A GEOGRAPHICAL STUDY OF CHANGING LANDUSE PATTERN AND PRODUCTIVITY IN INDAPUR TAHSIL PUNE DISTRICT

A Thesis Submitted to the

Tilak Maharashtra Vidyapeeth, Pune

For the Degree of Doctor of Philosophy (Vidyavachaspati) in Geography

Under the Faculty of Moral and Social Science

By

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April 2016

DECLARATION

*I hereby declare that the thesis entitled "**A GEOGRAPHICAL STUDY OF CHANGING LANDUSE PATTERN AND PRODUCTIVITY IN INDAPUR TAHSIL PUNE DISTRICT**" completed and written by me has not previously been formed as the basis for the award of any Degree or other similar title upon me of this or any other Vidyapeeth or examining body.*

Place : **Research Student**

Date : **Mulani M. S.**

CERTIFICATE

*This is to certify that the thesis entitled "**A GEOGRAPHICAL STUDY OF CHANGING LANDUSE PATTERN AND PRODUCTIVITY IN INDAPUR TAHSIL PUNE DISTRICT"** which is being submitted herewith for the award of the Degree of Vidyavachaspati (Ph.D.) in Geography of Tilak Maharashtra Vidyapeeth, Pune is the result of original research work completed by **Mulani Mahammad Sheklal** under my supervision and guidance. To the best of my knowledge and belief the work incorporated in this thesis has not formed the basis for the award of any Degree or similar title of this or any other University or examining body upon him .*

Place : **Research Guide**

Date :

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Place: Pune **Research Student**

Date: (**Mulani M. S.)**

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ABSTRACT

1.1 Abstract

The present study is concerned broadly with a changing agricultural landuse in Indapur Tahsil, Pune district. The study period from 1991 to 2011 was selected. The Indapur Tahsil is one of the Tahsils in Pune district consisting of 143 villages and three urban settlements. Geographically, this area extents from 17° 53′ to 18° 15′north latitudes and 74° 35′ to 75° 8′east longitude. Indapur Tahsil lies in southeast of Pune district. The geographical area of study area is 1552.93 square kilometres according to 2011 Census. According to 2011 Census the area has 384149 population, out of which 199213 are males and 183887 are females and the density of population is 247 per square kilometre.

The present study has undertaken with an objective to assess the agricultural landuse pattern in Indapur Tahsil of Pune district. This study highlights the fallowing aspects:

I) To study the physical background of study area
II) To study the general and agricultural landuse,
III) To identify agricultural regions of study area,
IV)To measure the productivity and agricultural development of study area.

Secondary data have obtained for 143 villages from Agriculture Department of Indapur Tahsil. Primary data obtained through questionnaires, interviews from selected sample villages. The data collected was then converted into percentage. Rafiullah's crop combination technique was applied to compute crop combination regions. Gibb's Martin Index had been applied for the Crop Diversification; Enyedi's Method was chosen to compute crop productivity and 'Z' score for

measure agricultural development of the region for selected villages of Indapur Tahsil.

The region belongs to Bhima and Nira catchment area. Light brown, medium deep black and deep black soil is found in the study region. Deep black appear soil is found along Nira bank side and this soil is suitable for the cultivation of sugarcane, wheat, corn, fodder and vegetables in study region. April experiences maximum temperature (40.03^0centigrades). Monsoon rainfall is prime source of receiving rainfall. June receives highest rainfall. Lift, well, canal and bore well are the sources irrigation.

Within twenty years (1991-2011), there has been tremendous change is observed in irrigated area. The south and the north part in Indapur has highest irrigation, resulting more area has brought under cultivation. Ujani dam is the main source of water; this dam has built on Bhima River. One national highway, four state highways, major district road, other district road and village roads provide transportation. The population density in the study area is influenced by both physical and socio economic factors. According to 2011 Census, study region has 384941 persons (93.80 percent rural and 6.20 percent urban population) and has 31.25 percent agricultural cultivators and agricultural labours in study region. The eighteen market centres are located either on national and state highway or major district roads and village roads in study area. In 2011 cultivators and agricultural labours have inclined from 15.09 percent to 19.71 percent and 11.68 percent to 15.13 percent from 2001 to 2011 years respectively. The reason of growth in cultivators, agricultural labours is that the area of fallow land has been changed in to the net sown area. Means that the net sown area has been increased and at same time fallow land area has been decreased.

The total area in study region covers 77.31 percent net sown area in 2011. In 1991, net sown area in study area shows steady decline towards central and north parts due to lack of irrigation but in 2011 the net sown area has increased due to fertile soil and irrigation facility. From 1991 to 2011 the total net sown area increased by 17.70 percent. Land not available for cultivation shows 0.01 percent increase during the study period. Increase in land not available for cultivation is found in north parts in study area. Cultivable waste in Indapur Tahsil shows increase in area and the total increase under this category is 1.00 percent during the span of twenty year. This increase is due to increasing population pressure on existing land. Fallow land indicates declining trend by 18.15 percent in study area. Due to irrigation facility more land has brought under cultivation. Forest cover has declined slowly by 0.56 percent to total area. But Bendewadi, Pondkulwadi, Dalaj No.1 and Rajwadi are the villages have increased forest land because of different programmes, introduced by Grampanchayat, Companies Colleges, and Government.

Crop cultivation mainly depends on fertile soil and irrigation. In study area sugarcane, corn and fruits have increased their acreage in study region. But jowar, oilseed and pulses have declined percent in this Tahsil during the study period. The variation in agricultural landuse relates with the extent of these ten crops with soil characteristics, irrigation and market centres. Sugarcane is identified as first ranking crop occupying 30.94 percent to net sown area. Sugarcane was cultivated on 20.70 percent in 1991 which is increased by 10.24 percent in 2011 due to fertile soil and irrigation by canal lift, well, etc. In Indapur Tahsil, corn is grown as a cash crop. Corn occupies 9.44 percent to net sown area. Medium deep soil, irrigation and nearness to weekly market centres are responsible for corn cultivation in study region. Wheat covers 8.83 percent net sown area in study region in 2011. Wheat concentration appears in central, north and

south parts on deep black soil. Fodder crops occupies 4.93 percent net sown area in north part in study area of dairy dominating area hence this crop is observed more land under fodder crops. Bajara is drought resistant crop. It covers 5.74 percent net sown area in west part on less rainfall region in Indapur Tahsil. Oilseeds are cultivated on 1.46 percent net sown area in study region. Oilseeds cultivation has less acreage due to larger coverage under sugarcane, corn and jowar in study region. Vegetables contributed 1.68 percent in study region. It is grown close to weekly market centres. Pulses occupy very less percent in study region accounting 1.28 percent. Indapur Tahsil has found significant increased area (9.09 percent) under fruit crop. It was 0.39 percent in 1991 which increased by 8.70 percent in 2011. There is assurance in local markets for fruits crops in Indapur Tahsil. It is found that progressive farmers are producing fruit crops as they afford high input cost. Fruits are cultivated by drip irrigation due to scarcity of water in central part of study area. Light brown shallow soil and medium deep black soil is batter for fruit cultivation in Indapur Tahsil

The knowledge of existing levels of productivity is necessary for better planning and management for development of backward areas. The population has been rapidly growing and as result it needs to be managed properly. Hence, it is crucial to make a detailed study of each crop and its production. Here an effort has been made to discover the crop productivity regions of Indapur Tahsil and the factors involved in it. There are eight sample selected by purposive sample method form the study area. In study region there are eight agricultural circles which are selected as sample namely, Anturne, Bawada, Bhigwan, Indapur, Kati, Loni, Palsdev and Sansar. Enyedi's Index is used for agricultural productivity for sugarcane, jowar, corn and wheat crops. Z score technique is used to measure the agricultural development. The index of productivity of jowar is high in

Anturane agricultural circle. The index of productivity of sugarcane is very low Anturane agricultural circle. The productivity of wheat is decreased in central and increased towards west and eastern part due to salinization and more sugarcane cultivation area. The productivity of corn is decreasing towards north and eastern part due to sugarcane cultivation.

The agricultural development is not uniform in Indapur Tahsil. High development index (more than 0.100) is observed in Indapur, Loni and Bawada agricultural circle. Only two agricultural circles having their development index below -0.200 fall under low level of agricultural development and these are Palasdev (-0.673) and Sansar (-0.305) that show low level of agricultural development. These two circle are agriculturally less developed because of low net sown area, less irrigation facility, less agricultural labour, For development, there is a need for restructuring of the agriculture.

1.2 Findings and Suggestions

The current research work mainly focus on changing landuse pattern which is responsible to change agriculture productivity and development in Indapur Tahsil. The net sown area has been increasing in study area. At the same time the area under fallow land has been decreasing, means that, it is good for agricultural productivity of crops and agricultural development in present and future.

The cultivation of sugarcane crop should slowly change or replaced by sugarbeet as the sugarbeet processing facility is available in Tahsil. By replacing sugarcane the problem of soil salinity can be overcome and more income can be generated form saline-alkali soil by growing newly introduced sugerbeet.

Floriculture activity should be introduced in study region due to increasing demand of flowers throughout the year in Indapur, Bhigwan, Baramati city and Pune metropolitan region.

