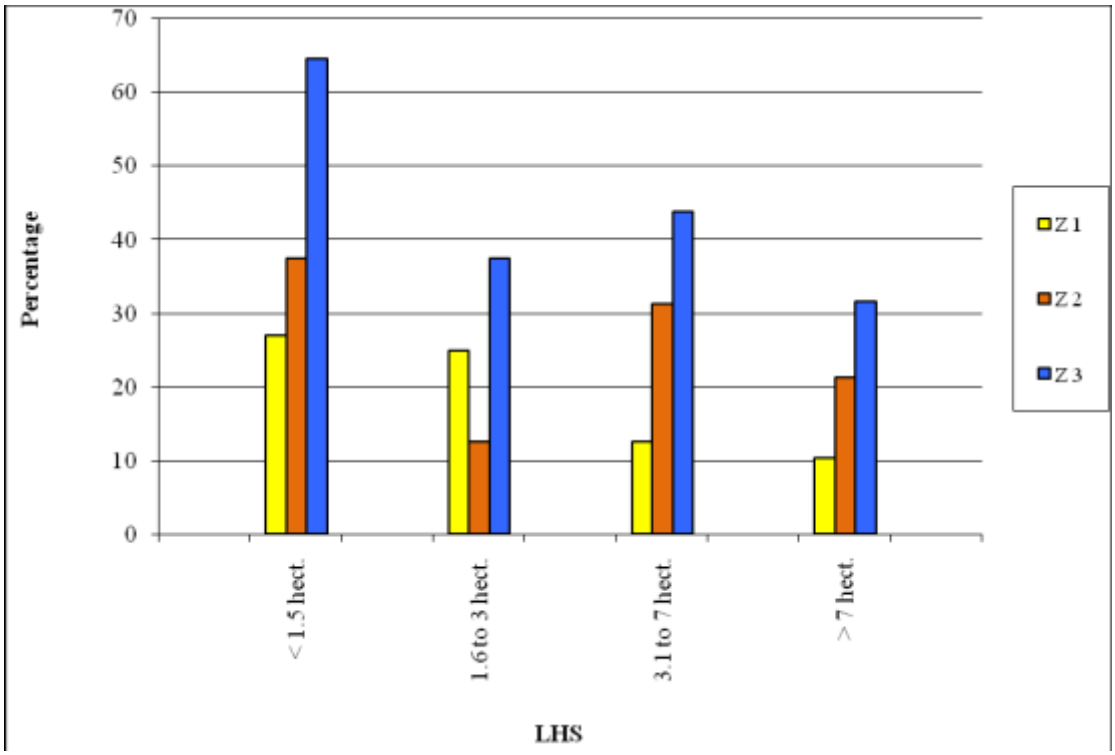
Un- irrigated villages.

LHS	PL n1	Z1 %	80% Ex n2	Z2 %	Total hhs N	Total % z3 Z1+Z2
< 1.5 hect.	51	25.0	40	20.00	64	45.00
1.6 to 3 hect.	38	16.7	28	16.70	61	33.40
3.1 to 7 hect.	21	15.5	16	08.50	35	24.00
< 7 hect.	10	12.5	08	05.30	15	17.80
Total	**120**	**17.42**	**92**	**12.62**	**175**	**30.04**

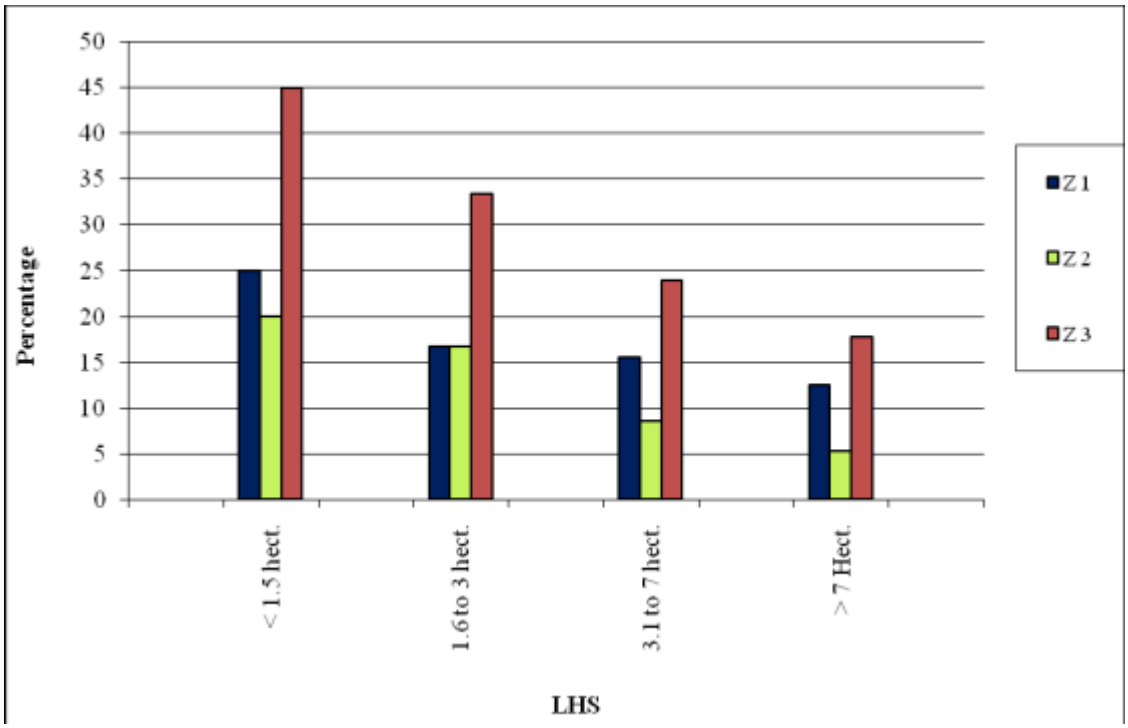
Note: Z1 = n1 /n

Z2 = n2 / n

Dig. 4.20: Poverty Line Analysis- Irrigated Villages



Dig. 4.21: Poverty Line Analysis- Un-irrigated Villages



Thus a comparison, among different LHS of irrigated villages shows that up to 07 hectares, there are a few (10%) and (27%) HHS that is above poverty line (column Z 1) but their percentage has swelled (40-60%) when some more HHS is identified with allowance (80% expenditure). From 07 hectares onwards, (column Z 1), the HHS above poverty line has gone up (40-70%), while (column Z 2) in above 07 hectares, the HHS above poverty line are (75% - 90%). Thus in irrigated villages 07 hectares can be treated as the dividing line, where from the percentage HHS, above and below poverty line' vary perceptibly.

In un- irrigated villages also, 3 hectares seem to be dividing line (column Z3). The first land holding size has 45% of HHS above poverty line. This figure has come down to 18% in the 4^{th} LHS. From the 07 hectares and lower LHS, the percentage HHS above poverty line have shone higher values (24, 33.40, 45)

Thus in magnitude, the values may differ from irrigated and un-irrigated villages, but 07 hectares seem to be dividing line, in both the cases to demarcate the poverty line.

The difference in the number of households below poverty line, in the two types of a village, which are similar in many respects, but for irrigation, speak volumes about the impact of irrigation on the wet cultivator's households. Thus the irrigated farmers could have better and assured income, thanks to irrigation. This observation corroborates (very well with) Rane's findings of his study.

Chapter.5

STATISTICAL TREATMENT

In the analysis of the costs, when one variable is studies, it is studied in isolation without taking into account the other variables effect on this variable. To get the combined effect of all the related variables as the ultimate result, the gross production multiple regression equation analysis has been in use (Earl O. Heady and John L. Dillon. 1961). This short of analysis answers some of the problem like (a) the contribution of each of the inputs to the total output and the extent, (b) the significant of otherwise contribution of each of the in puts to total production.

5.1: Cobb Douglas Function:

After a careful review of several production functions for the present study (Waheeduddin Khan and Tripathy R. N. 1972), the Cobb – Douglas type has been finally selected in the form: (Table- 5.1)

$$Y = AX_{1.}\, b_{1.}\, X_{2.}\, b_2 \ldots. Xn^{bn}$$

Where A = constant, b_1 = regression coefficients (production elasticities)

The sum of the regression coefficients gives the nature of returns to scale. By adopting the least square method A, b1 are estimated.

Y = Gross value of total output (Rs.)

X_1 = Land (Hectares)

X_2 = Human labour (man days) HL

X_3 = Animal labour (paid days) AL

X_4 = Fixed cost (Rs.) FC

X_5 = Variable cost (Rs.) VC

All the variables taken for analysis are estimated carefully, and simple correlation (r) values between independent variables are found to be less than the multiple correlation coefficient (r) value. Hence the multi- collinearity problem does not arise to mar the results and hence the results are not spurious (Lawrance, R. K. Lein. 1965, Introduction to Econometrics). The results are presented for each village separately for the farm business as a whole.

Table- 5.1

Cobb – Douglas Analysis Irrigated Villages

Y= 1, 03,700

	G.M.	***bi***	***T***
Area X_1	127	-5.13	-1.16
HL X_2	5081	-0.33	-0.07
AL X_3	1076	5.67	0.88
FC X_4	10250	0.84	0.71
VC X_5	26950	-0.05	-0.03
	Total	**0.99**	

n = 1105

A = 7.58

G.M. = Geometric Mean

R^2 = 0.99

R^{-2} = 0.99 Ave.

Rel. error = 4.99

SEE of the eqt. = 0.13

Durbin Wastsen Statistics 24,899

Table- 5.2

Cobb – Douglas Analysis Un-irrigated Villages

Y = 25,640

	G.M.	***bi***	***t***
Area X_1	63.46	-0.21	-0.56
HL X_2	1210	0.21	0.24
AL X_3	361	0.05	0.08
FC X_4	2257	-1.23	-1.02
VC X_5	5118	1.06	2.45
	Total	**1.00**	

n= 175

A = 9.60

G.M. = Geometric Mean

$R^2 = 0.97$

$R^{-2} = 0.83$ Ave.

Rel. error = 3.25

SEE of the eqt. = 0.09

Durbin Wastsen Statistics 1.60

The five input variables, considered together have explained the variations in the total production to the extent of 97% in Dry villages, while it is 99% in wet villages. The geometric mean values, presented for each of the variables in both villages, showed that irrigated villages values are higher than that for un- irrigated villages. This can be explained as due to extensive cultivation (due to irrigation) in irrigated villages over un-irrigated villages over un- irrigated villages. More area is cultivated in irrigated villages, which demands more of HL and AL. More of fixed cost means depreciation on the agricultural implements, draught

power, in terest on the (own or borrowed) working capital and land value (cultivated). More of variable cost indicates the usage of manure, fertilizer, PPM and other hire charges (Table- 5.2).

The production elasticity's (regression coefficients) indicate that the total output is increasing with an increase in any one of the inputs, while others are kept constant, at their geometric mean levels. Though in magnitude the b value is higher for irrigated villages (−5.13) than that of un-irrigated villages (−0.22) for the cultivated area, both the values are found to be statistically not significant (lower't'). This indicates that the extent of magnitude of area cultivated has no significant impact on higher yields. The human labour and animal labour contribution also seems to be not effecting the total yield in both the villages (with non significant't' values). Relatively speaking (HL) $b_2^{0.22}$ is more than (AL) $b_3^{0.05}$ in un-irrigated villages while it is the other way in irrigated villages. Fixed cost is also not significantly contributing to the total yield in both villages. While variable cost is significant in un- irrigated in irrigated villages the variable cost also could not bring in a change (influence) on the total output.

