CHAPTER - IV

-:- IRRIGATION AND AGRICULTURAL PRODUCTIVITY -:-

4.1 Inputs used

4.2 Methodology

4.3 Crop productivity and changes

4.4 Overall agricultural productivity and changes

4.5 Quantitative Analysis

References

The previous chapter is devoted to study the cropping pattern and changes therein. The present chapter aims to analyse, how far irrigation has changed the agricultural productivity. The term agricultural productivity is both a dynamic and a relative concept. It is used to express the efficiency of agriculture. Agricultural productivity is the level of existing performance of a unit of land which differentiates from one area to another (Ali,1978). Agricultural productivity of an area is influenced by a number of physical, social, economic, institutional and organisational factors. Besides these productivity also depends on availability of labour, supply of capital and encouragement by the government. Thus, it is the result of the combined interplay of physical and human factors.

4.1 INPUTS USED :

Mechanical, biological and chemical inputs are playing important role in transformation of agricultural crop yield in the study region. It is noted in the field observation that the adoption of farm technology is increasingly found in the irrigated areas. The improved iron plough, tractors, electric pumps, seedrills, spray pumps, duster, sugarcane crushers etc. are the modern machinery. Table 4.1 reveals the use of modern machinery in Karad taluka.

Wooden plough is traditional implement largely used in unirrigated hilly parts of the taluka. Iron plough is used for

TABLE 4.1 : Agricultural Implements in Karad taluka.

Sr. No.	Implements	1961-64	1984-87
1	Plough		
	i) Wooden	5502	3706
	ii) Iron	3872	5348
2	Tractors	27	378
3	Pumps for Irrigation		
	i) Electric	1632	6205
	ii) Diesel	142	678
4	Sprinkle sets	-	28
5	Sugarcane crushers		
	i) Power driven	36	157
	ii) Bullock driven	85	2
6	Double bowl seed drills	-	874
7	Thrashers	-	237
8	Plant protections		
	i) Dustar	-	228
	ii) Spray pumps	-	1211
	iii) Power spray	-	87

SOURCE : i) Socio Economic Review and District Statistical Abstract of the Satara District (1961-64 and 1984-87).

ii) Agricultural production plan of Karad Taluka, District - Satara 1986-87, T and V Scheme, Taluka - Karad, Dist. Satara.

deep ploughing as compared to wooden plough. In the study area the farmers are showing progressive trend in use of the mechanical inputs. The mechanization is not possible in western and eastern hilly areas of the Karad taluka. However, farmers in the level land of irrigated areas responding positively for the modernization of agriculture. The level land is always suitable for mechanized farming, provided other conditions are favourable (Singh,1984).

The adoption of biochemical inputs such as HYV seeds has increased as they respond more rapidly to the fertilizers and water input. There are 28 significant centres in Karad taluka which provides HYV seeds, fertilizers and pesticides to the farmers. Moreover, the Panchayat Samiti, the Karad Sahakari Kharedi Vikri Society Ltd., Karad and private traders provide HYVs,fertilizers and crop protection material. There are 69 co-operative societies and banks and they provide loan to the farmer to purchase biochemical inputs. The green manure is also used to maintain the fertility of the soil. Moreover for the protection of sensetive crop, pesticides are used which helps to increase the productivity of land.

4.2 METHODOLOGY :

Experts in Agricultural Geography have developed many techniques suitable for the measurement of agricultural productivity. The assessment of agricultural productivity in terms of grain equivalents per head of population, was first employed by

Buck (1937) in his study of land utilization. The need to determine the spatial variations in agricultural productivity statistically was realised by Kendall (1939) who devised for it a method called Ranking Co-efficient. L.D.Stamp (1943) determined the agricultural productivity by Kendall's method by selecting number of countries and some major crops. However, the method was found to be inaccurate as it did not take note of the areal strength of the individual crops.

Sapre and Deshpande (1964) tried to eliminate this defect by weighting the ranks of the individual crop by their proportions in the total cropped area in the region. The areal units were graded in ranking order according to their output per unit of area and ranking coefficients were derived. Singh Jasbir (1972) has attempted to measure the agricultural efficiency of Haryana in terms of nutrition per unit area. Singh, Jasbir et al.,(1982) recently applied a technique known as the crop yield and concentration indices ranking coefficient. Bhatia (1967) used the index suggested by Sapre and Despande with a slight modification. He used yield index of crops, instead of yield ranking of individual crops. P. Sen Gupta (1968) also used the same index as prepared by Bhatia for studying agricultural efficiency in India. Sinha (1972) has developed the Standard Deviation and Standard Core Method to determine the agricultural productivity in India at district level. Shinde, Jadhav and Pawar (1978) measured agricultural productivity of Maharashtra plateau by money value coefficient method.

In the present study first the individual crop productivity is assessed to show the variations in agricultural productivity by location quotient. Circles are chosen as the basic areal unit and the span of the study period covers 27 years from 1961-64 to 1984-89.

