CHAPTER - IV

GEOGRAPHICAL ASPECTS OF GRAPE-VINE CULTIVATION

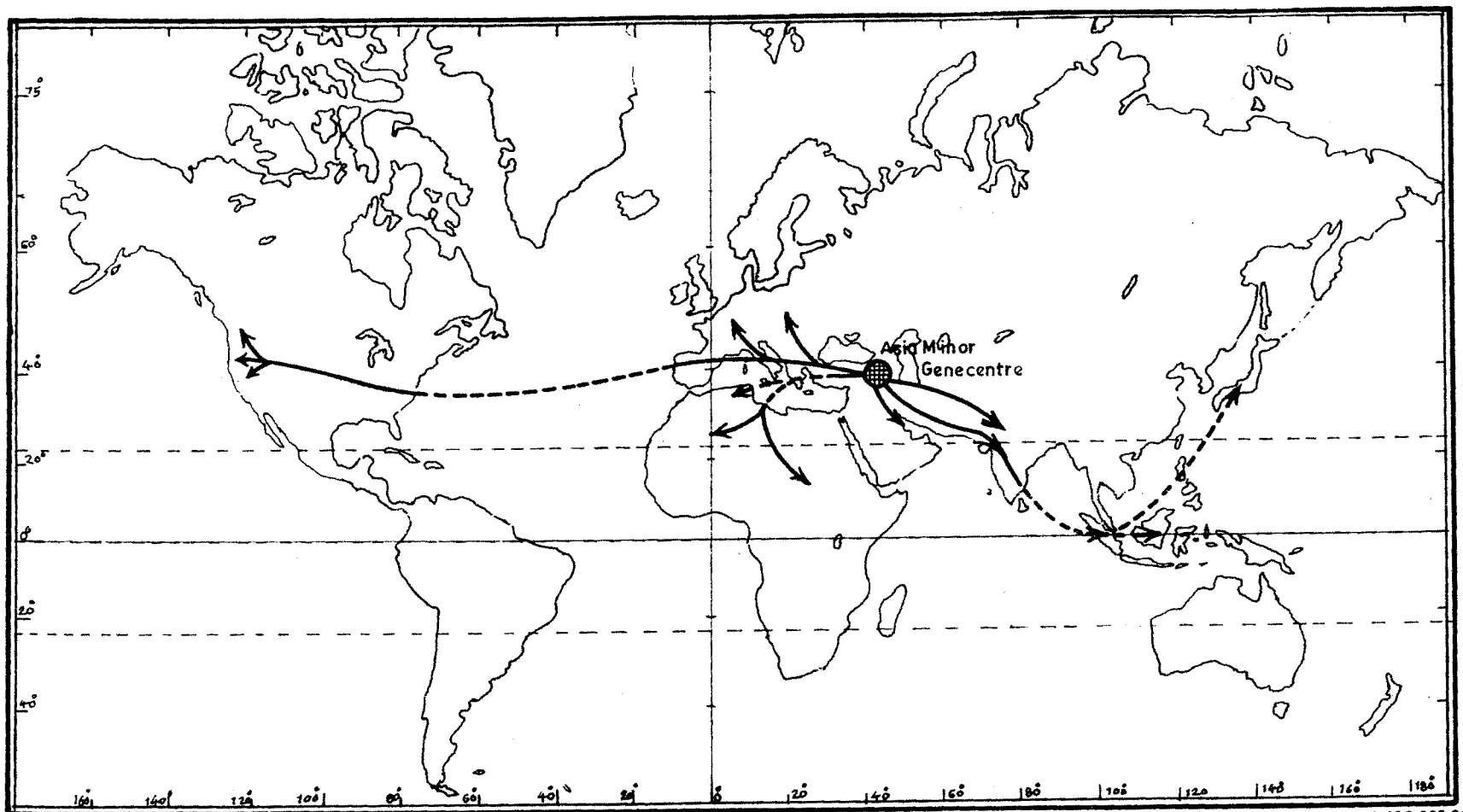
4.1 INTRODUCTION :

4.1.1 Origin and diffusion of grape-vine culture :

The institutional factors like irrigation and fertilizers are examined and analysed in previous chapter. The present chapter is concerned with geographical aspects of grape-vine cultivation in Miraj tahsil. The history of fruit culture dates back to early Greek and Roman period. It's antiquity can be assigned to the discovery of fossils of leaves and seeds in North America and Europe during Tertiary Period (Bassmann, Jordean and Kirchheimer,1938). Basically this plant is native of warm temperate zone. Grape culture also dates back to 2440 B.C. in Egypt (Winkler,1974). Recent botanical evidences unfold the fact that 'Asia Minor', a region between Caspian and Black seas, is the early home of grape-vine. It is believed that it was diffused from this original centre to North America even before the arrival of Europeans.

Grape-vine is botanically known as "Vitis vinifera", a original specy. Presently, North America, Europe, U.S.S.R. are the major areas of grape-vine cultivation in the world. From Asia Minor, many varieties of grape culture were diffused in many directions along with successive migrations of people from this genecentre during the historical events. Before 600 B.C. the Phoenicians, probably carried vine varieties to Greece, Rome and Southern France. During 2nd century A.D., Romans introduced it in Germany. Before this, table varieties might have been reached to North America from Mediterranian coast (Fig.4.1).

ORIGIN & DIFFUSION OF GRAPE VINE



Scale on the Equator 1:180,000,000

Fig. 4·1

The eastward diffusion of vines took place in 600 B.C. and it was spread far east through Persia and India. Later, the Europeans colonized new lands and grape-vines were travelled along with them. Today, 1,200,000 hectares of area is said to be under grape-vine in the world. However, it is mainly found in North America particularly in U.S.A., Canada and Mexico; Arjentina and Chile in South America; Algeria, Morocco in Africa; Austria, Bulgeria, France, Czechoslovakia, Germany, Greece, Italy, Hungery and Portugal in Europe; near Black and Caspian seas of Turkestan and Uzbckistan of U.S.S.R.; Cypres, Turkey, Isreal, Syria, Iran, Afganistan, Japan and China. In the tropical parts, India and Thailand are major areas for grape-vine cultivation.

4.1.2 Historical perspectives of grape-vine cultivation in India :

The cultivation of grape-vine has been practiced from the very old days. It was found in Himalyan Region (Cultural Encyclopedia of India, Vol.IV). The references of grape-vine cultivation are also found in Sanskrit literature like 'Brahat Sanhmitha' around 405 A.D. Indian had proper knowledge about the medicianal uses of grape as it was recommended to patients having digestive problems. In Aurvedas, it was used for medicinal purposes (Rahudkar,1987).

In fact, the introduction of grape-vine in India from middle easts was attempted by the invadors through Afganistan

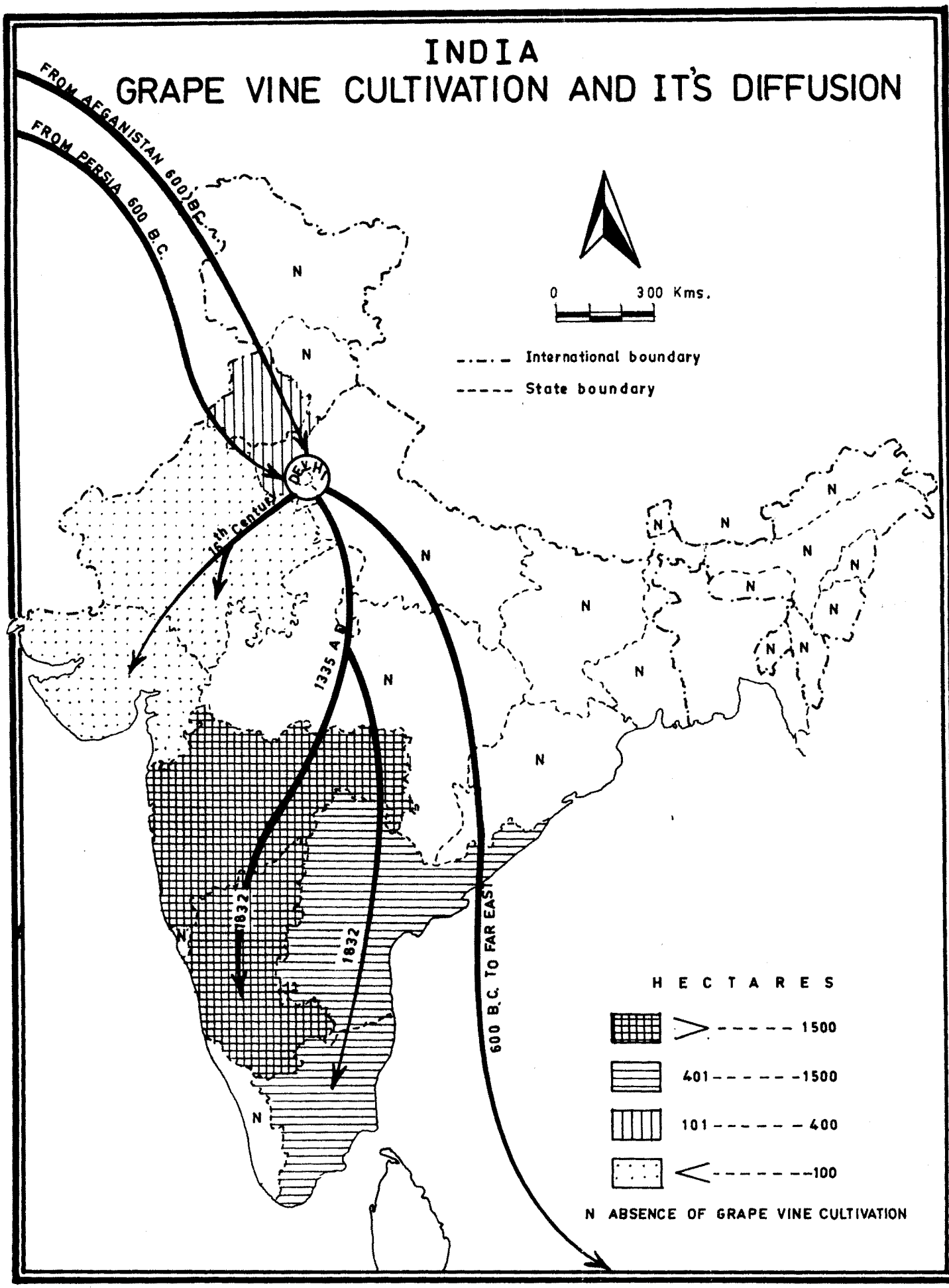

INDIA
GRAPE VINE CULTIVATION AND IT'S DIFFUSION
FROM AFGANISTAN 600 B.C.
FROM PERSIA 600 B.C.
DELHI
16th Century
1335 A.D.
1832
1832
600 B.C. TO FAR EAST
0 300 Kms.
International boundary
State boundary
N ABSENCE OF GRAPE VINE CULTIVATION
HECTARES
1500
401 - - - - - - 1500
101 - - - - - - 400
100

Fig. 4·2

(Fig.4.2). Systematic cultivation was started by Moghal Kings in Himachal Pradesh, Punjab, Western U.Pradesh and nearby Delhi. They gave considerable importance to vine cultivation. Credit goes to Akbar and Jahangir, for the spread of vine cultivation. Mention should be made of Mohmmad-bin-Tughlak who introduced grape-vine in Maharashtra in 14th century, near Aurangabad.

TABLE 4.1 : Statewise area under grape-vine cultivation in India, 1987-88.

Sr. No.	States	Area in hect.	Percent
1	Maharashtra	7,131	54.32
2	Karnatak	2,500	19.03
3	Andhra Pradesh	1,500	11.42
4	Tamil Nadu	900	6.85
5	Punjab	400	3.05
6	Haryana	400	3.05
7	Rajastan	100	0.76
8	Gujarat	100	0.76
9	Other	100	0.76
	Total	13,131	100.00

SOURCE : 'Draksh Bag', Dr.B.G.Bhujabal (1988), Continental Prakashan, Pune-30.

Table 4.1 exhibits the statewise hectareage (13,131 hect.) under grape-vine in India during 1987. It accounts for 54.32 percent area in Maharashtra followed by Karnataka (19.03), Andhra (11.42) and Tamil Nadu (6.85) in South India. Besides, the states like Punjab, Haryana, Rajastan, Gujarat and other shave occupied remaining area of grape cultivation. Fig.4.2 shows the spatial spread of grape-vine cultivation in India. Maharashtra is leading state with more than 7,131 hect. area under this crop.

