CHAPTER 5

Summary Conclusions and Policy Implications
Rice (paddy) is grown in almost all the continents of the world except Antarctica. The major rice producing countries in the world are China, India, Indonesia, Bangladesh, Thailand and Japan. (Singal Vikash – 1996). Among the rice growing countries, India has the largest area under rice in the world in 2003-04 (44 million hectares) and ranks second in production (132 million tonnes). China’s share in the world’s production was 28.25 per cent and that of India was 22.41 per cent in 2003-04.

Paddy (rice with husk) is generally cultivated in shallow-medium black soil and in the area where rainfall is higher or in irrigated area. Paddy is generally grown as wet crop or irrigated crop. Paddy farming requires higher moisture conserving soil. Paddy cultivation is conditioned by temperature parameters at different phases of growth. A temperature range of 20.6° C to 37.5° C is required for its optimum growth. The crop requires a higher temperature at the time of sowing and during its early growth. The temperature requirement for blossoming ranges between 26.5° C and 29.5° C. (Solapurkar and Balkundi-1972, Kainth G. S. and Mehra P. L. –1985)

There are three main seasons for growing paddy in India. The main rice-growing season in the country is the kharif. About 45 to 48 per cent rice crop is grown in this season. Nearly 43 per cent rice crop is grown in the pre-kharif (Autumn rice) season. The area under summer rice cultivation is only 9 per cent. (Hazra C.R.-2001 and Roy R.N. & et al -1980)

SIGNIFICANCE OF AGRICULTURE IN INDIAN ECONOMY

India is predominantly an agricultural economy with 72 per cent of its population living in villages and 58 per cent of the population largely depend on agriculture and allied agricultural activities for their livelihood (Fertilizer Statistics 2005-06).

The contribution of the agricultural sector in national income, employment, government’s revenues, raw materials for industries and foreign exchange resources show, the its importance in the economy.
The share of agriculture in national income has declined from 56.5 per cent in 1950-51 to 22 per cent in 2003-04 (advance estimates). Though the share of agriculture in national income has been declining, the workforce engaged in agriculture has marginal decline. The Census of India reveals that in absolute terms, agriculture provided employment to 97 million persons (70 per cent of total population) in 1951, which increased to 235 million persons (59 per cent) in 2001 (Misra and Puri – 2005). In short, agricultural sector has been a main source of employment to the working population. Another important feature of our economy is the dependence of industries on agriculture. This is because agriculture provides a number of raw materials required by industries. During 1970-71, the share of agricultural export to total exports was 31.66 per cent and it decreased to about 12.65 per cent in 2003-04 (Misra.and Puri – 2005). As a foreign exchange earner, it is an important source. Thus, agriculture is a dominant and important sector of the Indian economy.

**RICE ECONOMY AT A GLANCE IN INDIA**

Food grain crops play a very important role in the agricultural economy of India. An increasing agriculture output is important for providing the necessary food for the growing population (Prandila R.K.-1992). The total food grain production was 57,051 thousand tonnes in 1950-51. It increased to 2,15,000 thousand tonnes in 2005-06 (Fertilizer Statistics-2004-05). Food grains produced in India can be broadly classified into three major groups viz. (i) superior cereals, (ii) inferior cereals (coarse grains/millets) and (iii) pulses. Superior cereals crops are rice and wheat.

**Rice in Crop Pattern of India**

Since independence, crop pattern at the national level and state level has rapidly changed. The share of food grains in gross cropped area (GCA) was about 74 per cent in 1970-75 which declined to about 65 per cent in 1997-02 while the area under non-food gains increased rapidly. The share of cereals in GCA which was about 60 per cent in 1970-75 declined to 53 per cent in 1997-02. The share of pulses in GCA was about 13 per cent in 1970-75 and it declined to around 12 per cent in 1997-02. Thus, the share of cereals has declined more as compared to share of pulses (Patel A.S. – 1997).
Among the cereals, rice accounted for the largest share in GCA (about 23 to 24 per cent) during 1970-75 to 1997-02. Thus, rice has been an important crop at all India level and throughout the three and half-decades its share in GCA remained nearly at the same level (During the study period).

**Position of Rice**

Average area under rice which was 37643 thousand hectares in 1970-75 increased to 42322 thousand hectares (88.94 per cent rise) in 2000-05, while average production of rice which was 41639 thousand tonnes in 1970-75 increased to 84746 thousand tonnes (49.13 percent rise) in 2000-05.

Out of the total area under cereals, the area under rice was about 38 per cent in 1970-75 which significantly increased to near 44 per cent in 2000-05. Out of the total area under food grains, area under rice was nearly 31 per cent in 1970-75 which increased to 36 per cent in 2000-05. Out of the total cereals production, the share of rice production was 45 per cent in 1970-75 which marginally declined to 42.54 per cent in 2000-05. Out of the total food grains production, the share of rice production was about 40 per cent in 1970-75 which increased to 42.27 per cent of the total food grains in 2000-05. Thus, of the area under cereals as well as area under food grains during the study period the share of area under rice has increased significantly.

In India, major rice producing states are West Bangal, Tamil Nadu, Andhra Pradesh, Bihar, Orissa, Uttar Pradesh, and Madhya Pradesh. It is also cultivated in Jammu and Kashmir, Panjab, Haryana, Gujatat and Rajasthan.

**Rice in Food Consumption Pattern**

During the process of agricultural development, per capita net availability of food grain has increased. Among the cereals, superior cereals (rice and wheat) accounted for about 71 to 86 per cent during 1971 to 2001. Consequently the share of coarse grains has continuously declined from 29 per cent in 1971 to 14 percent in 2001. Rice is a major staple food in both rural and urban areas, constituting nearly more than half of the cereal consumption (Selvarajan and Ravishankar-1996). Per capita availability of rice has increased from 192.6 grams in 1971 to 208.1 grams in 2000-01. This was mainly due to increase in the production of rice in India.
Export of Rice

The total export of India was Rs. 1,538 crores in 1970-71, in which the share of agriculture was 31.66 per cent which increased to Rs. 2.91 lakh crores, in which the share of agriculture sector was 12.65 per cent in 2003-04. Due to fast development of other sectors of economy and uneven nature of Indian agriculture, the share of agricultural export in total exports had declined continuously during 1970-71 to 2003-04. However, the share of the export of rice in the total agricultural exports increased considerably during 1970-71 to 2002-03. Thus, rice is an important food crop which contributes a significant share in our export.

Rice Development Programmes (Promotional Activities)

For increasing the rice production and productivity, the government of India, has been implementing, from time to time, various rice development programmes. (Selvarajan S. and Ravishankar- 1996) These programmers are: (1) Rice Seed minikit Programme: Since 1972, (2) State level Training Programme on Rice Production Technology: Since 1975-76, (3) Special Rice Production Programme (SRPP): From 1985-86, (4) Special Food grains Production Programme (SFPP) and Rice: During 1988-89, (7 five years plans) 106 potential districts in 13 States i.e. 6 SRPP State. Among these states: Assam-3, Bihar-13, Madhya Pradesh-11, Orissa-5, Uttar Pradesh-21, West Bangal-7 and other 7states (Aandra Pradesh-8, Gujarat-4, Haryana-5, Karnataka-8, Maharasta-7 Punjab-3, Tamil Nadu-8) were identified for SFPP programme which was fully funded by the government, (5) Integrated Cereals Development Programme in Rice based Cropping System Area (ICAP-Rice), (6) Promotion of Hybrid Rice: Since 1989 and (7) Minimum Support Price of Rice

State-Wise Area, Production and Yield of Rice

In order to have a clear understanding regarding significance of rice economy at the macro level, the information regarding state wise - area, production and yield of rice were analyzed. A brief result of the analysis is presented in the following paragraphs.

(1) State - wise Area under Rice: The area under rice in India which was 37,592 thousand hectares in 1970-71 it increased to 42496 thousand hectares in 2003-04, i.e. 13.05 per cent increase during the period of study. During the entire study period
among rice producing states in India, the maximum area under rice was found in West Bengal (13 to 14 per cent of total area under rice), followed by Utter Pradesh (12 to 15 per cent), Bihar (11 to 14 per cent). The lowest area under rice was found in Kerala (1 to 2 per cent), Gujarat (around 1.5 per cent) and Haryana (1 to 1.5 per cent) during 1970-71 to 2003-04.

(2) State - wise Production of Rice: The production of rice which was 42,224 thousand tonnes in 1970-71 it increased to 88,285 thousand tonnes in 2003-04 (209.08 per cent rise) in India. The highest production of rice was found in West Bengal (around 14 to 17 per cent in total rice production), followed by Andhra Pradesh (10 to 13 per cent), Uttar Pradesh (9 to 15 per cent); while lower rice producing states were Kerala (1 to 3 per cent), Haryana (1 to 3 per cent) and Gujarat (near 1.5 per cent) during the last three decades.

(3) State - wise Yield of Rice: The per hectare yield of rice at the national level was 1123 kg. in 1970-71 in India which increased to 2077 kg. with 184.95 per cent rise during the study period. The highest yield of rice was observed in Punjab (3694 kg/hect.) in 2003-04, followed by Andhra Pradesh (3009 kg/hect.), Haryana (2749 kg/hect); whereas the lowest yield were observed in Madhya Pradesh (1315 kg/hect.), Orrisa (1511 kg/hect.) and Bihar (1566 kg/hect) in 2003-04.

RICE ECONOMY AT A GLANCE IN GUJARAT

According to 2001 Census of India, the total population of the state was 5.07 crore. The density of population in the state was 258 persons per sq km. The rural and urban population accounted for 62.64 per cent (3.17 cr.) and 37.36 per cent (1.89 cr.) respectively. The literacy rate in the state is 69.14 per cent in 2001.

According to Season and Crop Report of 2002-03, out of total reporting area in the state, 94.25 lakh hectares (50.1 per cent) was net area sown. The GCA was 106.31 lakh hectares. The cropping intensity, i.e. the rate of GCA to net cropped area for this year was 112.79 per cent (estimated). Out of the GCA, area under food crops was 43.32 per cent and the area under non-food crops was 56.68 per cent during the year 2002-03. Total foodgrain production was 6154 thousand tones in 2005-06.
The agriculture sector occupies a prominent place in the economy of Gujarat. Agriculture, as a primary sector, contributed about 47 per cent of the gross state domestic production at current prices in 1970-71, which declined to 20.43 per cent in 2005-06. In primary sector, the contribution of cultivators in the total main workers had gone down while share of agricultural laborers had almost remained stable (except in 1971). In Gujarat, 28 to 37 per cent of the total rural population was engaged in agricultural activities during the various census years (Dutta R.A. and S.R. Bhaiya – 2004). Moreover, agriculture provides food grains for people and fodder for livestock. It provides the bulk of our export in respect of oilseed, tobacco, cotton etc. that are important commodities to earn foreign exchange. Thus, Gujarat has achieved significant progress in agriculture sector.

**Rice in Cropping Pattern of Gujarat**

The cropping pattern of the state has gradually diversified from food grain corps to non-food grain crops. During the last three and half decades, the share of foodgrain crops in GCA declined significantly from 47 per cent in 1970-75 to 40 per cent in 1998-03. The area under rice had gradually increased during the above indicated period (4.60 per cent of GCA in 1970-75 and 6.74 per cent in 1998-03). Out of total cropped area under cereals in the state, rice ranked second than the bajara. Among the two superior cereals viz. rice and wheat, the area under rice occupied the first position.

**Place of Rice in Gujarat**

The absolute average area under rice which was 4,708 hundred hectares in 1970-73, continuously increased to 6,446 hundred hectares in 2000-05. The average production of rice was 4,264 hundred tonnes in 1970-75, which gradually increased to 9,471 hundred tonnes in 2000-05. The percentage share of area under rice was about 10.42 per cent to total cereals' area and 8.48 per cent to total food grains' area during 1970-75. This percentage share significantly increased to 21.89 per cent to total cereal's area and 17.43 per cent to total food grain's area during 2000-05. Similarly, the share of rice production was about 12.80 per cent to total cereal's production and 12.32 per cent to total food grain's production in 1970-75. It also considerably increased in 2000-05, to about 21.84 per cent to total cereals' production and 19.91 per cent to total food grains' production. Thus, as a cereal, share of area under rice in
total area under cereals and in total area under food grain as well as share of rice production in total cereal production and in total foodgrain production continuously increased during the study period.