At this point it would be of interest to note how the importance of each of the X- variables can be graded or ranked (Relative importance of different X- variables-398pp. Snedecor and Cochran: in Statistical Methods). The standard can be graded or ranked. The standard partial regression coefficient $\beta i\sqrt{}\partial^2 xi/\partial^2 y$ are calculated for each of the inputs and their magnitudes are ranked (irrespective of the sign). In un- irrigated villages the order is: variable cost, fixed cost and agricultural labour, area and fixed cost. The coefficients estimate the change in Y as a fraction of Y produced by one SD change in X_1.

Variable cost is the main stake in un-irrigated villages i.e. more of manure and fertilizer usage of resulting in better yields. This is supported

by the usage of working capital, animal and implements (which are the components in fixed cost); animal labour is ranked as the 3rd important input. But in irrigated villages fixed cost and animal labour are identified as the important variables. Also area under crops has come as an important variable. The productivity is no doubt a function of area as the overhead costs would come down with more area under the same crop, for the some investment.

In un- irrigated villages, the elasticity of output to variable cost (VC) is high and significant i.e., a unit increase in VC with other factors held at their GM levels, adds more to gross output, than an increase in other input factors does. The elasticity for FC is negative, but not significant. The response of output to an increase in land input is negative but not significant.

On irrigated village's farms, the production elasticities for individual input factors are more variant. The elasticity of output to animal labour input is positive and high but not significant. So also for FC As in the case of un- irrigated villages, here also the elasticity of output to land input is negative and not significant. The other inputs have also contributed to the output, but not significantly.

The sums of elasticity ($\sum bi$) are tested for deviation from unit to decide the nature of returns to scale. For both the villages, the test revealed increasing returns to scale ($\sum bi$=1.00) un-irrigated villages and ($\sum bi$- 0.99) irrigated villages.

5.2: Standard Normal From:

It is customary or conventional to fit a "log" function to the variables in the production function. In this study another attempt is made to transform the variables in to their standard normal (SNV) from $(x-\bar{x}/_{\partial}x)$ with zero mean and SD as unity. With this transformation

again, the multiple regression equations are fitted and the results are given below, for both the villages separately.

Table- 5.3

Multiple Regression Equations

	Un- irrigated villages		**Irrigated villages**	
Variable	***Bi***	***t***	***bi***	***t***
Area	0.05	0.08	-3.98	-2.47
HL	0.72	0.53	1.93	0.87
AL	0.38	0.25	1.17	0.49
FC	-2.20	-0.93	1.67	4.57
VC	1.82	1.53	0.21	0.34
bi	0.78		1.02	
Intercept	-0.00		-0.09	
R^2	0.95		0.99	
$\bar{R}^2$	0.65		0.99	
SEE of the eqt.	0.58		0.07	

In Case of un-irrigated villages, it is observed that none of the elasticities (regression coefficients) are statistically significant and their sum is 0.70 which is significantly different from unity, indicating constant returns to scale. But in case of irrigated villages, the elasticities for cultivated area and fixed cost are statistically significant. The sums of elasticities are found to be 1.00 and are not significantly different from unity indicating increasing returns to scale. The SEE of the equations is almost nil in case of irrigated villages, whereas it is (relatively) high for un- irrigated villages (Table 5.3).

Thus in addition to the normal procedure of log transformation, the SNV transformation has yielded some more realistic, meaningful and interesting results.

5.3: Marginal Value Products[1] (at Geometric Mean Levels):

By the production function analysis, it is possible now to evaluate the efficiency of factor proportions in production on farms in both villages (Table 5.4).

$$[MVP = dy/dx = bi \times y/x_1]$$

Table- 5.4

Marginal Value Products[1] (at Geometric Mean Levels)

Item	Un- irrigated villages M.V.P.	Irrigated villages M.V.P.
Area	- 87.47	- 41.95
HL	4.65	6.86
AL	3.91	5.46
FC	- 14.66	8.58
VC	5.35	- 0.20

$$MVP = \frac{dv}{dx} = bi \times \frac{\bar{y}}{\bar{x}_1}$$

The level of MVP of individual input factors in un- irrigated villages shows that between human and bullock labour, the MVP is almost the same; but within the two, MVP is higher for HL than AL. Working capital has larges MVP. Area and FC have shown (−) MVP, showing the over capitalisation of farms. For irrigated villages, bullock

labour and FC cost have shown (+) MVP of which bullock labour giving very high MVP. The impact of VC is (−) ^{ve} and insignificant. There seems to be wastage in the utilization of human labour. In both the villages it is commonly observed that land's MVP is (−) ^{ve} and very high. This may be interpreted as that in bigger LHS, the productivity is not in bigger LHS, the productivity is not commensurate with LHS but smaller farms are observed to be producing more.

5.4: The Discriminate Function Analysis- Hotellings T^2 Analysis:

So far the analyses were the comparison of the sample villages, with respect to one variable at a time. But it may be a fact that each variable may behave in a different way in isolation than when it is taken in a group, i.e. the group behaviour could be different from individual behaviour when comparison between the two villages, is made (Radhakrishna D. 1969).

There is a multivariate technique to study the extent to which different populations overlap one another. As a multivariate generalization of the t- test : given a number of related measurements made on each of the two groups, the investigator may want a single test of null hypothesis ; that the two population have the same means, with respect to all the measurements (Snedecor G. W., Cochran W. G. 1968). Historically the Discriminant function was developed independently by fisher (Fisher R. A. 1936), whose primary interest was in classification, by Mahalanobis in connection with a large study of the relation between Indian castes and Tribes and by Hotelling who produced the multivariate t- test (Mahalanobis P. C. 1930).

Let X be a normal variate with known means $\mu 1$ and $\mu 2$ in the two populations and knows S.D. (p), assumed to be same in both the population. The value of x is measured for new specimen that belongs to

one of the 2 populations. Our task is to classify the specimen into the correct population.

If $\mu 1 < \mu 2$ when $X > \mu 1 + \mu 2 /2$ specimen goes to I group.

$X > \mu 1 + \mu 2 /2$ specimen goes to II group.

The mean of the 2 populations serve as boundary point percentage *misclassification*; if the specimen actually comes from I group, our verdict is wrong whenever

$$X > \mu 1 + \mu 2 / 2 \textit{ i.e. } \text{whenever } x - \frac{\mu 1}{\partial} > \frac{\mu 2 - \mu}{\partial} = D/2\partial$$ where Δ is the distance

Between two means, Since $X - \mu/\partial$ are a SNV, the probability of misclassification in the area of the normal tail forms $\Delta/2\partial$ to ∞. For a high degree of accuracy in the classification $\Delta/2\partial$ most exceed 3.

Variables Selected and the Analysis:

There are many variables that can judge the performance or levels of living of the cultivators in sample villages. For the present study, only six important variables are taken, as the data is available readily on them, from the field study. Though the list is not exhaustive, for the purpose of assessing the overall performance of the distance between the two groups, the six variables are felt to be necessary and sufficient.

1. No. of earners in each household (number)
2. Assets per each household (Rs.)
3. Household income (Rs.)
4. Net returns from all sources per household (Rs.)
5. Intensity of cropping - farm - farm level (%) and
6. Per consumption unit expenditure on food items (Rs.)

For the two sets of villages, the normal eqts obtained are as follows:

1.34 L1	=	Δ -0.21
0.36 L1 + 12.15 L2	=	29.38
1.25L1 + 4.00L2 + 26.72L3	=	-1.29
-0.03L1 +-0.03L2 + 0.67L3 + 0.16L4	=	0.03
7.64L1 – 40.59L2+1384L3 + 1.30L4 + 1306.34L5	=	10.03
49.03L1+3.46L2–188.31L3-3.06L4–842.87L5+47910.15L6= (Lower triangle is given here)		178.97

The L1 is computed by the Doolittle method (Rao, C. R.1952) of inversion of the matrix. The diagonal element L1 is given as under:

No. of Earners	L1 = 0.8970	*di* -0.21
Assets	L2 = 0.1000	29.38
HH income	L3 = 0.0500	-1.29
Returns	L4 =7.2640	0.03
IOC	L5= 0.0006	19.03
PC Expd.	L6 =0.0004	178.97

Here Σ L1 *di* = 0.3322. The value of Δ /s for the Discriminant is given by

$\sqrt{}$ (n_1 +n_2−2 − 2) Σ L1 *di* = $\sqrt{}$ (209 + 98−2) (0.3322) = 10.06, indicates that the percentage misclassification is negligible or very low

Analysis of variance of the Discriminant function.

Source	df	S.S.	M.S.S.
1. Between villages	2	$n_1n_2 (\Sigma Ld)^2 / n_1+n_2$	3.6327
2. Within villages	304	(Σ LD)	0.00108

F= (1) / (2) = 3363.6

For (1) d. f. = 2, for (2) d. f. = $n_1 + n_2 – K– 1 = 304$.

The value of F is very large for the d. f. (2,304) as it must be, if the discriminate is to be effective in classification. Hotellings T^2 Statistis (Anderson, T. W. 1972).

The multivariate – "t" tests takes into account the combination group of six variables at one time and the distance between the sample villages is tested for statistical significance.

$$T^2 = \frac{n_1n_2}{n_1 + n_2} \sum L1di = 22.16$$

$$F = \frac{n_1+n_2 – K+1}{K (n_1 + n_2-2)} \times T^2$$

= (6,302)

= 3.65

Table values for

F6. ∞ = 2.80 at 1 % L.S.

= 3.74 at 0.1% L.S.

= Significant at 1 % L.S.

Thus it has been statistically proved, that the irrigated villages has significantly higher (group) values than un- irrigated villages, for the six important variables taken at one time and treated here, the Discriminant function has discriminated significantly the sample villages. Hotellings T^2 also has proved statistically the difference between irrigated and un-irrigated villages to be significant. Thus with irrigation as the only limiting factor, irrigated villages has been proved to be superior over un-irrigated villages, either for single variable and or when 6 variables are taken at a time. It is obvious and logically correct to support the conclusion, that when the important, necessary and sufficient variables like HH income, expenditure, returns etc., are considered, the irrigated villages has been observed to be at a higher level than the dry villages and the distance in also statistically significant.

Chapter. 6

MACRO LEVEL COMPARISON

To assess the importance of irrigation, 22 neighboring villages- 18 irrigated and 04 another mostly dry are compared in the previous chapters. To testing the assumption that whatever is true at the household level, may be also true at macro level, at macro level study is imperative.

The best alternative is to compare Shrigonda tahsil (which is fully irrigated) with a similar neighboring tahsil belonging to the same district. Such tahsil could be only Karjat (which is yet to be irrigated) and with Shrigonda. Only difference being the extent of irrigation, by the Kukadi Canal Project.

6.1: Data Base:

The Bureau of Economics and Statistics, Government of Maharashtra publisher every year a document, Tahsil wise called "District at a glance". This document contains data on 100 items, Tahsil wise; on different aspects of development. Such two documents are collected for ten years 2001- 2010 (where data is given for 2001-2010) and the latest year 2010. This year also corresponds to the reference year for this study 2010- 11. The agricultural data here relates to 2010-11. The population figures at tahsil level are compared between 2001 and 2010 (provisional). The livestock census and the agricultural census of land holding are compared between 2001 and 2010, as the latest 2011 livestock census has not been taken up. Thus the data would give a safe and meaningful comparison as the break even point is 2007, the year of release of water for the first time. Thus the comparison is two fold. Shrigonda tahsils compares (I) with itself between two points of time *viz*, 2007 and (ii) against Karjat tahsil during 2007-08 to assess the development (with respect to 20 indices) as a consequence of irrigation,

since irrigation is only the factor that is present in one tahsil and lacking in another.