4.1.3 Historical perspectives of grape-vine Cultivation in Maharashtra :

Moghal rulars gave emphasis on the propogation of grape-vine in India. As a result, viticulture reached to it's peak in Deccan during Aurangazeb's regime. It was introduced in Tamil Nadu in 1832 by French priest and later spread in Karnataka and Andhra Pradesh. The sub-tropical part of India records about 1100 hectares under vine whereas considerable area more than 12,031 hectares is found in South Indian States. India has only 0.1 percent of the world's total area under vine cultivation.

Although grape-vine was introduced in Maharashtra during 14th century nearby Aurangabad by Moghals, its systematic cultivation was started very recently. Dr.Chima, in 1921, tried to cultivate grape-vine establishing 'Ganeshkhind Research Centre' at Pune. Then in 1930, Shri Gole established 'Adarsha Godraj Mala' and developed varieties of grape-vine in Nasik district.

There is disagreement among the experts about the area under grape-vine in Maharashtra as there was no systematic collection of data. According to Vyankanta Raman, 4,000 hectares area was under grape-vine in 1968 whereas Khanduja was of the opinion that 2,000 hectares were under vine in 1972. Apart from this controvercy, the recent data shows that in most of the districts of the state, vine cultivation has been practiced. Owing to the semi-arid conditions grape receives favourable growth period in the state. Presently, it is irrigated cash crop confined mainly to Western Maharashtra. Fig.4.3 and Table 4.2 shows the distribution of vine cultivation in different district. Sangli is leading district where 1906 hectares (26.72%) area under grape-vine. This is followed by Nasik with 1600 hect. (22.43%), Pune (11.22%), Solapur (16.82%), Ahmednagar (7.72%), Aurangabad (2.80%) etc. About 7,131 hectares of irrigated area is under grape-vine in Maharashtra in 1988. The dry semi-arid conditions of summer and clear sky with dry winter seasons have encouraged grape cultivation in Maharashtra.

Presently three grape-vine zones can be identified as i) Nasik-Pune zone ii) Sangli-Solapur zone and iii) Marathwada-Vidarbha zone (Table 4.2). Nasik-Pune zone comprises the districts of Nasik, Pune, Dhulia, Jalgaon, Ahmednagar whereas Sangli-Solapur zone includes Satara, Sangli, parts of Kolhapur and Solapur and rest of the districts are included in Marathwada and Vidarbha.

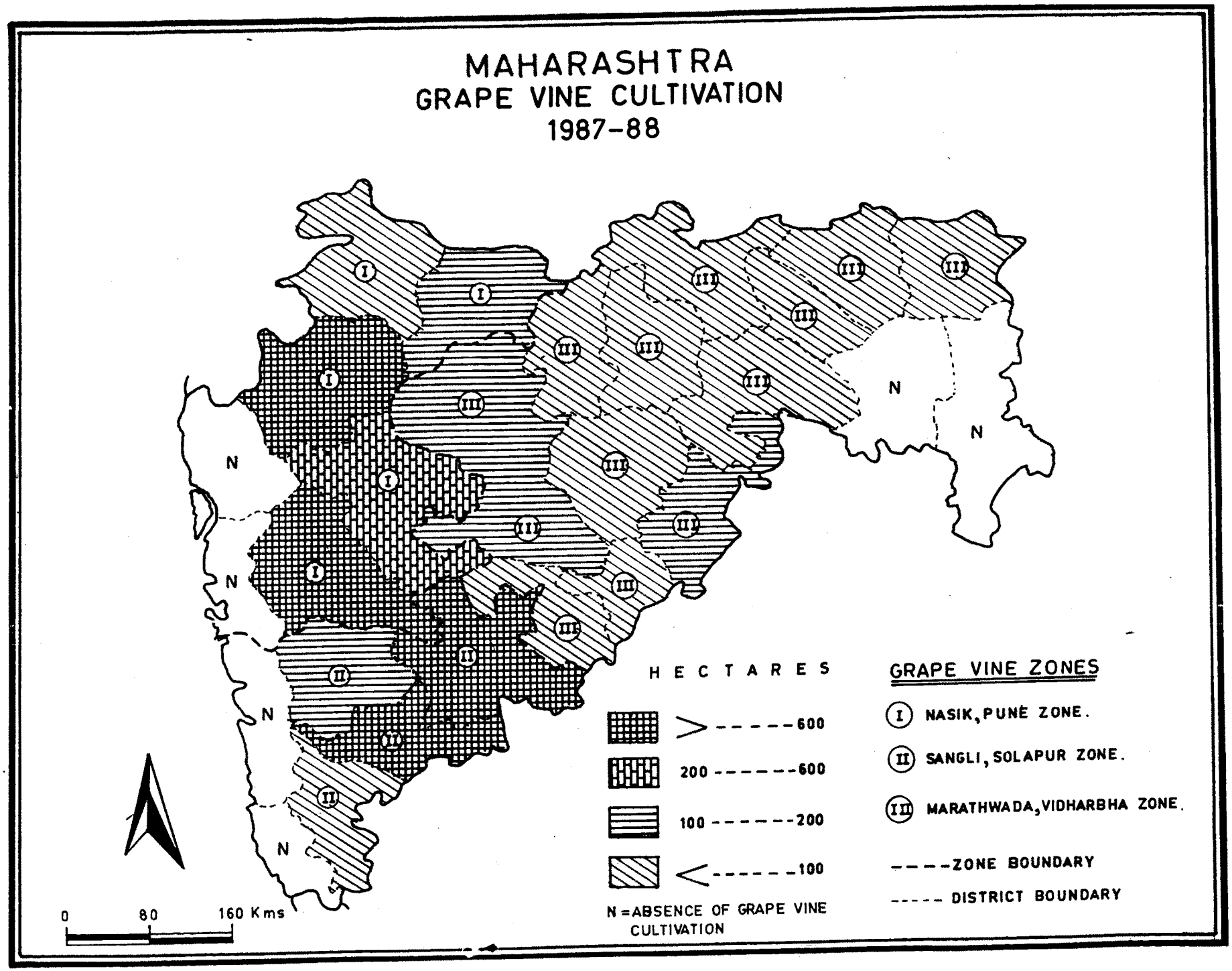

MAHARASHTRA
GRAPE VINE CULTIVATION
1987-88
HECTARES
> ------600
200 ------600
100 ------200
< ------100
N =ABSENCE OF GRAPE VINE CULTIVATION
GRAPE VINE ZONES
I NASIK, PUNE ZONE.
II SANGLI, SOLAPUR ZONE.
III MARATHWADA, VIDHARBHA ZONE.
----ZONE BOUNDARY
----- DISTRICT BOUNDARY
0 80 160 Kms

Fig. 4-3

TABLE 4.2 : Districtwise area under grape-vine in Maharashtra, 1987-88.

Sr. No.	Zones	Districts	Hect.	Percent
	Nasik-Pune			
1		Nasik	1600	22.43
2		Pune	800	11.22
3		Ahmednagar	550	7.72
4		Jalgaon	120	1.63
5		Dhulia	50	0.70
				43.70
	Sangli-Solapur			
6		Sangli	1905	26.72
7		Solapur	1200	16.82
8		Satara	200	2.80
9		Kolhapur	50	0.70
				47.04
	Marathwada-Vidharbha			
10		Osmanabad	35	0.49
11		Nanded	115	1.62
12		Parbhani	25	0.35
13		Aurangabad	200	2.80
14		Buldhana	75	1.05
15		Akola	50	0.70
16		Amravati	50	0.76
17		Yevatmal	60	0.85
18		Nagpur	45	0.64
				9.26
	Total		7131	100.00

SOURCE : 'Draksh Bag' by D.G.Bhujbal,Continental,1988,p.4.

Different varieties are grown in Miraj tahsil. Thomson Seedless is popular variety being grown in the tahsil occupying 58.57 percent (82.78 hect.) area of the total (Table 4.3).

TABLE 4.3 : Varietywise area under grape-vine in Miraj tahsil 1987.

Sr. No.	Variety of Grape-vine	Area in hect.	Percentage
1	Thomson seedless	82.78	58.57
2	Tas-A-Ganesh	22.92	16.21
3	Sonaka	25.65	18.14
4	Selection	7.54	5.33
5	Other	2.46	1.75
	Total	141.35	100.00

SOURCE : Compiled by the Author, 1987.

4.1.4 Grape-vine cultivation in Sangli district and Miraj tahsil :

The cultivation of vine in Sangli district is recent one and Tasgaon is the pioneering as well as leading tahsil (834 hect.) in grape-vine cultivation. Table 4.4 shows tahsilwise grape-vine area in 1987-88.

Miraj tahsil is second ranking regarding grape-vine (29.65%) cultivation. The recent developments in lift irrigation, awareness

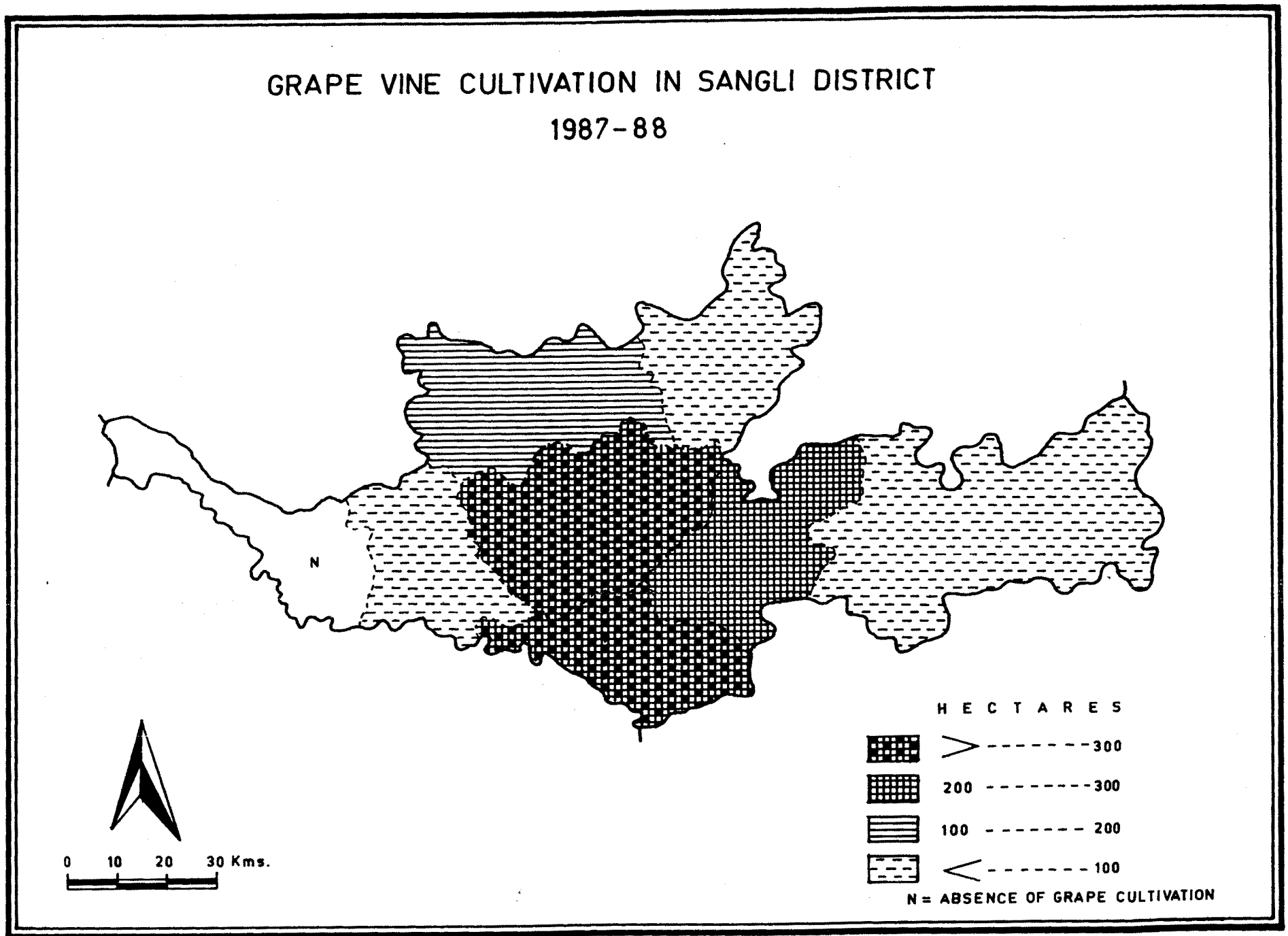

GRAPE VINE CULTIVATION IN SANGLI DISTRICT
1987-88
N
0 10 20 30 Kms.
HECTARES
> -------- 300
200 -------- 300
100 ------- 200
< -------- 100
N = ABSENCE OF GRAPE CULTIVATION

Fig. 4·4

of farmers, diffusion of vine from Tasgaon tahsil, transportation and market facilities, economic use of water and more lucrative than sugarcane etc. all have led to the development of grape cultivation. Kavathe-Mahankal (13.48%) is another tahsil where recent development of grape-vine has taken place. Sangli district has 1906 hectares area (26.72%) under vine which is first ranking in the state. Khanapur (5.24%), Walawa (3.68%), Jath (3.15%) and Atpadi (1.04%) are other tahsils in this regard.