Agro-based activities like dairy farming and poultry should be intensified in the north part iof study area. This would help to provide jobs for youth in rural area.

Farmers are facing problems of irrigation due to electricity load shading. If the electricity supply will provide continually then the crop production will increased.

The village roads should be constructed in northeast part of study region for mobilizing agricultural products. Indapur Tahsil is emerging as a sugarbeet processing hub with a unique and single of its kind industry, operated in private sector on newly introduced sugarbeet in Maharashtra state.

Baramati, a the nearest city to the most of villages in this Tahsil is emerging as an industrial area for wine production through grapes which would be the best option for sugarcane and it has certainly a great scope for providing raw material to newly wine park industry introduced at Baramati.

The area under pomegranate and grapes fruits has been increasing. It will help to develop pomegranate and grapes agro based industries.

Palasdev and Sansar Circle are agriculturally less developed because of low net sown area, less irrigation facility, less agricultural labour, low area under jowar, sugarcane, and wheat crops. For development, there is a need for restructuring of the agriculture.

1.3 Concluding Remarks

Indapur Tahsil belongs to rain shadow zone in Pune district, receiving rainfall between 400 to 500 mm. The fertile soil and irrigation have added to increase production of sugarcane. If the sugarcane cultivation continues in study area it may be serious for soil fertility. New industries like Wine Park and Sugarbeet Processing Plant at Kalas would be additional dimension in study region. The farmer's innovative ideas and availability of capital for better land use may result in rational land use. Such study may attract the attention of planners, agriculturists, farmers and administrators to look into this sector by planning based on local resources for proper landuse and yield. Thus, there is an ample scope for research, exploration, expansion and intensification regarding modern agricultural techniques etc.

Mulani M. S. **Dr. S. B. Zodage**

(Ph. D. Student) **(Research Guide)**

CHAPTER-I

INTRODUCTION

1.1 General Introduction

Agriculture is a basic activity of human beings since ancient time. This activity was carried out at subsistence level besides animal husbandry. Agriculture provides food grains to human beings and fodder for animals. After independence, Indian government has been paying more attention for the agricultural development through five year plans. Green revolution is responsible for increasing production to feed the population. As the population is increasing rapidly it is necessary to use every piece of land properly. In India due to variation in physic-cultural conditions several crops are grown in different parts of country but ironically Indian agriculture is largely dominated by the predominance of food and cash crops. In an area the prevalent landuse and cropping systems area the cumulative result of numerous interrelated physical and non-physical factors.(Vibha Singh) The rational land use can be increased by using capital, irrigation, high yield, better equipment in agriculture sector. Agriculture contributes twenty seven percent to India's total national income, about sixty eight percent populations is associated in the agriculture activity and ninety percent of rural population is engaged in agricultural and allied activities. Agriculture provides raw materials to small as well as large scale industries and much of export items (Davis, 1982) May agro-based industries give output and employment to many people. Rainfall is vital and instrumental in case of Indian agriculture.

The present study has modest attempt to study the changing landuse pattern of Indapur Tahsil in Pune district for its better landuse planning.

1.2 Literature Review

Agricultural Department in United States (1935), Shafi (1960), Mohmmad Ali (1967), Ganguli (1964), Karimi (1950) and Lahiri (1950) have attempted to study landuse survey and its studies. Later, S. Van Volkenberg, Clark University, Massachusetts brought World Landuse Survey in 1949. United Nation Educational and Social Scientific Organisation supported this idea and appointed a Commission in December in 1953 under the Chairmanship of Van Volkenberg at the International Geographical Congress and have proposed to carry out landuse survey in many parts of the world. Great Britain, United States of America, China and Poland have carried out Landuse survey which played commendable role in further landuse studies. Dr. P. Dayal (1957) has studied the agricultural geography of Bihar. Dr. K. Z. Amani (1968) presented two studies to find out the changes in landuse that have taken place during the period of forty years (1926–1966) in agricultural landuse and crop production in Aligarh district. In 1967, M. S. Siddiqi and A. Ahmad have studied the crop landuse in Luni Basin wherein they identified crop combinations and scheme of regional classification. B. K. Roy (1961) has conducted landuse study of five villages of Ballia district and examined the physical condition, occupational structure responsible for better landuse pattern. Mishra (1956) has prepared a model of agricultural landuse for Central Ranchi Plateau. M. Ameen (1956) and E. Ellefseen has studied the landuse of Delhi State.

A.N. Raina in 1971 has studied basic factors affecting landuse types in Kashmir Valley. Jasbir Singh dealt with the optimum carrying capacity of Punjab. B. N. Ganguli has attempted for landuse in Burki village. Bihar L. S. Bhat (1972) has stressed the necessity of concept of planning at village, block and district level. Spatial variation in level of agricultural development in Bulandshahr district of western Uttar Pradesh (India) is

studied by Gomatee Singh, Syed Waseem A. Ashraf (2012) Pattern of crop combination and diversification in Chandauli District, Uttar Pradesh is studied by Vibha Singh and Jagadhish Singh.(2013)

The notable work in Maharashtra State has attempted by C. T. Pawar (1978), Odilla Continho (1980), K. S. More (1980), P. R. Karmarkar (1981), V. S. Datye (1984), S. D. Shinde (1989), B. C. Vaidya (1997), B.D. Ghodke (2006) M. S. Mulani (2010),and S.B. Ogale (2013) for landuse study of various parts.

1.3 Choice of the Area

Indapur Tahsil is selected for the study. The choice and the topic under investigation are influenced by many considerations. Firstly, researcher belongs to Indapur Tahsil and is familiar with the study area. Secondly, study area falls in drought prone region of Deccan trap of Maharashtra state receiving annual average rainfall between 400-500 mm. It is distributed unevenly in study area. Thirdly, irrigation is dominant factor in study area having considerable impact on landuse in Indapur Tahsil. Bhima River, Nira River and Ujani dam are the sources of irrigation in study area. Fourthly, this area has not been studied in depth so far from the point of view of landuse by geographers.

1.4 Study Area

The Indapur Tahsil is one of the Tahsils in Pune district consisting of 143 villages and three urban settlements. It lies entirely in Bhima-Nira basin. Geographically, this area extents from 17° 53′ to 18° 15′north latitudes and 74° 35′ to 75° 8′east longitudes. The area is drained by Bhima on north and east sides and the Nira River in south side. Indapur Tahsil lies in southeast of Pune district, it is surrounded by Baramati Tahsil in west side, northwest sides lies Daund Tahsil, southwest sides lies Satara