**Utilization of Paddy (Rice)**

(a) **Use of Paddy Grain:** Rice is an important article of food for human beings. About 90 per cent of the rice is consumed for various cooking preparations. Paddy is used, as a food grain after preparing parboiled rice, this form of rice is popular mainly in West Bangal, Bihar, Orissa and Uttar Pradesh. The rice is used as converting/processing items by human in different regions of the country in different ways. Recently rice-processing commodities are most popular as a part of different fast food items. Rice is utilized for animals’ feed also. Rice is used in non-edible or preparation of different parched products. Rice is used in cottage wearing and indigenous cosmetic industries.

(B) **Use of by-Product of Paddy:** Paddy straw, husk and rice bran are main by-product of paddy. The paddy straw is utilized as a fodder for livestock as well as utilized in various industries i.e., paper, brick, packing product etc. as a raw material. Paddy straw is utilized in bulk quantity in packing of durable and soft commodities in transportation. Paddy husk and rice bran are by-products of the rice mills. They are utilized as raw materials for brewing and distilling starch manufacturing for textile industries. Paddy husk is also utilized in many uses at household level.

**PURPOSE OF THE STUDY**

The foregoing discussion indicates that the rice is an important food grain crop in India as well as in Gujarat. Rice is the staple food for more then 60 per cent population of the world. Indian people consume about 50 per cent rice in their daily meal (208.1 grams rice and food grains 417 grams - 2001). Among the rice growing countries in the world, India has covered the largest rice cultivated area of total rice cultivated area of the world and the second largest rice producer in the world. In cropping pattern of India, rice has occupied around 23 per cent of gross cropped area during the last four decades.
In Gujarat is agricultural economy, the area under non-food grain crops has increased gradually, but the area under rice has continuously but marginally increased (around 5 to 7 per cent) since 1970. Out of the total cropped area under cereals in Gujarat, rice ranked second position (6.74 per cent) during 1998-2003. In the two superior cereals viz., rice and wheat, the cropped area under rice occupied the first position.

In Gujarat, kharif is the main season for paddy cultivation. However, the development of irrigation facilities in the State made it possible to cultivate paddy in summer season also in various districts viz., Kheda, Anand, Valsad, and Surat etc. The area under summer paddy was 174 hundred hectares 2001-2002. However, the growth in production and yield of rice has not been uniform across the different districts of the State.

The present study investigates some of the vital and sensitive issues of the rice. The study makes the critical examination of growth of area, production and yield, cost of cultivation, net benefit/return, marketing pattern and their cost, efficiency, minimum support price and its impact on farm harvest price etc., of paddy cultivation in Gujarat.

Objectives of the Study

The objectives of the study are as follows:

(1) To examine the growth pattern of area, production and yield of rice for both kharif and summer seasons, district wise as well as Gujarat State as a whole during the last three decades;

(2) To identify the problems, locate problem of rice cultivation and suggest remedial measures;

(3) To examine the relationship between minimum support price (MSP) and farm harvest price (FHP) of paddy;

(4) To use the Cost concepts and efficiency measures being employed by Cost of Cultivation Scheme (GoI) of the selected sample paddy growers;

(5) To examine the relationship between the farm size and productivity of paddy of the sample farm households and to assess the factors responsible for the variations, if any;
(6) To examine the benefit-cost ratio of paddy cultivation of the selected sample households;
(7) To study the selling structure of paddy produce of the selected sample households; and
(8) To highlight the policy implications.

CHAPTER SCHEME

Chapter – I is Introductory one which, rice economy in India and Gujarat, Importance, Scope, objectives and methodology as well as review of relevant studies/literature. Chapter – II Growth pattern of the rice production and productivity and impact of minimum support price on farm harvest price of rice in Gujarat. Chapter – III reveals the constraints of agriculture in India and in Gujarat. The problems of rice cultivation and the remedial measures are also narrated in the chapter. Economics of paddy cultivation in Gujarat - a study of paddy cultivation, production of paddy, marketable surplus and marketing of paddy at the grass root level has been made. 120 farmers cultivating paddy in Kheda district of Gujarat were selected for the study. The socio economic profile of sample farmers, paddy cultivation practice, relationship between farm size and productivity, marketable surplus, marketing of paddy, problems faced while cultivating paddy, suggestions etc. are described at length in the Chapter IV. The major findings of the study and certain policy implications to improve the production and productivity of paddy are suggested in Chapter – V.

LIMITATION OF THE STUDY

The subject selected for the detailed study has a fairly wide scope, particularly in agriculture. But due to time and financial constraints, it is obviously not possible for an individual researcher to cover and give justice to all aspects of paddy economy of Gujarat. Apart from the policy issues relating to the paddy economy of Gujarat, the study is mainly limited to only Kheda district. From this district only five villages from Sojitra and five villages from Matar were selected for a micro study. The findings derived from the study may/may not be applied at the macro level.
METHODOLOGY OF STUDY

An attempt is made in the research work to study the changes in the instability and inequality in production and productivity of paddy crop over a period of time. The necessary data for area, production and yield of rice were collected from 1970-71 to 2004-05 for the purpose of analysis. The present study was confined to the period 1970-71 to 2004-05. The entire period was divided into four fractions namely: First period (1970-71 to 1974-75), initial period of new seed, fertilizer technology, Second period (1980-81 to 1984-85), spread of new technology, Third period (1990-91 to 1994-95), wide spread of new technology and new economic policy and Fourth period (2000-01 to 2004-05), open market policy.

All the districts of the State were taken into consideration for the analysis. However, in the absence of complete time series data for the period 1970-71 to 2004-05 for the newly formed districts viz., Patan, Dahod, Anand, Narmada, Navsari and Porbandar (before bifurcation 1997), these six districts were considered as part of Mehsana, Panchmahals, Kheda, Bharuch, Valsad and Junagadh districts respectively.

These districts of Gujarat were divided in two group i.e. (1) major rice producing districts (2) minor rice producing districts. Major Rice producing districts are Ahmedabad, Vadodara, Bharuch, Valsad, Dangs, Gandhinagar, Kheda, Mehsana, Panchmahals, Sabarkantha and Surat. The share of major rice producing districts was more than two per cent in area under rice cultivation. Minor rice producing districts are Banaskantha, Bhavnagar, Jannagar, Junagadh, Rajkot, Kutch, Rajkot and Surendranagar, whose share is less than two per cent in area under rice cultivation.

SOURCE OF THE DATA

The present study is based on the secondary data as well as primary data.

(1) Secondary Data

The secondary data on area, production and yield of paddy for the major rice producing countries, for the different States of India and for the different districts of Gujarat, other information related to the topic are collected from various published as well as unpublished sources.
(2) Primary Data

The primary data regarding socio-economic profile of the paddy growers, land utilization, cropping pattern, agriculture and non-agriculture assets, inputs and its expenditure, paddy produce and by-product, marketable surplus, knowledge of market like price of paddy per quintal and MSP, attitude/opinion, views of sample farmers regarding cost of production, transportation cost, marketing, suggestions for improvement etc. were collected through interview schedules from the paddy growers.

SAMPLING DESIGN

Selection of Sample District: An attempt is made in this research work to study Economics of the Paddy Cultivation in one district of Gujarat State (KHEDA district) which has the maximum area under the paddy crop in both kharif and summer seasons. As compared to other districts of the state, Kheda district had highest cultivated area under paddy (of the GCA) and hence, Kheda district was purposively selected for the in-depth study.

Selection of Sample Talukas: From the selected district, two tehsils having paddy as a major crop in kharif and summer season were selected for the study. Accordingly, Sojitra (61.63 per cent to GCA) and Matar (57.15 per cent to GCA) tehsils were selected.

Selection of Sample Villages: Five sample villages from each of the selected tehsils were selected purposively. From each selected taluka, it was selected 5 villages for the in-depth study. The primary data regarding cropping pattern, cost of cultivation of paddy, marketing of paddy, problems of paddy cultivation, opinions and suggestions of paddy etc. were collected by personal interviews. Thus, altogether 10 villages were selected from both the Talukas.

Selection of Paddy Growers: From each selected villages 12 paddy growers who cultivated paddy in both the seasons were randomly selected. The selected sample paddy growers were stratified into four categories of farm size groups. From each village 3 households were selected randomly in each category like marginal (up to 1 hectare), small (1.01 to 2 hectare), medium (2.01 to 4 hectare) and large (above 4
hectare). Thus, in the entire 120 (12 x 5 x 2) paddy growers (30 growers in each farm size groups) were selected from the selected sample 10 villages. The reference period for the study was the agricultural year 2006-07 and field survey for the study was conducted during June 2006 to July 2007.

RESEARCH TOOLS

The various tools and techniques are used in the analysis for the present study at the different stages in the chapters. The analysis is largely based on the statistical and mathematical measure viz. annual average, percent/percentage, average annual rate of change (per cent) and compound growth rate. The regression co-efficient least square methods were used, further, the statistical ‘t’ test is used to test the reliability of estimated regression co-efficient.

COST CONCEPTS

The cost concepts used in the present study are those laid down in the comprehensive cost of cultivation scheme for principal crops of the Gujarat state. The concepts of cost viz. Cost A, Cost B and Cost C2 have been used in the analysis. The inputs items included under each category of cost are indicated below:

- Cost: A
  i) Value of hired human labour
  ii) Value of hired bullock labour
  iii) Value of owned and hired bullock labour
  iv) Value of seed (both farm produced and purchased)
  v) Value of insecticides and pesticides
  vi) Value of manure (owned and purchased)
  vii) Value of fertilizers
  viii) Depreciation on implements, machinery, farm buildings etc.
  ix) Irrigation charges (payments made for canal water, etc.)
  x) Land revenue, cases and other taxes
  xi) Interest paid on crop loan
  xii) Interest on working capital
  xiii) Miscellaneous expenditure
- **Cost: B**

Cost A + inputted rental value of owned landless revenue paid + inputted interest on owned fixed capital (excluding land).

- **Cost: C₂**

Cost B + imputed value of family labour.

**REVIEW OF LITERATURE**

A comprehensive review of literature is an essential part of any scientific investigation. Therefore, an attempt has been made to review the research studies related to rice cultivation, cost of cultivation of paddy and marketing. A brief review of such work has been presented in the following paragraphs.

**Cost of cultivation of rice:** The studies reviewed show that the human labour, farm yard manures, chemical fertilizers and irrigation were the major cost components in the cost of paddy cultivation. Among these components, the cost of human labour was found higher. Further, the results of the studies indicates that hybrid rice had higher cost of cultivation as compared to high yielding varieties of rice while productivity and rate of return had higher in high yielding varieties of rice. The results of majority of the studies shows that per hectare cost of production decreased with the increase in size of farms.

**Growth of Rice Production:** The studies reviewed reveal that production of rice increased due to improvement of the productivity of rice. The major cause of increasing the productivity of rice was higher use of chemical fertilizers.

**Productivity of Rice:** The studies reviewed indicate that productivity of rice had increased considerably during last three decades and the use of modern inputs had played a key role in increasing the production and productivity of rice. The majority of the studies show that productivity performance had improved but significant variation in the growth of productivity of rice was observed.

**Market of Rice:** The studies reviewed reveal that the farmers had sold their marketable surplus immediately after the harvesting to privet traders.
GROWTH PATTERN OF AREA, PRODUCTION AND YIELD OF RICE

The compound growth rate of rice production was substantially higher for Gujarat (3.12 per cent) as compared to All India (0.58 per cent) during the study period. The variation in growth rate of rice production becomes more significant when the growth rate of area under rice is taken into account. While the compound growth rate of area under rice was 1.81 per cent for All India, it was only 0.75 per cent for Gujarat. Thus, Gujarat has achieved better performance mainly through increase in productivity of rice.

The production of rice in the country which was only 4.22 M.T. (million tonnes) in 1970-71 with a productivity level of 1123 kg./hect. increased to 5.68 M.T. with a productivity level of 1465 kg./hect. in 1987-88. Thus, during the study period (1970-71 to 1986-87) area under rice increased only by 3.23 per cent, the production increased by 34.66 per cent and hence the yield also increased by 30.48 per cent. After launching various Government Programmers, i.e., Special Food grains Production Programme: Rice (SFPP-1988-89), Integrated Programme for Rice Development (IPRD -1990-91), Promotion of Hybrid Rice – 1989 considerable acceleration was found in production of rice. The production of rice reached a level of 9.33 M.T. in 2001-02 with productivity level of 2079 kg./hect.

TREND OF AREA UNDER RICE

Movement towards rice economy and the distinguished features of such movement are noteworthy. It is observed that the crop pattern at the state and districts level has significant shift from food grain crops to non-food grain crops (Patel A.S. - 2006). The degree of concentration of rice crop in various districts is measured by average percentage of GCA as well as State’s total area under rice.