TABLE 4.4 : Tahsilwise area under grape-vine in Sangli District, 1987-88.

Sr. No.	Tahsil	Area (hect.)	Percent
1	Tasgaon	834	43.76
2	Miraj	565	29.65
3	Kavathe-Mahankal	257	13.48
4	Atpadi	20	1.04
5	Khanapur	100	5.24
6	Jath	60	3.15
7	Walawa	70	3.68
8	Shirala	Nil	Nil
	Total	1906	100.00

SOURCE : District Land Records, Sangli, 1987-88.

About 565 hectares of irrigated land of Miraj tahsil is under grape-vine which distributed in 252 vine yards of 52 villages. In view of limited water supply from wells, in the north and eastern parts of Miraj tahsil, the farmers have adopted vine cultivation which is sustanable in this part. As compared to cash crops like sugarcane in the western and south-western parts of Miraj tahsil, grape cultivation has offered good economic returns to farmers. As a result, most of the farmers are inclined to take vine crop wherever soil and water conditions are favourable. Appendix - I shows villagewise area under vine and number of gardens in the region.

4.1.5 Grape-vine species and varieties :

According to Masan (1987) there are 5,200 species of vine in the world and he assigned about 24,000 varieties. Several species classified according to their uses i.e. fruits, root stock and commercial. The principal old specy is 'Vitis vinifera Linnaeus'. The American species have contributed to viticulture. Important commercial species are table grapes, raisin grapes, wine grapes and canning grapes (Winkler,1974). Britishers have brought many varieties in India from 1832 onwards. In Maharashtra, Grape Research Centre, Pune has developed many varieties. Among them are Bhokari, Anabeshahi, Kalisahebi, Chimasahebi, Ravsahebi, Gulabi etc. But these varieties are replaced by Thomson seedless, Tas-A-Ganesh and Sonaka. Moreover, Thomson seedless is widely grown in the state and in the region too

(Table 4.3). This variety can sustain in high temperatures and is resistant to many pests and diseases.

The grapes are mainly used for eating, soft drinks, dry fruits and wine production. It is fairly good source of minerals like calcium, phosphorous, iron and vitamin like B_1 and B_{12}.

4.2 EDAPHIC FACTORS :

The region under study enjoys favourable edaphic conditions which are analysed in the earlier chapter. However, grape-vine plant requires specific conditions for its healthy growth and fair production. Moreover, climatic hydrological and pedological conditions play important role in the spatial spread of grape-vine cultivation in the region.

i) Slope :

Slope determines the drainage of the region. The slope of individual vine-yards is of immense importance to facilitate drainage. Generally, it is observed that the vine-yards, in the western parts (i.e. Krishna flood plain), carry gentle slope which has become constraint for drainage of irrigated water. This leads for the development of saline lands. Contrasting to this, the northern and eastern parts have moderate slope for vine yards and the drainage is fairly observed in this tract.

ii) Climate :

Among the climatic elements, temperature, rainfall, sun-light, frost conditions, are important in regards to grape-vine

cultivation. The crop requires temperature ranging from 20 to 25°C for its fair growth but it's growth ceases if temperature is less than 10°C and the sprouts and tender leaves are burned if temperatures exceed 35°C. The cutting of vine yards is, therefore, attempted from September end or beginning of October further which the clear sky and moderate temperature (20°C) seem to be favourable for it's growth in the region. During summer season, though temperatures are increased, the dense canopy of vine-yards and its shade gives no way to increase micro-temperature within the yards. This is also minimised by applying frequent irrigation, Generally, the temperatures are high after April cutting by which the maturity of stems and budding stages are adversely affected. But the region enjoys suitable temperature (above 25°C) during this period. 'Seedless Thomson' variety has got wide adoptibility for high temperatures. This variety is therefore, widely (98%) grown in the region (Bhujbal,1988).

Humid conditions are also equally important in the distribution and productivity of grape-vine cultivation. During rainy season (June-Sept.) the relative humidity ranges from 60 to 90 percent. The relative humidity more than 80 percent is harmful to vines and less than 60 percent is suitable for growth. Except rainy season rest of the year is generally dry with less humidity content. The period between October to March is favourable for the growth and harvesting of grapes. High humidity becomes constraint for plant growth since it favours the spread of pests.

GRAPE CALENDER

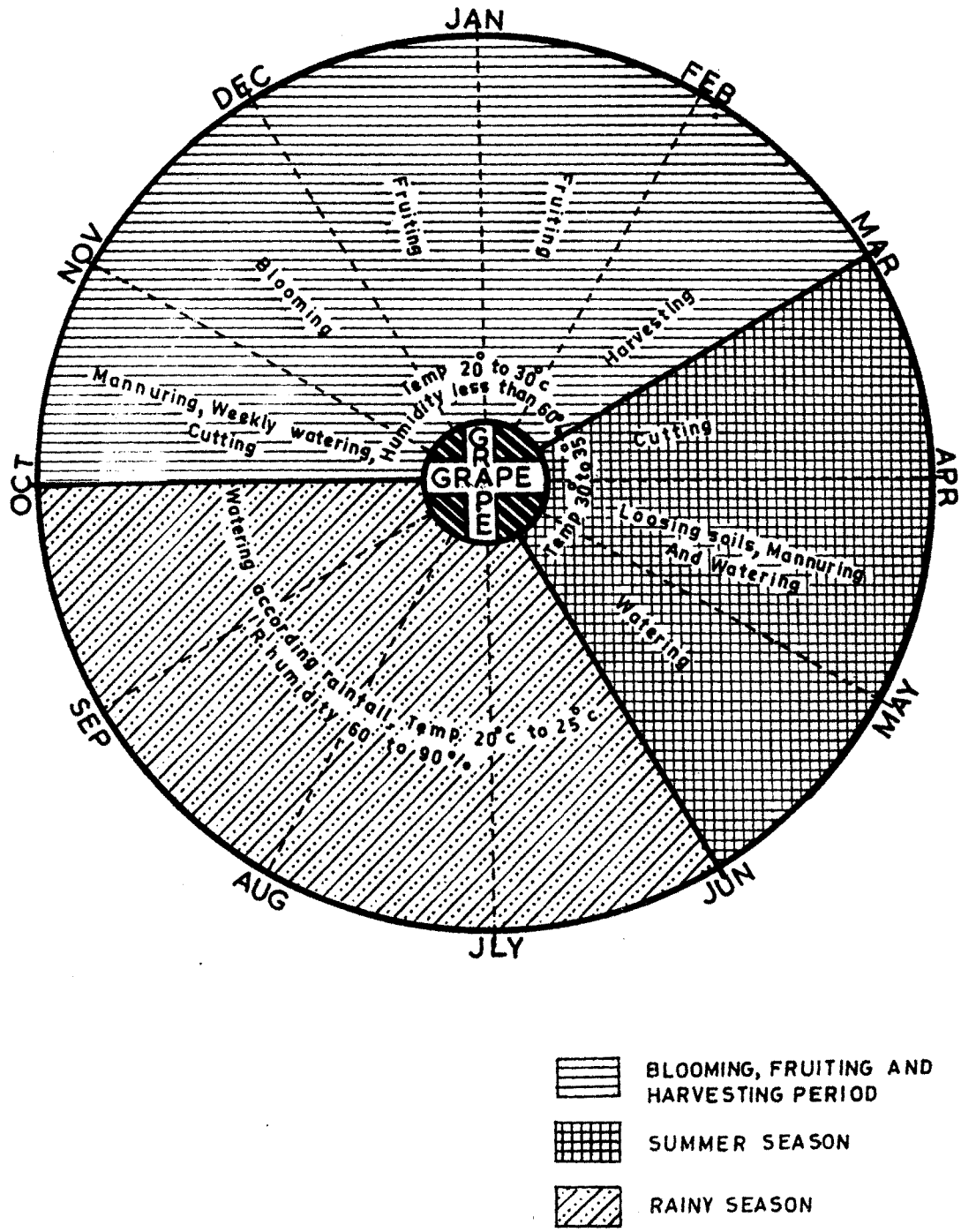


Fig. 4·12

The region with less than 750 mm rainfall is suitable for grape-vine cultivation (Bhujbal,1988). Miraj tahsil has 625 mm annual average. Rainfall, during fruiting season, is harmful to vine growth, it also favours the pest germination. There are occasional visits of cyclonic rainfall during November and December damaging grapes. Sometimes rainfall is associated with hails and high velocity winds damage grape production and its quality. In 1987 and 1988 seasons many vine yards of the region were damaged costing more than rupees one crore.

Grapes can be grown in different types of soils. It is deep rooted plant requiring deep fertile soils. But, coarse soils in the region are useful for proper drainage. The deep trenches upto 75 cm are prepared in coarse soils which are filled up with compost, decay of vegetation, fertilizers, transported soils etc. If drainage is not properly functioning it will affect the quality of grapes. Heavy soils are also used in the western parts of the region. Fig.4.12 shows the grape calender in which varieus operations are carried by the farmers.

4.3 AGRONOMIC PRACTICES :

Once the decision is taken to undertake grape-vine enterprise by the farmer, he has to consider many aspects like selection of the location, propagation of grapes, land preparation, trench preparation, interculture practices. After plantation he has to wait for one and half year for the first harvest.

But, agronomic practices, in general, can be grouped into two stages, i.e. i) Pre-plantation and ii) Post-plantation. The post plantation practices are repeated every year at specific period as long as grape-yards exist there.

A) Pre-plantation agronomic practices :

This includes the selection of land, land preparation and planting the seedlings.

i) Selection of land :

Selection of location is mainly controlled by irrigation facilities. Thus, the location of grape land is always near to irrigation sources. However, the attention has to be paid regarding the slope, drainage of the land. Generally, the land with gentle slope having proper drainage is selected. In the eastern parts, the lands nearby well irrigation are selected. But, recently with the introduction of pipelines, the lands away from irrigation sources are also selected which are suitable to grape cultivation. In the western heavy tracts, medium deep soils are selected for grape-vines.

ii) Land preparation :

Preparation of trenches is the common practice adopted in the region. These trenches are prepared with hand labour which require considerable capital investment. These trenches are filled with the layers of decay of vegetation, composts,

fertilizers etc. Fig.4.12-B also shows the material to be used for filling trenches. Plate 1, shows the trenches prepared for vine plantation in the region.

iii) Planting the vine :

Long rows, uniformly spaced with adequate turning speces at the ends make cultivation easier. Widely spaced vines are cheaper to cultivate than closely planted, since larger implements can be used. Vine-spacing varies greately in different areas of India. Accordingly, the plants are planted on the surface of each trench at equal intervals (Plate 2). The distance between two consequtive plants is 4 feet and between two rows is 6 feet in the region. The planting is generally made in July month and after this the plants are irrigated once in a week or according to water requirement during respective seasons. Plate 3 shows the planting process of vines. The most desirable spacing, therefore, is the widest that can be had without reducing the crop of the mature vine-yard or upsetting normal vineyard operations (Winkler,1974).