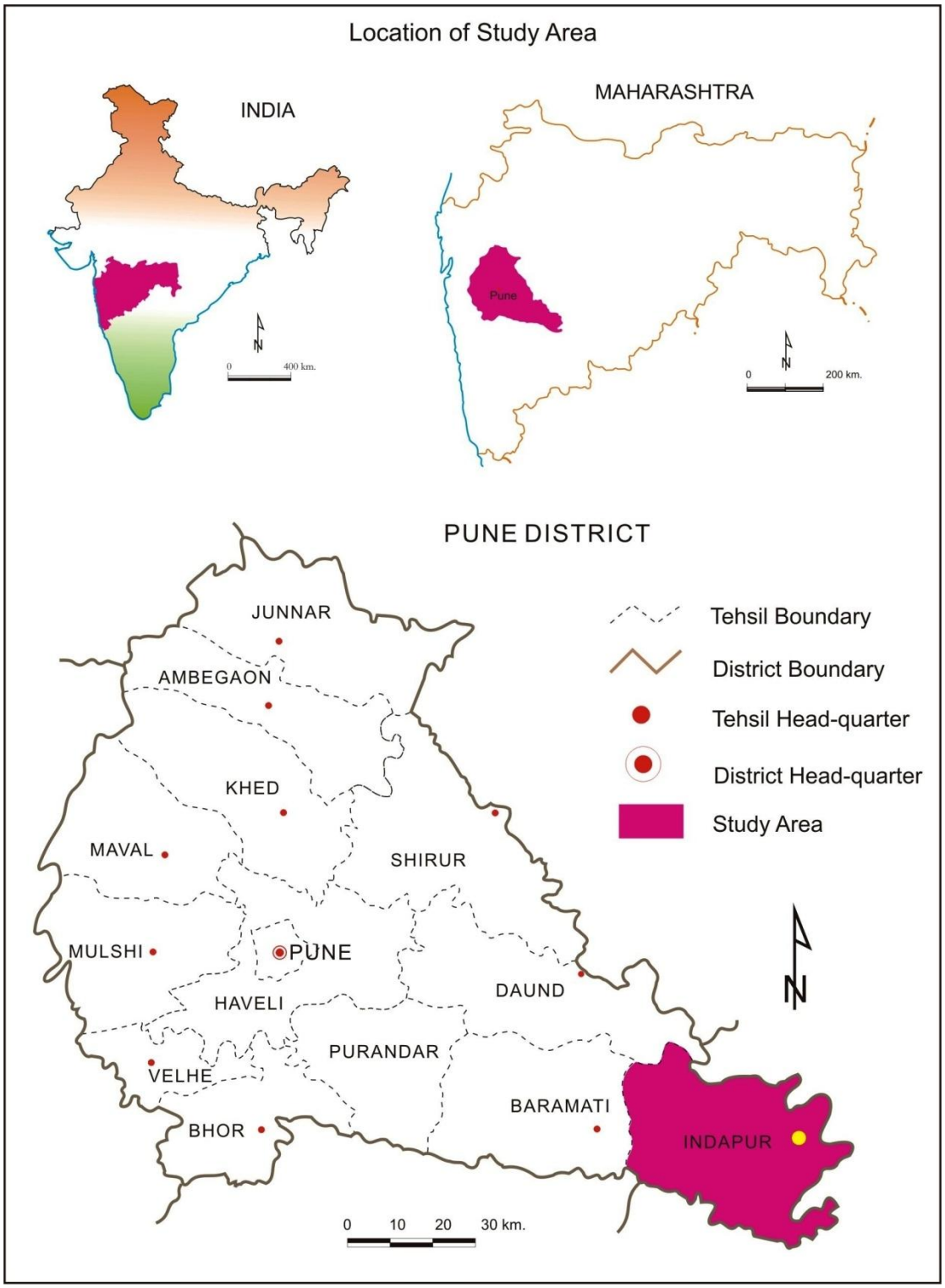

Location of Study Area
INDIA
0
400 km.
MAHARASHTRA
Pune
0
200 km.
PUNE DISTRICT
JUNNAR
AMBEGAON
KHED
MAVAL
SHIRUR
MULSHI
PUNE
HAVELI
DAUND
PURANDAR
VELHE
BARAMATI
BHOR
INDAPUR
0
10
20
30 km.
Tehsil Boundary
District Boundary
Tehsil Head-quarter
District Head-quarter
Study Area

Fig. 1.1

district and Solapur districts belong to east, south and north side. The geographical area of study area is 1552.93 square kilometres according to 2011 Census. (Fig. 1.1) The Bhima River and its tributary Nira flow in study area.

The study area experiences semi-arid climate. April, May and June are the hottest months with mean maximum temperature of 40° centigrade. Temperature gradually reduces in December and January with mean minimum Temperature 12° centigrade. The medium black and deep black soil appears within study area. The soil fertility encourages the growth of various crops like sugarcane, jowar, bajra, fruit, vegetables etc. According to 2011 Census the area has 384149 population, out of which 199213 are males and 183887 are females and the density of population is 247 per square kilometre. National highway, State highway, major district and other road are major roots of transport besides broad-gauge railway route in Indapur Tahsil. Indapur is an administrative head quarter of this Tahsil and three urban centres in the Indapur Tahsil.

1.5 Objectives

The present study has undertaken with an objective to assess the agricultural landuse pattern in Indapur Tahsil of Pune district. This study highlights the fallowing aspects:

I) To study the physical background of study area

II) To study the general and agricultural landuse,

III) To identify agricultural regions of study area,

IV) To measure the productivity and agricultural development of study area.

1.6 Data Sources

The present study is based on primary and secondary sources. Primary data is obtained for sample villages through questionnaires. The questionnaires cover aspect like crop landuse, production of crops, farmers' education, income from various sources and problems regarding agriculture and allied sectors. Besides this information concerted Talathi Sarpanch and Agricultural Mandal Adhikari (Circle officer) were contacted to get more information of sample villages. This data used for computing agricultural productivity and agricultural development of the study region.

The secondary published sources were namely, Tahsil Revenue Record, Socio-economic Abstract of Pune District, District Census Handbook, Department of Irrigation, Agriculture Trust of Indapur and Tahsil Land Record Office. The general landuse data on net sown area forest, fallow land, land not available for cultivation and waste land were obtained for 1991 and 2011 from Tahsil Revenue record of Indapur. The data regarding major ten crops were obtained for year 2011 at village level from secondary sources. The data collected were then converted into percentage. The spatial and temporal aspects of general and agricultural landuse are studied in depth.

1.7 Methodology

Research methodology is a way to systematically solve the research problem. The following methods are used for the study

- **Crop combination**

Rafiullah's (1965) Crop Combination technique has been introduced for 143 villages in Indapur Tahsil.

Formula- $d = \sqrt{\frac{\sum D_p^2 - D_n^2}{N^2}}$

Where

d = deviation

N = number of crops

D_p = Positive difference

D_n = Negative difference

- **Crop diversification**

Gibb's Martin Index has been applied to the Crop Diversification and computed for 143 villages in Indapur Tahsil.

Formula-

$$\textbf{Index of Diversification} = 1 - \frac{\sum X^2}{(\sum X)^2}$$

Where

X = Percentage of total cropped area occupied by each crop or hectare age under individual crop.

- **Crop Productivity**

Enyedi's Method was chosen to compute Crop Productivity for Indapur Tahsil-

$$\textbf{Productivity Index} = \frac{Y}{Y_n} \div \frac{T}{T_n} \times 100$$

Where

Y = Production of selected crop in a unit area

Y_n = Total production of selected crop in entire region

T = Area under selected crop in a unit area

T_n = Area under selected crop in entire region

- **Agricultural Development**

For determining the levels of agricultural development various variables will be used and the data of all the variables have been transformed into indices using Z-score technique.

Formula - $Z_i = \frac{X_i - \bar{X}}{SD}$

Where

Zi = standard score for the i^{th} observation,

X_i = original value of the i^{th} observation,

$\bar{X}$ = mean of the value of X variable,

SD = standard deviation of X variable.

The spatial distribution of crop productivity and agricultural development for eight selected villages will be computed, mapped and interpreted.

1.8 Arrangement of Text

The proposed study has arranged into six chapters.

The opening chapter put fourth objectives of the study, review of literature, sources of data and the methodological arrangement of text.

The chapter second has attempted to present the profile of study area on the basis of its location, physiography, drainage, climate, soil, vegetation, transportation, irrigation and population etc.

The chapter three unfolded the spatio-temporal analysis of general landuse and volume of change for net sown area, land not available for cultivation, cultivable waste, fallow land and forest cover in Indapur Tahsil.

The chapter four investigates the agricultural landuse pattern of ten selected crops where spatio-temporal variations have been examined in study area.

The chapter five attempts to study the crop regions by applying crop ranking, crop combination and crop diversification method.

The chapter sixth studies the productivity and agricultural development of the region.

The last chapter summarizes and suggestions.

1.9 Resume

The present chapter deals with the objectives of study, review of literature, sources of data, methodology and arrangement of the study. The Indapur Tahsil is one of the Tahsils in Pune district consisting of 143 villages and three urban settlements. Geographically, this area extents from 17° 53′ to 18° 15′north latitudes and 74° 35′ to 75° 8′east longitude. Indapur Tahsil lies in southeast of Pune district. The geographical area of study area is 1552.93 square kilometres according to 2011 Census. According to 2011 Census the area has 384149 population, out of which 199213 are males and 183887 are females and the density of population is 247 per square kilometre. Secondary data have obtained for 143 villages from Agriculture Department of Indapur Tahsil. Primary data obtained through questionnaires, interviews from selected sample villeges. The data collected was then converted into percentage. Rafiullah's crop combination technique was applied to compute crop combination regions. Gibb's Martin Index had been applied for the Crop Diversification; Enyedi's Method was chosen to compute crop productivity and 'Z' score for measure agricultural development of the region for selected villages of Indapur Tahsil.

CHAPTER-II

PROFILE OF STUDY REGION

2.1 General Introduction

The natural resources of any region are considered as vital importance for economic development. Hence, it is necessary to explore the potential in term of economic and social aspects. Land is the basic resource of human society. Its utilization shows a common relationship between ecological condition of a region and man. Climate, soil, transportation, occupational structure, population, vegetation and water have provided scope for further development of any region. It is therefore necessary to evaluate the agricultural landuse of Indapur. Indapur is one of the s in Pune district in Maharashtra state and it has elongated shape which running in east west direction. Physiographically, this lies in drought prone tract of Deccan plateau.