6.2: Population:

In Shrigonda Tahsil the population was 2, 35,706 during 2001. The Tahsil has recorded a decennial growth rate of 29.22% during 1981, as against 25.52 % for Ahmednagar district. This can be explained by the fact that newly irrigated areas attract people from outside and equally avert out- migration. Whereas the dry villages contribute to out migration in pursuit of work. Most of the able bodied and eligible workers could have been out- migrated to the neighboring villages and towns either alone or with families, in search of livelihood; where as people, who have gone out earlier (prior to irrigation) or with families in search of livelihood; where as people, who have gone out earlier (prior to irrigation) might have returned to their villages due to availability of work and assured water and work.*

*SIET Institue (1972), Rajpurohit, A. R. and Venkata Reddy, M. (1978), Katti, A. P. and Hasalkar. J. B., (1971).

6.3: Density:

The related factor is density. The geographical area being constant, the increase in population, shows increase in density. For Shrigonda tahsil the density was 198 (2001) and it has increased to 243 (2011).

6.4: Rural Population:

The rural population was 93.7 % of the total population for Shrigonda tahsil during 2001. Though it has not come down very much, the trend is decreasing, with 89.2% in 1991. In spite of the fact that Shrigonda tahsil had two towns. Over a decade, the proportion of rural

population has come down to 73.8% in Shrigonda Tahsil. Thus the decennial change, of rural population, is more prominent in Shrigonda Tahsil.

6.5: Workers:

During 2001, percentage of workers to total population is observed to be 68.1% for Shrigonda tahsil; while it is more for district (46.9%), but after a decade, irrigated villages recorded an increase of 2.4% while un-irrigated villages recorded 2.8%. But in absolute terms the worker's population has increased by 34% in Shrigonda tahsil, as against 21 % in irrigated villages. This indicates that economically active population have increased in number, in irrigated villages, while those in un- irrigated villages have not, to the same extent. This phenomenon can be attributed to irrigation facility made available in Shrigonda tahsil, as irrigation requires more labour, due to intensity of cropping and extensive cultivation.

The breakup of workers by occupation has given more interesting results. It is quite evident from the figure presented in (Table 6.1).

Table- 6.1

Percentage Distribution of Workers - Occupation wise-

At Tow Point of Time

Sr. No.		Irrigated villages			Un- irrigated Villages		
	Occupations	% of total workers					
		2001%	2010%	Δ	2001%	2010%	Δ
1.	Cultivators	30.81	40.61	9.8	32.9	34.1	1.2
2.	Agricultural Labour	40.11	33.80	−6.3	45.6	46.4	0.8
3.	Household Industry	7.17	4.61	−2.6	6.3	5.2	−1.1
4.	Other Workers	21.91	20.99	−0.09	15.1	14.2	−0.9

The workers under different heads have recorded different growth, over the decade.

In irrigated villages, cultivators have improved their number over the decade (9.8%). Other sectors have recorded a decrease, the maximum loss is observed in agriculture labour (− 6.3%). This those agricultural labours (during 2001-2010) have become cultivators (land owners), thanks to irrigation in Shrigonda tahsil. People who were in the household industry earlier have also turned to agriculture by possessing land, as a consequence of irrigation. These observations have clearly shown the impact of irrigation on the change in occupational pattern of the earners. These workers who were earlier pursuing different occupations appear to be slowly converging to agriculture, after the onset of irrigation in their villages (SIET Institue, 1972). The important factor is that majority (40.6%) have become cultivators of which nearly ¼ are of recent

addition. This factor cannot be overlooked as, such a phenomenon is not observed in the un-irrigated villages, which is still a dry tract. In un-irrigated villages over the decade there are only marginal changes in the occupational (re) distribution, unlike in irrigated villages. There is a small change (increase) of 1.2% in cultivators of irrigated villages over the decade. Basically (2001) irrigated villages had higher percentage of cultivators than un- irrigated villages. But after a decade, irrigated villages overtook un- irrigated villages in this aspect. Agricultural labour has increased marginally in irrigated villages after a decade; whereas they suffered a loss (in number) in un- irrigated villages due to irrigation for, the once agriculture labour has become cultivators. The household industry workers have also suffered a loss in number in un- irrigated villages (2001-1991). The "Other workers" are observed to have lost equally in the two categories (0.9% each). But during 2001, the ' other workers' are more in irrigated villages (21%) than in un-irrigated villages (14%), because the tertiary sector would be less, in a predominantly rural area. This is supported by less of the primary workers (74.4 %) in irrigated villages during 1991, while they are 80.5% in un- irrigated villages.

Rural Workers:

So far the discussion and the presentation of figures are related to the overall situation *i.e.* pertaining to the urban and rural population and workers.

Now that the study region mainly belongs to rural area, it would be of special interest to study at macro level the rural workers i.e., between the two categories over time.

During the latest census (2001), cultivators are observed to be almost half (49.4%) of the total workers in irrigated villages, as against

37% for un-irrigated villages in the tahsil. Over time also, the increase in cultivators in irrigated villages is phenomenal *i.e.,* during 2001, the percentage of cultivators is almost the same for both the villages (35%) each. Over the decade, un-irrigated villages have recorded only 1.3% increases. This indicates that in irrigated villages, irrigation has attracted villages, irrigation has attracted more of cultivators from within and from outside. This is a common observation in other commands of Maharashtra also. The newly irrigated or potential of notified areas would fetch higher market rates. The average land holding size in the study area is around 5 hectors, and irrigation has further strengthened and consolidated the land. This is must for higher productivity. Thus what is expected is happening in this irrigation benefited tahsil Shrigonda.

Thus the overall position of change in occupation by workers in two categories, at two points of time and over time shows the consolidation of cultivators in the "irrigation benefited" Tahsil Shrigonda, while agricultural labour is on increase in the dry tract. As matter of fact, there is a reduction in the agricultural labour of Shrigonda tahsil and almost a corresponding increase in cultivators. The secondary sector seems to have maintained status quo or a slight increase. The increase is perceptible in irrigated villages (2.4%) over the decade, while that of un-irrigated villages in occupational structure over time can be said as a consequence of irrigation.

6.6: Consolidation of Land or Change in Land Holding Sizes:

In Maharashtra agriculture landholding census was conducted during 1991- 2001. They were to be conducted in 2006. Moreover data relating to LHS, Just before and after introduction of irrigation shows, how the distribution of LHS has changed as a consequence of irrigation.

Now that water has flown for the first time during 2006, the two available census figures would bring out the effect, if there is only.

Table- 6.2

Number of Cultivators (%)

LHS (Hects.)	Irrigated Villages			Un- irrigated Villages		
	1991	2001	Δ	1991	2001	Δ
< 1.5 hect.	24.9	24.7	+0.2	27.0	26.6	0.4
1.6 to 3 hect.	37.9	40.5	−2.6	38.4	39.4	−1.0
3.1 to 7 hect.	17.3	24.5	−7.2	20.8	21.3	−0.5
> 7 hect.	19.9	10.3	+9.6	13.8	12.7	1.1
	100.0	100.0		100.0	100.0	
Total	**8919**	**9358+10**		**28125**	**28685+2**	

Table- 6.3

Area (%)

LHS (Hects.)	Irrigated Villages			Un- irrigated Villages		
	1991	2001	Δ	1991	2001	Δ
< 1.5 hect.	4.4	9.4	−5.0	10.7	11.4	−0.7
1.6 to 3 hect.	24.0	29.2	−5.2	25.8	27.1	−1.3
3.1 to 7 hect.	32.1	31.8	0.3	27.3	29.1	−1.8
> 7 hect.	39.56	29.6	9.9	36.2	32.4	3.8
	100.0	100.0		100.0	100.0	
Total	**40989**	**40459**		**119296**	**116592**	
Land man ratio	**1:4.81**	**1:4.32**		**1:4.24**	**1:4.06**	

Table 6.2 gives the values in terms of percentage over each LHS for the total. For ready reference the total values are given in absolute figures.

To start with, the base comparison shows that there is an increase in the number of cultivators in irrigated villages to the extent of 10 % over ten years (with 2006) in between: the year of start of irrigation while in un-irrigated villages the increase appears to be quite marginal (2.0%). The total land under cultivation seems to have suffered a loss over time. The loss in cultivated area is more in un- irrigated villages (−2.3%) than in irrigated villages (−1.3%). Thus the pressure on land seems to be more in irrigated villages than in un- irrigated villages. The reason is obvious: irrigation. The land man ratio in these villages gives another dimension of the problem. Prior to irrigation, in irrigated villages, land available per head was 4.81 hectares. Higher than that was available in un-irrigated villages (4.24), during 2001. With an increase in cultivators (+10.0) and a decrease in the area (−1.3), naturally the pressure has mounted up on land, over time. This has resulted in the reduction of land available per head to 4.32 hectares in irrigated villages (almost half hectare reduction per head). In un-irrigated villages the number of cultivators has increased only by 2% and the land available has also been reduced by 2.3 % over ten years. Hence, the per capita land availability is reduced by only 0.18 hectares in un- irrigated villages, over ten years. Thus in the post irrigation period also (2006), with half a hectares reduction, irrigated villages still enjoys higher area per head (Table 6.3).

Thus the changes in number of cultivators, over different LHS in each village, reveals that drastic changes have occurred in irrigated villages, while the changes are almost nil or marginal in (dry) un-irrigated villages.

6.7: Study of Changes in LHS:

In the highest land holding size (7 + hectares) over time, with the change in generations, land reforms etc., the big land is divided among the family members (brothers) (Table 6.2). But the process seems to be vigorous in irrigated villages (−4.7%) than in un- irrigated villages (−1.1%). This is mainly due to the fallow land or hitherto non- cultivated land due to rain fed conditions, is being brought under cultivation, thanks to assured water. The very big lands plots which would not be cultivated for various reasons (finance, personal, physical, management etc.) are made into manageable small plots and are brought under plough. Such a need has not arisen in un- irrigated villages, so the division is at a slow phase. Almost status quo is observed to be continuing in un- irrigated villages, with least coefficient of variation ($\partial/\bar{x}$) (over LHS); the redistribution seems to be very effective in irrigated villages. This can be solely attributable to the onset of irrigation. In un- irrigated villages, the loss in the highest LHS can be found as gain in the lowest LHS. In the dry track, small marginal land holding are encouraged and the transactions are still on, which is not praiseworthy.

(Table 6.4) Reveals, the redistribution of area in two categories of villages over time. Highest LHS (7 and above hectares) is observed to have lost as much as 10% of its area, over 5 years. Thus big land lords, not only in number but area wise also, suffered a big loss. What is applicable for redistribution of cultivator, equally applies to land also.

Though maximum number of cultivators have moved out of the lowest LHS (0-7 hectares), the area seems to be unchanged, over 5 years. The addition is maximum in (3-5 hectares) class. This is understandable, as land value goes up, due to introduction of irrigation. The local farmers sell that part of land which they have not been cultivating so far as they can make money and invest on the remaining land and make it suitable

for irrigation. The land they are ready to part with cannot be more than 5 hectares on an average. In the next higher class (> 7 hectares) the addition to the area is observed, but to a lesser extent (3.2%). Management of big land on the face of it is very difficult and it would be much more difficult when the land is brought under irrigation. The land is also not at one place (fragments). Those plots, which are, on the outskirts of the villages, are generally kept as follows. Hence they would be disposed of at the first instance.

Rank correlation the changes in area and changes in number of cultivators, for each village. The (+) ^{ve} value for irrigated villages 0.89 is found to be significant at 2% *i.e.,* while that of un- irrigated (0.71) has missed the significance. Thus irrigation has helped redistribution of land and cultivators, for better is not much of perceptible change in un-irrigated villages.