B) Post-plantation agronomic practices :

After the plantation of vines many operations are essential. The post-plantation comprises mainly of supports

of vines, training young vines, prunning, October cutting and April cutting, intercultural practices etc.

i) Supports of vines :

Grape-vines cannot be grown satisfactorily without some form of supports. These supports are of two types, short time and permanent. They are essential for a well formed strong and straight trunk. Short time supports are used until the vines are large, rigid and enough to stand alone. Permanent supports, in the form of trellises, are required for economic and consistent performance by vines. The selection of support depends upon the variety, age, method of harvesting and interculture etc. In Miraj tahsil, slim bamboos are used as short-time support and remained for four or six years. When their base is decayed they are replaced by new bamboos for another four to five years. Besides, long-term supports consists of iron angles and M.S.Steel wires. The number of wire depends on the age and bud quantity of vines. Plate 4 and 5 show the short and permanent supports.

The long term support is costly affair which cannot be offered by poor farmers. This requires much capital investment. For errection of long-term supports for one hectare, the capital investment is about Rs.75,000 in the region. However, there is less variation in the supports given to vines in the region.

ii) October cutting :

This is pre-fruiting cutting which is significant for attaining the quality and quantity of grapes. Usually, October

cutting is done in the first week of October which is followed by fertilizing and frequent irrigation as discussed in Chapter-IV.

iii) Intercultural practices :

The soils are loosened with hand or animal power. The ploughing is done with the help of bullock pair (Plate 6). Besides the beds with gentle slope are made by hand (Plate 7). The weeds and grasses are removed by hands and soil is loosened for aeriation. This helps to enrich soil fertility. Flood irrigation is common practice after these operations. Such operations are made every year. Besides prunning, girdeling, providing gybralic acids to berries, harvesting and then April cutting all these operations are attempted in the region every year. Table 4.5 shows the various implements used for diferent operations of grape yards in the region.

TABLE 4.5 : Implements used for intercultural practices in Miraj tahsil, 1986-87.

Sr. No.	Name of the Implement	Number of implements	Percentage
1	Iron ploughs	231	29.35
2	Tractors	26	3.30
3	Power spray pumps	240	30.50
4	Hand pumps	121	15.38
5	Foot pumps	61	7.75
6	Dusters	108	13.72
	Total	787	100.00

SOURCE : Compiled by the Author, 1987.

4.4 GROWTH OF AREA UNDER GRAPE-VINE (1969-87) :

Assuming the year 1969, a base year as 100 percent, the index values for the number of grape-vine hectareage have been worked out to indicate the growth of area under grape-vine. This could be best indicator to study the future trends of grape-cultivation. The growth in area under grape-vine is resulted from the influence of many factors. Fig.4.5 and Table 4.6 reveal the fact that despite the fluctuations in the area devoted to grape-vine, the tahsil shows upward trend of grape cultivation. The initial year 1969 is taken as the base year which markes overall beginning of grape-vine cultivation on commercial scale in the region. In the region under study, the beginning year has recorded 9 hectares under this crop whereas the total hectareage is reached to 565 hectares in 1987. Thus, during 19 years, there has been remarkable increase, i.e.6277.77 percent, over the base year. However, the region has experienced fluctuations in the area due to natural hazards like famine and drought conditions in the region. The year 1972 was characterised by wide spread famine conditions all over the state from which Miraj tahsil was not escaped. The trend was however due to gradual increase. The year 1977 recorded about 1077.77 percent growth i.e. 97 hectares. In the year of 1979, the tahsil recorded about 117 hectares area (1300 percent index value).

It is interesting to note that from 1981 (166 hect.)

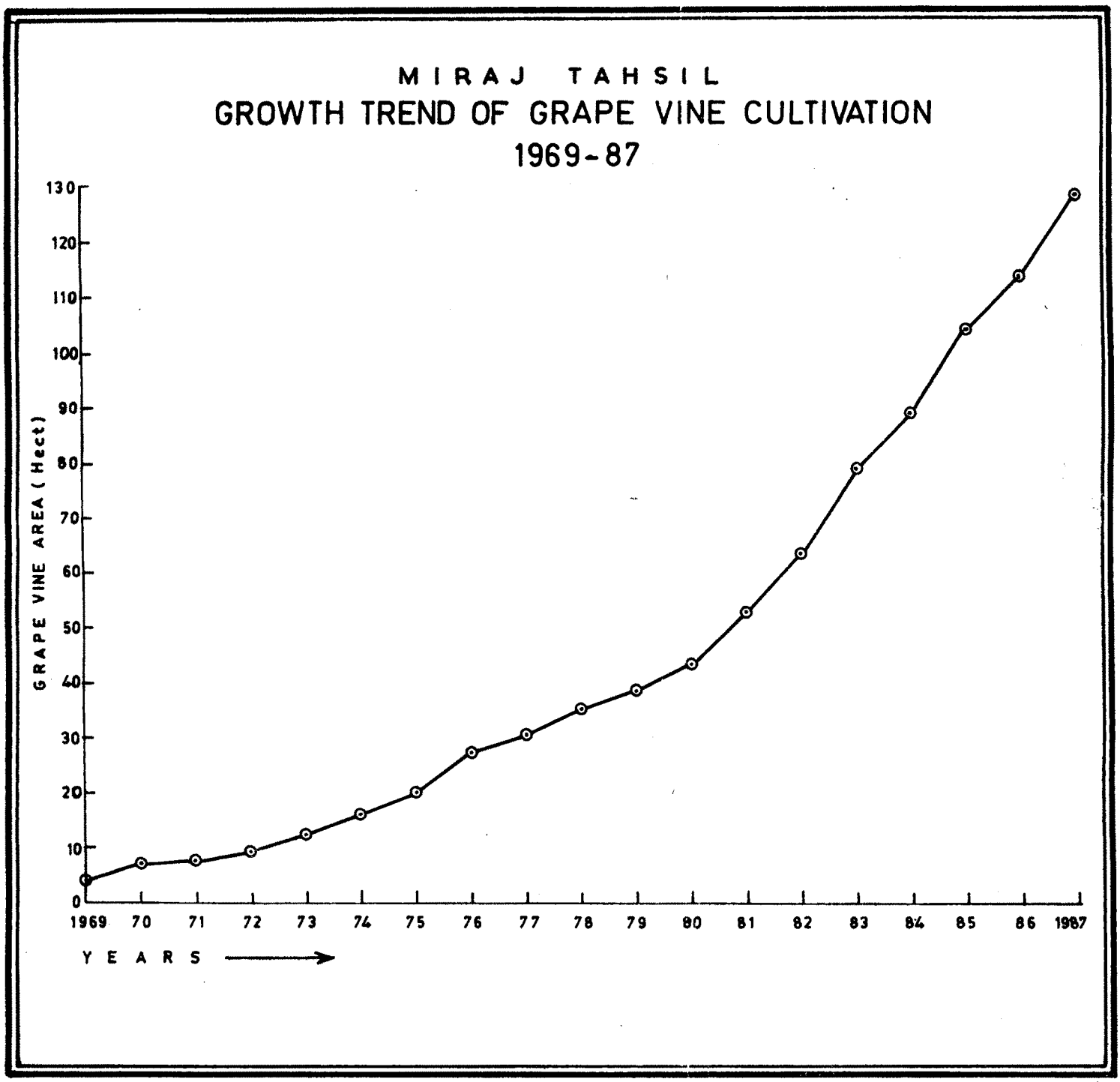

MIRAJ TAHSIL
GROWTH TREND OF GRAPE VINE CULTIVATION
1969-87
GRAPE VINE AREA (Hect)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1969 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 1987
YEARS

Fig. 4·5

TABLE 4.6 : Growth in grape-vine cultivation, Miraj tahsil (1969-1987).

Sr. No.	Years (1969 as base year)	Area under grape (hect.)	Index or growth (Base year 100)	Area (hect.) cumulative increase
1	1969	9	-	-
2	1970	22	244.44	244.44
3	1971	-	-	244.44
4	1972	26	288.88	533.32
5	1973	35	388.88	922.26
6	1974	55	611.11	1533.31
7	1975	71	788.88	2322.19
8	1976	90	1000.00	3322.19
9	1977	97	1077.77	4399.96
10	1978	112	1244.44	5644.40
11	1979	117	1300.00	6944.40
12	1980	147	1633.33	8577.73
13	1981	166	1844.44	10422.17
14	1982	202	2244.44	12666.61
15	1983	243	2700.00	15366.61
16	1984	297	3300.00	18666.61
17	1985	383	4255.55	22922.16
18	1986	467	5188.88	28111.04
19	1987	565	6277.77	34388.81
	Total		34388.81	34388.81

SOURCE : Compiled by the Author - 1987.

onwards, there is sound growth in grape-vine hectareage i.e. from 244.44 percent to 1844.44 percent over the base year of 1969. The absolute increase in area under grape-vine is represented in Fig.4.5. The last 19 years, there has been an upward trend of grape-vine area. The upshot of all the analysis is that grape-vine area during the last 19 years has increased more than 11 times in the region. Developments in water managements, expansion of market facilities, strengthening transportation, godown, cold-storage facilities and overall awareness among the farmers about this lucrative crop, have all contributed to the growth in grape-vine cultivation in the region.

4.5 CONCENTRATION OF GRAPE-VINE CULTIVATION 1986-87 :

The patterns of crop concentration reveal the variation in the intensity of crop in a given region at a point of time (Jadhav, 1984). The objective of the study pertaining to crop concentration patterns is mainly to differentiate the areas of high and low density of individual crops in the different parts of the region (Hussain,1979). The concentration of grape-vine cultivation in Miraj tahsil is subject to spatial variations and temporal changes too. The location quotient method advocated by Bhatia (1965) is employed here to analyse the patterns of grape-vine concentration in the region. Following statistical procedure is used to compute the index of concentration for each village.

$$IC = \frac{Au}{Tu} \div \frac{Ar}{Tr}$$

Where, IC = Index of crop concentration,

Au = Area under grape-vine in the village,

Tu = Total cropped area in the village,

Ar = Area under grape-vine in the region and

Tr = Total cropped area in the region.

Analysis :

The index values of all villages were grouped into five classes and arranged in descending order designated as very high high, moderate, low and very low areas of grape-vine intensity in 1986-87 (Fig.4.6).

i) Area of very high concentration (7150) :

This zone comprises the villages of Mhaisal (275.64), Kavalapur, Takali, Karoli, Kupwad and Khanderajuri with substantial proportion of area under grape. The assured water supply, favourable pedological and climatic conditions, nearness of market and communication facilities have all promoted vine cultivation.

ii) Areas of high concentration (100 to 150) :

This zone covers the areas of Bhose, Molgaon, Patgaon, Samberwadi, Soni villages where index values range between 100 and 150. This zone is also characterized by the favoural physical, social, economic and institutional factors encouraging grape-vine cultivation in the region.

iii) Areas of moderate concentration (50 to 100) :

The moderate intensity of grape-vine is mainly observed in the villages of Bedag, Belunki, Budhgaon, Gundewadi, Savali and Tung. These villages have the predominance of well irrigation which limits the grape-vine cultivation. The seasonal fluctuations in watertable and scarcity during summer season have led for moderate cultivation (Fig.4.6).

iv) Areas of low (25-50) and very low ($\leq$ 25) concentration :

About 16 villages are included in this zone where inadequate water is the major constraint for the development of grape-vine cultivation. The extreme eastern part possess such adverse condition. The villages in the west of this category has different problems like deep black soils, competition from sugarcane cultivation and salt content which is harmful for grape-vine are the barriers for the development of grape-vine cultivation (Fig.4.6).

On the whole, water supply determines the spread of grape-vine cultivation in the region. However, high capital investment required for such commercial crop cannot be offered by poor farmers though he has intension to undertake cultivation of this crop.