4.3 CROP PRODUCTIVITY AND CHANGES :

In the study of agricultural productivity it is of interest to know the general areas where different crops dominate and their contribution in agricultural productivity. For this purpose important crops viz. jowar, wheat, rice, maize, groundnut and sugarcane have been considered. These crops are grown in various parts of of taluka in different combinations and they contribute significantly to the agricultural productivity.

i) Jowar Productivity :

The distribution pattern of jowar productivity is plotted in Fig.4.1-B. The high (above 14% index) productivity of jowar occurs mainly in the northwest and southern part of study region, covering the Umbraj and Koparde circles. The area under high productivity covers about 9.85 percent of total cropped area in 1984-87. The south central and northern part of the taluka particularly Masur, Supne, Kole, Kale and Undale circles have recorded the moderate (7 to 14% Index) productivity of jowar contribute an area of about 3.21 percent of the total cropped area. Whereas,

KARAD —— TALUKA

CROP PRODUCTIVITY

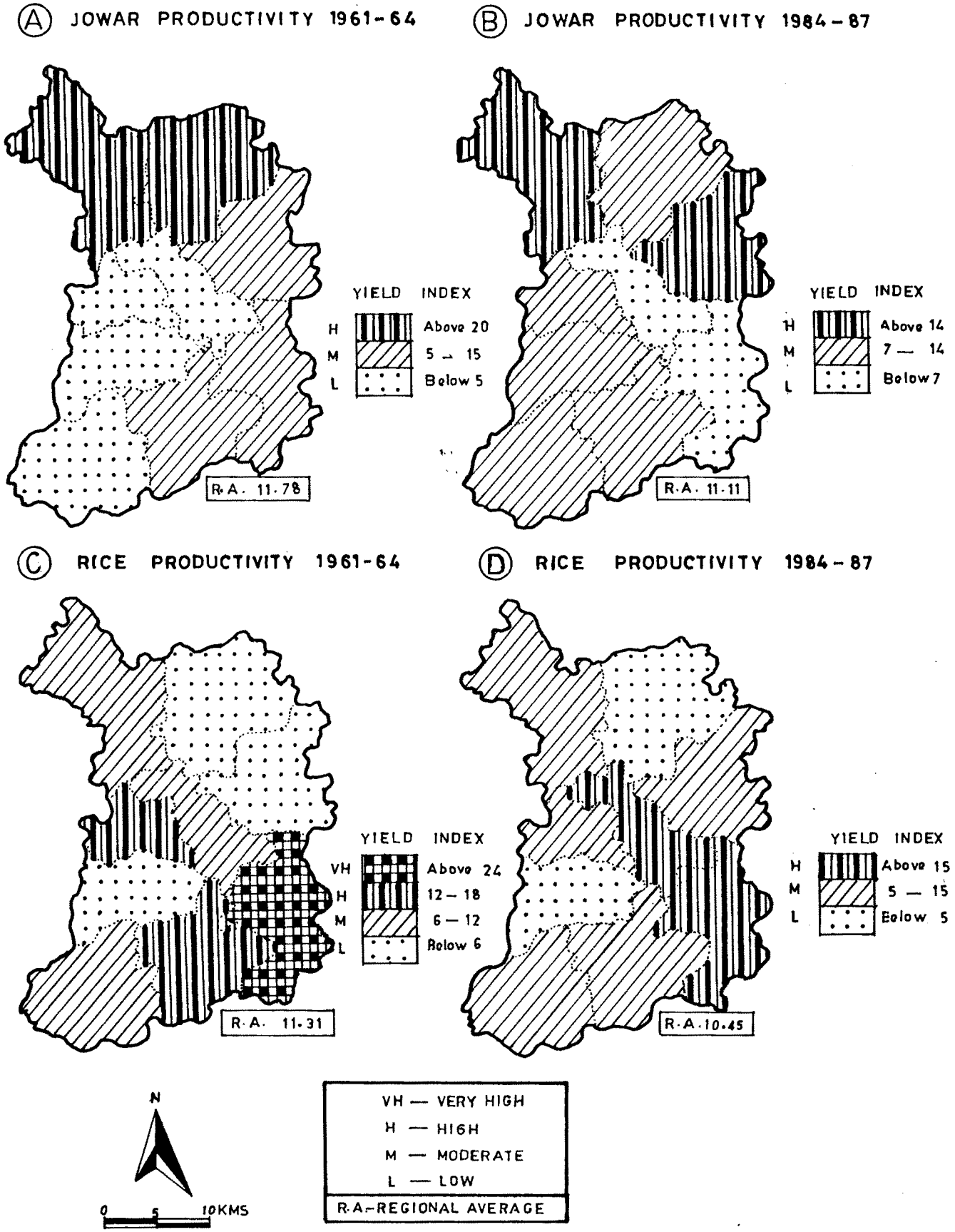

FIG 4.1

the area under low productivity has been decreased because the area is replaced by irrigated crops. But the area under moderate productivity has been increased because most of the eastern dry area is devoted to sugarcane.

ii) Rice productivity :

Fig.4.1-D reveals the spatial pattern of productivity of rice in the study region. The high (above 15 Yield Index (Y.I.))productivity of rice is confined to the central and southeastern part of the region. Where intensity of irrigation is high, soils are deep and fertile. It cowers Karad and Shenoli circles which contribute about 3.74 percent of total cropped area in 1984-87. The moderate productivity is found in the south and southwestern, northwest and northeastern part of the region. Particularly it is noted in Umbraj, Koparde, Supne, Kole and Undale circles which covered an area of about 5.24 percent of the total cropped area in 1984-87. The low (below 5 Y.I.) productivity of rice is noted in the northeastern and central part of the region.