2.2 Location, Situation and Site

Indapur is situated in Pune district. The northern and eastern border is demarcated by Bhima in Pune and Solapur districts while southern boundary is confined by Nira in Pune and Satara and Solapur districts. The west boundary is confined by Baramati and north boundary is delimited by Daund of Pune district. The region extends between 17° 53′ to 18° 15′ north latitudes and 74° 35′ to 75°08′east longitudes. The total geographical area of this is 1552.93 square kilometres having 383100 populations (2011). This consists of 143 settlements and three urban settlements. (Table- 2.1, Name and Code No. in Villages of the study area, Fig.2.1, Index No. of villages in the study area)

Table 2.1 Name and Code No. of Villages in Indapur Tahsil

Code No.	Name of Villages	Code No.	Name of Villages	Code No.	Name of Villages	Code No.	Name of Villages
1	Shetphalgadhe	19	Bandewadi	37	Thoratwadi	55	Jamb
2	Pimpale	20	Palasdeo	38	Birungwadi	56	Mankarwadi
3	Madanwadi	21	Malawadi No. 2	39	Bori	57	Chavanwadi
4	Takrarwadi	22	Bhawadi	40	Sansar	58	Kuravali
5	Dikasal	23	Loni	41	Bhavaninagar	59	Chikhali
6	Mumbhargaon	24	Varkute kh	42	Jachakvasti	60	Vyahli
7	Bandgarwadi	25	Nhavi	43	Belwadi	61	Kauthali
8	Poundhawadi	26	Balpudi	44	Sapkalwadi	62	Kacharwadi
9	Lamjewadi	27	Karewadi	45	Hinganewadi	63	NimgaonKeti
10	Nirgude	28	Lakdi	46	Tawashi	64	Gotandi
11	Mhasobachiwadi	29	Nimbodi	47	Pawarwadi	65	Shelgaon
12	Vaysewadi	30	Shindewadi	48	Kardanwadi	66	Bhadrnewadi
13	Akole	31	Kazad	49	Lasurne	67	Anthurne
14	Bhadalwadi	32	Kalas	50	Jankshan	68	Kadbanwadi
15	Dalaj No. 1	33	Pilewadi	51	Thoratwadi	69	Hangarwadi
16	Dalaj No. 2	34	Gosaviwadi	52	Paritwadi	70	Pitkeshwar
17	Dalaj No. 3	35	Maradwadi	53	Udhat	71	VarkuteKh
18	Kalewadi	36	Rui	54	Gholapwadi	72	Kati

Code No.	Name of Villages	Code No.	Name of Villages	Code No.	Name of Villages	Code No.	Name of Villages
73	Jadhavwadi	91	PimpriKh	109	Tarangwadi	127	Boratwadi
74	Sarafwadin	92	Malwadi No. 1	110	Zagdewadi	128	Chakati
75	Ghorpadwadi	93	Kalthan No. 2	111	Pandharwadi	129	Pithewadi
76	Sirsatwadi	94	Narutwadi	112	Vedapuri	130	Nirnimgaon
77	Ranmodwadi	95	Galandwadi No. 1	113	Bedshing	131	Kacharewadi
78	Nimsakhar	96	Vangali	114	Babhulgaon	132	Sarati
79	Nirwangi	97	Rajwadi	115	Bhatnimgaon	133	Ganeshwadi
80	Chandgaon	98	Gagargaon	116	Awasari	134	PimpriBk
81	Agoti No. 1	99	Bijwadi	117	Shetphal Haveli	135	Tannu
82	Agoti No. 2	100	Pondkulwadi	118	Reda	136	Nirsingpur
83	Gangavalan	101	Indapur	119	Bhodani	137	Girvi
84	Kalashi	102	Shah	120	Surwade	138	Ozare
85	Kalthan No. 1	103	Kandalgaon	121	Bhandgaon	139	Gondi
86	Shirsodi	104	Taratgaon	122	Vakilwasti	140	Lumewadi
87	Padasthal	105	Hingangaon	123	Bawada	141	Bambdwadi
88	Takali	106	Sardewadi	124	Lakhewadi	142	Kalamb
89	Ajoti	107	Galandwadi No. 2	125	Redani	143	Bhigwan
90	Sugaon	108	Gokhali	126	Khorachi		

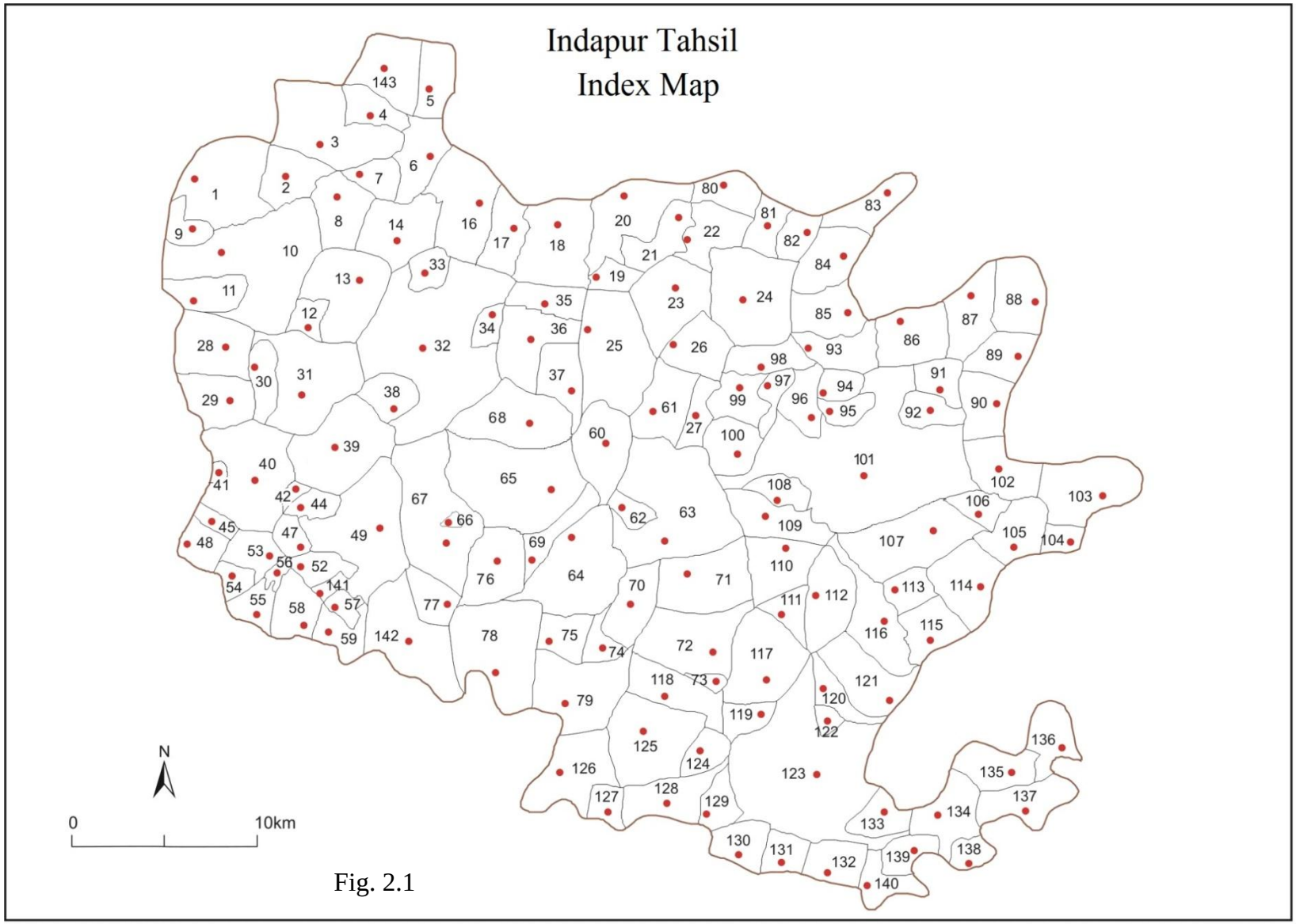


Fig. 2.1

2.3 Physiography

Physiography of Indapur is characterized by broad valleys divided by flat topped interfluves. The slope decreases towards eastwards (Fig. 2.2).Indapur Tahsil lies between Bhima River and Nira River. The northern and the central parts cover by low hills and flat topped surface. The southern part is flat with deep black soil. The amount of rainfall plays an important role in the evolution of the landscape (Datye, 1984). The average height of study area is 544 meters from mean sea level. The direction of slope is eastward. The Bhima flows from west to east and then towards south near the eastern boundary of this. This has length of 103 kilometres within study area and serves to north-eastern and eastern parts. Nira has 64 kilometres total length in study region lying southern part of study area.

2.4 Drainage

The drainage in the study region is mainly dominated by Bhima River and Nira River and many other small streams (Fig.-2.3).The Bhima River originates near Bhimashankar on the crest of Sahyadri range (700 meters). In the initial eight kilometres, Bhima River descends down to 600 meters. The Bhima River receives water from Indrayani,Vel, Mula-Mutha, Ghod and Nira Rivers. Nira originates near to Shirgaon village in Bhor in Pune district.

The confluence of Bhima and Nira appears near Narsingpur village in south-east part in Indapur (Fig.-2.3). The total length of Bhima River and Nira River are 103 and 64 kilometres respectively in study region. Both rivers bring water during rainy season and shrink during summer. Bhima River is located in northern and north-eastern parts in study region, Whereas 21 settlements are situated on the boundary of the Nira River in Indapur.