4.6 SPATIAL PATTERN OF GRAPE-VINE CULTIVATION (1986-87) :

The study pertaining to the distributional pattern of absolute area under grape-vine and its percentage ratio with

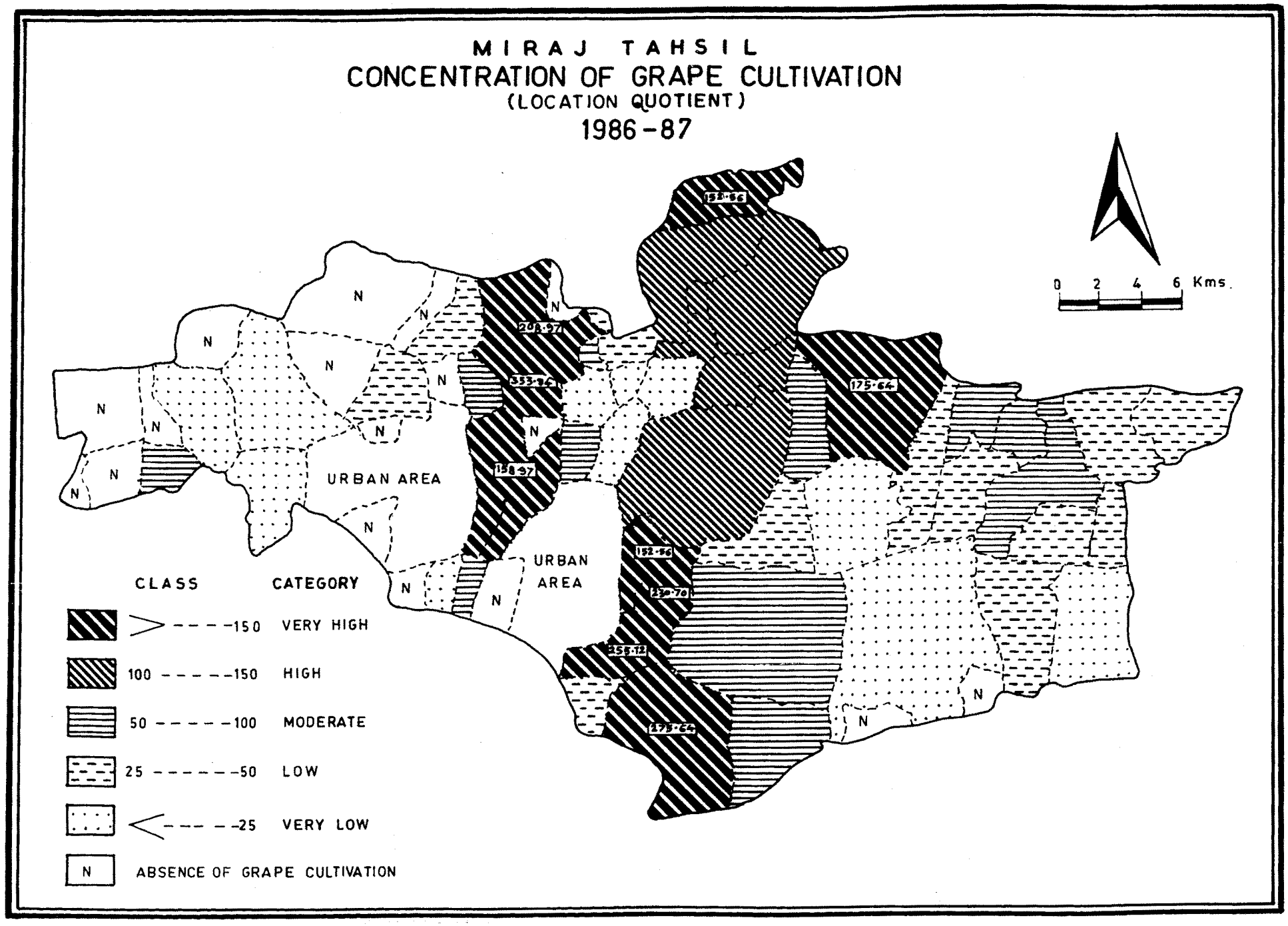

MIRAJ TAHSIL
CONCENTRATION OF GRAPE CULTIVATION
(LOCATION QUOTIENT)
1986-87
0 2 4 6 Kms.
URBAN AREA
URBAN AREA
158·86
208·97
333·26
158·97
175·64
152·96
230·70
255·12
478·64
N
CLASS
CATEGORY
>----150 VERY HIGH
100 -----150 HIGH
50 -----100 MODERATE
25 ------50 LOW
<--- --25 VERY LOW
N ABSENCE OF GRAPE CULTIVATION

Fig. 4·6

total harvested area are of immense importance. For, it reflects the spatial dimensions of this particular crop cultivation which has been controlled by a number of variables like physical and non-physical environments. An attempt has beem made here to collect villagewise data of area under grape cultivation as there is no authentic secondary data about this crop. Fig.4.7 and 4.8 show the spatial pattern of grape-vine cultivation in terms of percentage of harvested area and absolute area respectively.

A) Spatial pattern :

The regions average of grape-vine area to total harvested area is about 0.78 percent. Three zones have been identified as the zone with significant proportion of grape-vine with harvested area, moderate and less significant.

i) Zone of significant hectareage of grape-vine ($\geq$ 1.5 percent) :

The zone comprises the villages of Takali (8.99%0, Kavalapur (2.76%), Mhaisal (2.15%), Vadoli (1.99%), Bolwad (1.80%), where grape-vine cultivation is developed due to favourability of water, transport, market, awareness of farmers etc. In view of water available in the villages of dry areas, grape-vine seems to be suitable cash crop as compared to sugarcane.

ii) Moderate zone (1.0 to 1.5%) :

The moderate proportion of grape-vine area with total harvested area is observed in the villages of Karoli (1.19%),

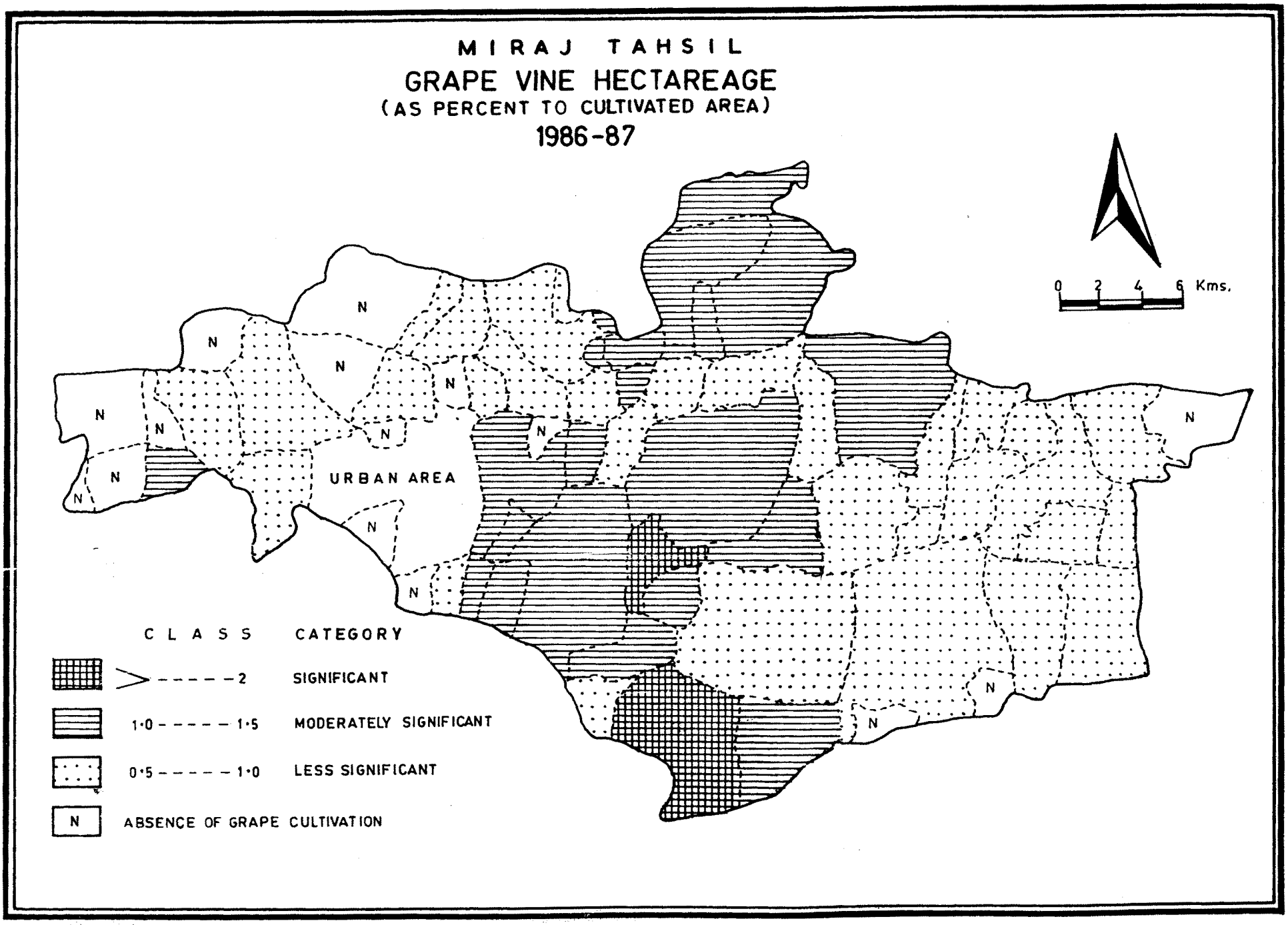

MIRAJ TAHSIL
GRAPE VINE HECTAREAGE
(AS PERCENT TO CULTIVATED AREA)
1986-87
0 2 4 6 Kms.
URBAN AREA
N
CLASS CATEGORY
> - - - - - 2 SIGNIFICANT
1·0 - - - - - 1·5 MODERATELY SIGNIFICANT
0·5 - - - - - 1·0 LESS SIGNIFICANT
N ABSENCE OF GRAPE CULTIVATION

Fig. 4·7

Khanderajuri (1.01%), Kupwad (1.24%), Malgaon (1.16%) and Patgaon (1.16%). All these villages record the dominance of well irrigation and relatively shallow soils with dry climate. However, recent emergence of grape cultivation is also resulted from theaavailability of market and transport facilities and common awareness of the suitability of this crop to the region.

iii) Less significant zone (less than 1.00 percent) :

This zone is observed in the remaining parts where proportion of grape-vine area is less significant. The villages like Arag (0.17%), Dhamni (0.08%), Dhavali (0.06%), Erandoli (0.18%), Kanadwadi (0.04%), K.Digraj (0.04%), Khatav (0.12%), Lingnoor (0.19%), Manmodi (0.14%), Salgare (0.17%), Shipur (0.20%) and Tanang (0.12%) etc. have recorded very poor proportion of grape-vine area to harvested area. The intensity of irrigation is poor in those villages which has discouraged the cultivation of grape-vine. However, there are some villages which have recorded relatively sound position comparing to the above villages. The villages, for example, Gundewadi (0.65%), Narvad (0.68%), Rasulwadi (0.73%), Samberwadi (0.91%), Savali (0.57%), Soni (0.92%) and Tung (0.64%) have shown such position (Fig.4.7).

B) Distributional pattern of grape-vine hectareage (1986-87) :

Fig.4.8 exhibits the distributional pattern of grape-vine hectareage in each village of the region. The region has 564.45