There is considerable increase in the area of moderate productivity during this period (Fig.4.1-C & D). Due to the decrease in rainfall, the area of high productivity is also replaced by moderate productivity in the region.

iii) Wheat productivity :

The spatial pattern of wheat productivity is depicted in Fig.4.2-B, reveals the high productivity of wheat in the Shenoli

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CROP PRODUCTIVITY

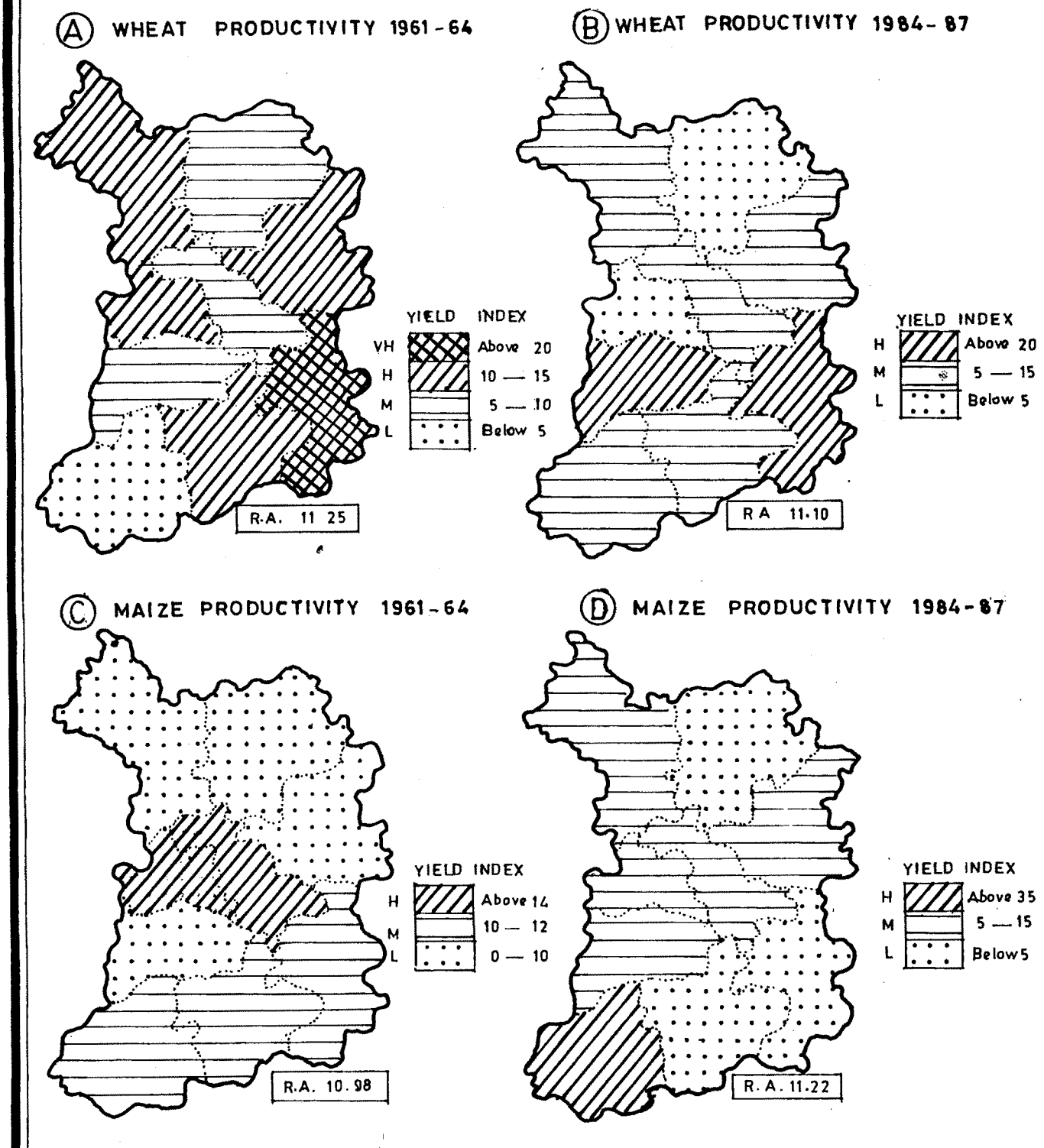

FIG 4.2

and Kole circles. These circles contributes an area of about 0.89 percent of the total cropped area in 1984-87.

The moderate productivity (5 to 15 Y.I.) of wheat is is observed in Umbraj, Karad, Koparde, Kole and Undale circles which contribute an area of about 1.20 percent of the gross cropped area. The low (below 5 Index) productivity of wheat is recorded in Supne and Masur circles of the study region. The area under low productivity is 0.17 percent of the total area. The area under high productivity has decreased during the study period due to the replacement of the area by cash crops. The area of moderate productivity has been increased due to use of fertilizers and HYV seeds.

iv) Maize productivity :

The distributional pattern of maize productivity have been plotted in Fig.4.2-D. The high (above 35% Index) productivity of maize is noted in the southwestern part of the study region in Undale circle. The high productivity circle contributed an area of 0.26% in 1984-87. The moderate (5 to 15 Y.I.) productivity is recorded in central and northwestern part of the region occupying Karad, Kole, Supne, Umbraj and Koparde circles, together contribute the area of 0.39% of the total cropped area. The low productivity is observed in south eastern and northeastern part of the region which contributed the area of about 0.22% of the total cropped area.

The area uhder high productivity of maize remained mostly unchanged during the study period (Fig.4.2-C & D). But the area under moderate and low productivity of maize is decreased during the period.

v) Sugarcane productivity :

The soil, climate and irrigation are the important factors which affects the productivity of sugarcane. " The productivity of sugarcane is the manifestation of the integrated impact of factors like physical, social, economic and institutional," (Jadhav,1984). The distribution pattern of productivity of sugarcane is plotted in the Fig.4.3-B. The high (above 35 Y.I.) productivity of sugarcane is noted in south-eastern part of the region. Shenoli circle recorded high productivity of sugarcane which is due to irrigation facilities, deep black soil, establishment of sugar factories, heavy use of fertilizers and technology adopted by the farmers. The area under high productivity is about 5.04% of the gross cropped area in 1984-87. The moderate productivity of sugarcane is noted in Karad, Koparde, Kole, Kale, Supne and Umbraj circles of the study region. The area under moderate productivity contributes an area of about 9.28% of the total cropped area. The low productivity of sugarcane is observed in the Masur and Undale circles. This may be attributed to various factors such as poor soil and low intensity of irrigation.