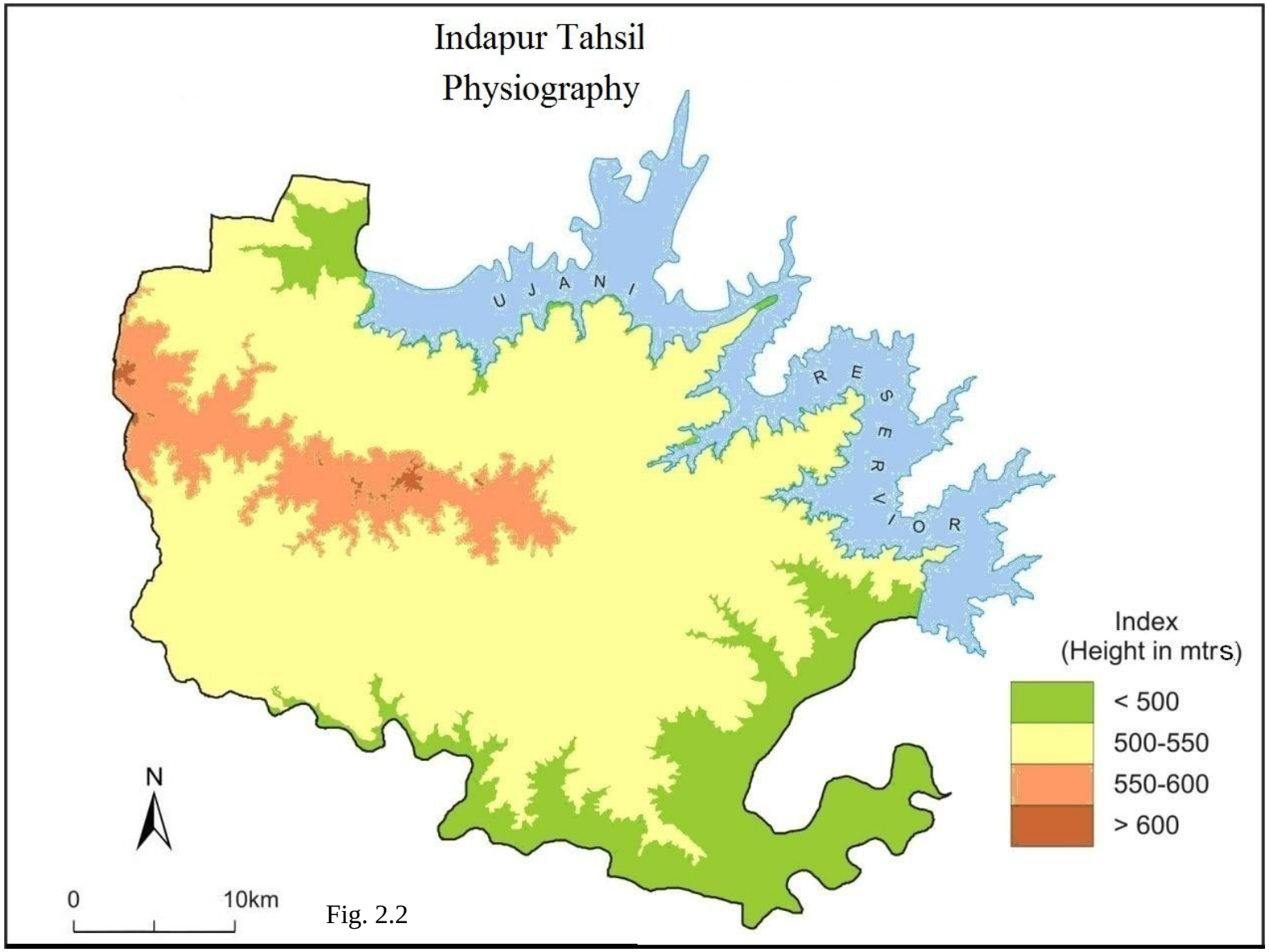

Indapur Tahsil
Physiography
U J A N I
R E S E R V I O R
Index
(Height in mtrs)
< 500
500-550
550-600
> 600
N
0
10km

Fig. 2.2

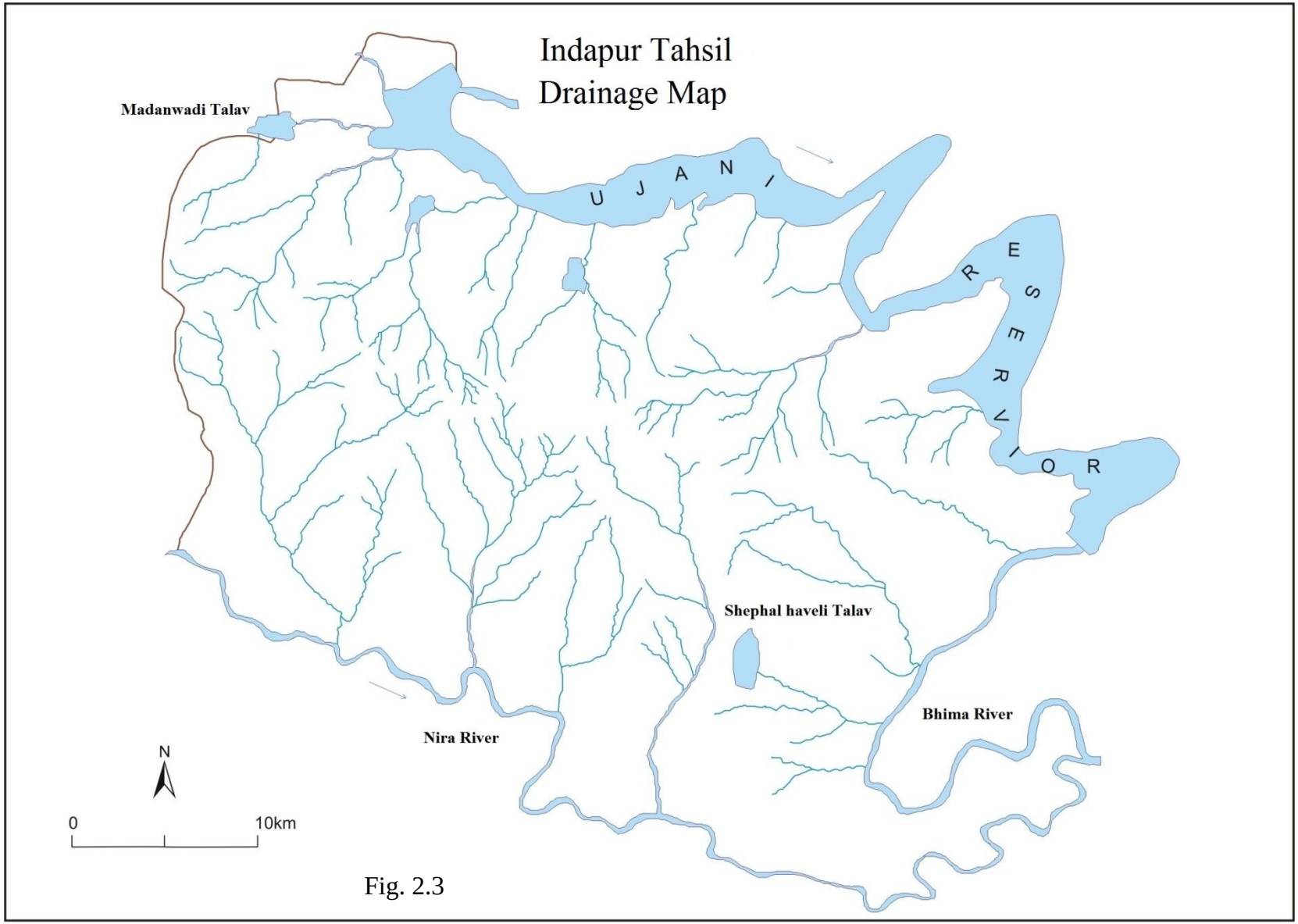

Indapur Tahsil
Drainage Map
Madanwadi Talav
U J A N I
R E S E R V O I R
Shephal haveli Talav
Nira River
Bhima River
N
0
10km

Fig. 2.3

2.5 Climate

Due to limited latitudinal extent of the study region the temperature does not change significantly. (Table-2.3 and Fig.-2.4) The climate of the study region is dry and hot. Three seasons experiences, namely, winter, rainy and summer in study region. The rainfall is mainly received from the south-west monsoon. Monsoon sets in the month of June and lasts up to October. The annual average rainfall receives 450 to 550 mms. The highest rainfall is observed in June and it is recorded (267 mm) (Table-2.2 and Fig.-2.4) Agro-climatically, this study region belongs to a scarcity zone. 80 to 90 precent rainfall receives from southeast monsoon during rainy season and remaining very less rainfall receives from retreat of monsoon. Table-2.2 shows the monthly average rainfall in the study region. The highest rainfall received in June (267mm.) and the lowest in October (18 mm.).

Table-2.2: Monthly Average Rainfall of Indapur

Months	Rainfall	Months	Rainfall
January	000.00	July	059.00
February	000.00	August	227.00
March	000.00	September	253.00
April	000.00	October	018.00
May	030.00	November	020.00
June	267.00	December	000.00

Source: Shri. Chhatrapati Sahkari Sakhar Karkhana, Bhavaninagar, Indapur

Note: Rainfall is given in mm.