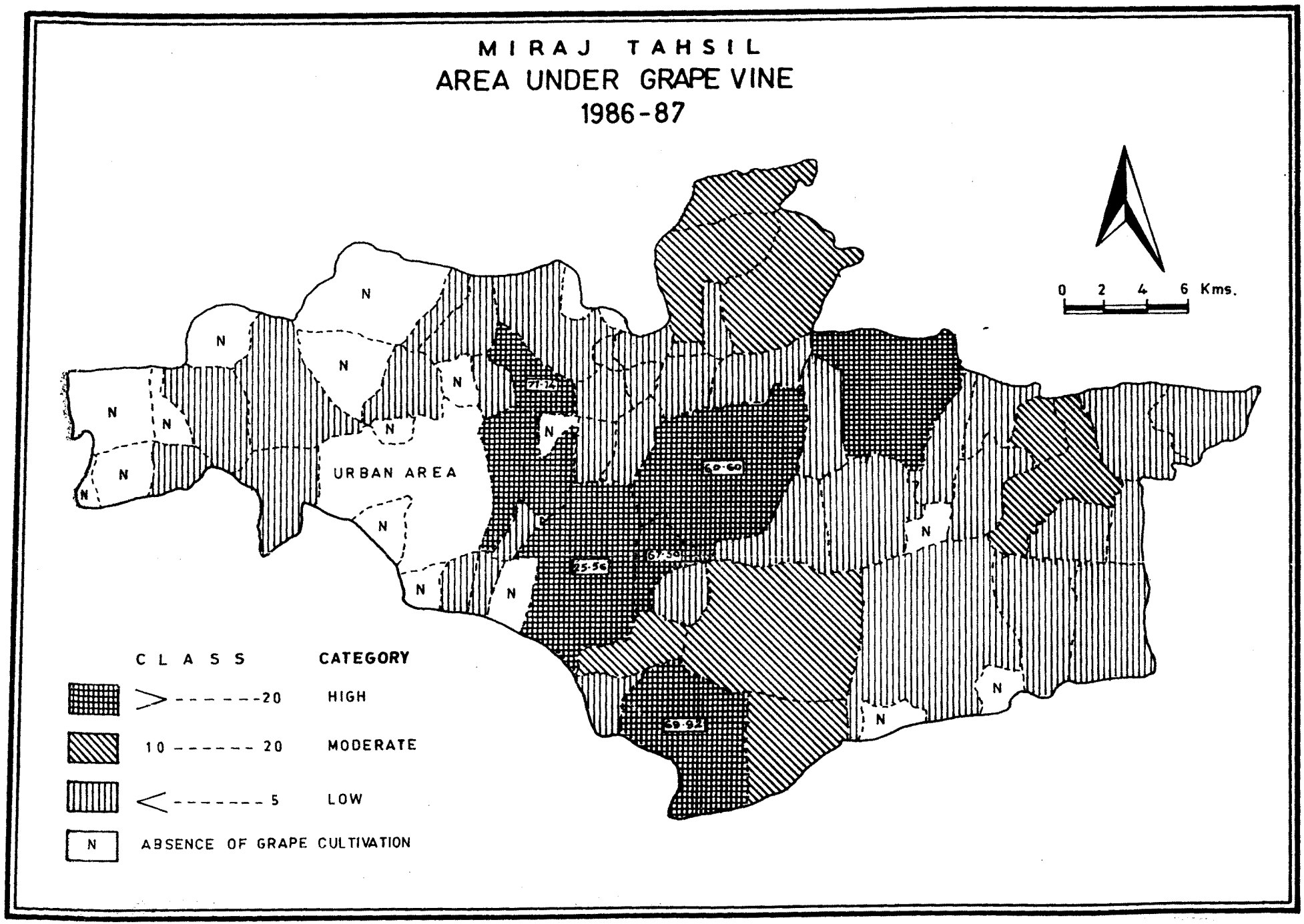

MIRAJ TAHSIL
AREA UNDER GRAPE VINE
1986-87
0 2 4 6 Kms.
URBAN AREA
71·74
60·60
67·58
55·56
59·92
N
CLASS
CATEGORY
> ------20
HIGH
10 ------ 20
MODERATE
< ------- 5
LOW
N
ABSENCE OF GRAPE CULTIVATION

Fig. 4-8

hectares of area spread in 52 villages in the region. The highest hectareage (71.14 hect.) under grape-vine is recorded by Kavalapur village followed by Mhaisal (69.92 hect.),Malgaon (60.60 hect.), Takali (57.30 hect.), Khanderajuri (38.44 hect.), Miraj rural area (25.56 hect.) and Kupwad (20.14 hect.) villages. These villages are benefitted from the nearness of market facilities, availability of water either from lift irrigation or well irrigation and high frequency of transport facilities. The moderate hectareage (between 10 to 20 hect.) is found in 6 villages in the north and south where water is made available from well and lifts respectively. The zone of low hectareage (below 10 hect.) is mainly confined to the west and east. The salt tolerance nature of sugarcane, in the west, has discouraged the cultivation of grape-vine. Moreover, the eastern parts have the major constraint of inadequate water leading to low proportion of grape-vine hectareage.

It is evident from the above analysis that water is main controlling factor for the distribution of area under grape-vine. Besides, deep black soils and their saline nature in lift irrigated areas of the west, have obstracted the development of hectareage. The total grape-vine area (564.45 hect.) is distributed among 1527 grape-vine yards of the region. It is interesting to note that the number of vine yards differs from village to village which can be analysed.

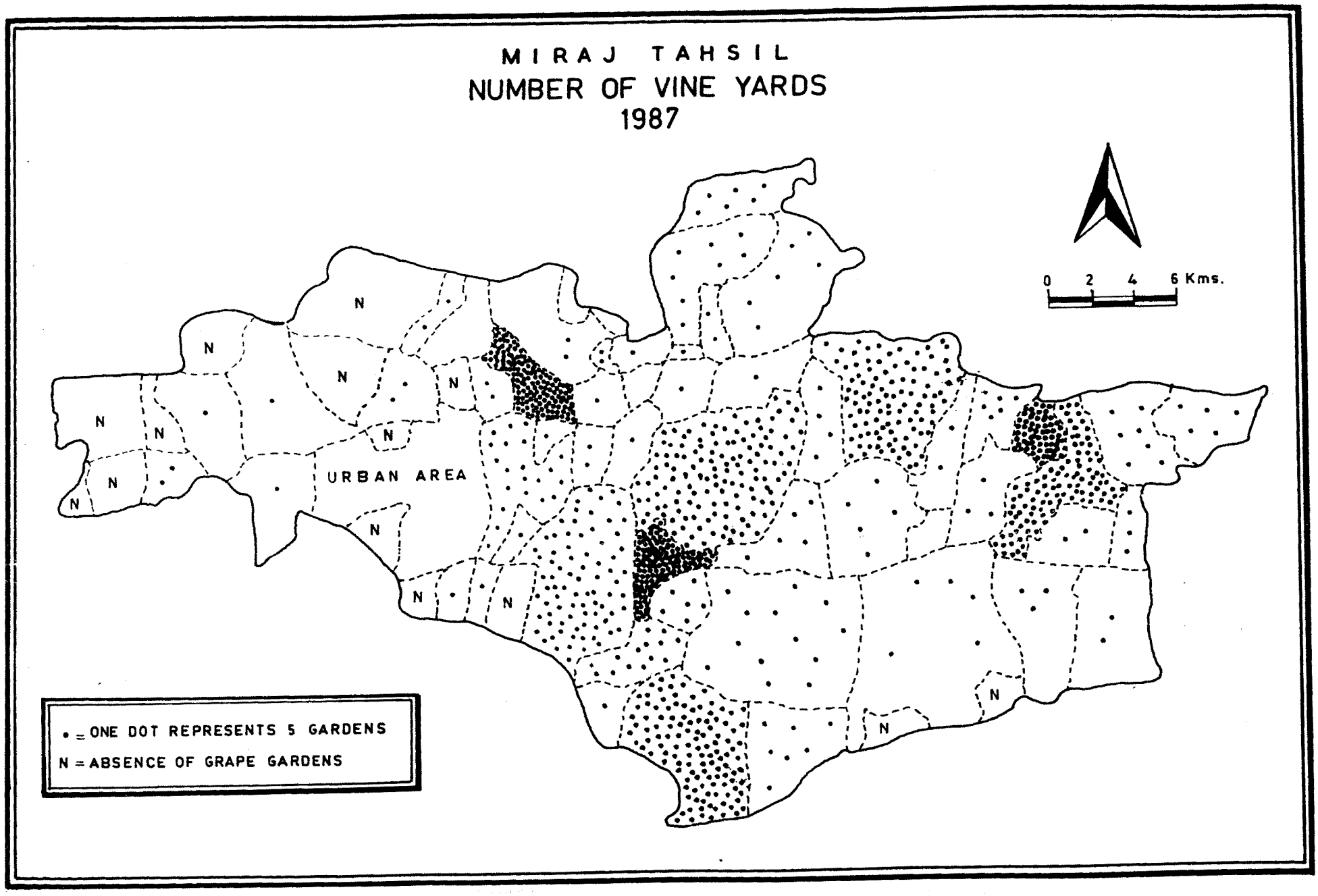

MIRAJ TAHSIL
NUMBER OF VINE YARDS
1987
0 2 4 6 Kms.
URBAN AREA
N
• = ONE DOT REPRESENTS 5 GARDENS
N = ABSENCE OF GRAPE GARDENS

Fig. 4·9

4.7 DISTRIBUTION OF GRAPE-VINE YARDS (1986-87) :

The grape-vine yards of different sizes are unevenly distributed in various villages (Fig.4.9). Takali has recorded 150 gardens followed by the villages of Kavalapur (147), Malgaon (131), Mhaisal (122), Khanderajuri (102), Belunki (100), Kadamwadi (67), Miraj rural area (81) and Kupwad (21). The central and eastern parts have the more number of vine yards as compared to the west. The reason is obvious that coarse and shallow black soils have proper drainage with favourability of dry climatic conditions to encourage farmers for undertaking the cultivation of grape-vine.

4.8 RANKING OF GRAPE-VINE (1986-87) :

Fig.4.10 reveals the ranking status of irrigated crops in 40 villages where grape-vine cultivation is practised by the farmers. There are five major irrigated crops grown in the region i.e. sugarcane, grape-vine, maize, wheat and chilly. Moreover, sugarcane records higher (80%) proportion of irrigated area. Whereas, grape-vine accounts for 12.15 percent to total irrigated area. Wheat and maize are the other food crops which are grown seasonally. Cotton is also cultivated on irrigated areas in the eastern parts of the villages. Among these crops grape-vine is first ranking crop in 8 villages in the northern part of the region (Table 4.7). The villages like Lingnur, Soni, Kharkatwadi, Manmodi, Kupwadi, Wanlesswadi, Tanang, Kalmbi etc.

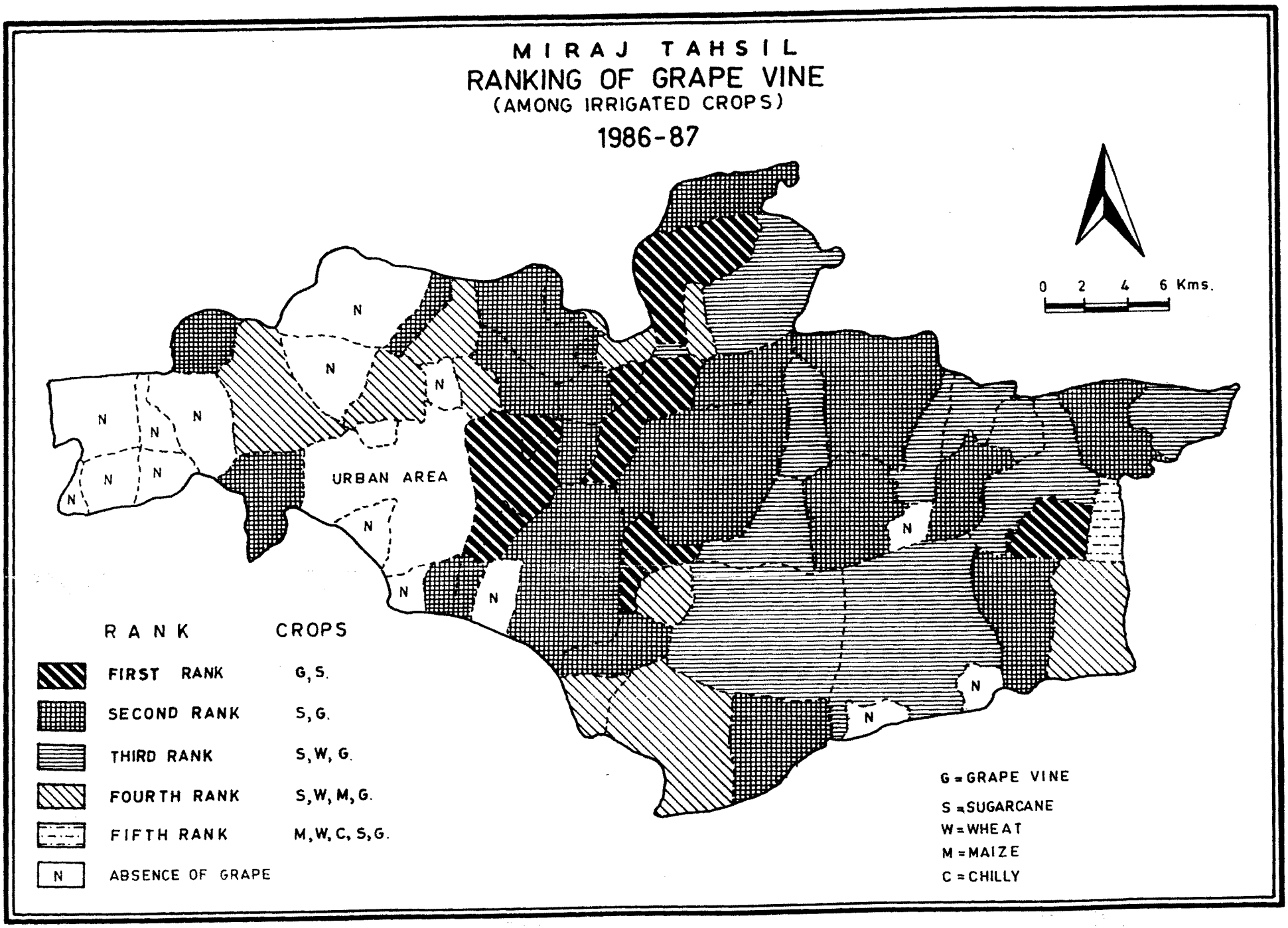

MIRAJ TAHSIL
RANKING OF GRAPE VINE
(AMONG IRRIGATED CROPS)
1986-87
0 2 4 6 Kms.
URBAN AREA
N
RANK
CROPS
FIRST RANK
G, S.
SECOND RANK
S, G.
THIRD RANK
S, W, G.
FOURTH RANK
S, W, M, G.
FIFTH RANK
M, W, C, S, G.
N
ABSENCE OF GRAPE
G = GRAPE VINE
S = SUGARCANE
W = WHEAT
M = MAIZE
C = CHILLY

Fig. 4·10

TABLE 4.7 : Ranking status of grape-vine in relation to other irrigated crops in Miraj tahsil 1986-87.