• KARAD TALUKA •

CROP PRODUCTIVITY

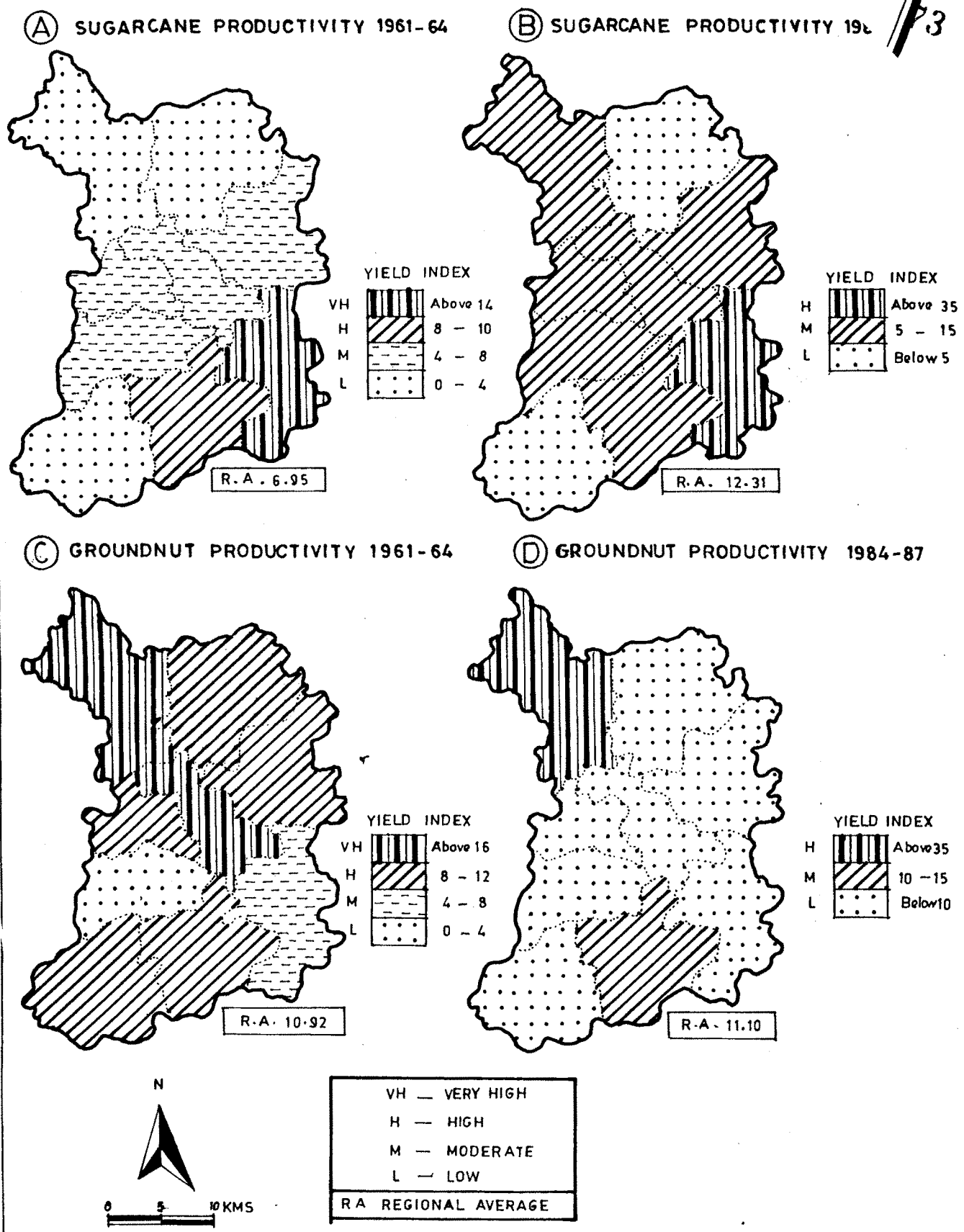

FIG. 4.3

The area of high productivity has been increased by 0.56% during the period under study. And the moderate productivity has increased by 6.55% of the gross cropped area during the last 27 years (Fig.4.3-A & B). The low productivity of sugarcane has noted insignificant change during the period under study.

vi) Groundnut :

Fig.4.3-D reveals the spatial pattern of productivity of groundnut in the study region. The major area of high (above 35 Y.I.) productivity of groundnut is confined to northwestern part of the region. Umbraj circle has noted high productivity of groundnut. In this circle shallow to medium deep black soil and favourable climatic conditions are responsible. The area under high groundnut productivity is about 4.70% of the gross cropped area. The moderate productivity is noted in Kole circle which cover an area of about 2.31% to the gross cropped area in 1984-87. The low (below 10 Y.I.) productivity of groundnut is noted in Masur, Koparde, Karad, Supne, Kole, Undale and Shenoli circles of the study area.

The area under high productivity has significantly declined by 16.06% during the period under investigation because it is replaced by irrigated cash crops. The area under moderate and low productivity have been increased by 1.99 and 8.01 percent to the gross cropped area respectively (Fig.4.3-C & D).