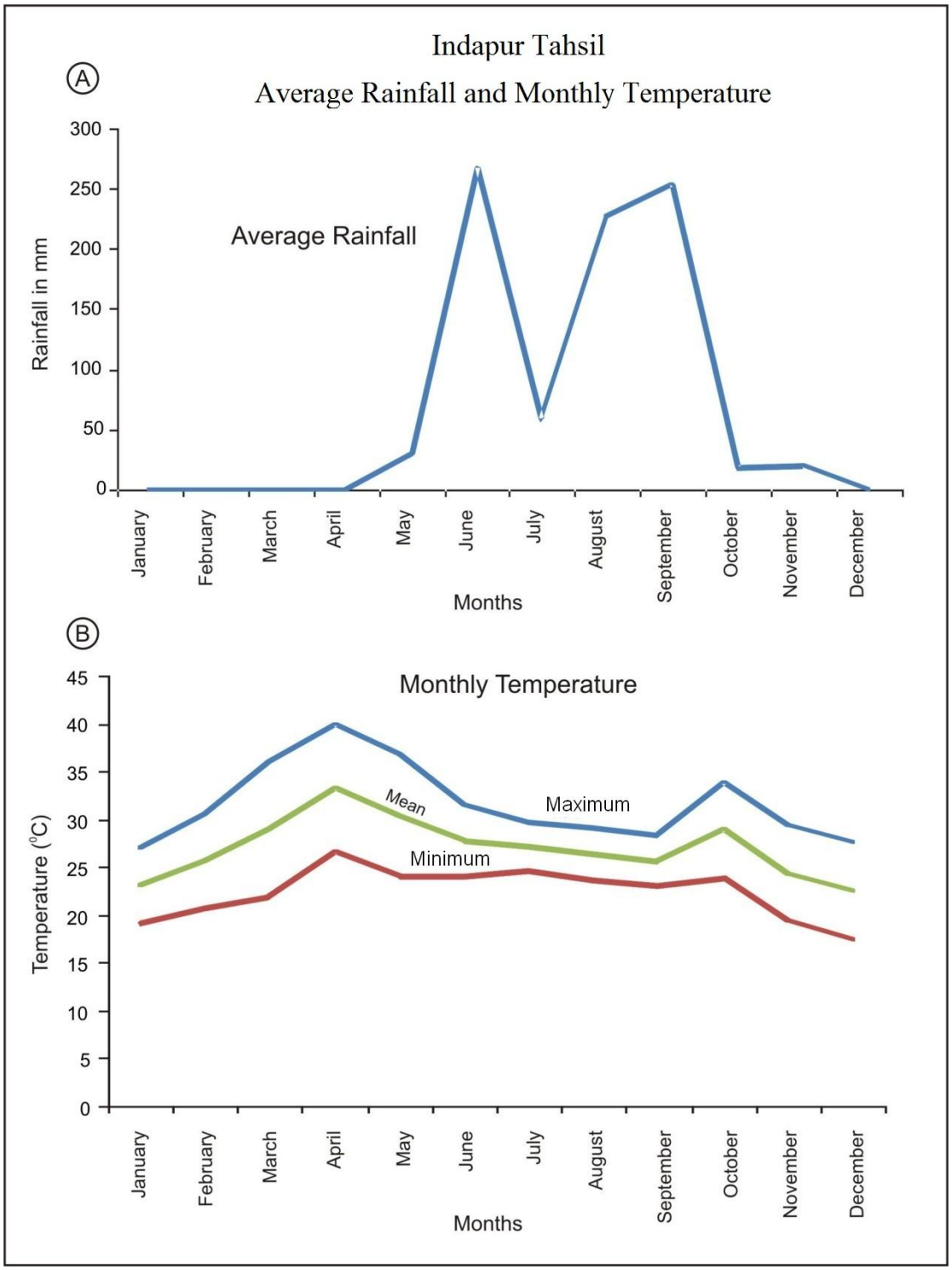

Indapur Tahsil
Average Rainfall and Monthly Temperature
A
Average Rainfall
Rainfall in mm
300
250
200
150
100
50
0
January
February
March
April
May
June
July
August
September
October
November
December
Months
B
Monthly Temperature
Mean
Maximum
Minimum
Temperature (°C)
45
40
35
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
Months

Fig. 2.4

Table-2.3: Mean Monthly Temperature of Indapur

Months	Max.	Min.	Mean	Months	Max.	Min.	Mean
January	27.02	19.17	23.09	July	29.74	24.70	27.22
February	30.53	20.75	25.64	August	29.25	23.74	26.49
March	36.11	21.92	29.01	September	28.32	23.00	25.66
April	40.03	26.60	33.31	October	33.96	23.93	28.94
May	36.82	24.10	30.46	November	29.30	19.33	24.31
June	31.55	24.11	27.83	December	27.67	17.45	22.56

Source: Shri. Chhatrapati Sahkari Sakhar Karkhana, Bhavaninagar, Indapur

Note: i] Temperature in degree centigrade.

ii] Max. = Maximum, Min. = Minimum.

2.6 Types of soil

Soil plays a key role in crop cultivation in Indapur Tahsil. The relief, drainage and climate exert influence on the growth of plants. Crop growth depends on soil texture, structure, thickness and colour. The organic, inorganic matter and water are essential for crop growth therefore, it is essential to study the soil types. The soil of study region are derived from trap and it can be divided in three groups, namely, light brown shallow soil, medium deep black soils, and deep black soils. (Fig.-2.5). The black soil contains high moisture holding capacity. Deep black soil varies its depth and it appears along River Nira left bank whereas the light brown soil is found in northern parts and has coarser in texture and shallow in depth. Soil is distributed in the study area as per physiography of region

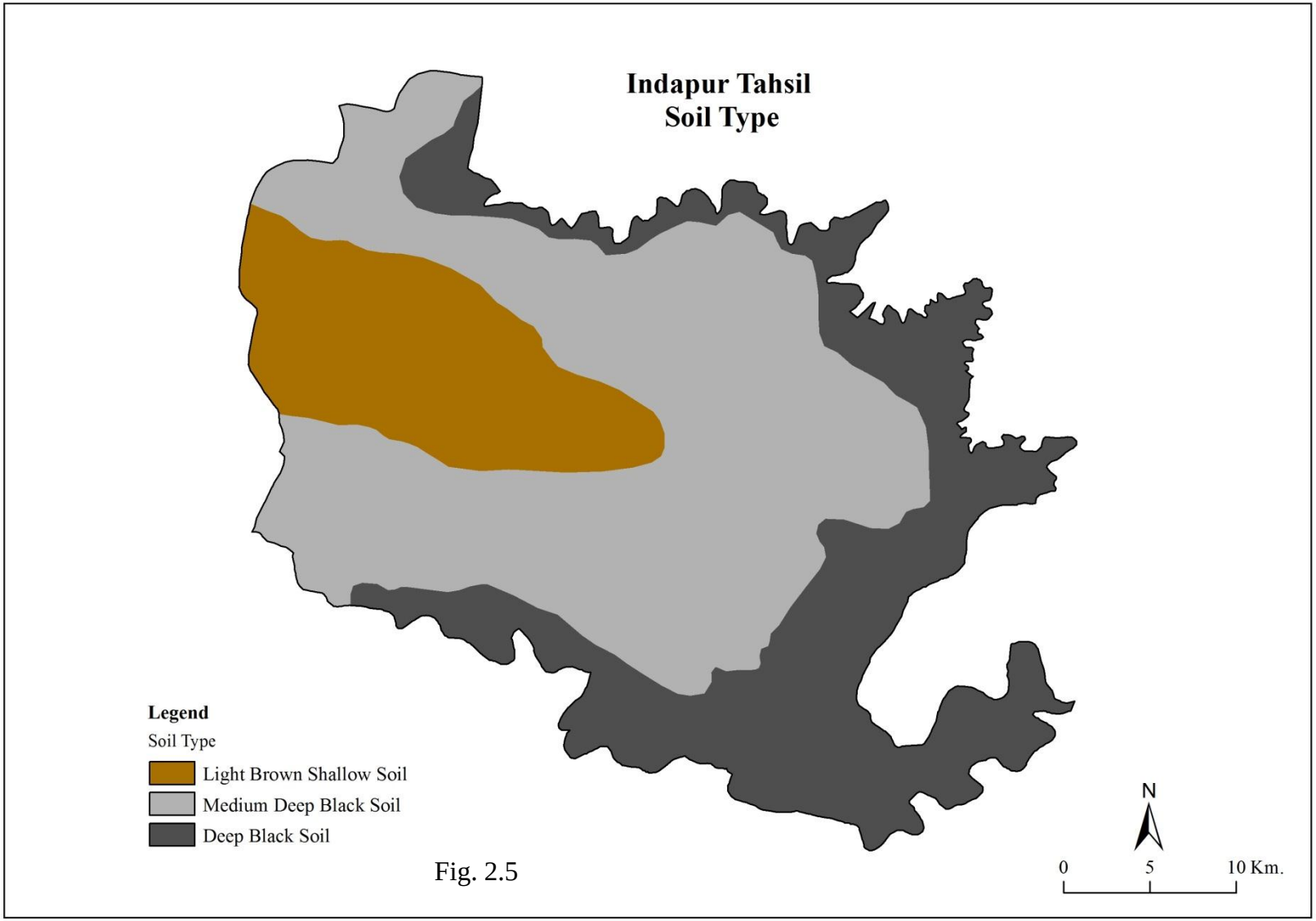

Indapur Tahsil
Soil Type
Legend
Soil Type
Light Brown Shallow Soil
Medium Deep Black Soil
Deep Black Soil
N
0
5
10 Km.