Percentage Share of Area under Rice to GCA among the Districts

The proportion of GCA under rice had increased up to 90’s but then it had declined during 2000’s. The districts having more than 20 per cent of their GCA under rice during 2000’s were Valsad (27.17 per cent), Kheda (23.58 per cent), Dangs (22.92 per cent) and Panchmahals (21.49 per cent).
Among the major rice growing districts, the proportion of GCA under rice had significantly increased in the districts of Ahmedabad, Bharuch, Gandhinagar, Kheda, and Surat. It had marginally declined in Vadodara, Valsad and Panchmahals. While in Kheda and Ahmedabad districts, area under rice impressively increased over the study period. Valsad district ranked first in the proportion of GCA under rice which, was followed by Kheda and Panchmahals districts.

**Percentage Share of Districts in the State's Total Area under Rice**

The percentage share of Ahmedabad, Dangs, Gandhinagar, Kheda and Surat districts in the area under rice had improved significantly during the study period. Such percentage share had declined in the districts of Vadodara, Panchmahals and Sabarkantha during the study period. The percentage share of Kheda in total area under rice had increased significantly during 1980-85 as compared to 1970-75. Kheda district ranked first in the percentage share of area under rice during study period except 1970-75, followed by Panchmahals and Valsad districts.

**TREND OF IRRIGATED AREA UNDER RICE**

**Share of Irrigated Area under Rice to Gross Irrigated Area among the Districts**

The trend of irrigated area under rice, at the district level, is reflected by the percentage share of area in gross irrigated area in the districts of the State. The percentage share of irrigated area under rice in GIA had witnessed marginal changes during the different decades in the State. Rice covered the largest portion of GIA in the districts of Ahmedabad, Kheda, and Valsad, which was followed by Surat. The percentage share had continuously increased in Kheda and Gandhinagar. Valsad and Surat were also important rice producing districts but their shares had continuously declined over the study period.

**Percentage Share of Irrigated Area under Rice in various Districts of the States’ Total Irrigated Area under Rice**

The percentage share of irrigated area under rice in the total irrigated area under rice had increased with some fluctuation in Ahmedabad and Kheda districts during the study period. The districts which did not report any change in its percentage share were Vadodara, Valsad and Surat, while the share of Panchmahals in
total irrigated area under rice increased during 90’s but than it declined marginally during 2000’s.

The Percentage Share of Irrigated Area under Rice in Total Area under Rice in various Districts of the State

Irrigated area under rice had increased by more than 50 per cent in total area under rice in 2000’s in the State. The rice was mainly cultivated under irrigation condition in Ahmedabad district from 70’s while in Kheda, Gandhinagar from 80’s and Vadodara, Valsad, Surat and Sabarkantha from 90’s. Thus, rice cultivation under irrigated area increased during the period under study. It is noticeable that the Kheda district, had witnessed rapid increase in percentage of area under irrigation to total area under rice crop.

AREA UNDER RICE IN GUJARAT
Total Area under Rice (Kharif and Summer)

An average annual area under rice in the State was 4,708 hundred hectares (hh) in 1970-75, which increased to 6,366 hh in 2000-05. Area under rice between the first (1970-75) and the second (1980-85) period increased while between the third (1990-95) and the forth (2000-05) period, it declined. Over the study period, an absolute change was found to be tune of 1,658 hundred hectares (35.20 per cent rise). Thus, area under rice in Gujarat has increased during the study period.

During the study period i.e., the 4th over the 1st period, area under rice increased in all districts except two Sabarkantha (-24.56 per cent) and Mehsana (-15.99 per cent) districts. Thus, the percentage of area under rice was observed to be the highest in Gandhinagar (1426.19 per cent) and lowest in Valsad districts (4.39 per cent).

Area under Rice in Kharif Season

An average annual area under kharif rice in Gujarat was 4,708 hundred hectares, which increased to 6,201 hh in 2000-05. In absolute term, area under this crop had increased by 1,493 hundred hectares (31.71 per cent) and was stuck between the first and the forth period.
During the overall study period, the area under kharif rice increased in all districts except three districts viz., Sabarkantha (24.26 per cent), Mehsana (15.99 per cent) and Valsad (3.21 per cent). The highest percentage rise (1426.19 per cent of this area) was observed for Gandhinagar, followed by Dangs (168.03 per cent) and Vadodara (6.28 per cent) districts.

Area under Rice in Summer Season

Rice, as a summer crop, was cultivated under little area in Gujarat state because as it requires huge irrigation facilities. Summer rice is grown in Valsad, Kheda, Surat and some part of Panchmahals and Bharuch districts in the State.

During 1980-85 annual average area under summer rice was 68 hundred hectares (hh), which significantly rose to 164 hh in 2000-05. Among the summer rice producing districts, a noticeable increase was found in Valsad district i.e., the area under rice in summer season had increased from 56 hundred hectares to 69 hundred hectares during the study period. In third period, area in this season increased appreciably in Kheda and Surat districts than the previous period and in Surat district it was again better in fourth period.

Irrigated Area under Rice

For the period of 1970-75, average annual irrigated rice area was 1,390 hundred hectares in Gujarat, which had continuously increased to 3,402 hundred hectares up to 2000-05. Between the 1980-85 and the 1970-75, the percentage of irrigated rice area augment by 73.28 and it was higher as compared to other two periods over the study period. Area under irrigated rice had increased remarkably in all the major rice producing districts except Vadodara during the whole study period. The maximum increase was found in Gandhinagar district (1909.68 per cent).

Unirrigated Area under Rice

The average annual unirrigated area under rice was 3,319 hundred hectares in 1970-75, which declined to 2,963 hundred hectares in 2000-05. The area under unirrigated rice in Gujarat had declined by 10.70 per cent during the study period. Over the study period, the area under unirrigated rice decreased mostly in all the districts except Dangs (168.03 per cent), Gandhinagar (63.64 per cent), Surat (31.63
per cent) and Bharuch (8.64 per cent). Among other districts, the maximum percentage declined was found in Ahmedabad (81.92 per cent), followed by Sabarkantha (77.89 per cent).

PRODUCTION OF RICE IN GUJARAT

Percentage Share of District Rice Production in the State Rice Production

The percentage share of rice production had increased in Ahmedabad, Dangs, Gandhinagar, Kheda and Surat districts. Among these districts, the production of rice had increased significantly in Kheda followed by Surat and Ahmedabad districts during the study period. The percentage share of Kheda in the total rice production of the state had increased significantly during 1980-85 as compared to 1970-75. Kheda district ranked first in the percentage share of rice production during the study period except 1970-75.

Total Production of Rice

The average annual production of rice in Gujarat State was 4,264 hundred tonnes in 1970-75 which noticeably increased to 9,471 hundred tonnes in 2000-05. Between the 1st and the 2nd period production of rice increased by nearly double with 91.21 per cent (4,264 hundred tonnes). It again rose by 19.63 per cent (8,154 to 9,754 hundred tonnes) between the 2nd and the 3rd period, whereas between the 3rd and the 4th period it reduced (2.91 per cent). Over the three and a half decades, production of rice increased more than double with 122.10 per cent (4,264 hundred tonnes). Throughout the whole study period, rice production was better in all the districts (except Panchmahals). Rice production drastically increased in case of Gandhinagar (3994.54 per cent). Vadodara district had no record any change during the study period.

Production of Kharif Rice

The average annual production of rice in in the kharif season was 4,264 hundred tonnes in 1970-75, which extraordinarily went up to 9,145 hundred tonnes in 1990-95; whereas, the production was marginally declined to 8,925 hundred tonnes in 2000-05. During the entire period, the production of rice in kharif season rose in all the districts except Panchmahals. In the case of Gandhinagar district, production went up very fast. Sabarkantha was at the last position in raising rice production.
Production of Summer Rice

The average production of summer rice was 232 hundred tonnes in 1980-85 and its increased by more than one and half fold (162.73 per cent) in 1990-95; but it decreased marginally (10.41 per cent) in 2000-05. In 1980-85, Valsad was the principal rice producer district of the state. In 1990-95, Surat and Kheda were other major summer rice producing districts and their share considerably increased yet Valsad had remained as a dominant district. During the second and the forth period, production of rice increased in all districts. Out of them, Kheda district was at the top position (1147.62 per cent).

Production of Irrigated and Unirrigated Rice

For the state as a whole, the average production of irrigated rice did not report noticeable change in the 2000-05 over 1990-95. At the district level, this production had fallen. In this period, production of rice increased in Bharuch (167.56 per cent) and was followed by Gandhinagar. The production of unirrigated rice decreased at the State level as well as at the district level except two viz., Gandhinagar (280 per cent) and Dangs (108.72 per cent) districts.

YIELD OF RICE IN GUJARAT

Productivity of Rice

The average per hectare yield of rice which was 906 kg in 1970-75 increased to 1,341 kg in 1980-85, 1,443 kg in 1990-95 and again marginally increased to 1,488 kg in 2000-05 in Gujarat. Thus, between the 2nd and 1st period, yield of rice increased by 48.04 per cent and was more as compared to previous two decades. During the 3rd over the 2nd, it was increased lower by only 3.11 per cent. During the overall study period, i.e., 1970-75 to 2000-05 the percentage yield rate increased by 64.28.

The yield of rice was relatively higher than state’s rice yield in almost all the districts except Valsad, Kheda, Surat and Ahmedabad during the first period. In 1990-95, yield was significantly higher than state’s rice yield in Valsad, Kheda, Ahmedabad, Surat and Gandhinagar while for the remaining districts it was lower. In third period (1990-95) the yield of rice was higher except Vadodara, Bharuch, Dangs, Panchmahals and Sabarkantha districts as compared to yield of state. Finally, for the period 2000-05, in cases of Ahmedabad, Valsad, Gandhinagar, and Surat districts
were relatively more than the state’s rice yield. For the other districts it was lower than the state’s yield.

During the overall study period, the yield of rice increased in all the rice growing districts except Panchmahals (13.93 per cent). The maximum yield was found in Gandhinagar (168.29 per cent) as compared to earlier periods.

**Yield of Kharif Rice**

The yield of kharif rice had increased in Gujarat from 906 kg in 1970-75 to 1,439 kg in 2000-05 (58.91 per cent rise). The yield rate increased noticeably during the second over the first period in Gujarat while for remaining periods it had marginally increased. It varied from 5.19 to 3.86 percent.

During the study period, yield of kharif rice had improved in all districts (except Bharuch) in the 2nd over the 1st period. During the 3rd over the 2nd period, some districts like Panchmahals (20.39 per cent), Dangs (15.53 per cent), Ahmedabad (4.99 per cent) and Kheda (1.84 per cent) the yield had gone down as compared to the earlier period. Yield of rice increased in Ahmedabad, Dangs, Kheda and Surat districts during the 4th over 3rd period. However, it declined in Vadodara and Mehsana districts as compared to the previous period. The yield of kharif rice increased in all major rice producing districts except Panchmahals over the study period i.e., the 4th over the 1st period. Yield of rice increased more in the Gandhinagar district (168.29 per cent).

**Yield of Summer Rice**

The average per hectare yield of summer rice in Gujarat which was 3,429 kg in 1980-85 increased to 3,792 kg in 1990-95 (10.59 per cent rise). It had marginally fallen to 3,323 kg (3.09 per cent fall) in 2000-05. Among the summer rice growing districts of the state, Valsad had higher per hectare yield than the state’s yield during all the periods and in the remaining districts had less yield than that of the state during the various periods. Yield was the quite good in 1990-95 for the Valsad district. The yield of summer rice increased in Kheda (18.43 per cent) and Surat (4.62 per cent) while declined in Valsad (3.35 per cent) over the two and a half decades.
Yield of Irrigated Rice

The average yield of irrigated rice increased marginally (3.68 per cent) during the third to forth period in Gujarat. Bharuch, Valsad, Gandhinagar and Surat districts had higher yield as compared to state yield during both the periods. Surat district had secured a top position with 2631 kg and 2550 kg in the 3rd and the 4th periods respectively. The yield increased significantly in Sabarkantha (21.84 per cent), Panchmahals (17.44 per cent), Bharuch (17.30 per cent) and Gandhinagar (10.88 per cent), In Ahmedabad and Vadodara districts a marginal increase was found and in the remaining it had declined.

Yield of Unirrigated Rice

For the state of Gujarat, the yield of unirrigated rice per hectare had gone down (4.80 per cent) during the last decade. Valsad, Dangs, Mehsana and Surat districts had higher yield as compared to state’s yield in the third and fourth periods. Among these districts, Valsad was at very strong position during both periods. Except above districts, remaining districts had significantly lower yield than state’s yield.