Table- 6.4

Land Utilization and Irrigation

Sr. No.	Use Type	Irrigated Villages		Un- irrigated Villages	
		2001	2010	2001	2010
1.	Total geographical Area (hect.)	19032	19032	4967	4967
2.	Forest	4.75%	4.75%	14.3%	14.3%
3.	Land not available for cultivation	3364	3376	1046	996
4.	N.C. land / fallow	2860	3540	1240	1310
5.	Net area sown	14488	13230	3017	2912
6.	Net area irrigation	4162	4425	683	692
7.	% of irrigation (by canal)	73%	76%	--	--
8.	Tanks	28%	35%	10%	8%
9.	Wells	37%	32%	75%	64%

6.8: Land Utilization and Irrigation:

The total geographical area in irrigated villages is 19,032 hectares as against 4,967 hectares of un- irrigated villages.

During 2001 the net area sown, (as % to the total geographical area) was 76.12% for irrigated villages, while it was 60.74% in un-irrigated villages. Surprisingly, after irrigation, in irrigated villages the net area sown has come down to 69.51% and in un- irrigated villages the net area sown has marginally come down to 58.62 %. This may be because these lands, which were cultivated under rain fed conditions so far, are on higher altitude, away from canal, not economical and on outskirts of the villages, hence might have been discarded for cultivation even after the introduction of irrigation. Thus there is a slight reduction in the net area sown in irrigated villages, during 2001. The existing 69.51% land, which is shown, can be said to be fully utilized. But only 2.12%

reduction in net area sown in un- irrigated villages has no impact on the already existing rain fed cultivation.

In irrigated villages around 22% of the net area sown was irrigated during 2001 and it has gone up to 24 % during 2001. While in un-irrigated villages the area under irrigation was 13.75% during 2001 and it has gone up to only 13.93% during 2010. Out of 13,230 hectares irrigated by canals. (During 2010) 76% is irrigated by canals. Whereas in un-irrigated villages canal irrigation facilities not found, while 64% is irrigated by wells. Wells were 1057 during 2001 and they have gone up to 1265 (20% increase). Whereas, the number of irrigation wells continued to be 1830 in irrigated villages. Thus canal irrigation is predominant in irrigated villages whereas well irrigation is quite popular in un- irrigated villages, within the limited sense of the term. On he basis of he facts and figures presented above, irrigated villages (with 23.25% of irrigated area) as against (13.93% irrigated area) un- irrigated villages with more similarities is comparable for the differentials in development and whatever be the differences, can be attributed to the important and major difference *i.e.* irrigation.

Table- 6.5

Crop Pattern: (%) Area

	Irrigated Villages		Un- irrigated Villages	
Crops	**2001**	**2010**	**2001**	**2010**
Jowar	23.7	20.2	35.1	38.4
Bajra	19.4	16.4	17.4	19.1
Wheat	23.6	27.3	9.3	12.2
Sugarcane	32.9	42.6	5.5	6.3
Groundnut	4.6	5.6	2.1	2.5
Pulses	3.2	5.1	0.9	0.8
Area under HVY	10.5	7.3	1.1	1.3

6.9: Crop Pattern:

In these two categories of villages major cereal crops are jowar, bajra wheat and sugarcane, Tue, gram, vegetables and some other pulses are also grown. Considering the share of crops in the increase in irrigated area, there is an indication of a shift in crop pattern. Food grains as a whole have shown a declining relative significance, in spite of improvements in the shares of crops like wheat, sugarcane, bajra (Nadkarni, M. V, 11-12 pp., Impact of Irrigation; *op. cit*).

During 2001 the area under cereals and pulses was 70.6% of the total net area sown in irrigated villages. Of which wheat was 23.6% jowar 23.7% and pulses 3.2. After ten years, the area under food grains has just gone up by 1%. The gladdening factor is the area under pulses has gone up which is the need of the hour.

In un- irrigated villages, the area under food grains was lesser (48%) than the corresponding area in irrigated villages (70.6%). The area under jowar is comparable, but the area under wheat and pulses is to less (for 2001). Jowar, a traditional and subsistence crop, is grown in

maximum possible area under rain fed condition. Though the yield is not encouraging, it is sufficient for self consumption for most of the cultivators. After ten years the area under food crops has come down in un- irrigated villages by 7.1%. This could be due to high commercialization. Food grains, with a low yield, low marketable surplus and low market prices are not remunerative to be grown on all the areas benefited by irrigation (canal or well). After under food grains has also come down, to accommodate subsistence requirement. Other areas are diverted to raise commercial crops.

Sugarcane have improved their position to 32.9% from 42.6% in irrigated villages; over ten years. Under Kukadi Canal 20 % of irrigated area is specially earmarked for 'two season crop' like cotton and lemon. So, the area is fully utilized during 2001 in irrigated villages. Overall commercial crops have improved their position to 27.7% (2010), as against 19.5% (2001). Miscellaneous crops have covered a considerable (10%) area sown during 2001, and it has been reduced to the nearest minimum of 0.7% during 2010, after effect of irrigation. After the onset of irrigation, people cannot afford to waste land under nonremunerative and long duration crops (Table 6.5).

In un- irrigated villages food grain crops were occupying almost half of the net sown (62.8%) during 2001. Groundnut and sunflower being the Oil seed crops, is grown under wells (number of irrigation wells; very high (1057) and area irrigated under wells is 75% in un-irrigated villages. People have grown cotton, groundnut and linseed. However, overall area under commercial corps has also suffered a loss of 10 % over ten years in un- irrigated villages. Miscellaneous crops have taken a very important role to the extent of 20 % of the net area sown. Thus the diversification of land is more evident in un- irrigated villages which is almost nil in irrigated villages.

Thus irrigation (76% in irrigated villages, 12% in un- irrigated villages, 12 % in un- irrigated villages) has its impact on crop pattern also in sample villages. As Kukadi Canal Project is basically protective in nature, the tahsil being a drought hit area over years, people are supposed to grow sufficient food crops to tide over the drought situation and develop self sufficiency reliance in food grains. This is what is being done precisely in irrigated villages while land is not put to proper optimum use in the dry track of un- irrigated villages in Shrigonda tahsil. The yield rates are also different in the two categories of sample villages.

6.10: Markets:

The increased production, obviously leads to increase in market surplus. This has to reach a point for sale. Regulated markets and sub-markets are some of the important points, other than private points. The turnover by regulated sum main markets at two points of time *i.e.*, 2001 and 2010 brings out very interesting facts. During 2001 only 48 lakh rupees worth of transactions took place at irrigated village's regulated market. While it has gone to a fourfold increase during 2010 speaks volumes for agricultural development in irrigated villages. Unfortunately the related data for un- irrigated villages (2010) is not available to market a ready comparison.

6.11: Implements:

Number of agricultural implements used were 15,413 during (2001) in irrigated villages *i.e*. 0.37 % hectares of the sown area. They have gone up to 18,418 during 2010 *i.e.,* 0.47% hectares. This goes well with the wet cultivation. While the picture is discouraging in the (dry) un-irrigated villages. During pre irrigation period, both villages have almost same ratio of agricultural implements vs land cultivated (0.38). But after

ten years, as observed earlier, number of cultivators has come down and the agricultural labour has increased in un- irrigated villages. Hence agricultural implements used per hectare in un- irrigated villages has also been reduced to (0.30)

Table- 6.6

Ten Year Change in Livestock Position

	Irrigated Villages			Un- irrigated villages		
Livestock	**Δ%**	**2001**	**2010**	**2001**	**2010**	**Δ%**
Cattle	29	40266	47467	16093	12503	5
Buffaloes	20	20768	21338	6061	5032	3
Sheep	7	19671	24663	8326	7792	5
Goats	4	28894	27186	11636	12165	-
Poultry	1	24781	23246	4426	4916	-
Net area	-	19032	18706	4967	4977	-
Population	-	32609	47563	4889	6903	-

6.12: Live Stock:

The index based on per hectare comparison has brought into light, interesting observation i.e. the per hectare availability of cattle has gone up in irrigated villages (0.30 to 0.41) while in un- irrigated villages it is down (0.36 to 0.34). This itself stands as an important contribution of irrigation in irrigated villages. So also, the bullock power has recorded on decrease in irrigated villages (0.15 to 0.12) while in un- irrigated villages it is marginal (0.17 to 0.18). Sheep and goat heads have also increased per hectare in irrigated villages while poultry had a very marginal decrease. In un- irrigated villages goat and poultry had recorded increase, over time. Thus it can be concluded that irrigation has a bearing on the development of livestock, though indirectly to a large extent. Irrigated village's bears a testimony for the same, as against a (dry) un- irrigated village. The growth of livestock in un- irrigated villages can be treated as

‘ natural’ without any extraneous factor, while in irrigated villages, it can be attributed the ‘inducing’ factor- irrigation (Table 6.6).

6.13: Electrification:

The number of villages, electrified is another indicator for development. During 2001-02 all 18 villages were electrified. But household wise electrification in irrigated villages (2001) 53% households are electrified, their number has gone up to 94% during 2010 *i.e*., 41% more of the households got electrified over the ten years of post irrigation in sample irrigated villages. In sample un- irrigated villages 47 % of the household were electrified during 2001, and another 14% were electrified during the later ten years period. Thus the development is faster in irrigated villages. This fact is clearly borne out by number of villages, yet to be electrified in two categories of sample villages. They are only 2 % in irrigated villages while they are 8% in un- irrigated villages.

Table- 6.7

Registered MV and Road Length (Km.)

	Irrigated Villages		**Un- irrigated villages**	
	2001	**2010**	**2001**	**2010**
Registered MV	453	1526	141	705
Road length (Km.)	1240	1465	320	379

6.14: Motor Vehicles and Roads:

When once agriculture production reaches the optimum peak level, the movement of grains also goes up towards towns and markets. The people, as well as the agriculture produce should move towards markets- the people may go many times for (fetching) inputs, credit, for meeting the extension agents etc., this is another indicator of development

prosperity. This is shown by two factors (i) number of registered motor vehicles while the number of registered motor vehicles was only. 453 during 2001 in irrigated villages they have gone up to 1526 during 2010, 380% increase. This testifies the manifold increase and need for movement of people. Comparatively in un- irrigated villages the vehicles were 141 during 2001, their number has gone up to 705 *i.e.,* 160% increase for 2010. Either absolute number or the increment, over ten years, have shown how rapidly, the vehicles have increased in the newly irrigated villages, as against the natural growth in un- irrigated villages, (ii) another indicator is the pucca road length = existing and newly laid in these two categories of villages. The road newly laid has shown 224% increase in irrigated villages as against 140% in un- irrigated villages between March 2001 to March 2010. Another way of looking at this developmental aspect is the rood length (Kms) per 100 Km. area of the sample villages. The road length was 20 Km / 100 sq. Km area in irrigated villages during 2001 and it has tremendously increased to 44 Km/ 100 sq. km in 2010. To start with in 2001, in un- irrigated villages also, the figure was almost the same as irrigated villages (21km/ 100sq. Km) this vast difference in the most important developmental activity testified the urgent need felt by irrigated villages people to reach out to improve their prosperity (Table 6.7).