4.4 OVERALL AGRICULTURAL PRODUCTIVITY AND CHANGES :

The overall agricultural productivity is measured by applying Bhatia's, Majid Husain's and Sapre and Deshpande's methods, in order to study the regional differences in levels of agricultural productivity which helps to delimit the weaker areas from the point of view of agricultural production.

i) Bhatia's Method :

The overall pattern of crop productivity is determined by the Bhatia's yield index method. He suggests that the contribution of each crop to agricultural efficiency is in relation to its proportionate share to the crop land. Bhatia's formula of agricultural efficiency is read thus :

$$Iya = \frac{Yc}{Yr} \times 100$$

Where, Iya = Yield Index of crop 'a'

Yc = is the hectare yield of crop 'a' in the component areal unit

Yr = is the hectare yield of crop 'a' in the entire region

$$Ei = \frac{Iya \times Ca + Iyb \times Cb + \ldots + Irn \times Cn}{Ca + Cb + \ldots + Cn}$$

Where 'Ei' is the agricultural efficiency index, Iya, Iyb ... Iyn are the yield indices of various crops, and Ca, Cb ... Cn

are the percentage of crop land under different crops. With this technique the values are computed and depicted in Fig.4.4 -A & B which reveals three distinct areas as follow.

a) High productivity :

The high level of productivity is largely confined to the southeastern areas covering the Shenoli circle of the study region. Shenoli circle contribute the area of about 52.72% of the gross cropped in 1984-87. While in 1961-64 the area under high productivity is about 28.37% of the gross cropped area. It has been decreased by 24.35 percent during the period under study. It is due to increase in the area under degraded soil.

b) Moderate productivity :

This category consist of central, northwestern and southern part of the study region covering Umbraj, Karad, Koparde, Supne and Kale circles where the yield index is between 8 - 16 in 1984-87. The area under moderate productivity is about 52.53 percent of the gross cropped area. While in 1961-64 the area under moderate productivity was about 32.75% of the gross cropped area. During the study period area under moderate productivity has increased by 19.78% of the gross cropped area.

c) Low productivity :

The low (below 8 Y.I.) productivity level prevails largely in northeastern and southwestern part of the study

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OVER-ALL AGRICULTURAL PRODUCTIVITY (BHATIA'S METHOD)