COMPOUND GROWTH RATE OF RICE

The total production of rice had increased at the rate of 2.91 per cent per annum during 1970-71 to 2004-05 in the state. District wise breakup of the data shows that in the major rice producing districts, Gandhinagar reported highest growth rate of production (13.25 per cent per annum) during the whole period which was followed by Dangs (4.67 per cent per annum). The production of rice increased at the annual rate of 4.42 per cent in Surat, 3.58 per cent in Ahmedabad and 3.36 per cent in Kheda districts during the study period. On an average, the production had increased significantly, mainly due to increase in productivity and area under rice.

The growth rate of productivity and area were 1.67 and 1.23 respectively per cent for the state during the period 1970-71 to 2004-05. Annual growth rate of area and yield was positive for the major rice producing districts except Mehsana, Panchmahals and Sabarkantha during the same period. Growth rate of rice yield was higher as compared to that of area for the districts of Vadodara, Bharuch, Valsad and Surat. While growth rate of area was higher than growth rate of yield for Ahmedabad, Dangs, Kheda, and Mehsana. Sabarkantha had negative growth rate of area and
positive growth rate of yield while Panchmahals had positive growth rate of area and negative growth rate of yield during the study period.

**Growth Rate of Kharif Rice**

The production of kharif rice had increased significantly at the rate of 2.67 per cent per annum during 1970-71 to 2004-05 for the Gujarat. Among the major kharif rice producing districts, Gandhinagar had reported highest growth rate of production 13.25 per cent per annum followed by Dangs 4.67 per cent, Surat 3.94 per cent, Ahmedabad 3.58 per cent, Sabarkantha 2.72 per cent and Valsad 2.02 per cent per annum during the study period. Thus, the main rice producing districts had registered significant and positive growth rates of rice production. Except Surendranagar district, the growth rate of production was negative in the all other rice growing districts during the 1970-71 to 2004-05.

The growth rate of productivity and area were significant and positive with 1.54 and 1.11 per cent respectively for the state as a whole during the period of 1970-71 to 2004-05. Annual growth rate of area and yield was positive for the major rice producing districts except Mehsana, Panchmahals and Sabarkantha. Growth rate of yield was higher as compared to area for the Surat district only while growth rate of area was higher than yield for the districts of Kheda, and Valsad districts.

**Growth Rate of Summer Rice**

The production of summer rice had increased significantly at the rate of 6.71 per cent per annum during 1980-81 to 2004-05 for Gujarat. The major summer rice producing districts were Valsad, Kheda and Surat districts. Among these districts, Kheda district reported significant and the highest growth rate of production (18.85 per cent per annum) which was followed by Surat (14.80 per cent per annum) and Valsad (2.49 per cent per annum). On an average the production had increased significantly mainly due to increase in area under rice in summer season. Growth rates of area and productivity had been significant and positive with 6.13 and 0.55 per cent for the state as a whole during the period of 1980-81 to 2004-05. Growth rate of yield was higher than area for only Kheda district. While growth rate of area was higher than yield for the Valsad and Surat districts.
IMPACT OF MINIMUM SUPPORT PRICE ON FARM HARVEST PRICE OF RICE

An attempt was to examine the impact of minimum support price (MSP) on farm harvest price (FHP) of paddy in terms of the relative as well as absolute change in these prices for the period under study i.e. 1970-71 to 2001-02. The relationship between the variables under study was examined by calculating their simple correlation and simple regression.

Minimum support price is one of the effective instruments of agricultural price policy in India. At present, government of India announces the MSP for about 25 agricultural commodities. The “Commission for Agricultural Costs and Prices” (CACP) recommends the MSP to the Government and on the basis of these recommendations the Government of India announces the MSP. The system of fixation of MSP commenced in 1965-66. (Acharya S.S and R.T. Jogi – 2003)

Requirement of Minimum Support Price

In the middle of 1960s, India had to import food grains in very large quantity and due to this reason India had to launch a new agricultural strategy for development. As a part of this, agricultural price policy was introduced. Simultaneously, the government had launched various programs and instruments. Among these instruments, the main instrument was minimum support prices (MSP). During sixties, the farmers faced large fluctuations in prices of their produces due to bumper production and hence they required MSP. In the context of these requirements, Food grain Prices Committee (1966) recommended the fixation of MSP for food grains every year. (Shah V.D. and H.F. Patel-2003)

Support Price for Paddy

The minimum support price for paddy recommended by CACP and fixed by the Government every year. Among the different agricultural commodities, paddy as a common was brought under the MSP policy from the crop year 1966-67. (Acharya S.S. and R.T. Jogi – 2003)
Minimum Support Price (MSP) and Farm Harvest Price (FHP) of Paddy

The per quintal MSP for rice consistently increased from Rs. 53 in 1970-71 to Rs. 530 in 2001-02 with significant average compound growth rate of 8.06 per cent per annum. The coefficient of variation about the trend for MSP of rice worked out to 0.73. The FHP per quintal of rice increased from Rs. 78.09 in 1970-71 to Rs. 711 in 2001-02 with significant average compound growth rate of 7.22 per cent per annum. It was found that MSP and FHP were positively co-related i.e. when MSP moved up FHP also moved up. It was also observed that the gaps between FHP and MSP were noticeable in Gujarat during the study period. This clearly indicates that FHP always remained significantly higher than MSP for rice in Gujarat. Further, on an average, the per annum compound growth rate had almost remained the same for both MSP and FHP during the 1970-71 to 2001-02. Thus, it may be concluded that when the MSP increased FHP also increased during the period under study. The MSP and FHP was highly correlated (0.9828 correlation co-efficient) during 1970-71 to 2001-02.

CONSTRAINTS OF AGRICULTURE IN INDIA

There are many constraints in the agricultural sector; however, for the simplification of discussion, they are grouped into four categories viz. (1) General constraints (2) Technological constraints (3) Resource constraints and (4) Capital constraints. An attempt has been made in the following paragraphs to analysis these constraints in brief.

(1) GENERAL CONSTRAINTS

(a) Pressure of population on land: The excessive pressure of population leads to fragmentation of land which ultimately results in small size of landholdings and restricts farm practices. Therefore, farmers do not earn enough income to meet their basic minimum needs. (Bhargava B.K. and Vandana Sethi -2007). The per person grain harvested area which was 0.22 per hectare during 1950 in India declined to 0.10 per hectare during 2000 (Ramasamy C.-2004).

(b) Rainfall Problem: In India, about 36 per cent of net cropped area receives rainfall below 750 mm. Therefore, farmers can not adopt fully the high yielding varieties and modern technology on their farms because they require more use of water.
(c) **Irrigation Constraints:** These are no appreciable improvement in net irrigated area since the mid-1990s due to the lack of adequate allocation of funds. The increased dependence on groundwater irrigation increases the cost of cultivation. (Narayanamoorthy A.-2007, Bhargava B.K. and Vandana Sethi -2007).

(2) **TECHNOLOGICAL CONSTRAINTS**

(a) **Modern Varieties:** Agricultural production grew at an average annual rate of 3.82 per cent per annum in the 1980s. Since 1990, production growth was slowed, growing at only 2.09 per cent per annum because of lack of up gradation of technology (Fan and Shenggen - 2002). Technological stagnation has adversely affected the productivity of growth of crops in some states of India. The modern varieties of various crops adversely affected the productivity. Growth had remained either flat or had declined in the progressive states. This is due to differential levels of adoption of new technologies, varying degrees of water control, imbalances in infrastructure development and other factors. Differential levels of adoption of modern varieties was also one of the causes for stagnation in yield levels (Narayanamoorthy A. – 2007).

(b) **Chemical Fertilizer Use:** Over and unbalanced use of fertilizers in the assured areas of irrigation is leading to declining input output ratio. It also adversely affects the micronutrient, soil quality and groundwater resources. The fertilizer use efficiency was 17.1 in 1970-71, but decreased 8.1 in 1988-89 and expected to decline to 6.5 in 2000 due to improper technique of application (Sankaran A. – 1990). Imbalances in the fertilizers use were found in all the periods and in various states. The fertilizer consumption which was 25.63 kg per hectare during 1970s and increased to 72.43 kg per hectare during 1990s.

(c) **Mechanization:** Mechanization complements modern varieties to realize the production potential. Labour cost saving mechanical technologies with less drudgery and higher burden of maintenance of draught animals were the factors responsible for decline in use of animal labour. The rate of
machine labour utilization per hectare had grown at the rate of 2.60 per cent per annum. Despite the decrease in use of human and animal labour, there was a rapid rise in wage rates for human and animal labour (Ramasamy C -2004).

(d) **Rain fed Bias:** In the rainfed areas, the productivities of crops are closely linked with the onset and extant of rainfall. Limited irrigation water will continue to be a major constraint for agricultural growth in rain fed areas. The past few decades have shown a secular rise in area under HYVs in rain fed and dry areas and has reached at a reasonable level. However, the productivities have been lower in dry areas as compared to irrigated areas due to poor adoption of associated technologies in the dry areas.

(3) **RESOURCE CONSTRAINTS**

(a) **Marginalization of Holding:** During the liberalization era, over 40 per cent of the rural households became landless or near landless in India. Only about two-third of the owned land belonged to the marginal, small and semi-medium size groups (Ramasamy C. – 2004). The decades 1971-72 to 1991-92 witnessed a marked intensification of the marginalization process. The number small farmers just doubled during the next two decades. The average size of holding decreased from 2.30 hectares in 1970-71 to 1.41 hectares in 1990-91. The number of operational holdings increased from about 70 million in 1970-71 to 106 million in 1990-91. This trend of magnification will continue in the future. More than one-third land is owned and cultivated under small and marginal holdings and their share is increasing progressively. (Vyas V.S.-2002 & Ranjana - 2005).

(b) **Land Degradation:** Natural resource degradation in rural areas is causes serious a concern. The qualitative dimension relates to the loss of nutrients and the pollution of soil environment by agricultural and non agricultural activities. There are large differences in the extent of land degradation due to various reasons. The estimates vary from about 36 million hectares to 188 million hectares (Ramasamy C.- 2004). In India, nearly 141 million
hectares is subject to water and soil erosion. In addition, nearly 34 million hectares is affected by other types of land degradation, i.e., water logging, alkaline and arid soils, salinity, and ravines and gullies etc. Incidence of land degradation is particularly severe in Rajasthan, Madhya Pradesh and Maharashtra. Other seriously affected states are Andhra Pradesh, Gujarat, Karnataka and Uttar Pradesh. These seven states account for three forth of the area affected by soil and land degradation (Vyas V.S.-2002).

(e) **Water Demand:** Agriculture is not only a single largest water consumer but also it is increasingly becoming a cause of water quality deterioration. The production of modern crop varieties, especially of rice and sugarcane, demand larger supply of water. Therefore, even though technological solution have the potential to solve the food problem, they are not sufficient to solve resource problems. Both equity and efficiency are the critical issues in water resource management given the highly uneven distribution of water resources across different regions of the country as well as the inequalities in across to irrigation water across farms within an area. Inequality in farm level access to irrigation water is another major problem as both surface water and groundwater. Due to the adoption of new agricultural technologies the demand for irrigation water has increased significantly, which ultimately has resulted in exploitation of groundwater in many parts of India. (Verma H. M. and Bhaiya S.R.-2004).

(4) **CAPITAL CONSTRAINTS**

(a) **Agricultural Investment:** India being primarily an agricultural economy, the due importance has been given to this sector over a period of time. However, there could be reduction in governments’ expenditure on agriculture consequent to industrialization and implementation of structural adjustment policies. The percentage share of government expenditure on agriculture and allied activates has been declining during the globalization era. At present agriculture shares only 5.2 per cent of the total pubic outlay (Ramasamy C. - 2004). Falling real pubic investment in agriculture is a cause of major concern.
(b) **Capital Formation:** The share of agricultural sector in the domestic product is declining over the years because of relatively lower investment made by the public and private sectors on agriculture. The capital formation in agriculture grew at the rate of 8.51 per cent during 1970s and declined at the rate of 0.33 per cent during 1980s and there was nominal increase during 1990s (1.99 per cent). This was mainly because a large proportion of the total resources ploughed into agriculture sector went to current expenditures on subsidies for fertilizers, irrigation, electricity, credit and other agricultural inputs.