Fig. 2.5

2.7 Irrigation

Regular supply of water is essential for the growth of crops. Due to untimely rainfall, irrigation is important aspect for better crop growth in Indapur Tahsil. The irrigation was less in 1991 but in 2011 the situation has changed. Presently in central part of Indapur has more area under irrigation.(Fig 2.6) One main reason for economic development is the availability of irrigation in study area. The study region is observed lift, well and canal irrigation besides bore well irrigation. Within the span of twenty years (1992-2011) there has been tremendous change in irrigated area. Eleven villages have more than 60 percent irrigated area in 1991 whereas in 2011 forty villages have more than 60 percent irrigated area. The north and east part of Indapur Tahsil has increased irrigation facilities due to lift irrigation. The south part of Indapur has better irrigation facility having more area under cultivation. Thoratwadi (98.50) is the highest area under irrigation in 2011. Ujani dam is the main source of water. This dam has built on Bhima, the backwater of this dam is useful for north and east parts in Indapur for lift irrigation. (Appendix-B)

2.8 Transportation

Indapur has one national and four state highways, major district roads, other district roads and village roads and one railway route (Table-2.4 and Fig.-2.7). Pune-Solapur national highway-9 runs in north south direction in Indapur having length of 46.4 kilometres. This highway connects Indapur, Loni, Palasdev and Bhigwan market centres.

There are four state highways connect weekly market centres in study region and has length of 98.20 kilometres, namely, Indapur-Nira state highway-66 (40 kilometres), Baamati-Pathardi state highway-68 (21.90 kilometres) (Fig.2.7), state highway-69 Karad-Dalaj (27.85 kilometres),

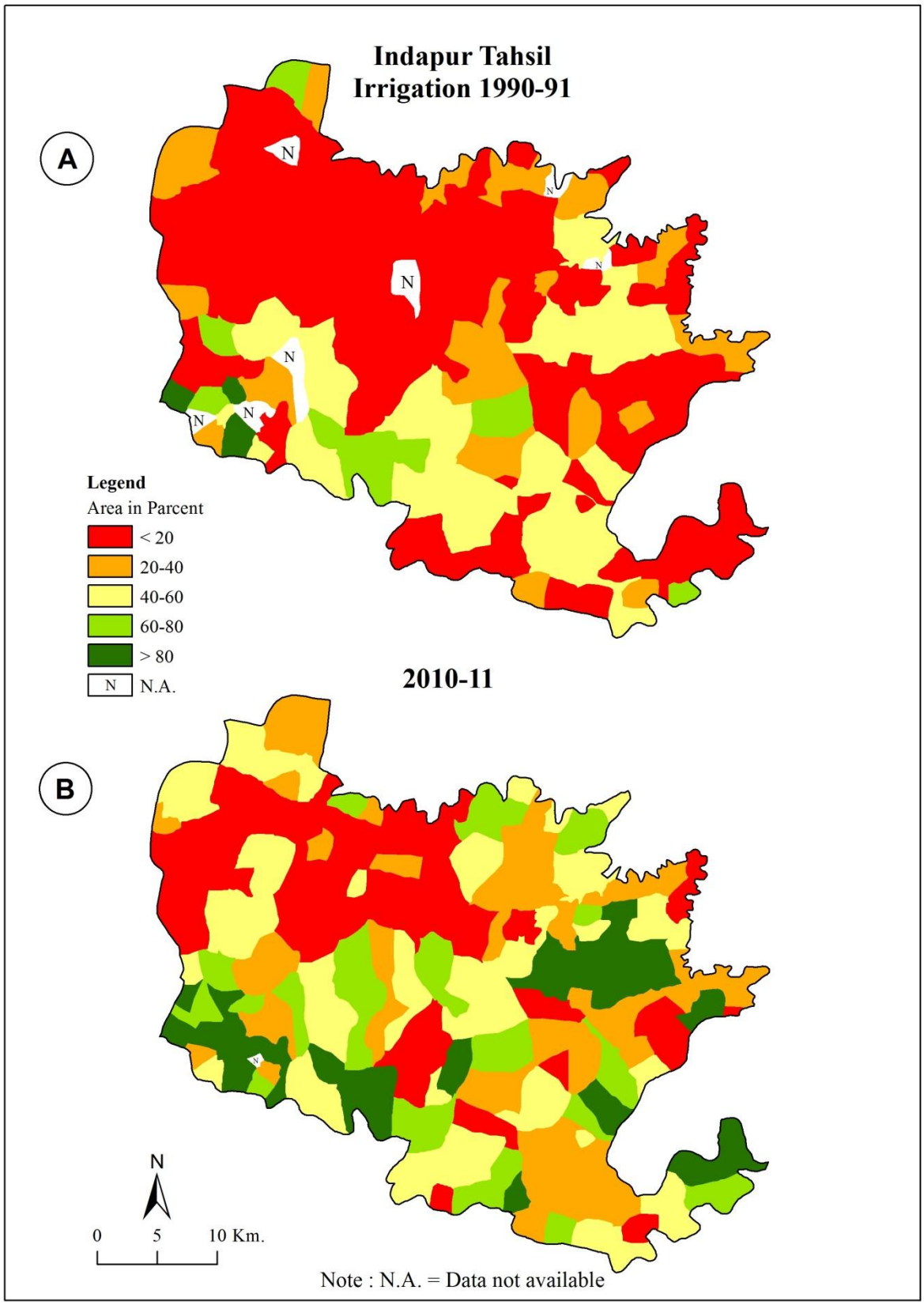

Indapur Tahsil
Irrigation 1990-91
A
N
Legend
Area in Parcent
< 20
20-40
40-60
60-80
> 80
N
N.A.
2010-11
B
N
0
5
10 Km.
Note : N.A. = Data not available

Fig 2.6

the fourth state highway-71 Indapur-Sangola (22.40 kilometres) in study region.(Fig. 2.7).

Table-2.4: Transportation in Indapur Tahsil

Category	Length (Kms.)	Category	Length (Kms.)
National Highway	46.40	Other District Roads	326.00
State Highway	98.20	Village Roads	737.00
Major District Roads	211.05	Railway Route	06.00

Source: Public Work Division, Pune.

Major district roads in the study region connect various places and market centres having length of 211.05 kilometres. The major district roads support the transport of agricultural production within market centres for the distribution of produce. Baramati-Narsinghpur road links Kurwali, Nimsakhar, Redani, Bawada and Narsinghpur market centres (Fig.-2.7). Similarly other district roads are found well linkages, link with major district road, national highway and state highway in study region. The total length of other district roads are 326.00 kilometres in Indapur and these roads help to collect and transport agricultural products to market centres and finally to consumers too. These roads are also well linked with interior rural area for the collection and distribution of goods. The length of village roads in study area is 737.00 kilometres. The railway route has length of six kilometres broad-gauge connecting Pune and Solapur city.