Sr. No.	Rank	Crops Ranking order	Name of the villages
1	I	G-S	Lingnoor, Soni, Kharkatwadi, Manmodi, Kupwad, Walnesswadi, Tanang, Kalambi.
2	II	S-G	Salgare, Narwad, Erandoli, Shipur, Khanderajuri, Shiddhewadi, Malgaon, Miraj, Vaddi, Savali, Kakadwadi, Kavalapur, Tung, Samdoli, Khotwadi,
3	III	S-W-G	Chabukswarwadi, Belunki, Kadamwadi, Dongarwadi, Payapachiwadi, Arag, Bedag, Mallewadi, Gundewadi, Bhose.
4	IV	S-W-M-G	Khatav, Mhaisal, Bolwad, Patgaon, Rasurwadi, Karnal, Bisul, Malwadi.
5	V	M-W-C-S-G	Janraowadi

Note : S - Sugarcane, W - Wheat, G - Grape-vine
M - Maize, C - Chilly

SOURCE : Compiled by the author, 1987.

have shown first rank regarding grape-vine which has been followed by sugarcane.

Grape-vine has acquired second position in 14 village after sugarcane in the north and north-eastern parts of the region. Third rank of grape-vine, after sugarcane and wheat, is observed in 9 villages in the south-eastern parts. Grape-vine records fourth rank after sugarcane, wheat, maize in 8 villages in the western parts of the region (Fig.4.10). Janrao-wadi, in the extreme east has shown five crops irrigated during the period under investigation. Here, grape-vine has attained fifth rank after maize, wheat, chilly and sugarcane.

The above analysis unfolds the fact that sugarcane is dominant and first order crop in the western tract whereas the central and northern parts have shown grape-vine cultivation as first ranking. Such ranking status of this crop can be attributed to physico-socio-economic and institutional factors. Table 4.7 exhibits the ranks of different irrigated crops in various villages during 1987.

4.9 PRODUCTIVITY OF GRAPE-VINE 1986-87 :

In the earlier pages, emphasis was given on the area under grape-vine in its spatial context. The yields of grape-vine per unit of area (hect.) is also important aspect of grape-vine cultivation. It is significant parameter to judge the influence of physical-social economic and organisational attributes. An increase in area under grape-vine alone will

not solve the problem of its shortage in market. In order to meet the growing demands for grape for different purposes, its increasing yields per unit of area are necessary.

The productivity of any crop is the manifestation of the integrated impact of above mentioned factors. Here, an attempt is made to assess villagewise (grape-vine yardwise) productivity of grape-vine. The data of yields per hectare of grape were collected through personal visits to each gardens and average yields per hectare for each village was determined. The yield indices for grape-vine were then calculated for each village by employing following formula developed by Shinde and Jadhav (1978).

$$Cyi = \frac{Ye}{Yr} \times 100$$

Shere, Cyi = Yield Index of grape-vine in the village

Ye = Average yield per hect. of grape in the village

Yr = Average yield per hect. of grape in the entire region

Analysis :

The villages were grouped according to their index values and arranged in descending order designated as high, medium, low and poor zones of grape-vine productivity (Fig.4.11). Table 4.8 shows villagewise yields of grape in the tahsil.

TABLE 4.8 : Yields of grape in different villages, 1987.

(Figs.Kg per hect.)

Sr. No.	Village	Yields	Sr. No.	Village	Yields
1	Arag	28,152	27	Kharkat	24,800
2	Bamni	19,284	28	Khatav	24,900
3	Bedag	35,124	29	Kupwad	22,650
4	Belunki	25,376	30	Lingnoor	40,360
5	Bhose	13,864	31	Malgaon	31,600
6	Bisur	45,832	32	Mallewadi	30,850
7	Bolwad	30,040	33	Manmodi	44,000
8	Budhgaon	21,500	34	Mhaisal	40,000
9	Chabu Wai	26,000	35	Miraj	42,000
10	Dhamni	34,800	36	Narwad	31,664
11	Dhavali	40,000	37	Patgaon	23,570
12	Dongarwadi	22,600	38	Payapachiwadi	27,350
13	Erandoli	30,000	39	Pasulwadi	27,550
14	Gundewadi	23,100	40	Salgare	28,700
15	Janraowadi	20,660	41	Sanvekwadu	30,000
16	Kadamwadi	32,970	42	Samdoli	26,280
17	Kakadwadi	28,330	43	Santosuri	14,760
18	Kalambi	26,000	44	Sakali	22,400
19	Kanadwadi	28,800	45	Shipur	26,748
20	Karnal	28,840	46	Shiddhewadi	30,400
21	Karoli	16,000	47	Soni	29,500
22	K.Diyaeer	24,700	48	Takari	35,600
23	Kakalapur	28,850	49	Tanana	28,000
24	Kavathepir	17,550	50	Tunr	24,096
25	Kavaji Khot	28,000	51	Vaddi	23,100
26	Khanderai	25,880	52	Walnesswadi	28,000

SOURCE : Compiled by the author, 1987.

i) Zone of high productivity (above 200) :

This zone comprises 6 villages occupying about 271 hectares in 524 gardens during 1987. Most of these villages are located in the south-western parts of Miraj tahsil which are marked by lift irrigation and dominance of sugarcane cultivation (Fig.4.11). This part comprises the area of Krishna river plain proper where deep to medium black soils exists. Assured supply of water, substantial use of fertilizers, nearness of market and conversant nature of farmers with modern techniques have led to increase per hectare production. The villages like Mhaisal (40,000 kg), Miraj, Karnal (42,000 kg), Manmodi (44,000 kg), Dhavali (40,000 kg) and Lingnoor (40,360 kg) have all recorded more than average production (34,600 kg) of the region. But, the production is of inferior quality as compared to the eastern parts (personal observations).

ii) Zone of medium productivity (150 to 200) :

About 455 vine yards of 11 villages covering about 126 hectares of land is included in this zone (Fig.4.11). The per hectare production ranges from 30,000 to 40,000 kg which is relatively important in the context of quality and quantity of grape production. The villages of Bedag, Bolwad, Dhamni, Malewadi, Malgaon, Sidyewadi and Takali are worth to be noted in this regards. These villages are located near to first zone. The vine-yards of this zone are benefitted from an assured irrigation, fertilizer consumption, proper farm management practices and modern techniques, nearness of market.

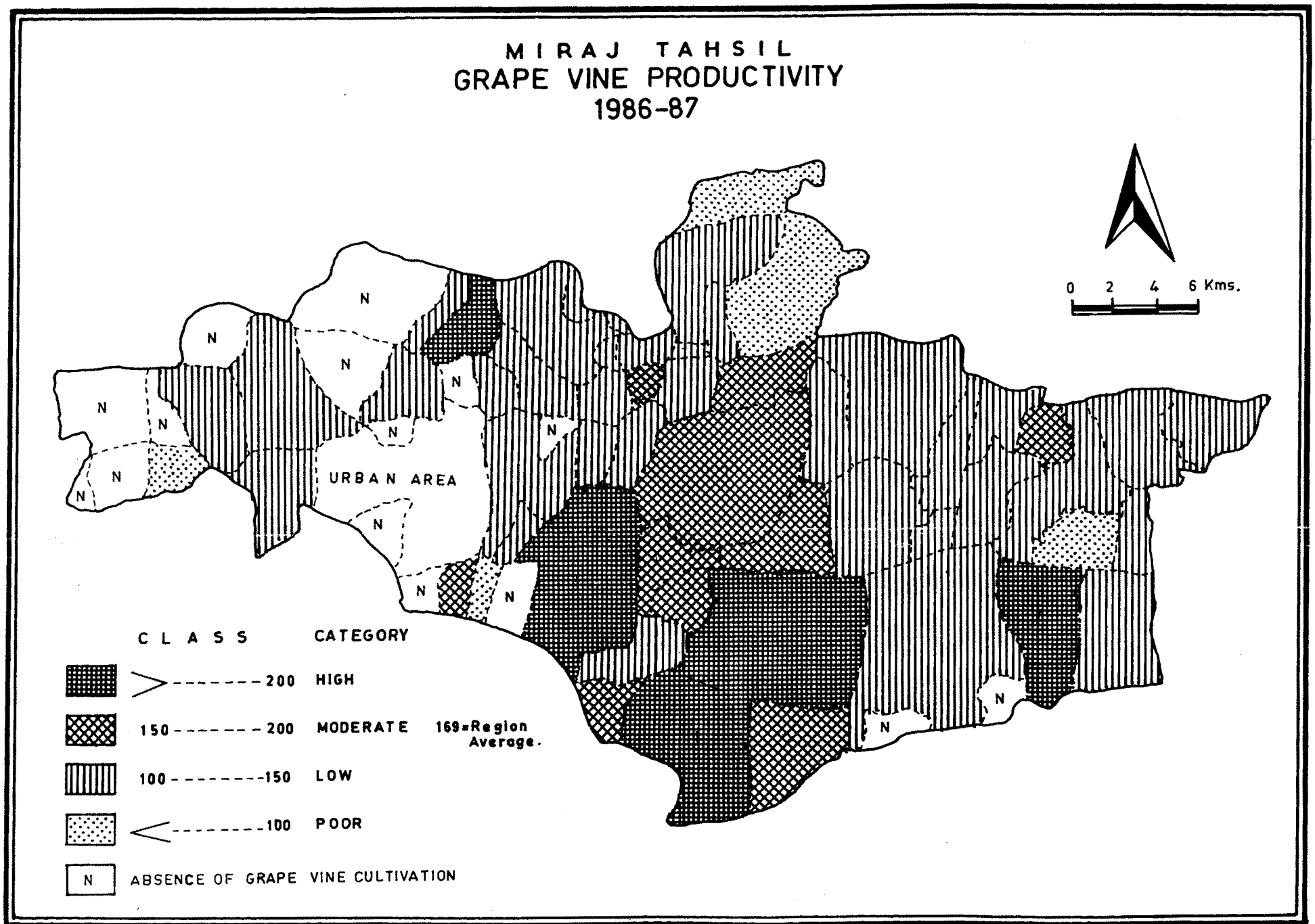

MIRAJ TAHSIL
GRAPE VINE PRODUCTIVITY
1986-87
0 2 4 6 Kms.
URBAN AREA
N
CLASS
CATEGORY
> ------- 200 HIGH
150 ------- 200 MODERATE
100 ------- 150 LOW
< ------- 100 POOR
169=Region Average.
N ABSENCE OF GRAPE VINE CULTIVATION

Fig. 4-11

iii) Zone of low productivity (100 to 150) :

This is an extensive tract covering 247 vine yards with 100 hectares of area in 30 villages (Fig.4.11). The villages in extreme eastern, western and north-western parts have recorded the yield of grapes ranging between 20,000 and 30,000 kg per hect. In fact, it is below the average of the region i.e. 34,600 kg per hectare. Although the dryness of climate and proper drainage of soils are observed in this part, inadequate water supply from the wells, small holdings of vine yards, increasing distance from the market and low proportion of fertilizer application have all led to low productivity.

iv) Zone of poor productivity (below 100) :

The villages of Bamni (19284 kg), Bhose (13864 kg), Karoli (16000 kg), Kavathepir (17550 kg) and Santosuri (14760 kg) have shown poor performance in grape productivity. About 200 vine yards with 67 hectares area are observed in this zone. The distance from the market, inadequate water supply from the wells and consequent less consumption of fertilizers are the major constraints causing poor productivity.