Table- 6.8

Percentage of Literacy

Sex	Year	Irrigated Villages		Un- irrigated Villages	
Male	2001 2010	48.7 53.8	5.1	52.0 56.8	4.8
Female	2001 2010	18.4 22.2	3.8	17.6 24.1	7.5
Overall	2001 2010	33.5 38.0	4.5	34.6 40.3	5.7

6.15: Literacy:

The literacy levels are compared, to know how they have changed over time between the categories of sample. Villages. The overall figures are higher in un-irrigated villages (during 2001). In un- irrigated villages, the percentage of literates are 40.3 as against 38.0% in irrigated villages both the values are observed to be lower than the district figure (42.16). But relatively un-irrigated villages have a higher literacy rate. During the last census (2001) irrigated villages had only 33.5% literates, while un-irrigated villages had 34.6%. Thus education could be said to be of slow pace in irrigated villages. Between male literates, irrigated villages seem to have a very thin edge over un- irrigated villages. The decennial increment was 5.1 in irrigated villages as against 4.8 for un-irrigated villages. Un- irrigated villages an overall literacy rate of 40.30% as against 38.00 % of irrigated villages. While male literates are 56.8% in un- irrigated villages they are 53.8% in irrigated villages. For female literates, the gap between the two sample village categories figures is still wider; 24.1% of un- irrigated villages and 22.2% of irrigated villages (Table 6.8).

This is further supported by the number of educational institutes available in some sample villages, at two points of time. The ratio (school: student) is found to be 1:242 during 2001 in irrigated villages and it has further deteriorated to 1:298. Actually with progress of time and development, the number of students for school should come down. Not much of additions took place in un- irrigated villages. It was 226 students per school during 2001 and it has gone up to 251 during 2010. These figures are discouraging and could be one of the important reasons for low literacy. Unless more schools are opened, the enrolment cannot be expected to go up.

6.16: Role of Co- operative:

For the 13,230 hectares of net area sown in irrigated villages (2010) the membership of 8000 in agriculture credit co- operatives society is quite high ; while in un- irrigated villages 2912 hectares are cultivated and 880 membership is recorded.

In irrigated villages Rs. 66.7 lakhs are reported to have been advanced under short term as against Rs. 12.6 lakhs in un- irrigated villages (as on 30/06/2010) each member got Rs. 833 in irrigated villages while a member in un- irrigated village's got Rs. 177. This shown the need and turnover in irrigated village's society which is a true reflection of the intensified activity going on there. The other way of measuring the usefulness of the co- operative societeis credit scheme is; how many rupees are advanced for each hectare of area sown. It is Rs. 170 in irrigated villages against Rs. 36 in un- irrigated villages. This also shows how the money taken for agricultural purpose is put to proper use (as not much can be done with Rs. 36 per hectare in agriculture neither input not wages can be met with this meagre amount). The medium and long term loans are in higher magnitude in un-irrigated villages when compared to

be the corresponding futures for irrigated villages. The reasons for these loans can be well digging, which is obvious.

6.17: Primary Land Development Bank's Role:

The primary land development bank advances loans for the activities related to land development. They have got a specific amount worked out for hectare depending on the slope of the land to be leveled. The development is a must and a must and a precondition before water is let into the fields. Hence this activity seems to be very brisk during 2001, the year just before the actual release of the water through Kukadi canal project, at least in the higher reaches of the canal. That is why in irrigated villages PLDs has advanced as high as Rs. 10 lakhs during 2001. This helped farmers to make their lands suitable to receive water and they have received the benefit of irrigation. That year in un- irrigated villages also PLDs have advanced Rs. 1.5 lakhs may be to buy pump sets and improve lift irrigation. With time, as most of the notified area is brought under irrigation, during 2010, in irrigated villages only Rs. 1, 96,000 are advanced for this activity. Un- irrigated villages being the neighboring and upper villages to irrigated villages. (So far as canal flow is concerned) gets irrigation canal water to irrigated villages. Taking into account the impact of inflation and leisurely manner in which land development activity is going on in un-irrigated villages, during 2010 also primary land development bank has advanced Rs. 2.8 lakhs. This could be for lift as well as canal irrigation.

6.18: Health Facilities:

With no hospital, 8 dispensaries, one each of primary health center, Primary Health unit and Family welfare centers (as on March 2010) and total bed strength 74, it need not be said that Shrigonda tahsil is very

poorly served with the medical facilities. For 214060 populations the above mentioned medical facilities can be treated as practically nil. With only one hospital, two each primary Health centers and family welfare centers and one primary health unit with a total bed strength of 10 beds in u-irrigated villages, serving 5,089 people is deplorably inadequate. It would be meaningless, to derive any indices for comparison, as the facilities are too meagre to be compared.

Macro comparison (basic, financial, social, infrastructure items) between the two categories of sample villages, at two point of time, it is evident that irrigated villages seems to have an edge over un- irrigated villages in most of the developmental indicators. This has further corroborated the findings at the micro level (household level) that irrigation is the cause to effect positive changes in the region, benefited Kukadi Canal Project. The benefited Kukadi canal project. The benefit is quantified and is felt observed in general (tahsil level) and in particular at household level. Thus the two tier comparison rules out the chance element if any i.e., the changes in the variables studied could have been due to chance or fluke. The micro level and macro level comparison and the corroboration of the results confirm that the positive or fast changes in irrigated track (over dry track) are mainly due to irrigation, which is the only limiting facto, while in all other aspects, the two villages in Tahsils are similar.

Table- 6.9
Variables and Symbols used

Sr. No.	Variables	Symbols used
1.	Land Holding Size	LHS
2.	Work Participation Ratio	WPR
3.	Numbers	N
4.	Significant	SIG
5.	Rabi	R
6.	Kharif	K
7.	Jowar	J
8.	Bajra	B
9.	Sugarcane	S
10.	Gross Returns	GR
11.	Farm Business Income	FBI
12.	Returns to family Labour Management	RFLM
13.	Non- Food	NF
14.	Observed	O
15.	Expected	E
16.	Household	HH
17.	Human Labour	HL
18.	Animal Labour	AL
19.	Fixed Cost	FC
20.	Variable Cost	VC
21.	Primary Land Development	PLD
22.	Standard Normal Variables	SNV
23.	Marginal Value Products	MVP
24.	Geometric Mean	GM
25.	Command Area Development Authority	CADA
26.	Public Private Partnership	PPP
27.	Primary Rate Interface	PRI
28.	Foreign Direct Investment	FDI

Source: By the Research Student

Chapter. 7

CONCLUSION, PLANNING FOR FURTHER DEVELOPMENT AND SUGGESTION

7.1: Conclusion:

In Maharashtra state agriculture provides employment for 75% of the total population and it contributes 46.4% to the state income (Economic Survey, 1980, Bureau of Economics & Statistics, Govt. of Maharashtra, Bombay). Maharashtra state has got only 33 lakhs hectare of the net area cultivated under irrigation as against the country 17% the main / major source of irrigation being canal (40%). The state has been a food deficit state, with frequent, recurrent and chronic famine districts. One such district an Ahmednagar where the local resource, Godavari and Bhima rivers.

There are innumerable references and studies in India and abroad to show that irrigation a necessary and sufficient condition, improves the yields to two or three times over the dry farming, in judicious combination with other inputs; irrigation assures water, certainty of outcome, reduces the instability of outcome, reduces the instability of yields, shift in crop pattern from coarse grains to commercial crops, multiple cropping, increases the effective area under cultivation, whereby the regional disparities in development could be removed lessened.

Thus agriculture development, coupled with assured water would go a long way to open new vistas of development in rural areas. Though agriculture is a component of complex, multifaceted and multi dimensional rural development, its importance and or role is most prominent, needs no gain saying. This study aims at studying the overall impact and effect of improving irrigation on the agricultural development in particular and rural development, as a consequence, in general, as

experienced in two categories of sample villages under Kukadi Canal Project command area of Shrigonda Tahsil, in Ahmednagar district in Maharashtra State.

To study whether irrigation improves the standard of living of the rural masses and helps the rural development, this study aims at reviewing the impact of irrigation on rural development, through the development of agriculture under an irrigation project. The study aims at quantifying and linking the interwoven characteristics of development with irrigation as the starting point for the around development of the rural areas.

The main objectives are to study in depth how irrigation holds the key for agriculture development and consequently rural development at micro level (households of cultivators).

At the cultivator household level, some topics are taken up for in-depth study. The following topics are, by no means exhaustive but felt to be sufficient to assess irrigation impact. The study aims at observing the changes in the post- irrigation period in the;

1. Work participation of own / family female labour.
2. Attendance of the school going children (4-15 years) either to school or for work.
3. Area under cash crops; sugarcane, pulses, oil seeds, cotton, lemon.
4. Use of inputs *viz*., on time and in sufficient quantities, thus minimizing the wastage.
5. Optimum (own hired) labour usage.
6. Intake of quality foods (milk, meat, ghee etc.)
7. Proportion of (per capita consumption unit) expenditure on non food items in the total expenditure.
8. Per capita income; overall and source wise
9. Indebtedness and its impact on agricultural production

10. Housing conditions and availability of amenities facilities (household wise)
11. Position of people with reference to poverty line.

At macro level irrigated villages is compared (over time and extent of benefit derived) with the neighboring dry village. Secondary information is collected on important variables which can be quantified; changes in literacy, population, employment, land use, crop pattern, agricultural implements, social infrastructure, communication, connectivity etc. this is supplemented by personal observation and opinions expressed by various local leaders of the sample villages.

Limitations:

(i) Only one year reference period (though rainfall was normal and not a drought year). It is not safe to generalize from the results obtained and conclusions arrived at, on the basis of only one year's inquiry, though the year of inquiry coincided with adequate rainfall in both villages' categories. To that extent the difference in output between irrigated and un- irrigated villages, which might have been noticeable, in an otherwise drought year is mitigated;

(ii) Study is not follow- up but cross- sectional in nature;

(iii) Memory bias of the respondent: as the data for a full agricultural year was collected in one or two sittings, during 2002 for the agricultural year 2001-02.

(iv) Generally the tendency is to overestimate the income and production. This is overcome to a great extent by cross- checking the villages level data (check list) and personal observation.

A considerably big village, with careful consideration of population, area targeted for irrigation, actually sown and actually irrigated, number of cultivator's households, location *i.e*. away from the urban influence etc. is ultimately selected as the experimental villages. Another neighboring mostly dry village is selected to serve the purpose of control. Excepting irrigation both the villages (experimental and control) have similarities in all respects like soil, climate, temperature, rainfall, sociological, economic, ecological and cultural factors, farm practices and other factors farm practices and other factors essential to farm business.

By adopting the probability proportional sampling technique with main thrust on land holding size, 1105 cultivator sample households from irrigated villages and 175 cultivator (dry) sample households from control un- irrigated villages are selected from the up to date khata book, available with the village accountant (a revenue official).

7.2: Planning for Further Development:

In 22 sample villages, as it is common in Shrigonda Tahsil region, Maratha and Mali caste is dominant in the population (so also in sample) followed by Scheduled castes.

In irrigated villages, the family labour participation has come down, with an increase in the land holding size especially that of female labour. Whereas in un- irrigated villages, for almost all land holding sizes the work participation by sex and age is uniform.

In the older (+56 years) age groups, the literates are observed to be more in irrigated villages. So also in the real school going age group *viz*., 5-10, 11-14, 15-20 years. Irrigated villages have recorded higher percentage of literates over un- irrigated villages. This shows that affluence (new riches) has helped the younger generation in irrigated

villages to be sent to school, instead of work - a realization to the parents of today, of the importance of education.

In irrigated villages, irrigated by Kukadi Canal Project, (in sample) 76% of the area cultivated is irrigated. Majority of the farmers (78%) are reported is irrigated their land to the extent of “50% and more”. Land holding size- wise small farmers have brought more area under irrigation. This aspect is further testified by negative correlation between land holding sizes and percentage area irrigated.

With Jowar as the leading crop, mixed crops are also popular with 8% area under them. Crops during Kharif season are still not popular (only 16% of area) as against 40 % area allotted. Sugarcane has stood the challenge and is popular with 42.6 % of the cropped area, against (28% area allotted). Farmers are observed to have recognized the need of the hour and are cultivating pulses and oil seeds.