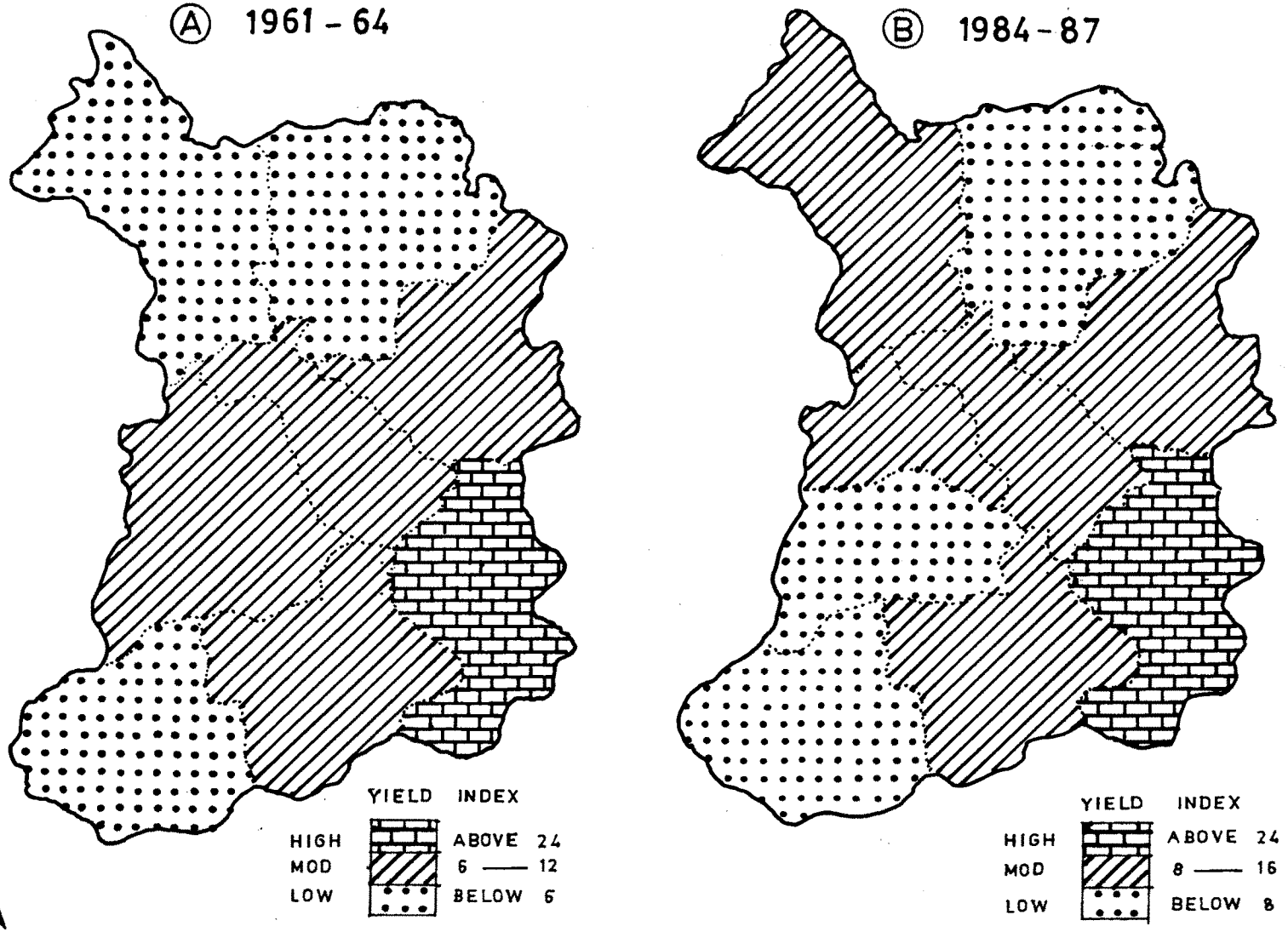


FIG. 4.4

region (Fig.4.4-B). The circle of Masur, Kole and Undale show a low level of productivity. The area under low productivity is about 19.10% of the gross cropped area in 1984-87. While in 1961-64 it was about 14.53% of the gross cropped area. During the period under study the low level of productivity has been increased by 4.57%. The low level productivity can be attributed to hilly terrain, poor soils, low irrigation and old agricultural practices.

ii) Sapre and Deshpande's Method :

In order to measure and eleminate the weaker areas from the point of view of agricultural productivity, Sapre and Deshpande (1964) have modified the ranking coefficient approach by giving weightage of the area under different crops. While applying this technique six crops grown in all the circles of the taluka are selected. These crops are ranked in order to their yield unit in nine circles of Karad taluka. Then the percentage of each crop is multiplied by ranks and the weighted average rank is obtained and the same is represented cartographically. Three categories have been identified, they are as follow.

a) High productivity :

The areas of very high and high productivity are confined to the northwestern part of the study region (Fig.4.5-B). Umbraj

circle recorded very high productivity whereas Supne, Shenoli and Undale have recorded high productivity. This is the area of deep black soil, high intensity of irrigation and more use of fertilizers. This has been reflected in high agricultural productivity. The area under high productivity contributed about 33.08 percent in 1984-87. Whereas in 1961-64 the area of high productivity covered 9.06% area of the region.

b) Moderate productivity :

The moderate productivity (12-15 co-efficient value) is noted in the Masur, Koparde, Supne and Kale circles of the study region (Fig.4.5-B). However, these circles contributed 50.72% area in 1984-87. Here the irrigation facilities are moderate. The soils are poor, therefore the average yield is moderate.

c) Low productivity :

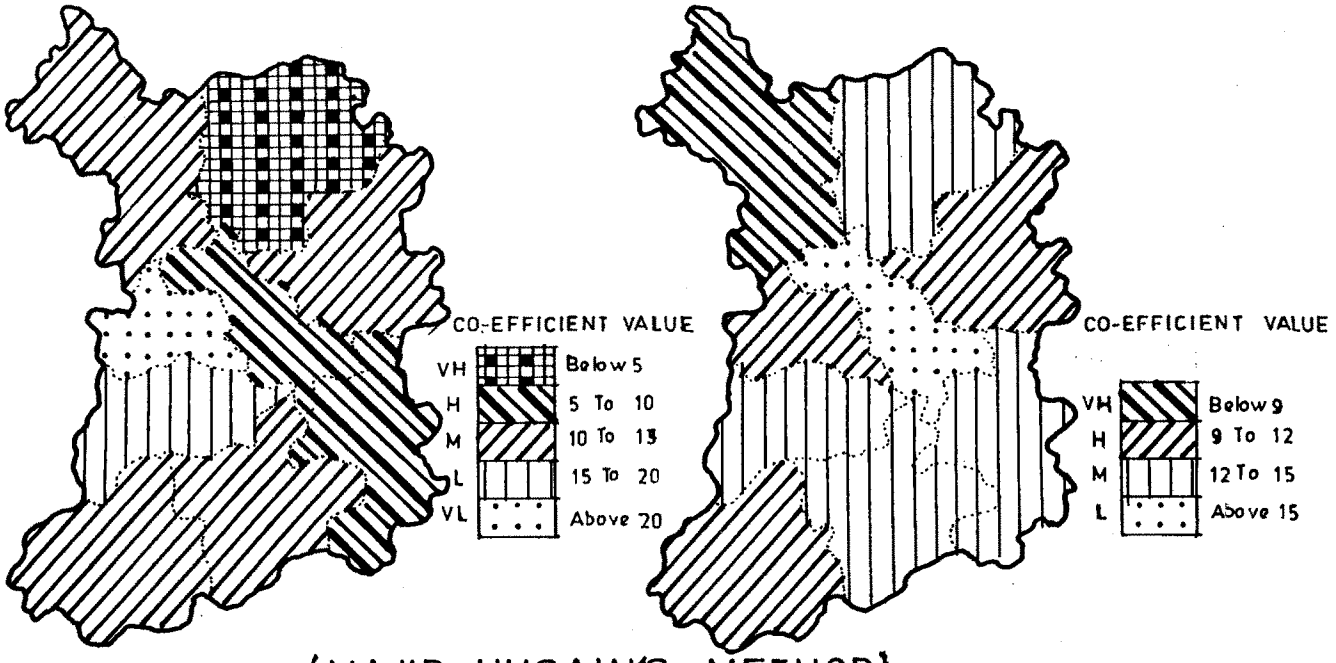
The areas of low level of agricultural productivity occur in Karad circle only (Fig.4.5-B). It contribute an area of about 16.20% in 1984-87. The poor soil and low intensity of irrigation have retained this area into low productivity. During the period under study the area under high productivity is increased by 24.02% (Fig.4.5-A & B). Whereas, the area under moderate productivity has been declined by 0.21%. The low productivity is noted in the Kole circle which covered an area about 38.4% in 1961-64 and this area under low productivity has decreased by 22.20%.