**AGRICULTURAL CONSTRAINTS IN GUJARAT**

Rice is the staple food in the country and in Gujarat; therefore, here it can be made an attempt to discuss some major constraints of rice cultivation because that is directly linked with production and productivity of rice. They also determine the economic conditions of the farmers. These constraints can be grouped in to four categories viz. (1) Natural Constraints, (2) Social constraints, (3) Research constraints and (4) General constraints

(1) **NATURAL CONSTRAINTS**

(a) **Poor Rainfall:** In Gujarat overall position of rainfall is relatively poor. The net cultivated area covered under below 750 mm is about 67 per cent which is larger in Gujarat. Even in good years, there is a gap between two spells of rainfall, sometimes exceeding one month or there is delayed rainfall or missing the last round of rains in September. Sometimes there are two recurring droughts (Patel A.S. – 2006).

(b) **Arid and Semi-arid Area:** The proportion of arid (19.61 per cent) and semi arid (9.46 per cent) area in total net sown area is high.

(c) **Salinity Problem:** There is salinity ingress due to heavy withdrawal of groundwater and little recharge. This is happening in Banaskantha, Ahmedabad, Gandhinagar, Sabarkantha and Mehsana. Salinity in coastal areas is often due to underground faults in seacoast. This problem also prevails in Bhavnagar, Junagadh, Amreli and Kutch.
(d) **Drought Prone Districts:** There are 11 drought prone districts in the state. The drought prone area covered about 29 per cent of the total area. About 18 per cent of the total population lives in these districts (Patel A.S. – 2004).

(e) **High Salinity and Water Logging:** Area adversely influenced by salinity and water logging constituted 21.80 and 16.52 per cent of irrigated area respectively in Gujarat, while the corresponding figures were 9.37 per cent and 9.67 per cent of irrigation utilization respectively at the nation level (Patel A.S. – 2006).

(f) **Irrigation Potential:** The irrigation potential capacities are lower in Gujarat as compared to the national level. Besides, the utilization from the available irrigation potential is weak in Gujarat as compared to the national level.

(2) **SOCIAL CONSTRAINTS**

a) High growth of population

b) Increased fragmentation of landholding

c) Low level of female literacy in many districts like Banaskantha, Panchmahals, Dangs etc. (below 40 per cent), level of female literacy in many districts viz. Kutch, Sabarkantha, Surendranagar, Jamnagar, Junagadh, Amreli, Bhavnagar was between 40 to 50 per cent.

d) Low social status of women and low gender ratio

e) A high percentage of population belongs to schedule tribes (near 15 per cent – 2001) and schedule caste (7 per cent – 2001) and majority of them live in rural areas and are below poverty line. They are also unable to absorb new technology and take risk.

(3) **RESEARCH CONSTRAINTS**

a) Research based improvements are not made in seeds of various crops.

b) Limited expertise available for research in agro-forestry, horticulture-floriculture and fodder crops.

c) Limited knowledge and literature available for post-harvest management activates for the corps.

d) Limited research facility in biotechnology.
e) Little information on cropping system based agriculture for various agroclimatic conditions.
f) Very few research in organic farming
g) Package of practices for integrated pest management not available for many crops.
h) The research on efficient use of water saving devices like sprinklers, drip irrigation are lacking.
i) Lake of effective strategy for management of vast and semi arid soils.

(4) GENERAL CONSTRAINTS

(a) Pressure of population on Land: Increased pressure of population on land has resulted in fall in average operational holding from 4.11 hectares in 1970-71 to 2.93 hectares in 1990-91 and 2.62 hectares in 1995-96 in Gujarat. The share of marginal and small holders was 52.29 per cent and its share in total operated area was 17.79 per cent (Statistical Abstract – 2001).

(b) Fertilizer Use: Average fertilizer use was very low per hectare in Gujarat (only 0.85 kg NPK in 1960-61) as against of India (2 kg NPK). It was 71 kg NPK per hectare in Gujarat which was lower than the India (87 kg) in 2000-01. Due to poor rainfall situation and frequent draughts in Gujarat the use of fertilizer was adversely affected.

(3) Constraint of Irrigation: Gujarat is relatively poor in respect of both groundwater and surface water resources in comparison to all India position (Patel A.S.-1997). The water resources of Gujarat, even after considering allocated share from the inter-state rivers, are hardly 2 per cent of the country’s total water resources. Therefore, the per capita availability of water in Gujarat is only 40 per cent of the India’s average (Patel C.C. -2001). Moreover, inter district disparity in the availability of irrigation water is very high (Patel Arun- 1993).
MAJOR PADDY CULTIVATION PROBLEMS

The major paddy cultivation problems are as follows:

(1) **Yield Gap in Paddy**: India is still among the countries with the lowest rice yields. About 70 per cent of the 414 rice growing districts report yields lower than the national average, clearly indicating that well after the advent of high yielding technology, a sizable area is categorized as low producing. Sixty per cent of the low productivity rice areas are in Bihar, Orrisa, Assam, West Bengal and Uttar Pradesh. Moreover, 32 per cent of the irrigated rice areas produce low yields. Yield gap analysis further reveals that 30 to 40 per cent of the potential yield is yet to be tapped with the available high yielding varieties sown on highly productive irrigated soils (Ramasamy C. - 2004). After a long period of technological breakthroughs and adoption, yield gap still exists in many states. There was noticeable gap found in states during 1990-91 to 1997-98. The gap was more than 50 per cent i.e.56.50 per cent to 75 per cent between state average yield and experimental average yield of rice in many states of the country.

(2) **Low level Yield of Rice**: Despite of being an ‘agriculturally advanced’ state the yield of rice in Gujarat was found lower than the national average (except 1970-71 year). The yield of rice in Gujarat was 55.40 per cent below than that of Bihar, which is a backward state with massive illiteracy. The yield of rice was much below than that of other leading states like Punjab, Tamil Nadu, Haryana, Karnataka and Andhra Pradesh. Thus, even through 90 per cent of rice grown in high yielding varieties, it appears that adequate attention has not been paid to improve yields.

(3) **Stagnant Area under Rice**: Gujarat had higher area under cultivation of rice (4.89 lakh hectares) than Punjab (3.9 lakh hectares) and Haryana (2.69 lakh hectares) in 1970-71. Area under rice cultivation had reached to 6.75 lakh hectares, a growth of 38.04 per cent in Gujarat in 2003-04, whereas, in Punjab area under cultivation of rice increased to 26.14 lakh hectares (a growth of 570.26 per cent) and in Haryana to 10.16 lakh hectares (a growth of 277.70 per cent).

(4) **Benefit Cost Ratio of Rice Declines**: The surplus production of rice could not be exported profitably as the ruling price in the international markets was not affordable.
Consequently with mounting stocks, the prices of commodities in the domestic market fell far below the cost of production. In case of paddy, a proportionate increase in the cost of production was more than the increase in income and as a result, the benefit cost ratio declined (Ramasamy - 2004).

RICE CULTIVATION PROBLEMS IN GUJRAT

The share of non-food grain crops in GCA has increased from nearly 53 per cent to 60 per cent during the study period i.e., 1970-75 to 1998-2003. (Patel A.S - 2006). Among various food grains crop, the area under rice had gradually increased over the study period. The percentage share of area under rice in total cereal's area as well as in total food grain's area significantly increased during the study period. However, there were many rice cultivation problems in Gujarat at the district level. Some major problems are narrated below.

RICE CULTIVATION PROBLEMS

(1) Low Productivity Level of Rice: The overall growth performance of agriculture in Gujarat is observed poor. Hence poor productivity performance in respect of paddy in Gujarat may be a part of the general trend observed in the state. At the district level, out of 11 major rice growing districts, only in 5 districts the yield rates had shown a noticeable change in the study period.

(2) Price of Paddy: The MSP declared by the Government for each crop is uniform for all the states of India. Due to large variations in cost of production of crops from state to state, district to district and farmer to farmer, it is obvious that declared MSP cannot ensure cost plus situation for all farmers. There was wide variation in the yield level of paddy, high inter district variation of cost of production. Cost of production of paddy was Rs. 510 per quintal in Sabarkantha in 2000-01 agriculture year and the MSP declared for paddy was Rs. 510 per quintal. A comparison of cost of paddy and MSP clearly suggest that declared MSP was not favorable to paddy growers of the state (Shah V. D. and Patel H. F. - 2003).

(3) Use of HYV Seeds of Paddy and Productivity

According to Gujarat Agro vision 2010, a working document, yield of rice was static during 1988-89 to 1997-98. The yield was 20 per cent lower than the nation average. However, almost 90 per cent area was under HYV.
(4) Extension Activities: Agricultural education and extension activities act as a support in the adoption process by the farmers by providing inputs at every stage of the farming practices till it results economic surplus. There is a lack of regularity in visits made by the extension personal, therefore, the system of extension activities and services have remained very poor and ultimate objective of growth and development is not achieved satisfactory (Gujarat Agrovision – 2000). This situation and attitude toward these services of the farmers has effects on the farming practices, which also inversely affects the paddy cultivation, because this crop has higher disease during the maturity.

(5) Problems regarding Areas under Paddy Crop Cultivation: Area under rice has not shown any significant changes. Rice is mainly a rain fed crop. Alluvial soils and heavy rainfall or availability of irrigation are the two dominant favorable factors for the geographical distribution of rice in Gujarat (Dutta Rajeshree A – 1993). Among the major rice growing districts, there are variation in alluvial soils which affects the yield of paddy. During the study period, the irrigated area has increased remarkably in Kheda, Gandhinagar, Mehsana and Surat district only while it has increased gradually in the remaining districts. The paddy crop is the most irrigated crop and lack of sufficient development of irrigation facilities in the paddy growing district results in the stagnation in the area under rice cultivation.

(6) Agro-climatic related Problems: Water logging and salinity are major constraints in the major rice growing districts such as Surat, Bharuch, Valsad and Dangs districts. The groundwater potential inadequately tapped in these districts. The large area prone to soil erosion is in Vadodara, Kheda and Panchmahals due to undulating terrain depleting soil fertility and crop productivity. Some pockets suffer from water logging and soil salinity problems in these districts. The inherent salinity in large areas is in Ahmedabad, Gandhinagar, Mehsana and Sabarkantha districts (Dutta Rajeshree A – 1993).

a. Arid land - The districts included in this type of land are Mehsana and Sabarkantha. These districts are suffering from inadequate and erratic rainfall.

b. Semi Arid land – Gandhinagar, Ahmedabad, Kheda, Panchmahals and Vadodara districts would be included in this category. Soil salinity in this region is caused by weathering of the marine sedimentary rocks. Due to
salinity of soil problem, some part of these districts agricultural land has lost its productivity considerably.

Thus, various agro climatic problems have affected the rice cultivation and its productivity.

VARIABILITY IN PRODUCTIVITY OF RICE IN GUJARAT

The nature of variability in productivity per hectare over time is worth inquiring. In order to inquire in to this aspect the estimates of co-efficient of variations (C.V.) were carried separately for the various decades. The co-efficient of variations (C.V.) indicates the disparities or inequality among the districts. In this context, an attempt is made here to examine the extent of variability in the yield of rice in different districts of the state.

Productivity of Rice: The C.V. of rice productivity decreased in the second period as compared to first period but there was further a marginal increase in the state. During the first to third period, C.V. continuously decreased for Ahmedabad, Vadodara, Bharuch, Gandhinagar, Kheda and Mehsana districts, whereas; the C.V. increased in Valsad, Sabarkantha, Banaskantha, Bhavnagar and Jamnagar districts. For the forth period, C.V. was been observed to significantly high for all districts except Vadodara, Bharuch, Surat, Dangs and Panchmahals.

Productivity of Kharif Rice: Among the main rice-growing district in the kharif season, C.V. continuously declined in all districts. The extent of decrease were found to be considered as significant for Ahmedabad, Bharuch, Kheda, Mehsana and Panchmahals districts as well as the state during the last three decades. For the forth period, C.V. was observed to be significantly high for all districts except Vadodara, Bharuch, Surat, Dangs and Panchmahals.

Productivity of Summer Rice: During the second to third period, C.V. significantly decreased in all summer rice producing districts except Valsad. For the state as whole, C.V. was marginally high in second period.

Productivity of Irrigated Rice: The C.V. of irrigated rice yield was marginally declined in second period but increased marginally in the third period while it
significantly increased in the forth period. Among the main rice-growing district area under irrigated rice, the C.V. of yield of irrigated area continuously declined in Ahmedabad, Vadodara, Valsad, Gandhinagar and Mehsana. Among the major rice producing districts, Surat had higher and Kheda had lower C.V.

Productivity of Unirrigated Rice: The C.V. of yield of unirrigated area increased in almost all major rice growing districts in 1990-91 to 1999-2000 periods as against 1970-71 to 1979-80 but it declined in the state as a whole.