4.10 PLANNING FACTORS IN GRAPE-VINE CULTIVATION OF MIRAJ TAHSIL :

Although Miraj tahsil is second ranking regarding area under grape-vine (565 hect.), the grape production is not satisfactory. Some villages in the southwest have recorded satisfactory

production i.e. more than 40,000 kg per hectare. However, the production is of poor quality. In order to improve the quality and quantity of production per hectare, there is need of suitable strategy. Based on the observations and previous analysis the following measures would be helpful in this context.

1) Size of grape-vine holdings :

Table 4.9 reveals that the size of grape-vine holdings are varying considerably. There is more (33.33%) proportion of small sized yards of 84 vine yards with the size of below 0.30 hectares. Whereas, highest proportion is also observed by small sized yards of 96 gardens (38.09%) ranging between 0.30 to 0.65 hectares. This has been followed by the group having 0.65 to 1.25 hectare size distributed in 48 gardens. Thus, about 180 vine yards possess less than 0.65 hectare size.

TABLE 4.9 : Size of grape-vine holdings in Miraj tahsil,1987.

Sr. No.	Size class	Size Category	Number of vine yards	Percentage
1	Over 5.00 hect.	Large significantly size	1	0.39
2	2.50 to 5.00 hect.	Large size	3	1.19
3	1.25 to 2.50 "	Semi large size	20	7.93
4	0.65 to 1.25 "	Medium size	48	19.07
5	0.30 to 0.65 "	Small size	96	38.07
6	Below 0.30 "	Very small size	84	33.33
	Total		252	100.00

SOURCE : Compiled by the author,1987.

The semi large sized holding (1.25 to 2.50 hect.) are confined to 20 gardens (7.93%) whereas 3 vine yards are between 2.50 to 5 hectares size (1.19%). The significant size of grape-vine yard (above 5 hectare) is observed in Mhaisal village owned by Shri B.R.Mali, a leading grape-grower.

The revealing fact is that the size of grape-vine yards is determined by the availability of water. Owing to limited water supply, well irrigation has led to small sized holdings which are found in the eastern and northern parts of region. Such small sized holdings become the barrier for farm operation, marketing, capital investment and application of modern technology. Sometimes already fragmented small holdings are brought under grape-vine cultivation when irrigation is introduced. The emphasis should be given to augment productivity of these vine-yards by providing inputs at reasonable rates in time. The loan facilities can be extended to these small holders so as to increase productivity.

2) Grape-vine varieties :

Presently the region has dominance of table grape variety under cultivation. The grape-vine, being vegetatively propogated, is subject to attack by several pests and diseases. Successful grape-vine development programme will have to be based on dynamic breeding which may sustain pests and natural hazards of low temperature, more moisture content etc. Grape Research Stations may be established in this region to evolve suitable variety to the atmospheric conditions in the region. Grape Owner's Association will have scope to play it's role in this regard.

3) Better seeds :

The seeds of grape-vine are obtained locally which are not properly treated. Healthy and well treated seeds are essential for proper growth of vines. Sometimes transported seeds may carry virus diseases which affect new vine yards. It is necessary to give proper guidance to farmers for seed treatments. The availability of good seed calls for a well chalkedout programme of maintenance of seed nurseries by Grape Owner's Association, Government organisations or Agricultural Colleges of the region. They should sholder the responsibility of providing good quality seeds and maintain seed nurseries. The farmers should be advised to change seeds at least once in ten years.

4) Pest and Disease control :

The growth of grape-vine and also its yield is affected by various types of diseases and pests in which, the plant as a whole or any part there does not perform its normal function. The pests damage the growing plant as well as grapes. The productivity of grape-vine is considerably decreased due to these diseases and pests. Climatic conditions play vital role in the infection of pests. Clear sky with dry conditions, 25°C temp. are favourable for grape cultivation. However, invasion of cold waves, cloudy or oversky etc. all damage the crop productivity. The farmers in the region are well awared about these facts who adopt some measures to overcome these hazards. The use of Bodamil, Beludin, Sulfur, Copper, Zink, Bliman, Fytolon, B.H.C.,Boroo pest

is made to check the diseases. Artificial smoke by burning dung cakes is made to heat the vine yards during cold waves. But the vine yards suffers from in time non-availability of pesticides and insecticides. Besides, adultrations of pesticides is also another problem due to which the grapes are damaged recently. The firm steps should be taken to curb such malpractices. The pesticides and insecticides should be made available to grape growers at nearby places. This requires to open depots at central places from which farmers may enjoy these facilities in time.

5) Balanced fertilization :

As analysed earlier, the region has anamolous consumption of chemical fertilizers. Most of the farmers are ignorant of the use of balanced fertilizers. It cannot be adopted unless soils of grape-vines are chemically examined. However, many grape growers are reluctant to test the soils frequently by sending soils sample to soil laboratories located at taluka or district places. The farmers must be made aware of this vital aspect. The mobile soil laboratories would be fruitful which could approach farmers directly and suggest balanced doses. The Grape Owners Association should insist on balanced fertilizers in the light of water availability and soil characteristics of grape yards. Besides, fertilizers should be made available when they are required.

6) Economic use of water :

The author observed regional disparity in the use of water to grape vines. The western belt has sufficient water supply from lifts. The flood irrigation method is mainly used in this tract which leads for excess use of water. The deep to moderate black soils, excess use of water alongwith heavy fertilizer doses cause the imbalance in the nutrients of soils. Consequently most of the grape-vine soils carry more than 8 pH value showing saline nature. The grape-vine is less sustainable for saline as well as alkaline soils. In this tract volumetric water supply may be adopted by providing water meters to farmers. Besides, grape yards should have proper drainage system as outlet for excess water. The pipeline should be extended upto grape fields so as to check percolation of water. Introduction of drip and sprinkler irrigation systems may be adopted for long run economic planning for water use. Moreover, the grape growers should be made aware to use water economically. The eastern parts should adopt drip irrigation in order to conserve water.

7) Training and Information Centres :

Training is inevitable to farmers for the proper understanding of new methods of cultivation and use of modern techniques. The propogation can be made by establishing training centres at central places. The information regarding new varieties of grapes, pests and diseases, measures to be adopted, provision of research

information through literature materials would be fruitful. Alternate mobile units of trained personnel should visit grape yards and guide farmers.

4.11 CORRELATION ANALYSIS :

Relationship of grape-vine area with other variables is of vital importance to understand the development of grape-vine cultivation in the region. The emergence of grape-vine cultivation has been resulted from the functioning of these attributes. The following variables have been chosen to establish the correlation among them. The fieldwise data was collected through personal visits to each vine yards to fill in the schedules for each component. The index values were calculated to maintain the uniformity in the scale of measurement. For the assessment of drainage of soils field observations were attempted and weightages were given as good, moderate and poor drainages based on slope. The data pertaining to texture and NPK states of soils were obtained from the results of soil laboratories collected by the farmers frequently.

Average amount of rainfall was also collected from some progressive farmers who maintained field records. Besides, the author, being a grape-vine cultivator, has maintained data for the last ten years. The average market price was calculated from yearwise prices for the period 1975 to 1986. For the computation of index for mechanization the improved implements like, number of

electric motor pumps, oil engines, tractors, dusters etc. were considered. While calculating the index value for each variable following simple formula was used in which the ratio of the average figure of each village is calculated with the region's average. The formula is as follows :

$$Ip = \frac{Sv}{Sr} \times 100$$

Where, Ip = Index value for 'a' variable

Sv = Average of 'a' variable in the village

Sr = Average of 'a' variable in the region

Pearson's co-efficient correlation (r) formula is used here for correlation matrix. The formula is :-

$$r = \left\{ xy - \frac{\xi^x \times \xi^y}{N} \right\}$$

Where, x = Independent variable,

y = Dependent variable and

N = Number of observations.

About 16 variables (Table 4.10) were selected to workout the correlation matrix. As analysed earlier that grape-vine cultivation is outcome of integrated impact of many factors. The variables responsible for vine cultivation are considered here

TABLE 4.10 : Correlation Matrix

Sr. No.	Particular	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Area under grape-vine	1.00	0.64	0.05	0.18	0.47	0.80	0.87	0.51	0.15	0.32	0.12	0.16	0.69	0.18	-0.04	0.45
2	Texture of soils		1.00	0.89	0.78	0.88	0.81	0.72	0.62	-0.51	0.69	-0.35	-0.38	0.25	-0.16	-0.09	0.04
3	Drainage of soils			1.00	0.71	0.66	0.91	0.46	0.59	-0.21	0.53	-0.39	-0.34	0.45	-0.30	-0.32	0.59
4	NPK status of soils				1.00	0.35	-0.03	-0.19	0.34	-0.05	0.42	-0.16	-0.21	-0.06	-0.09	-0.17	0.18
5	Intensity of rainfall					1.00	0.69	0.72	0.10	0.22	0.34	-0.05	-0.01	-0.07	-0.17	-0.04	-0.35
6	Watertable (Wells)						1.00	0.56	0.82	0.15	0.45	-0.02	-0.07	-0.16	-0.20	-0.32	-0.19
7	Intensity of Irrigation							1.00	0.91	0.67	0.49	0.14	0.17	-0.15	-0.06	-0.12	0.43
8	Per hect. use of fertiliser								1.00	0.19	0.12	0.52	0.58	0.29	0.14	-0.22	0.62
9	Index Mechanisation									1.00	0.17	0.45	0.41	-0.31	0.44	0.11	0.35
10	Per hectare use of manure										1.00	-0.01	-0.05	0.21	0.18	0.07	0.48
11	Per hectare use of pesticides											1.00	0.03	0.17	0.12	0.04	0.09
12	Per hectare use of Insecticides												1.00	0.07	0.21	0.03	0.01
13	Per kg market price for grape													1.00	0.76	0.61	0.15
14	Road density (per km^2)														1.00	0.27	0.04
15	Average distance of gardens from major Market															1.00	0.18
16	Farmers perception for grape-vine enterprises																1.00

SOURCE : Compiled by the Author; based on field data, 1987.

to find out their interrelationship. Table 4.10 shows 'r' values of correlation of 16 selected variables. The striking fact is that vine area is positively related to almost all factors except distance factor from market. The high positive correlation (0.89) exists between vine area and intensity of irrigation further which followed by watertable in the region. Thus, grape cultivation is possible only when irrigation facilities are available. The correlationship between vine area and soil texture (0.64) and that of NPK status of soils shows also positive relationship. Intensity of rainfall is also positively related (0.67) to grape cultivation. The perception farmers with grape gardening is positively (0.45) related which plays important role as they take risk in undertaking grape enterprises against the natural hazards of hail storms, cold waves, high temperatures and scarcity of water during summer seasons in the east. Mention should be made of distance from the market which is negatively related with minus 0.04 'r' value. This indicates that the increasing number of transport vehicles and transport facilities are made available by the Grape Grower's Association. Thus, increasing distance from the market does not affect much on the development of grape-vine area. The interrelationship of other variables to each other is given in Table 4.10 which is self explainatory showing 'r' values of different variables.

R E F E R E N C E S

1. Bassermann, Jordean and Kirchheimer (1938) : Geschichte des Weinbans, Frankfurt am Main, Verlags - Anstalt, A.G., Vol.1, p.1.

2. Bhujbal, B.G. (1988) : 'Draksh Bag'. Continental Prakashan, Pune, pp.1-18.

3. Bhatia, S.S. (1965) : Patterns of crop concentration and diversification in India. Economic Geography, 41, pp.39-56.

4. Hussain, M. (1979) : Agricultural Geography. Inter-India Publications, Delhi, pp.149-154.

5. Jadhav, M.G. (1984) : Sugarcane cultivation - A Regional Analysis. Himalaya Publishing House, Bombay, pp.73-89.

6. Rahudkar (1987) : "Baliraja" special issue on grape-vine cultivation in Marathi. 'History of grape-vine in India', Krishi Vidnyan Publication, Pune, pp.19-22.

7. Shinde,S.D. and Jadhav, M.G. (1978) : Agricultural Productivity in Maharashtra Plateau : A geographical analysis, National Geographer, Vol.13, No.1, June, pp.35-41.

8. Winkler, A.J. (1974) : General viticulture, University of Calfornia Press, pp.1-58.

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