In un- irrigated villages there are no Kharif crops, but only mixed corps; Area under food grains is not so high. Jowar is raised as a food grain crop with 38.4 % area under it. In the higher land holding size food crops, pulses as relay crops, are prominent.

Returns per hectare in irrigated villages have given sugarcane the top rank, followed by wheat, Jowar and Bajra, as nobody grows Jowar on commercial proposition.

Money (working capital) invested per hectare is observed to be increasing with farm size. The overall ratio of returns to investment is 1.20 in irrigated villages, while it is 0.21 in un- irrigated villages. For sugarcane 2.66 in irrigated and 1.66 un- irrigated villages.

Proportion of family labour participation is declining with increasing land holding size; with negative correlation in irrigated villages. But is un- irrigated villages, there is no decline in family labour participation with increase in farm size. Area cultivated by bullock pair is

more in un- irrigated villages indicating the number of operations and the intensity of cultivation.

Out of pocket expenses (overall) are to the extent of 47 % (of the total input costs) in irrigated villages, while OPE is 41% in un- irrigated villages. Out of pocket expense is found to be increasing with farm size.

Gross and net revenue (per hectare) are found to be increasing with land holding size. The percentages of profits are different in two sample village categories: 16% irrigated and 12 % un- irrigated villages.

Use of family labour is considerably productive in irrigated villages and to a lesser extent in un- irrigated villages. The overall labour productivity is more in irrigated (20.3) against un- irrigated villages (19.3)

Average asset value per farm (household) is Rs. 44,386 in irrigated villages against Rs. 24, 178 of un- irrigated villages wherein land is the single, major contributor (90 %) in both the sample villages.

The draught power has increased six fold between the 1st and highest land holding size in irrigated villages. Milk animals are present in all land holding sizes (especially so, in lower land holding size). The production is (milk, dung, calves) used for different purposes: for sale in lower land holding size and for own use in higher land holding size. In un- irrigated villages draught animals are not many but they are treated as a source of income.

Many farmers are borrows, and the private money lender in holding his carts. Next in importance is the co- operative society, while bank's role is insignificant due to the procedural difficulties. The borrowers are more in un- irrigated villages (than in irrigated villages). The main purpose for going in for loan, for majority of the cultivators, is agriculture and related activities. Some of them floated loans for private reasons (marriage, education etc.) also. The ratio of debt to asset is low in

higher land holding size of irrigated villages, but the ratio (overall) is more in un-irrigated villages because of poor assets.

The household income is more in irrigated villages (Rs. 3,790) than in un- irrigated villages (Rs.2, 052). Within irrigated villages highest land holding size has 3 ½ times annual household income than the smaller land holding size, major source of income is through labour and then from livestock. Agriculture replaces labour as a source of income with progressive farm size. Small farmers of irrigated villages thus cannot solely depend on farm income but depend on livestock and labour for livelihood. In dry cultivation, the diversity of occupations and hence sources of income varies, unlike in wet village.

In irrigated villages, there is a positive and significant correlation between per consumption expenditure and land holding size. Percentage of expenditure on nonfood items has not crossed 20% even in the higher land holding size. In absolute terms, per consumption unit per annum expenditure for irrigated villages is Rs. 1716 (food 1476 + non- food 240) against Rs. 1121 (F 932 + NF 189) for un- irrigated villages. In the non – food expenditure, clothing appears to have taken the major share, while travel and fuel are other important expenditure.

An exercise to identify the households below the poverty line; with Rs. 1600 per head per year expenditure as the dividing line in the 22 villages 31% and un- irrigated villages 9 % of the households are observed to be above poverty line. There are also some border line cases, falling within 20% allowance range. They are identified and included in the group. Thus another 33 % in irrigated villages and 12% in un-irrigated villages are pushed above the poverty line. More households are above poverty line in irrigated villages than in un- irrigated villages.

Average number of rooms available per household is 2.40 in irrigated villages. From 6 member household onwards, the numbers of

rooms are above the 'village average' in both the sample villages. Mostly mud is used for wall, roof and floor. But of late, wood and stone (cement, bricks) are being used. Which shows the affordability and awareness of the irrigated farmers?

Thus basically the traditional way of life is continuing in both the villages while in irrigated villages some attempts are being made to move towards way of living.

In order to confirm whether these results are due to irrigation or by chance, macro level categories of sample villages is attempted. The comparison is between the two categories at two different point of time and the same Tahsil over time i.e. five years before the release of water (2001) and another latest (2010). This irrigated villages is compared with un- irrigated villages is compared with un-irrigated villages (at 2001) and again during (2010). Once again irrigated villages are compared between 2001 and 2010. Thus the differences observed if any, between un-irrigated and irrigated villages can be attributed as due to irrigation. Secondly when irrigated villages are compared between two points of time (before and after the introduction of irrigation) in a follow-up way, the differences can be attributed to irrigation.

Total population has recorded a decennial growth rate of 25.8% in irrigated as against 13.1 % in un- irrigated villages. While for the Tahsil the figure is 25.5%. The high value in irrigated villages may be natural and also due to immigration. Obviously the density of irrigated villages is also more. The general observation is that percentage of rural population is on decline in the two categories of sample villages between 2001- 2010 (2.5% in irrigated villages; 2.1 % in un- irrigated villages). Percentage of workers to total population is the same in both the categories during 1991 and the decennial change is also almost the same (un- irrigated villages 2.8%, irrigated villages 2.4%). When growth in workers is compared,

irrigated villages have registered an increase of 34% as against 21% in un- irrigated villages between 2001 to 2010.

Occupation wise, there is an increase in cultivators to the extent of 9.8% in irrigated villages (2001-2010) whereas it is less in the agricultural labour (−6.3%), household industry (−2.6 %) and other workers (−0.9%). Thus it can be understood that there is a readjustment among occupations i.e., the gains in the cultivators are almost half of the total workers in irrigated villages as against 37 % in un- irrigated villages. Over the decade they have recorded only 1.3% increase in un- irrigated villages while in irrigated villages it is 14.7 %, which speaks volumes about the impact of irrigation on the occupational changes - from non - agriculture base to agriculture base. Sex wise also this behavior is observed to be valid.

Agricultural labour is more in un-irrigated villages while cultivators are more in irrigated villages during 2001 and 2010. The increase in agricultural labour in irrigated villages over decade is about 10 % while in un- irrigated villages there is no perceptible increase. Female agricultural labour has recorded a reduction in irrigated villages between 2006 – 2010. This is due to the fact that economic escalation prohibits women from agricultural labour work whereas in un- irrigated villages, the figures continue to be the same at 2001 and 2010. Other workers have also recorded an increase in irrigated villages. Proving the point that, when the primary sector develops, it will certainly have impact on the tertiary sector too. The related infrastructure like transport, trade, communication, commerce etc. develops as a consequence of the development in agriculture. Thus the overall picture shows that the primary sector has consolidated its position in irrigated villages after the inflow of irrigation.

There is an overall increase of the cultivators in irrigated villages by 10% while the increase is only 2 % in un- irrigated villages, between the two censures (2006 to 2010). There is a great loss of numbers in (0 + 1.5) hectare class (−7.8%) and in above >7 hectare class (−4.7 %) in irrigated villages. This shown that large farms have made their plots into viable and economic units as a consequence of irrigation. While in the middle land holding size (1.6 - 3 hectare class) there are gains ; In un-irrigated villages between two censuses, in each land holding size, the change is quite marginal; the biggest land holding size losing only (−1.1%).

Man – land ratio was1: (4.82) in irrigated villages during 2001 and it has come down to 1: (4.32) during 2010 indicating the pressure on land i.e. 0.5 hectares loss per head. But in un- irrigated villages the loss per head is observed to be 0.18 hectares only. The area in each land holding size has increased in irrigated villages during 2006 over 2001. But the loss is terrible in the highest land holding size (−9.9%), while the maximum gain is observed in 3.1 to 7 hectare class (+5.2%) In un-irrigated villages though the highest land holding size has suffered a loss (−3.8%) of area, the gain is not substantial in any other class. Very little changes are observed in other lower land holding sizes. This is because dry cultivation does not require dry cultivation does not require any economical viable unit of land.

In irrigated villages, during 2001 only 26% of the net area sown was irrigated, while it was 6.3% in un-irrigated villages. With time, this figure has touched 76% in irrigated villages, but in un- irrigated it is almost the same (07%). The source of irrigation in irrigated village's canal; (78%) of irrigated area is under canals, whereas in un- irrigated villages well; (68%) irrigated the lands and canal (0%).

In irrigated villages the area under cereals was 70.6% in 2001 and it has gone up be 1% 2010. Where as in un- irrigated villages it was 48% and is now 41%. Pulses, oilseeds, sugarcane have improved the area under them to 17.7% from 19.5% in (2001) in irrigated villages the commercial crops (groundnut, lemon) have lost their area by 10% (17 % to 7 %) over years. This shows the diversification of crop pattern to withstand the vagaries of the monsoon and survival.

The regulated market's turnout has increased by four fold in irrigated villages between 2001-2010 which speaks volumes about the production, market surplus available at the regulated markets, in addition to many more non- official channels.

Agricultural implements available per hectare have increased in irrigated villages over time, while they have recorded a decrease in un-irrigated villages.

The number of villages electrified between 2001 and 2010 is more in sample irrigated villages and also the sum total is 94 % as against 91 % in sample un- irrigated villages.

The movement, (grains and persons) from villages to the nearest markets to sell the produce or to bring inputs, can be measured indirectly by the road length land number of vehicles available. There is a tremendous increase in the number of motor vehicles registered in irrigated villages between 2001 and 2010. It is an unprecedented record of 380% while in un- irrigated villages the increase is observed to be 160 %. Thus in absolute number and increment, un- irrigated villages is no match for irrigated villages in this aspect. Pucca road length (newly laid) is also more in irrigated villages (224%) as against un- irrigated villages (14%). Road length (Km) 100 sq. km in irrigated villages has gone up to 1,240 km from 1,465 Kms over ten years whereas it was 321 Km (2000)

and it 379 Km (2010) in un- irrigated villages. The fast development can be attributed as due to irrigation.

Rural figures show that overall literacy in un- irrigated villages as 39% as against 37% of irrigated villages. The existence or development of schools in both the sample village categories, at two points of time is very discouraging.

Membership in cooperative societies is almost the same in two samples. Categories, against the area cultivated. But the amount advanced per member is more in irrigated villages (Rs. 833) than un- irrigated villages (Rs.171). Per hectare figure are also more for irrigated villages. Thus the usefulness and proper utilization of loans in irrigated villages is obvious, indicating the intensity of agricultural activity going on there.

Primary Land Development Bank's main role is to see that land is developed well in advance before canals are ready to receive water. So its activity was brisk during 2001 in irrigated villages. But it has come down in 2010. In un- irrigated villages the advances by primary land development bank continue to glow due to dry cultivation, which requires money although.

To sum up, canal irrigation in certain parts of the command area land to substantial increase in agriculture production increased income, employment opportunities, greater division of labour, and occupation specialization, increasing consumption, improved living conditions, social, geographic mobility were set in, in other wise static society, thus initiating a process of social change (Alexander, K. C. 1980).

In fine at the summing up of the findings, one is lead invariably to the conclusion that irrigation has played the role successfully in transforming the once dry villages to prosperity. Though generalizations at this stage may be dangerous, reliability of the observations under similar circumstances may be quite possible in this command area.

In fine, for the better and optimum utilization of canal irrigation by irrigated village's farmers, some suggestions are given here in which go a long way for the self sufficiency and overall rural development.