Highest and Lowest Yield Levels

An attempt is made to judge the nature of variability through the data of maximum and minimum levels of yield of rice per hectare. Generally, with the economic and agricultural development, the yield of crops are expected to go up, further the variance of yield is expected to go down. The absence of such expected trend with fluctuating yield of rice is considered as an indication of instability.

Total Rice Yield

During 1970-71 to 1974-75 the per hectare yield of rice found maximum 1,234 kg and minimum 526 kg in Gujarat. The variation was about 57 pre cent (708 kg.) during this period. Among the major rice growing districts the maximum yield was 1,575 kg in Kheda and minimum yield was 20 kg in Panchmahals. The high variation was observed in Panchmahals (97.88) and low variation was observed in Surat district (41.54 per cent).

During 1980-81 to 1984-85, the higher per hectare yield was obtained (1,947 kg) in Kheda and lower yield was obtained (300 kg) in Bharuch district. Panchmahals district registered higher variation about 81 per cent and lower variation was found was in Mehsana (16.36 per cent).

For the state as whole, the per hectare yield of rice was found maximum 1,590 kg and minimum 1,211 kg in Gujarat during 1990-91 to 1994-95. The variation was 378 kg (28.8 pre cent) during this period. The higher per hectare yield was obtained for Gandhinagar (2,480 kg) and lower per hectare yield was obtained for Panchmahals
district (242 kg). Panchmahals district registered higher variation 74.55 per cent and lower in Surat only 10.82 per cent.

During 2000-01 to 2004-05, the per hectare yield of rice was found maximum 2,010 kg and minimum 896 kg in Gujarat. The variation was 1,115 kg (55.45 pre cent) during this period. The per hectare higher yield was obtained for Valsad (4,214 kg) and lower per hectare yield was obtained for Panchmahals district (66 kg). The higher variation was found again in Panchmahals district (94.49 per cent) and lower in Surat (16.90 per cent).

Yield of Kharif Rice

During 1970-71 to 1974-75 per hectare yield of rice found maximum 1,234 kg and minimum 526 kg in Gujarat. The variation was about 57 per cent (708 kg) during this period. Among the major rice growing districts the maximum yield was (1,575 kg) in Kheda and minimum was (20 kg) in Panchmahals during the 1970-71 to 1974-75. The high variation was observed in Panchmahals (97.88) and low variation was observed in Surat district (41.54 per cent).

The per hectare yield of rice was found maximum 1,501 kg and minimum 980 kg in Gujarat during 1980-81 to 1984-85. The variation was 521 kg (34.68 per cent) during this period. The higher per hectare yield was obtained in Valsad (2,216 kg) and lower was obtained in Vadodara district (422 kg). Panchmahals district registered higher variation (about 81 per cent) and lower was registered in Mehsana (16.36 per cent).

The per hectare yield of rice was found maximum 1,537 kg and minimum 1,151 kg in Gujarat during 1990-91 to 1994-95. The variation was 386 kg (25.12 per cent) during this period. The higher per hectare yield was obtained for Gandhinagar (2,480 kg) and lower was obtained for Panchmahals district (242 kg). Panchmahals district registered higher variation (74.26 per cent) and lower was registered in Surat (8.37 per cent).

For the state as whole, the per hectare yield of rice was found maximum 1,952 kg and minimum 851 kg in Gujarat. The variation was 1,100 kg (56.38 pre...
cent) during this period. The per hectare higher yield was obtained for Valsad (4,275 kg) and lower was obtained for Panchmahals district (66 kg). The higher variation was found again in Panchmahals district (94.47 per cent) and lower was in Surat (14.16 per cent).

**Yield of Summer Rice**

During 1980-81 to 1984-85 the per hectare yield of rice was found maximum 4,367 kg and minimum 2,950 kg in Gujarat. The variation was about 32 per cent (1,417 kg.) during this period. Among the major rice growing districts the maximum yield was in Valsad (4,492 kg) and minimum was in Surat (2,167 kg). The higher variation was observed in Surat (4,277 kg).

The per hectare yield of rice was found maximum 4,571 kg and minimum 3,043 kg in Gujarat during 1990-91 to 1994-95. The variation was 1,528 kg (33 per cent) during this period. The higher per hectare yield was obtained again in Valsad (5,500 kg) and lower was obtained in Kheda district (2,537 kg).

The per hectare yield of rice was found maximum 4,636 kg and minimum 2,841 kg in Gujarat during 2000-01 to 2004-2005. The variation was 1,795 kg (39 per cent) during this period. The higher and lower per hectare yield was obtained in Surat (4,824 kg and 2,228 kg).

**SOCIO AND AGRO ECONOMIC PROFILE OF SAMPLE FAREMRS**

In chapter IV “Socio and agro economic profile of sample farmers; cost of production, marketable surplus and marketing of paddy” on the basis of a farm level survey to analyses, the socio and agro economic profile, cost of paddy cultivation, production, marketable surplus of paddy and opinions etc. of selected 120 sample households have been presented. Two tehsils namely Sojitra and Matar of Kheda district were selected and from each selected tehsil, 60 samples of paddy growers were selected. The results and finding of the micro study are presented in this chapter. A brief outline of the results of the survey its presented in the following paragraphs:
Population

The sample households had a total population of 736 persons. Out of the total population, 70.52 per cent were male and 29.48 per cent were female. Marginal, small, medium and large farm households were 161 (21.88 per cent), 167 (22.69 per cent), 195 (26.49 per cent) and 213 (28.94 per cent) persons respectively.

Working Population

Out of the total population, 61.82 per cent were working population. The percentage of working population was highest (77.95 per cent) in the group of medium farmers and it was lowest (54.49 per cent) in the group of small farmers.

Annual Income

The average annual income of the sample farmers was Rs. 1.86 lack in the reference year. Majority of the sample households' (39.17 per cent) average annual income were Rs. 1 to 2 lack and only 7.50 per cent farmers' average annual income were above Rs.4 lack. The major sources of the income of the small and medium farmers were farming. Average annual income of the big farmers was 3.59 lacks.

Family Size

The average family size of the sample households was 6.13. The family size of marginal, small, medium and large farmers was 5.37, 5.57, 6.50 and 7.10 respectively. The majority of the farmers (67.50 per cent) had below 6 family members.

CHARACTERISTICS OF SAMPLE HOUSEHOLDS' HEAD

Age Group

The age of the farmer has been an important factor for making quick decision regarding adoption of new seeds, fertilizers, pesticides etc. The age of the respondents ranged from 20 to 90 years. The average age of the heads of the farm households was about 48 years. Among the various groups of farmers, large farmers were old (above 53 years) as compared to other size groups of farmers. Out of 120 farmers, 51 farmers (42.50 per cent) were from middle age group (26 – 45 years). Majority of the sample farmers (55.83 per cent) were old aged. The reason was that in the sample area young ones were not capable of taking the responsibility as a farmer.
Educational States

The formal education helps farmers to understand the consequences of new technology and therefore an attempt is made to examine the educational status of paddy growers. Out of the total sample farmers, 61.67 per cent of the heads of the family were educated up to primary school and 30 per cent had education between primary school and higher secondary school. Only 1.67 per cent heads had education above higher secondary. Out of the total sample farmers, only 4.17 per cent farmers were illiterate. It was noticed that there was no relationship between education and size of the operational holding of the farmers.

Caste

It is seen that majority of the sample farmers (84.17 per cent) were from general category, followed by scheduled castes (9.17 per cent) and other backward class (6.67 per cent). The similar trend was found amongst marginal and large size while small and medium farm size groups reached differently.

Occupation

Out of total sample farmers, 28.33 per cent farmers were fully dependent on farming only, while remaining farmers (71.67 per cent) were engaged in other occupation along with farming. Among the different farm groups, medium (36.67 per cent) and large (40 per cent) farm groups were engaged only in farming because they had higher cultivated area. On the other hand, marginal and small farm groups did farming as well as other economic activities due to less cultivated area. About 47.50 per cent farmers were engaged in farming as well as in animal husbandry. More than 50 per cent of the marginal farmers were dependent on farming along with labour. It can be concluded that majority of the paddy growers were found to be dependent on farming along with animal husbandry as well as labour.

OWNERSHIP OF FARM IMPLEMENTS AND EQUIPMENTS

The ownership of farm implements and equipments help in carrying out the farm operation efficiently and therefore it is pertinent to analyze ownership of farm implements and equipments owned by sample farm households.
(A) Traditional Farm Implements

Traditional farm implements are very important in Indian farming. Out of total implements (1614), 15.55 per cent, 21.56 per cent, 25.84 per cent and 37.05 per cent implements were with marginal, small, medium and big farm groups, respectively.

(B) Non-traditional Agricultural Assets

Tractors and Trolleys

Out of total 23 tractors and 22 trolleys, the majority of ownership of tractors and trolleys were with large farm group (89.57 per cent tractors and 72.73 per cent trolleys).

Wells and Tube wells

In respect of ownership of wells, out of 24 wells, 4 (16.67 per cent), 9 (37.50 per cent) and 11 (45.83 per cent) were owned by small, medium and large farm groups. In case of ownership of tube wells, out of 12 tub wells, 8 (66.63 per cent) were owned by big farmers only.

Electrical and Diesel Pumps

As regard to ownership of electrical pumps, out of 208 electric pumps, 102 each (49.51 per cent) were owned by marginal and big farm groups; while only 2 (0.97 per cent) owned by medium farm group. Out of 25 diesel pumps, 5 (20 per cent) were owned by small farm group, 9 (38 per cent) were owned by medium farm group, and 11 (49 per cent) were owned by big farm group.

Ownership of Livestock

The allied activity i.e., animal husbandry is a subsequent source of income with farming for the farmers and hence it is appropriate, to examine the ownership of livestock. Out of the total animals, 15.68 per cent, 21.75 per cent, 23.44 per cent and 39.12 per cent were owned by marginal, small, medium and large farm groups respectively. Ownership of animals is also positively related with the farm groups. Average household ownership of animals was 4.94.
Investment in Implements and Equipments

Per farm household's investment in implements and equipments was Rs. 1,24,867. The investment was in non-traditional implements and equipments were Rs. 1,22,224 while in traditional implements was Rs. 2,643. Out of investments in non-traditional implements and equipments, Rs. 67,800 (55.47 per cent) was only in tractor, Rs. 21,625 (17.69 per cent) was in tube well, Rs. 7,342 (6 per cent) was in trolley and remaining investment was in pipes, diesel pumps, thresher, electric pumps and spraying pump. It is interesting to observe that category wise investment in farm implements and equipments were positively related with farm size groups. The maximum investment was Rs. 3,45,695 by large farm group and minimum investment Rs. 17,588 by marginal farm group.

Ownership of Residential Structures and Cattle Sheds

On an average, the value of all types of houses worked out to Rs. 79,141. Average value of all types of houses for marginal, small, medium and large farm groups worked out to be Rs. 30,550, Rs. 58,748, Rs. 76,684 and Rs, 1,27,154 respectively.

LAND USE PATTERN

Size of operational holding influences the cost of cultivation of crops, adoption of modern and new technology and capital investment in agriculture. The size of operational holding was examined in this chapter.

Average owned land holding was 2.06 hectares per sample farm household. It was 0.64 hectare for marginal farm group and reached up to 4.25 hectares for large farm group. The average operational holding was 2.57 hectares per sample farmer. Net cultivated area was 2.50 hectares per farmer. Area sown in more than one season was 2.29 hectares per farmer and therefore gross cropped area was 4.79 hectares per farmer.

Cropping Intensity

Cropping intensity measured in percentage terms is a ratio of GCA and the net operated area. The cropping intensity of paddy growers worked out to 1.92.
Cropping Pattern

Our prime objective was to analyze the cost of cultivation of paddy, income, profit and yield and hence an attempt was made to examine cropping pattern adopted by sample households. For the sample farmers, non-food grain crops constituted only about 6.54 per cent while food grain crops accounted for 92.19 per cent of TCA.

Among the food grain crops, paddy was a main crop (accounting for 71.75 per cent of total cropped area). The kharif paddy and summer paddy crop accounted 47.36 per cent and 24.39 per cent respectively. Thus, larger area was cultivated under kharif paddy as compared to that under summer paddy. Paddy was an important food grain crop of the study area and its relative share was 83.84 per cent of total cropped area (TCA) for marginal farmers and 68.45 per cent for large farmers. For small farmers this share was 67.58 per cent and for medium farmers, it was 73.25 per cent of TCA.