○ KARAD TALUKA ○

AGRICULTURAL PRODUCTIVITY (SAPRE & DESHPANDE'S METHOD)

Ⓐ 1961-64

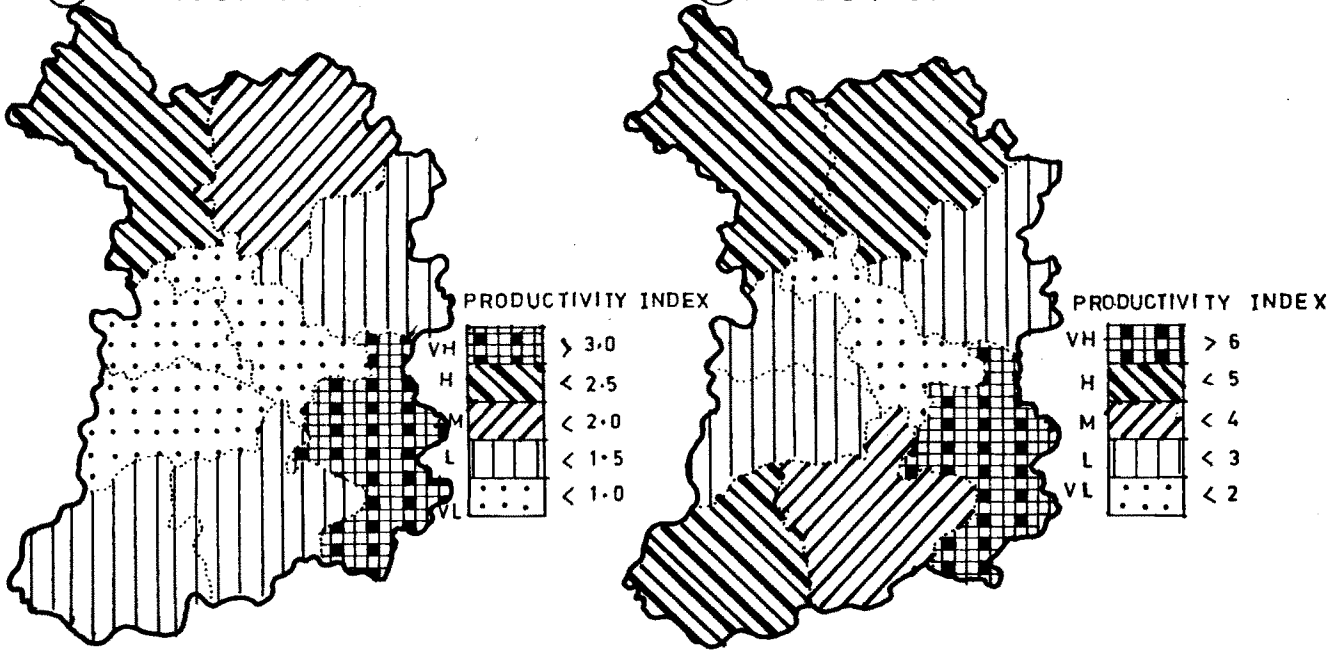
Ⓑ 1984-87



(MAJID HUSAIN'S METHOD)

Ⓒ 1961-64

Ⓓ 1984-87



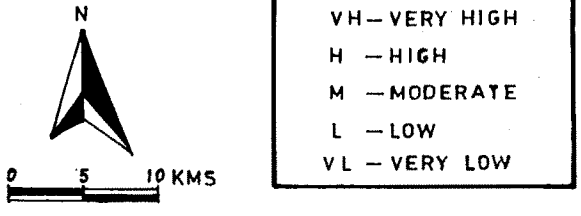


FIG 4·5

iii) Majid Husain's Method :

Considering the weakness of the above ranking co-efficient method for the delination of agricultural productivity and to obtain the more reliable picture of agricultural efficiency, it is essential to take into consideration all crops grown in an areal unit at a given point of time. This is possible by converting the total production of each crop in an areal unit into money value with the help of prevailing prices. For the determination of agricultural efficiency other things remaining the same, higher the return in terms of money, the greater is the productivity of land (Husain,1979). The procedure is lengthy, but the results thus obtained are far more accurate, authentic and reliable. All the crops for which data are available have been taken into account for the delination of agricultural efficiency of the region. The crop prices of the nearest market centre in the Karad taluka were taken into consideration. In order to delinate the pattern of agricultural productivity in Karad taluka an index has been computed as below.

$$\text{Productivity Index} = \frac{\text{Production value in money of all crops in a unit}}{\text{Total cropped area in a Taluka}} \div \frac{\text{Production value of all crops in the entire region}}{\text{Total cropped area in entire region}}$$

With the above method the productivity index of each component areal unit was obtained. The productivity indices of all the

areal units were put in an asscending order and index scale was prepared by dividing the arry in-to pentiles for distinguishing the very low, low, medium, high and very high productivity rating in the region.

a) Very high and high agricultural productivity :

The area of very high productivity is confined to Shenoli circle and high productivity occurred in Umbraj, Masur and Undale circles (Fig.4.5-D). The area of high productivity is about 25.05% in 1984-87.

b) Moderate productivity :

The area under moderate (4 productivity index) productivity is observed in Kole circle where development of irrigation is moderate. Soils are not fertile resulting into moderate agricultural productivity. The area under moderate productivity is about 20% in 1984-87.

c) Very low and low productivity :

The area of very low and low level of productivity is noted in Karad, Koparde, Supne and Kole circles. Low irrigation development, old agricultural implements, low grade soil and uncertainty of rainfall are responsible for this low level. The area under low productivity is about 55% in 1984-87.