Implications:

i) In such cases as the study region, where the irrigation is protective in nature, more should be done for the improvement of dry cultivation and nonfarm activities to complement the benefits arising out of irrigation. The judicious combination (spread effects) will help the entire region to develop uniformly (balanced development) otherwise some pockets will develop, amidst poverty belts leading to social tensions;

ii) Canal system should be improved with lining to avoid the wastage due to seepage and to improve the distributor efficiency.

iii) Proper drainage system should be adhered to and the water logged areas should be reclaimed;

iv) Along with adequate irrigation, farmers should be properly trained to adopt package practices and modern agricultural implements to reap the benefits quickly and continuously;

v) More and more involvement of farmers in the extension activities *i.e.,* the land leveling, on farm development and water management activities is a must, to have higher returns per unit of water used;

vi) In time release of water by the irrigation department otherwise late sowing results in low yields; and

vii) Improvement of market and warehouse facilities, financial institutions to replace private money lender; the villain of the piece.

The systemic purposive sampling was chosen for selecting the sample villages. Topographic maps, satellite imageries were used and also extensive field work curried out to prepare general landuse and agricultural landuse of sample village. The selection of these sample villages was based on crop combination regions of this study area. Two villages from each region were selected by considering the aspects like population, accessibility and distance from central markets in nearby city, terrain condition. The location of selected sample village is shown in Map.2.5. The crop landuse of every parcel of land was depicted on village map. Topographical map and satellite image were used to identify villages and village boundary to derived cadastral map for each individual village. Questionnaire were prepared and administered to farmers and to concerned authorities. These questionnaires were consisted of questions related to family information, crop landuse, income expenditure, agricultural inputs, production, irrigation, occupation, income sources and village problems. Then proposed following planning for further development.

The preceding chapter has attempted to examine and identification of certain characteristics related to landuse and physio-socio-economic variables. This study has unfolded physiographic, climatic and marketing facility. These characteristic all together determine the existing pattern of agricultural landuse of Shrigonda Tahsil. An attempt has been made to identify certain aspects further planning and batter improves the agricultural field for getting yield/production. This has been obtained by over lapping all the measure maps of aspects of Shrigonda Tahsil and has found out following four, region for further planning as below.

1. Central Region

2. South-Central Region

3. Northern Region and

4. Eastern Region.

1. Central Region: - This region extends along the pleatue Saraswati River on deep fertile alluvial soil covering an area of 1364 hectares (10 % to total area in central part, Map. 3.3). The climate of region is hot summer and general dryness during south-west monsoon season receiving rainfall from 475mm which 72 %. Mean annual temperature is 38ºC. The elevation of the region is less than 659 meters above mean sea level; slope range is identified less than 5%, 63.9% of total net sown area falls in this region. Two soil types, namely, fine textured alluvial soil in north and Red or Tambat in southern part. The whole soil is normally black or blackish. Alluvial sediments are the most productive soil in this region. The region has a large number of deep wells and these wells irrigate considerable percentage of land and promote agricultural intensity and increasing crop productivity.

Stalinization produced by over irrigation is the main problem resulting low soil productivity on alluvial soil in north part in this region. Science this region has been under cultivation for last several years the soils have lost some of its elements required for successful production of crops. Control of surface water, aquifer development and sustainable exploitation and transfer of water for the benefit of consumers. Digging number of deep wells without consideration of ground water capacity is resulting going downward of water level. Mismatching of sanding cropped lands with the determined land suitability classes in 60% of total net sown area is another problem in this region. The region also suffered from lake of marketing planning and storage systems resulting unreliable price for agricultural productions. Farmers face problems of inadequate supply of fertilizers. Sometimes they purchase from the black-market and pay heavy price but sometimes fertilizer becomes out of market when it is required.

Soil Stalinization can be solved by transporting some of the top soil and mixing them with unfertile soil and developed irrigation system to prevent over irrigation of cropped lands and also taking sample soil from each field to the laboratory and by the analysis only shortening can be detected to find out land capability and manures and fertilizers can be added. Government authority should take care of the construction of proper wells at proper place and proper distribution of water and using modern irrigation systems to save and enrichment of ground water aquifers for bringing more land under cultivation. Land capability and cropped landuse should be match with the determined land suitability classes. Marketing planning for production, consideration actual and recommendation to increasing agricultural product. In order to increasing fertilizers should be given adequate and proper supply of chemical fertilizers by the government to the farmers. And also the government should organize distribution of fertilizer in such a way that farmers become able to get regular and insured supply of fertilizer and give consolidation of land holding to proper use of fertilizers. Changing the farming system from monoculture to a multi-cropping system in concerning fields and from multi-cropping systems without a mechanism to keep soil fertility to crop rotation systems that do maintain fertility. An organized and efficient extension service to acquaint the farmers with the use of modern inputs in the field of agriculture plus guidance on crop management. Land utilization cropping patterns, cooperation existing between the government agencies and relevant Tahsil departments and village authorities should be strengthened for sustainable management and utilization of the land resources.

2. South- Central Region: - This region consists of piedmonts and alluvial fans covers 25.3% to total area extend from the southeast to the

northwest. The elevation ranges from 500 to 800 meters above mean sea level with slope range between 5 to 20 %. The general direction of slopes is towards south and central parts in this region. The region receives mean annual rainfall about 475mm and mean annual temperature 25.5^0C, 4.7 total net sown area and 16.7% of total population are identified in this portion. Seventy three percent of total cropped area is under perennial crops. Soil types are varies place to place namely Black or Kali, Laterite and Gray soil and deep sandy soil with high permeability. This soil with high permeability. These soil types have key role to feeding the ground water aquifers in south-central part.

Shortage of water availability and irrigation facility and low productivity are two main problems resulting low agricultural products. The most part of the region covered by shallow soil and poor vegetation covers resulting soil erosion and decline soil productivity. This area served inaccessible transportation network. Lake of market centers, shortage of agricultural implements and fertilizers are another problem that restricts setting of agricultural product. Over grazing caused very poor density of pastures.

In order to watershed management and prevent soil erosion in steep slopes and cropped lands measures should be taken to increase the soil productivity in area under cultivation. Construction of tub well and well in proper places is helping to obtain more water for bringing more land under cultivation. Increasing the use of chemicals and fertilizers, to promote agricultural productivity and putting to practice new cultivation methods. Protecting the pasture through rehabilitation, enrichment of species and withdrawing herds from pastures in this region. Developing pressurized irrigation systems, in order to promote the efficient utilization of water resources and brining more land under cultivation. Establishing

local market centers. Developing farm to market roads, and roads connecting each farming locality center to Tahsil and district headquarters.

3. Northern Region: - This region has rugged topography. Hilly elevation mountain range with high steep slopes more than 40% observed 185 in this region (Map- 3.4). It covers an area of 32.6% of total area in this region. This region receives 396mm mean annual rainfall and 28.8^0C mean annual temperature. Cropped area occupied 29.3% to total net sown area in this region. 14.7% total population is living in this region with population density of 32.8 persons per square kilometers. Most of the area covered by fallow land. Three soil types are observed in this region, namely, laterite, which made by igneous rocks and two small patches in northern and western parts *i.e.* coarse textured alluvial and bharad soil and salt marsh soils. These soil types are very thin in steep slopes to coarse shallow in gently slopes and shallow-deep in the valleys. 60.5% of total net sown areas are under Jowar crops. Jowar and Bajra is the leading crop and region falls in monoculture region.

Rugged topography caused scarcity of agricultural land (8.8% to total area). This region is located in remote area from Shrigonda headquarter, hence inaccessibility of transport network and like of central market are another problem which effects on agricultural product. Migration to the Ahmednagar, Shirur, Supa and other cities of resulted low population density and lack of labours is found in this area. Uncertain rainfall affected the agricultural operations in this region because natural vegetation covers and cultivators highly depend on the rainfall, therefore extensive standing drought and overgrazing highly effected to declining of forests, 259 pastures and area under cultivation. As the result 11.8% of

pastures and 12.3% forests decreased within the last 15 years in this region. Overgrazing and forests cutting created soil erosion on agricultural lands as well as natural vegetation covers. This area falls in monoculture region. Undulating of terrain and small land holding is another problem which has negative effects using machinery in the farms.

Reclamation of new land for cultivation is an expensive process therefore efforts must be made to utilize the available natural resources to obtain maximum output by increasing the yield per hectare and thus solving the problem of land limitation to a great extent. In order to obtain the optimum yield per hectare, irrigation systems will be improved and, by harnessing the available water and regulating its flow through the construction of irrigation networks. Control of surface water and transfer of water for the benefit of consumers. Establishing marketing and storage facilities in order encourage the farmers, policies will be designed to stabilize prices and thereby support and protect agricultural products. To prevent the breaking up of farms into small uneconomic holdings and to enable farmers to use farm machinery and consolidate their holding, farm corporations will likewise be expanded and small-size machinery and tools for the operation of small holdings. Improving farmer's income and standard of living to reduce migration to cities and providing adequate manpower in different fields for the operation of desired plains. Changing the farming system from monoculture to a different cropping system, and from different cropping systems without a mechanism to keep soil fertility to crop rotation systems that do maintain fertility.

4. Eastern Region: - Eastern region is falls in scarcity zone. It receives 270.7mm mean annual rainfall and 25.6 mean annual temperature. This region occupied 25% of total area consist of one rural Tahsil, namely Shrigonda in eastern part the study region. Population of

this region was recorded 12.8%, with population density of 26.9 persons per square kilometers (2010) 6.7% of total net sown area is identified in this region in 2011. Leading crops in this region are Wheat, Jowar and Bajra. This region in two crop combination region.

Agricultural sector in this region suffers from insufficient of water and soil Stalinization on arable lands. No systematic investigation has been down with connection of types in this area. Low population density and lack of labours is found in this region. Inaccessibility of transport network and lake of market centers are other problems which effects on agricultural product because of long distance between this region and central market in this region. Shortage of agricultural implements and fertilizers are another problem that 140 restrict setting of agricultural product. Traditional landuse systems are another problem, in this region.
In order to solving soil salinity comprehensive investigation is require by the government to conduct a soil survey based on the geopedologic approach in order to determine soil properties and the relevant land qualities. In order to obtain the optimum yield per hectare, irrigation systems will be improved and, by harnessing the available water and regulating its flow through the construction of irrigation networks, control of surface water and constriction of canals to increasing water requirement for standing crops and bringing new land under cultivation. Promoting off-farm income generating activity for the farmers and their relatives. Utilization of possibilities that may be providing by the reclamation of new land, provision of facilities, in particular, facilities of water and power availability for agricultural use.

Many issues important for agricultural development are outside agriculture and yet are critical for it. In fact many issues for agriculture are strictly outside the sector but are critical in the new development ray

of the economy. Based on the aquifer mapping exercise, we need to develop sustainable groundwater management plans for each aquifer. This requires action on the ground involving partnerships of stakeholders at the village-level with hydro-geologists and social mobilizes, who would guide collective sharing and sequential use of groundwater based on a careful understanding of the storage and transmission characteristics of different aquifers in each of the hydro-geological settings outlined in the study area. Promising work on a reasonable scale has started in this direction in Andhra Pradesh. The Andhra Pradesh Farmer Managed. Groundwater Systems (Association Promoting Farmers Managed Groundwater Systems) project is supported by the Food and Agriculture Organization and implemented by NGOs in seven drought-prone districts of Andhra Pradesh. The project employs participatory hydro-geological monitoring, by engaging farmers in data collection and analysis, and building their understanding of the dynamics and status of groundwater in local aquifers.