The relative share in the area under kharif paddy was 49.64 per cent for marginal farmers and 46.36 per cent for large farmers of TCA. For small farmers, the share was 47.66 per cent and medium farmers’ share was 48.69 per cent. Area under summer paddy decreased from 34.20 per cent of TCA for marginal farmers to 22.09 per cent for large farmers while for small farmers the share was 27.74 per cent and for medium farmers; it was 24.57 per cent of TCA. Among the varieties of paddy grown by farmers, Gujari is very popular in the study area in both kharif and summer seasons. Its share accounted for 37.25 per cent in kharif season and 19.95 per cent in summer season.

Cost of Cultivation of Paddy (Kharif and Summer)

Total per hectare cost of cultivation (Cost \( C_2 \)) under paddy had fluctuated between Rs. 21,807 in respect of medium farmers to Rs. 23,677 in case of marginal farmers with the overall average of Rs 22,617. The cost of cultivation and farm size groups were inversely related with the land holding groups. The share of Cost A in the total cost of cultivation for all the size of holding was 74.84 per cent.

Among the various components of Cost \( C_2 \), the cost on human labour had occupied a first position with 29.33 per cent (Rs. 6,634), rental value of own land 15.81 per cent (Rs. 3,576), chemical fertilizers 13.36 per cent (Rs. 3,022), tractor
charges 12.52 (Rs. 2,831), irrigation charges 7.40 per cent (Rs. 1,675), family labour 7.11 (Rs. 1,608), farm yard manure 4 per cent (Rs. 905) etc. Thus, it could be inferred that the human labour, chemical fertilizers, tractor charges and irrigation were the major cost components in the paddy cultivation.

Cost of Cultivation of Paddy in Kharif Season

Total overall average cost of cultivation (Cost C2) of per hectare kharif paddy was Rs. 22,630. This cost ranged from Rs. 21,640 in respect of medium farmers to Rs. 24,832 in case of marginal farmers. The cost of cultivation and farm size groups were inversely related with the land holding groups. The share of Cost A in the total cost of cultivation for all the size of holding was 76.83 per cent.

Among the various Cost C2, the cost on hired human labour occupied the first position with 29.76 per cent (Rs. 6,735), rental value of own land 14.05 per cent (Rs. 3,181), tractor charges 12.98 (Rs. 2,938), chemical fertilizers 12.85 per cent (Rs. 2,909), family human labour 6.81 (Rs. 1,541), farm yard manure 6.05 per cent (Rs. 1,369), irrigation charges 5.72 per cent (Rs. 1,296). Thus, it can be inferred that the human labour, tractor charges, chemical fertilizes, farm yard manure, irrigation were the major cost components in the kharif paddy cultivation.

Cost of Cultivation of Paddy in Summer Season

The overall per hectare average cost of cultivation of paddy was Rs 22,595 in summer season. This cost of cultivation ranged from Rs. 21,623 in respect of small farmers to Rs. 23,306 in case of large farmers. It is interesting to note that the relation between cost of production and farm size groups was quite positive with the land holding groups. The overall average Cost A was 71.09 per cent in cost C2.

The cost on hired human labour occupied was first position with 28.52 per cent (Rs. 6,444) followed by rental value of own land 19.09 per cent (Rs. 4,314), chemical fertilizers 14.31 per cent (Rs. 3,233), tractor charges 11.65 (Rs. 2,632), irrigation charges 10.55 per cent (Rs. 2,383), family human labour 7.68 (Rs. 1,735) of the Cost C2. Thus, it can be noted that the human labour, chemical fertilizes, tractor charges, irrigation were the major cost components in the summer paddy cultivation.
Comparison of Cost of Cultivation of Paddy between Kharif and Summer Season

The results of comparison of cost of kharif season paddy and summer season paddy are as follow:

1. Usually, the farmers have to put farm yard manure in their farms every year before the monsoon season start. Therefore, the cost of farm yard manure was significant in the kharif season.

2. In case of seed/seedling of paddy, the requirements of per hectare paddy seed was more in summer season because the pace between two sapling were less as compared to kharif paddy. So, the expenditure on seed/seedling was marginally high.

3. The cost of fertilizer was slightly higher for summer paddy as against kharif paddy due to more use of fertilizers especially UREA and DAP. The growth of paddy plants are usually slow in summer season and hence the farmers have to use more doses of fertilizers in this season.

4. The summer paddy totally depends on irrigation either canal irrigation or other sources of irrigation. The expenses of irrigation were significantly higher in summer paddy. The main reasons were: (1) The rate of canal water per acre was more in summer, (2) Availability of canal water for irrigation was irregular, so the farmers had to use other sources of irrigation which were quite expensive, (3) The per hour charges of irrigation differed from source to source and from seller to seller due to lack of appropriate supply of electricity, (4) When the canal water did not reach at farms due to slow flow of water, the farmers of the study area were forced to go for other irrigation sources and (5) The requirement of watering was more in summer season as compared to kharif season of paddy.

5. Generally in the wet crops of the kharif season, particularly kharif paddy, various disease and insects were found and hence the cost of pesticides was significantly more in this season as compared to the cost of pesticides in summer paddy.

YIELD OF PADDY

1. The average per hectare yield of paddy was 50.79 quintals (Kharif and summer seasons).
2. The average per hectare yield of paddy was 59.24 quintals in summer season as against 46.26 quintals in kharif season. The main reason was that the productivity of paddy was higher due to low level of diseases was lower in the summer season.

3. Farm size group wise variation in yield level of paddy in kharif season was found insignificant.

4. Farm size group wise variation in yield level of paddy in summer season was found quite significant.

Cost of Production, Return and Input-Output Ratio of Paddy

Total Paddy (Kharif and Summer): The average per hectare gross return of total paddy varied from Rs. 37,007 in the case of large farmers to Rs. 33,651 in the case of medium farmers, with an overall average of Rs. 35,757. The average returns over cost A, cost B and cost C2 were Rs. 18,832, Rs. 14,748 and Rs. 13140 respectively. This clearly indicates that the paddy cultivation was profitable during the reference period. The average per quintal cost C2 of total paddy was estimated to be Rs. 445. The input-out ratio was favorable for all the farm size holding groups. It was 1:2.72 for all the farmers as a whole. On an average one rupee invested in the cultivation of paddy earns Rs. 2.72.

Kharif Paddy: On an average per hectare gross return of kharif paddy was Rs. 31,806 and it varied from Rs. 32,767 in case of large farmers to Rs. 30,633 in case of small farmers. The average returns over cost A, cost B and cost C2 were Rs. 14,419, Rs. 10,717 and Rs. 9,176 respectively. Thus, paddy cultivation was profitable in kharif seasons during the study period. The average per quintal cost C2 of total paddy was estimated to be Rs. 489. The input-out ratio was favorable for all the farm size holding groups. It was 1:3.47 for all the farmers as a whole. It indicated that an average one rupee invested in the cultivation of paddy earns Rs. 3.47.

Summer Paddy: On an average per hectare gross return of paddy Rs. 43,142 in summer season and it varied from Rs. 45,542 in case of large farmers to Rs. 39,495 in case of marginal farmers. The average returns over cost A, cost B and cost C2 were Rs. 27,079, Rs. 22,282 and Rs. 20,548 respectively. Thus, summer paddy cultivation
was also profitable during the reference year. The average per quintal cost $C_2$ of total paddy was estimated to be Rs. 381. The input-out ratio was favorable for all the farm size holding groups and it was 1:2.10 for all sample farms. As a result one rupee invested in the cultivation of paddy earns Rs. 2.10.

**Utilization and Disposal Pattern of Paddy**

The marketable surplus of any crop depends on the various factors such as requirement of storage capacity and facility, requirement of money, home consumption, seed, market price etc.

Per household own production of paddy by the sample farmers was 176.83 quintals. The sample farmers had given 4.35 per cent (7.70 quintals) of their total paddy production of others as their crop share. 2.77 per cent (4.90 quintals) of the total production was kept for home consumption and 0.55 per cent (1.02 quintals) of the total paddy production was utilized as seed, donation etc. Thus out of the total paddy production, 92.33 per cent (163.26 quintals) remained as a marketable surplus.

In the kharif paddy, per household own production of paddy by the sample farmers was 104.77 quintals. The sample farmers had given 9.62 per cent (10.08 quintals) of their total paddy production of others as their crop share. Only 4.56 per cent (4.78 quintals) of the total production was kept for home consumption and 0.33 per cent (0.35 quintal) and 0.41 per cent (0.43 quintal) of the total paddy production was utilized as seed, donation respectively. Thus out of the total paddy production, 90.38 per cent (94.69 quintals) remained as a marketable surplus.

During summer paddy season, per household production of paddy was 72.06 quintals. The sample farmers were kept 0.16 per cent (0.12 quintal) of the total production for home consumption. 0.11 per cent (0.08 quintal) and 0.24 per cent (0.16 quintal) of the total paddy production was utilized as seed, donation as well as other payments respectively. Thus out of the total paddy production, 95.16 per cent (68.57 quintals) remained as a marketable surplus.

The marketed surplus of paddy shows that it had increased with landholding groups from 52.04 quintals (90.67 per cent) for marginal farm households to 163.26
quintals (92.33 per cent) for large farm households. The marketable surplus of paddy production in kharif season increased with the landholding groups from 27.07 quintals (86.12 per cent) for marginal farm group to 206.17 (92.29 per cent) for large farm group. During summer season, it ranged between 24.97 quintals (96.17 per cent) for marginal farm group to 135.70 quintals (94.24 per cent) for large farm group. It clearly shows that there was a positive relationship between the sample farm groups and marketable surplus.

A comparison of utilization and disposal pattern of paddy clearly shows that:

- Per household higher own production of paddy was obtained in kharif season (104.77 quintals) than the summer season (72.06 quintals),
- Marketable surplus was higher (95.16 per cent of own production) in summer season as compared to the kharif season (90.38 per cent); and
- Per household home consumption of paddy in total paddy production was higher in the kharif season (4.78 quintals or 4.56 per cent). Per household’s this was 0.12 quintal or 0.16 per cent only in summer season

MARKET EXPENDITURE

The market costs include transportation cost and other charges. The market costs was positively related with the size of land holding groups and it varied from Rs. 1,637 for large farm group to Rs. 356 for marginal farm group. The average market expenditures of paddy worked out to Rs. 497 in kharif season and Rs. 336 in summer season. This cost varied from Rs. 181 for marginal farm group to 996 for large farm group in kharif season. In summer season, it varied from Rs. 175 for marginal farm group to Rs. 642 for large farm group. It is observed that there was a highly positive relation between the market costs and the size of land holdings.

Per quintal marketing cost was higher (Rs. 5.25) in kharif paddy as against summer paddy (Rs. 4.89). The marketable surplus was lower in kharif season as compared to summer season. In various categories of farm groups, the marginal farmers had paid higher cost for marketing as compared to other farm groups because the surplus of paddy was less in the case of marginal farm group via-a-vis other farm groups.
Plight of Paddy Growers at the Market

The choice of month to sell a crop is a significant factor for the farmers. The selected sample farmers have sold their paddy production in November and December in kharif season. Majority of the sample farmers (60.33 per cent) had sold their paddy surplus mostly in the November. The requirement of cash money was the main reason to sell their production after the immediate harvesting period.

In summer season the sample farmers had sold their paddy surplus in May and June. About 66.67 per cent of the total sample farmers had sold their paddy in May. Expect small farm group, all other farm groups sold their production immediately after harvesting because the farmers had a fear of reduce prices in the later period.

Place and Distance of Paddy Market

68.33 per cent of the sample farmers had sold their paddy surplus in the rural market and avoided long traveling in kharif season. Out of the total sample households, 35 per cent farmers had sold their kharif paddy surplus within a radius of 3 kms in the rural market and 30 per cent farmers had sold paddy surplus up to 5 kms in urban market.

RELATION OF PRICE TO MSP AND COST C2

Among the many factors, the selling price of a crop was found to be an important factor for the farmers. In this context, a comparison of paddy crop price received by sample farmers, minimum support price and cost C2 was made.