During the period under study the very high and high productivity has been declined by 24.95%. The moderate productivity covered an area of about 27.27% in 1961-64 and it has been

decreased by 7.27%. The low and very low productivity covered an area of about 22.72% during 27 years period the area under this category has been increased by 32.38% in the taluka (Fig. 4.5-C and D).

The analysis of the spatial distribution of agricultural productivity in Karad taluka reveals the regional imbalances in the agricultural productivity. This is because of uneven distribution of irrigation facilities. This relation between the two is also investigated by calculating the simple co-rrelation values.

4.5 QUANTITATIVE ANALYSIS :

Irrigation is one of the most significant inputs for the proper growth of plants. Moreover, it is life giving agent to plants in arid and semi-arid areas where crops can not be raised successfully if water is not available in adequate quantity. Without irrigation, there is no use of fertilizers, HYV seeds, pesticides and modern implements. And it affects the per hectare yield of crops. It is observed that during the last 27 years, the assured irrigation facilities have been developed considerably in the study region. And due to the availability of irrigated water the modern inputs have been widely adopted by the farmers of the Karad taluka, which resulted in increase in per hectare yield of crops. It is observed that there is a very close positive relationship between the irrigation and per hectare yield of crops. Fig.4.6 shows the positive relationship between the

CORRELATION BETWEEN NET AREA IRRIGATED AND CROP YIELD IN KARAD TALUKA

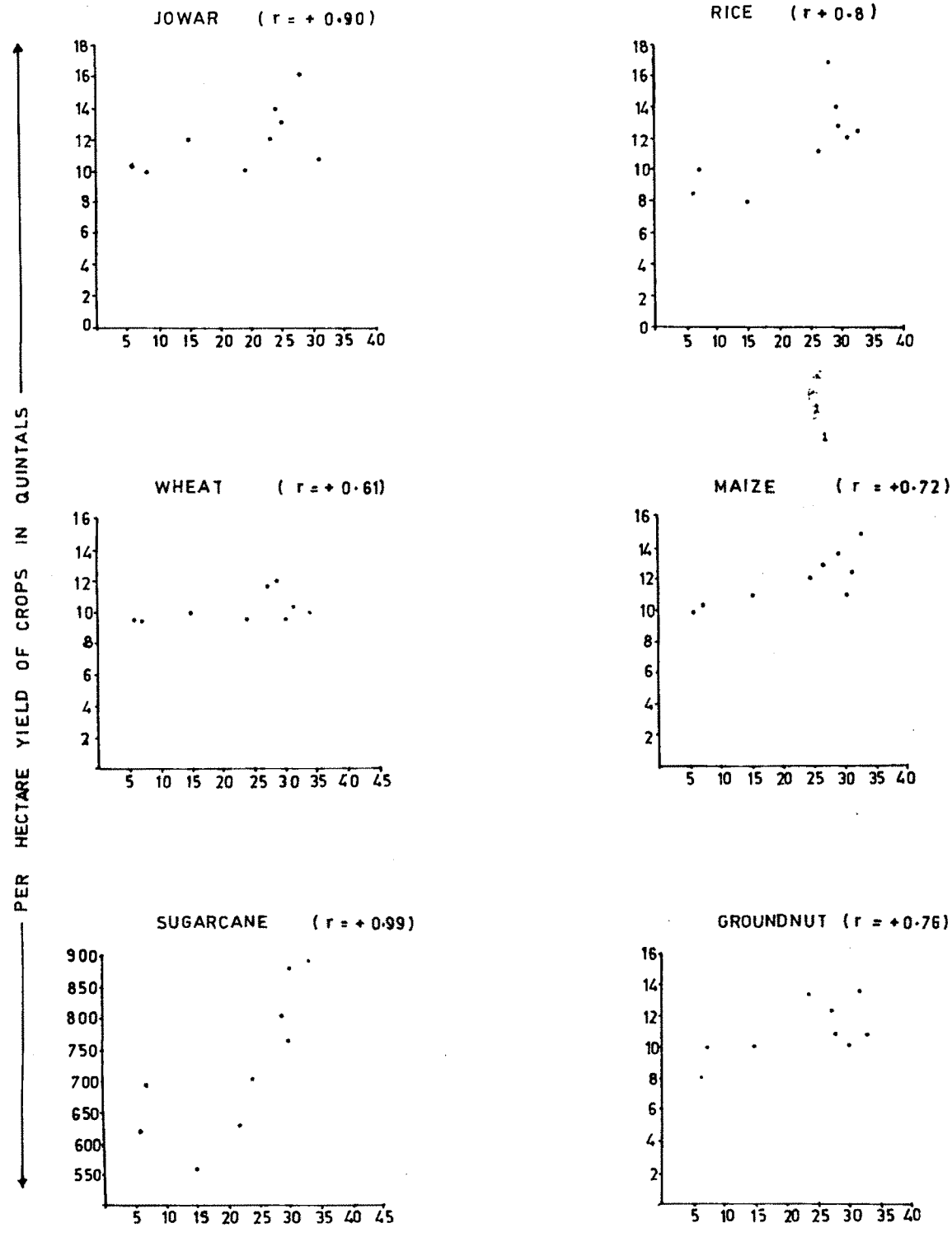


FIG. 4·6

net area irrigated and the per hectare yield of crops in the Karad taluka. Thus, the irrigation played a vital role in accelerating per hectare yield and total production in the study region.

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