This is complemented with crop water budgeting, whereby the quantity of water required for crops is assessed at the aquifer level and compared with the amount of groundwater actually available to arrive at a suitable cropping pattern that would permit sustainable groundwater use. The point is that the difficulty of a bureaucratic approach to water management in dry areas is being questioned. But water is not just a technical issue. Water as a problem area has to get beyond command performance policies. New Technology is easy and cheap. There is a lot of people and for an approach titled ‘inclusive growth’ a critical slip up. Worse still the Planning Commission having missed the bus on decentralized urbanization in the last decade, still continues with its old projections for the future. Rural population it continues to say will be 60% in 2030.

Steps to greatly improve governance in water management through Water User Associations such as Pani Panchayats and similar PRI-based institutions. A focus on Command Area Development and the rehabilitation and physical modernization of existing major irrigation systems. Extensive rainwater harvesting assisted by space-based maps with active ground trusting and convergence with other development schemes. Comprehensive aquifer mapping and extensive ground water recharge. Move towards sprinkler and drip irrigation and away from flood irrigation. Enable assured irrigation to much more land far beyond the present 42 per cent of arable land. Strengthen drinking water resources. Integrate these activities with existing surface reservoir based canal irrigation.

Technology is the main prime mover of productivity in agriculture where natural resources are fixed. Studies have shown that at least one third of the future growth in productivity should come through innovations in crop technologies. Public sector technology generation often fails to take into account farmers' needs, perceptions and location-specific conditions for each crop, leading to significant gaps between the varieties released by public sector institutions and the number of varieties actually used by the farmers. Private sector research and the seed industry often focus on those crops and varieties which have adequate scale (massive markets) and scope (repeated sales). As a result, some crops/crop groups get little research attention. This phenomenon is most visible predominantly rain fed crops like pulses and some oilseeds.

The approach's severe indictment of public sector research and the belief that the private sector left to itself will solve the research gap in dry land areas and for a rapidly diversifying agriculture is touching but misplaced in terms of a reading of experience. The rural urban continuum has another approach. It wants Public Private Partnerships and goes back

to the Hybrid Paddy experience which was a PPP, but led strategically by the Indian Council of Agricultural Research. The failure now is that the Indian Council of Agricultural Research is not even mandated to play a strategically leading role. I discovered to my horror that we still don't have a road map for example for pulses to reach the average yield levels of Canada or Australia of 20 qtls./hec plus. Back of envelope calculations show that when the Indian Council of Agricultural Research builds up such a road map it may cost us more than three thousand corores of rupees to get going in a five year strategy and that needs a Public Private Partnerships, but not the way the Approach wants it, for the private sector want do it, left to the market the way the planners want.

The Planning Commission has declared that 'it is necessary to remain abreast with latest advances in bio-technology', I hope putting at rest the brinjal episode. Now more is needed which they don't say. Given the long-term nature of the problem and the fact that large investment is needed to develop new molecules, a degree of regulation will be needed. Investors need a reasonable assurance of returns or they will not commit financial and, more importantly, experienced managerial and technical resources. For pulses itself for example, the research plan will cost hundreds of corrodes of rupees, if the experience of hybrid paddy is any indication. Such PPP projects will need public resource commitments in terms of meeting the so-called viability gaps. Also, public-sector involvement is essential for sustainability and environmental-safety aspects. A Central organization working on what are called long-range, marginal cost principles, which have been advocated for power projects, for example, could work out fair pricing solutions. Anybody doing better than the average efficiency cost estimates, giving a fair rate of return, would keep the profits. It has been demonstrated time and again that the nation gains in such strategies. For example, pricing strategies which rely

on group efficiency cost norms have given very powerful returns in terms of energy savings in the nitrogenous fertilizer industry and after eight years of discussion, it is reported that a committee under a planning commission member is suggesting this approach, which was the basis of pricing which a committee that chaired had recommended many years ago.

- The planners say that 'farmers suffer even in years of a good harvest, since they are not able to get good price realization. The obvious solution is for these farmers to aggregate their produce and reach bigger markets… Alternative models based on the idea of Producers' Companies and Commodity Interest Groups are now beginning to take off. 'But there is no overarching strategy for this as we saw.

- For infrastructure having missed the emerging markets is terribly weak. 'Road connectivity, development of horticulture, dairying & other animal husbandry and expansion of cash crops, provide the necessary wherewithal for greater market access of the farm sector. This is particularly important for the segment of "high value" agriculture, where the demand pressures are going to be most intense in the coming years, and major investments are needed in the development of efficient value chains to save on high wastages and intermediation costs. This is logically the domain of the private sector.

- For the planners to miss out that infrastructure for a diversifying agriculture is a planning task and even Public Private Partnerships are difficult in small towns because they don't have the comfort as Credit Rating and Information Services of India Ltd. brings out is

sad. So in spite of all the good words there is no detailed strategy in the study area on widespread agricultural growth.

- This strategy is now being suggested by the proposed FDI policy. It is very sensible not to delay any more the answers to the question of strengthening the food and agricultural supply chain. If anything is holding back the sustainability of a nine percent growth rate it is wage goods inflation. We get misunderstood when we say that the seasonal fall of food prices official spokesmen love to predict is non sequester because even eight percent food inflation is inconsistent with competitiveness since the interest rates of major economies are lower than five percent. The other great advantage is that the government has on Foreign Direct Investment in retail, placed its cards on the table so that we can have a reasoned debate. The difficulty, however, is that the Foreign Direct Investment policy as reportedly passed by the Cabinet, but now sent back by Parliament ignores the most important part of the requirements of growth. It does not have a place for agricultural producer groups in it. Also it is exclusively metro based. The problem is in the small towns where the millions of farmers from villages are going to sell their produce as now documented by the discovery of Census Towns as we saw above. These glaring gaps have to be filled in the legislation.

- The first thing is to allow investment in smaller towns (in fact Census Towns not even officially recognized as Towns, a point we have been making from 2005). Reform is not for metros but for widespread agricultural growth and to exclude agriculturists and smaller towns is illogical. Government will have to give comfort for that in PPPs but that's what policy is about. Policy must not

keep farmers and their producer groups and cooperatives out of the ambit of the special categories of this legislation but to make them a central part of it. The eccentricity of the government to keep farmers out of a legislation met for them is truly extraordinary. Farmers Producer Companies and Cooperatives in non metro so called backward areas have existing tie ups with FDI, with Nestle, Cadbury and so on. To keep them out this time is strange. The research community must build on ideas ignored but important.

7.3: Suggestions:

1. As the northern part of the study area is lacking in the irrigational facilities there is wide scope to develop a co-operative lift irrigation facilities in this area. Along with the enhancement of agricultural facilities it will reduce the outgoing migration.
2. The sugar industry located in the study area is one of the major sources of employment generation. However as this industry provide seasonal employment. An attempt should be made in direction of strengthening other sources of employment.
3. As considerable numbers of farmers face the problem of over irrigation, a proper action should be taken in this direction so that the problems of over irrigation would be minimized.
4. Outsider population is very much interested in investing money in agricultural land. The farmers are losing their ancestral assets. In view of changing the mentality of local people after should be made near future to aware the native population.
5. Though, most of the agriculture in study area is irrigated, majority of the farmers are not interested in adopting modern agricultural

techniques. Awareness among the farmers about use of these techniques is very much needed.

6. Soil testing and the knowledge of crop water requirement are of immense importance while planning the crops in existing agro climatic conditions. Therefore farmers should be aware about resource based crop planning.
7. Sometimes farmers in the study area go for mall practices to get more water for irrigation. This practices leads to the misuse of water resources and also results in to the Stalinization of land. In view of eliminating this problem farmers are required to motivate to go rational use of water resources.
8. It was observed during field visit that farmers in the study area are not aware of the government schemes those are launch for the betterment of farmer's community. An awareness campaign should be implemented in the regard.
9. Dairy industry is one of the emerging economic activities in the study area. This industry has great potential to stabilize to economic condition of the farmers. Thus the dairy industry should be strengthening.
10. It was observed during field visit that the sudden economic upliftment of the people due to sell of land has deteriorated the moral values and cultural ethics among the youth. Value education should be provided to the sufferers so that they can overcome this problem.
11. As the production of the paper lemon is high in the study area, a food processing industry based on paper lemon should be established. This will provide the job opportunities and also will give more returns to the farmers.
12. In view of tapping the potential wind power available in the study area, erection of wind mills is needed.

13. The farmers belonging to the Adhalgaon sub-division irrigation face the problem of water distribution of canal. This is because of incomplete work of minor distributaries. Concern authorities therefore suggested looking in to matter.
14. During the period of rotation a considerable amount of water drains in to the Hanga River. If small check dams are constructed on the river such water can be utilized for agricultural purpose.

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[Photograph No.1 Visapur Dam near Visapur]

[Photograph No.2 Water Released from Visapur Dam]

[Photograph No.3 Visapur Canal- Built by British Government]

[Photograph No.4 Visapur Dam Joint Canal]

[Photograph No.5 Ghod Dam near Chinchani]

[Photograph No.6 Ghod Dam- Left Bank Canal]

[Photograph No.7 Fisher man in Ghod Dam]

[Photograph No.8 Concrete Water Canal Kukadi Project]

[Photograph No.9 Main Left Bank Canal- Kukadi Project]

[Photograph No.10 Managements of Irrigation techniques]

[Photograph No.11 Water Tunnel- Bhose Khind, Length 14 Km.]

[Photograph No.12 Water Lifting from Ghod Left Bank Canal]

[Photograph No.13 Visapur Sub Canal No. 0/210]

[Photograph No.14 Kukadi Project-Visapur distributory Canal]

[Photograph No.15 Kukadi Project, Hanga Jalsetu at Pimpalgaon Pisa, Length-1.7Km.]

[Photograph No. 16 View of Hanga Jalsetu, at Pimpalgaon Pisa]

[Photograph No.17 Sugarcane Farm at Mundhekarwadi]

[Photograph No.18 Newly plantation Sugarcane field at Kharatwadi]

[Photograph No.19 Crop Combination, Sugarcane and Lemon at Pedgaon]

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[Photograph No.21 Modern Agro-technique for Chilly Crop at Nimbavi]

[Photograph No.22 Jowar field at Wadali]

[Photograph No.23 Onion field at Rajapur]

[Photograph No.24 Grapes field at Pargaon]

[Photograph No.25 Crop Combination, Banana and Onion at Deulgaon]

[Photograph No.26 Agriculture Labour,s in the field at Yewati]

[Photograph No.27 Applying Pesticides and Insecticides on crops at Yewati]

[Photograph No.28 Farmers engaged in Jowar Field at Thitesangavi]

[Photograph No.29 Onion Seeds and Wheat Crop at Wadgaon-Shindodi]

[Photograph No.30 Cotton Crops field at Chikhali]

[Photograph No.31 Drip Irrigation with Tube well in Lemon field at Velu]

[Photograph No.32 Sunflower Crops field at Walghud]

[Photograph No.33 Lemon Storehouse nearby Lemon field at Pargaon]

[Photograph No.34 Labours engaged in Lemon Packing at Pargaon]

[Photograph No.35 Lemon Packed bags in Storehouse at Pargaon]

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[Photograph No.37 Shrigonda Co-operative Sugar Factory, Shrigonda Factory]

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[Photograph No.42 Sugarcane Cutting process at Wangdari]

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[Photograph No.44 Co-operative Milk Chilling Plant at Kasti]

[Photograph No.45 Shivdattakurpa Dairy Pvt. Ltd, at Hiradgaon Phata]

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[Photograph No.48 Weekly Market at Shrigonda]

[Photograph No.49Vegetables sellers in weekly market at Shrigonda]

[Photograph No.50 Weekly Livestock Market at Kasti]

[Photograph No.51 Fallow Land near Chikhali]