The market price of paddy received by sample farmers was higher than minimum support price as well as cost C2 (35.58 per cent in kharif and 74.02 per cent in summer) which helped farmers to get reasonable gains. The market price of paddy was higher (14.31 per cent) in summer season as compared to kharif season (7.41 per cent). The comparison with cost C2 shows that, the variation was higher (74.02 per cent) in summer season. The farmers of the same village received the different prices of paddy. About 12.50 per cent and 3.33 per cent sample farmers received paddy price less than MSP in kharif and summer seasons respectively.
REGRESSION RESULTS

In order to judge the relationship between gross output (Y) for paddy crop and total input expenditure - C₂ (X) for paddy cultivation the following linear regression equation was estimated by least square method of estimation.

\[ Y = a + bX \]

Where;

Y: Gross output of paddy in Rs, sum of main production value (Rs.) and by-product value (Rs.)

a: intercept of the function (equation)

X: Total input expenditure for paddy cultivation in Rs. (Cost C₂) and

b: Slope of the equation which, in this form of function; indicates the marginal productivity of “X”, i.e. if X increase by 1 Rs. than “Y” increase by “b” Rs.

This equation was estimated for paddy of kharif season and summer seasons as well as for paddy of both the seasons by combining observations. The results are presented in following paragraphs

**Kharif Paddy:** The co-efficient of determination (R²) for kharif paddy was 0.90 which was significant at 1 per cent level of significance. This indicates that 90 per cent of variation in gross output of kharif paddy was explained by the input expenditure. The value of ‘b’ was 1.47 Rs. for kharif paddy, which was significant at 1 per cent level of significance. This shows that, 1 Rs. increase in input expenditure resulted into an increase in gross output of paddy by 1.47. On an average, the value of ‘b’ for kharif paddy remained between Rs. 1.42 to 1.52.

**Summer Paddy:** The co-efficient of determination (R²) is 0.94, which was significant at 1 per cent level of significance. This shows that 94 per cent of variation in gross output of summer paddy was explained by the input expenditure. The value of ‘b’ was 2.01 Rs. for summer paddy, which was significant at 1 per cent level of significance. This shows that, 1 Rs. increase in input expenditure resulted into an increase in gross output of summer paddy by 2.01.
output of paddy by 2.01. On an average, the value of ‘b’ for summer paddy remained between Rs. 1.96 to 2.06.

The regression results of comparison of kharif paddy between summer paddy are as following:

1. There was a higher value of co-efficient of determination ($R^2$) for the summer paddy (0.94 per cent) as compared to that of the kharif paddy (0.90 per cent)

2. The value of “b” was higher (Rs. 2.01) for summer paddy than that for the kharif paddy (Rs. 1.47). Both were significant at 1 per cent level of significance. This means that the paddy cultivation in summer season was more remunerative to farmers than kharif season.

3. The range value of “b” for summer paddy was Rs. 1.96 to 2.06, whereas for the kharif paddy, it was Rs.1.42 to 1.52. So, farmers took more initiative to cultivation of summer paddy than kharif paddy because paddy farming in summer season was more remunerative as compared to that in the kharif paddy.

**Total Paddy (Kharif and Summer):** For total paddy (combined observation of kharif and summer seasons), the co-efficient of determination ($R^2$) was 0.93 which was significant at 1 per cent level of significance. This indicates that 93 per cent of variation in gross output of kharif paddy was explained by the input expenditure. The value of ‘b’ was 1.17 Rs. for kharif paddy, which was significant at 1 per cent level of significance. This shows that, 1 Rs. increase in input expenditure resulted into an increase in gross output of paddy by 1.17. On an average, the value of ‘b’ for total paddy remained between Rs. 1.13 to 1.21.

**SAMPLE FARMERS’ VIEWS/OPINIONS AND PROBLEMS RELATED TO PADDY CULTIVATION**

The farmers’ opinions/views regarding some important issues of paddy cultivation are given in the following paragraphs:

1. All the selected sample farmers had been cultivating kharif paddy for the last many years.
2. Regarding cultivation of paddy in summer season it was found that out of 120 selected farmers, 8 (6.66 per cent) were found cultivating this crop for more than 10 years, 32 farmers (26.67 per cent) were growing paddy for 5 to 10 years, 54 farmers (45 per cent) had been cultivating summer paddy for 3 to 5 years and 26 farmers (21.67 per cent) had been cultivating this crop for 1 to 3 years.

3. High net return obtained from paddy in summer season was the major reason for cultivating this crop by an increasing number of farmers in the study area.

4. The selected farmers received the information about varieties and quality of seeds from well experienced co-operative societies (37.16 per cent), advanced farmers (29.73 per cent), and Garmsevaks (18.92 per cent).

5. The majority of the sample farmers purchased paddy seeds from the different co-operative societies.

6. Majority of the selected farmers prepared seedbed in own farms for paddy cultivation in both the seasons.

7. In kharif season, the paddy crop depended on rainfall, however, due to short fall of rain, about 7 times irrigation was required during the season. While in summer season, 12 times irrigation was required.

8. The canal water was the main source of irrigation for about 90 farmers (75 per cent), tube wells for 7 farmers (5.83 per cent) and combined sources i.e., canal as well as tub well for 23 farmers (19.17 per cent).

9. During the field survey, it was observed that there prevailed large variations in the rate of irrigation water sold by privet sellers.

10. The sample farmers used three types of fertilizers viz., chemical, farm yard manure and oil cakes.
11. Among the various chemical fertilizers, 113 farmers (94.17 per cent) preferred UREA followed by DAP (94 farmers or 78.33 per cent) for the paddy cultivation in the kharif and summer seasons.

12. Majority of the selected sample growers (94 farmers or 78.33 per cent) sold their paddy produce to rural traders in the village itself.

13. Almost all the farmers used to sell their paddy produce immediately after harvesting. The requirement of cash and fear of a fall in the price of paddy were the major reasons for the immediate sale of paddy after harvest.

14. It may be noted here that majority farmers (106 farmers or 88.33 in kharif paddy and 96 farmers or 80 per cent) were not satisfied with present system of marketing. There was common opinion that undue pressure was exercised by the traders.

15. Out of the total 120 sample farmers, only 44 farmers (36.67 per cent) were having awareness of minimum support price.

16. According to the sample farmers, paddy cultivation involves the following risks: (1) uncertainly of rain, (2) uncertainly of canal water for irrigation, (3) crop diseases and (4) Fall in price

PROBLEMS OF PADDY CULTIVATION
The major problems faced by the sample farmers were as follows.

1. According to 34.17 per cent farmers (41 farmers), excess supply of water was the major problem during monsoon season.

2. About 14 per cent paddy growers (17 farmers) faced the problem of over water in paddy farm in kharif season as the other paddy growers were watering their farms.
3. 44.17 per cent sample farmers reported that they faced the problem of crop diseases and insects during kharif season.

4. The problem of irrigation was faced by 21 farmers (17.50 per cent) in kharif season 80 farmers (66.67 per cent) faced the same problem in summer season.

5. Canal was observed to be the main source of water for irrigation for the majority of the sample farmers. Due to untimely and irregular availability of canal water, particularly in summer season, crop yield was adversely affected.

6. Due to irregular and untimely supply of water in canal, the farmers were forced to use the tube wells irrigation which was a costly practice.

7. Continuous farming of paddy in both the seasons deteriorates the fertility of land and hence the productivity of paddy went down.

8. About 27 farmers (22.50 per cent) reported that due to continuous use of canal water, the salinity in land had increased.

9. In case of fertilizers, 40 per cent farmers noted that fertilizer rates were burdensome.

10. Major problems related to marketing of paddy were: (1) inadequate price, (2) lack of organized efforts by paddy cultivators to get high prices (3) traders were in organization and they offered low price for paddy and (4) lack of scientific method of price fixation.

11. As regards the market price of paddy, 106 sample farmers (88.33 per cent) in kharif season and 96 farmers (80 per cent) in summer season were not satisfied with the price they received.

12. Only 11 sample farmers (9.17 per cent) in kharif season and 50 farmers (41.67 per cent) in summer season were not satisfied with their paddy productivity. The productivity of paddy was far below than the productivity expected by them.
Policy Implications and Suggestions

On the basis of the study, the following conclusions emerge. The findings and conclusions derived on the basis of the study could be utilized by the policy makers, agricultural researchers and extension agencies.

1. The study shows the characteristics and problems of the paddy growing farmers of the Kheda district of Gujarat which will serve as guiding principles for the planners and extension workers for planning and implementing programmes related to the farmers, particularly paddy growers.

2. A study of paddy economy at farm level, as attempted here, clearly indicates that an increasing number of farmers are found opting for paddy cultivation in kharif and summer seasons in the study area. The expanding area pinpoints at the nature of bright scope of summer paddy in Gujarat. Therefore, necessary efforts are required to be made to explore further possibilities for shift in crop pattern toward summer paddy.

3. Though concerted efforts are underway and better results are also obtained, such efforts should be continuously maintained and encouraged to ensure advancement in the development and practicing of new varieties of paddy.

4. To ensure stability in yield, variations in yield per hectare across the districts and across farmers in each districts need to be reduced, sustained, regular and effective measures will go a long way in educating farmers about the correct and scientific methods of using various strategic inputs.

5. During the study period, low level of education was observed among the paddy growers. It is fact that level of education contributes in extent of knowledge, adoption of economic and technological changes and overall modernization. Hence, high priority should be given to improve the existing level of education among the paddy growing farmers.

6. It was found that due to the lack of availability of canal water for irrigation, farmers were dependent on other sources of irrigation i.e., tube wells. Due to
the problem of frequent electric power cut and as the water was given mostly during night hours, paddy growers had to spend much time for application of irrigation. This increased the cost of labour. To solve the problem, proper electric power policy should be formed in keeping the views of unorganized farmers’ genuine difficulties.

7. The paddy growers are found using more irrigation than the requirement in the both seasons. Due to irregular water supply the farmers have a tendency to give more irrigation in order to remove the fear of dry crop or failure of crop, even through it is not required. This tendency of farmers increases the cost of production. It is suggested that the farmers should be given assurance of timely, regular and adequate water supply.

8. Canal is observed to be the main source of water for irrigation for the farmers. Due to untimely and irregular availability of canal water particularly, in summer season, adversely affects the yield. Hence, proper canal water irrigation policy should be while considering the views of unorganized farmers.

9. It was found form the views of the farmers that farmers do not use canal water of irrigation in proper manner. They over utilize the available facility and hence their occurs wastage of water and it also affects the crops of the adjoining fields. It is, therefore, suggested to adopt a proper water use policy.

10. The farmers, generally, used organic manures in kharif paddy only. They did not use organic manures in summer paddy. As due to over use of chemical fertilizers on the farms in summer paddy, the soil was adversely affected and hence it is suggested to use organic manures in summer season also.

11. It was observed that farmers applied fertilizers in non-scientific manner no their fields. However, none of the sample farmers had got their soil tasted to know the specific requirement of their soil. Therefore, a facility of mobile soil testing laboratory should be regularly available to the farmers at their field level.
12. Paddy growers should be trained on fertilizers and nutrient management so that they could manage these costly inputs economically and rationally. Many of the paddy growing soils are different. Therefore, knowledge of needed micro nutrients should be given to farmers by extension agencies working in the area.

13. Farmers' religious belief regarding the killing of pests must be changed and they should be trained to adopt proper measures to control pests and diseases.

14. Efforts should be made to increase the yield of paddy by applying adequate and timely supply of critical inputs such as improved seed, fertilizers and pesticides.

15. The farmers generally sell their paddy produce in immediate post harvest season due to one or other reasons. By constructing godowns in villages and linking credit advancement with marketing of the produce through co-operative marketing societies could easily solve such problem.

16. Usually major production of paddy comes in the local market immediately after harvest, the high pressure of supply in short period not only pushes down the prices but also reduces operational efficiency of marketing. Therefore, it is now high time to adopt the introduction of the slip system for ensuring orderly arrivals as suggested by the Commission for Agricultural Costs and Prices.

17. In order ascertain a fair dealing in marketing, it is necessary for paddy producers to organize Growers' Co-operative Society. This will help in stringing their bargaining power and avoid exploitation of middlemen or traders.

18. With a view to provide remunerative prices to the paddy growers, measures should be taken by the Government through proper price policy. Announcement of the minimum support price should be made before the sowing time of the crop. This would help farmers to allocate an appropriate area for paddy.
19. The crop insurance scheme covers many crops, including paddy crop. The scheme provides protections to the farmers against the risks and uncertainties arising out of natural hazards. But it was found that the majority of the farmers were not aware about such scheme as majority of them were illiterate or less educated.

20. There prevails a need to integrate and strengthen the market intelligence system in the state in respect of information on market arrivals, price of crop in different market yards etc. so that rural farmers can avail all the information easily and at proper time. This will help rural farmers to take proper decision on marketing of paddy.

21. To ensure rapid expansion in area and production of paddy a rapid enhancement of paddy market is imminent. This will help maintain or raise the present level of remunerative prices and relatively high level of per hectare income for a long time.
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