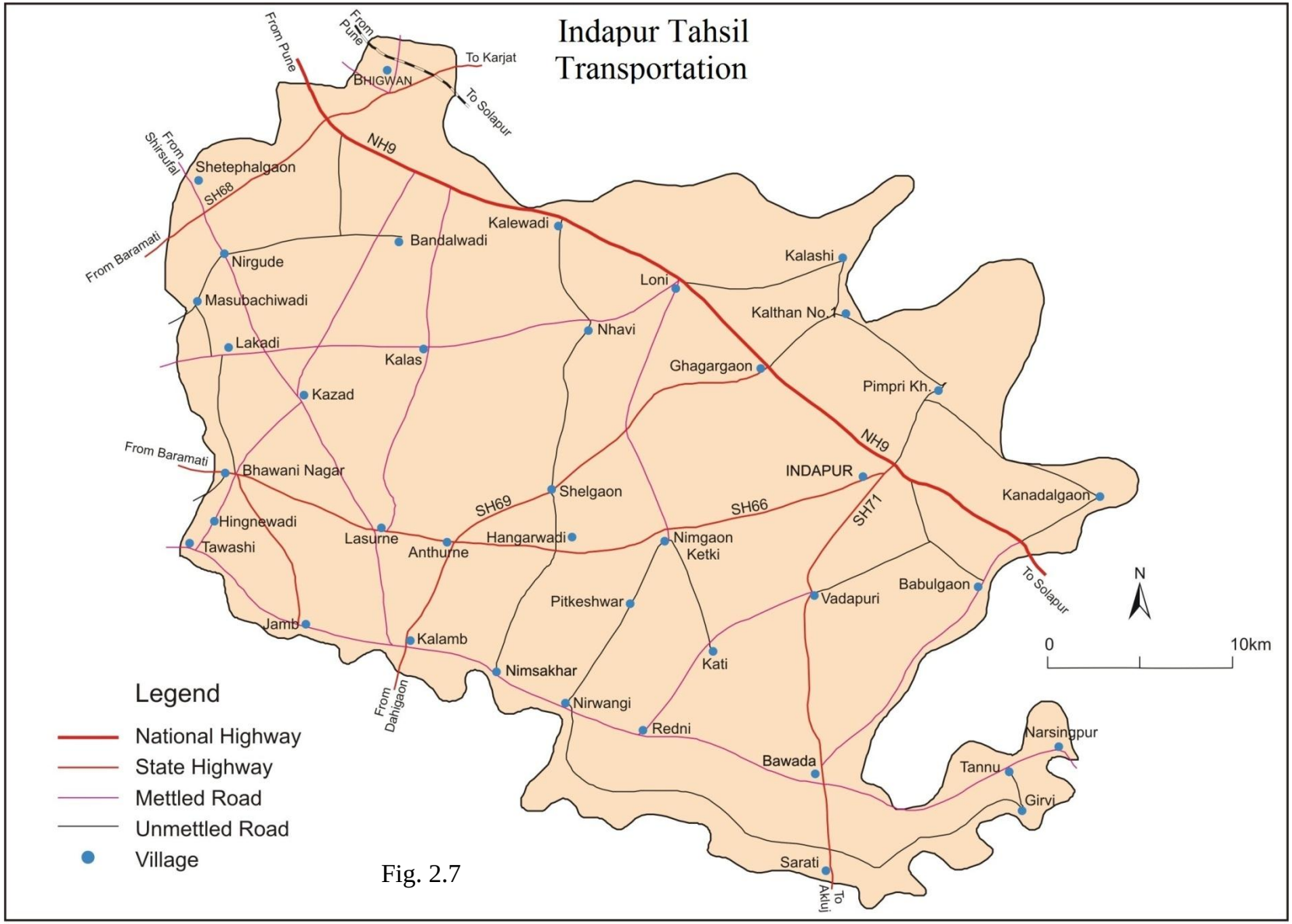

Indapur Tahsil
Transportation
From Pune
From Pune
To Karjat
BHIGWAN
To Solapur
NH9
From Shirsufal
Shetephalgaon
SH68
From Baramati
Nirgude
Bandalwadi
Kalewadi
Kalashi
Loni
Masubachiwadi
Kalthan No.1
Nhavi
Lakadi
Kalas
Ghagargaon
Pimpri Kh.
Kazad
NH9
From Baramati
Bhawani Nagar
INDAPUR
Shelgaon
Kanadalgaon
SH69
SH66
SH71
Hingnewadi
Lasurne
Hangarwadi
Nimgaon Ketki
Tawashi
Anthurne
Babulgaon
To Solapur
Pitkeshwar
Vadapuri
Jamb
Kalamb
Kati
Nimsakhar
From Dahigaon
Nirwangi
Redni
Narsingpur
Bawada
Tannu
Girvi
Sarati
To Akluj
N
0
10km
Legend
National Highway
State Highway
Mettled Road
Unmettled Road
Village

Fig. 2.7

2.9 Population

Population is human factor which supports the development of any region. Indapur Tahsil has 384941 persons according to 2011 Census and population density of 247 persons per square kilometre. Population density in 1991 was 194 persons per square kilometre. Indapur city recorded highest population 25515 persons followed by Kalamb-(16338), Nimgaon-ketki (12397) and Bawada (10734) and lowest have noticed at Taratgaon (288 person). The spatial distribution of population density is shown in Fig.-2.8 for 2011.

It is observed that the highest density has recorded at Indapur (1889) followed by Bhawaninagar (1888 persons per square kilometre), Junkshan (1612 persons per square kilometre) and Gholapwadi (1098 persons per square kilometre)) while lowest population density found at Sugaon (36 persons) followed by Kadbanwadi (59 persons) and Kalthan No.2 (68 persons). In Indapur Bhavaninagar, Junkshan and Gholpwadi villages have found more than 1000 persons .Eight villages have lying fall a population density ranging 500 to 750 persons. (Kalamb (640), Bhigwan (600), Sapkalwadi (598),Ranmodwadi (562), Udhat (553),Sansar(542), Mankarwadi(533) and Pawarwadi (501) village). These villages are found in southwest, northwest and northeast part of Indapur.

Forty five villages in the study region have density of 250 to 500 persons per square kilometre. Eighty eight villages in study region have density of less than 250 persons in study region. These villages are located in the interior parts within the study region. The high density is observed in irrigated and industrially developed area in study region (Appendix-B).

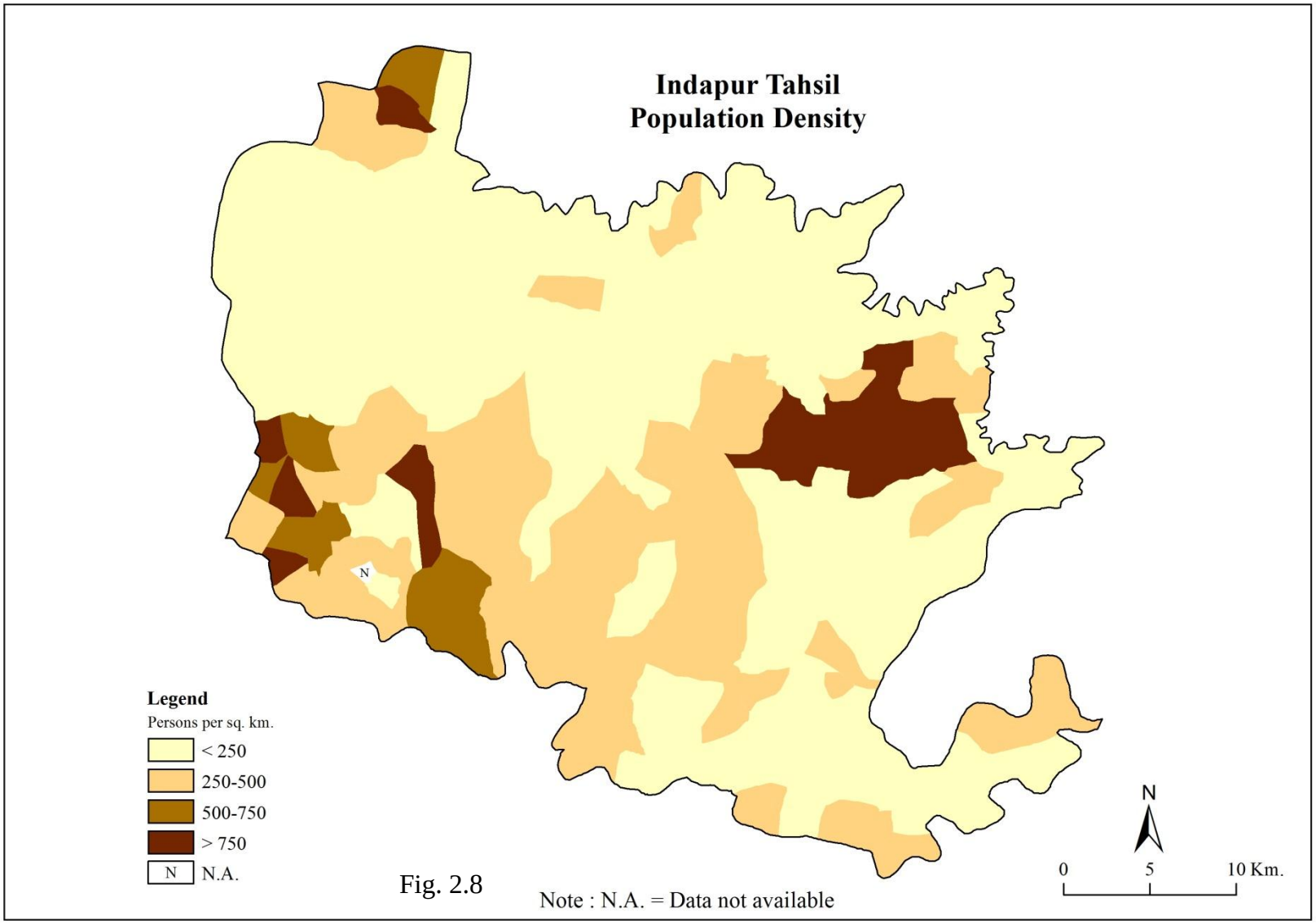


Fig. 2.8

Note : N.A. = Data not available

2.10 Weekly Market Centres

A weekly market centres are the central economic institutions for exchanging commodities particularly in developing economies (Diddee, 1978). In countryside, mostly settlements are purely agriculture-based and weekly market centres perform economic and social functions. Weekly markets centres are distributing and collecting agricultural produce besides mobilizing rural local resources. There are eighteen weekly market centres in study area (Fig.-2.9). These weekly market centres support for exchanging agricultural as well as industrial goods and provide an opportunity to consumers, sellers and traders. Indapur, Loni, Palasdev and Bhigwan market centres lie on National highway-9 and has found accessible throughout the year. Shelgaon, Kalas, Mahatma Fulenagar and Narsingpur market centres have better connection with others surrounding villages (Fig.-2.9) and remaining market centres are laying on either state highway or major district roads. Lakhewadi market centre is recently started lying on Baramati-Narsingpur major district road in study region.

2.11 Occupational Structure

Overall economic development depends on natural resources, agriculture practice and farmer's decision and agriculture labours. Planning Commission of India in 1951 has classified population into three occupational structures, namely, main workers, non-workers and marginal workers. These workers have been further classified into three categories, namely, cultivators, agricultural labours and other workers. Main workers are those who are engaged in economic production activity for the major part of preceding year i.e. at least six months or 180 days.

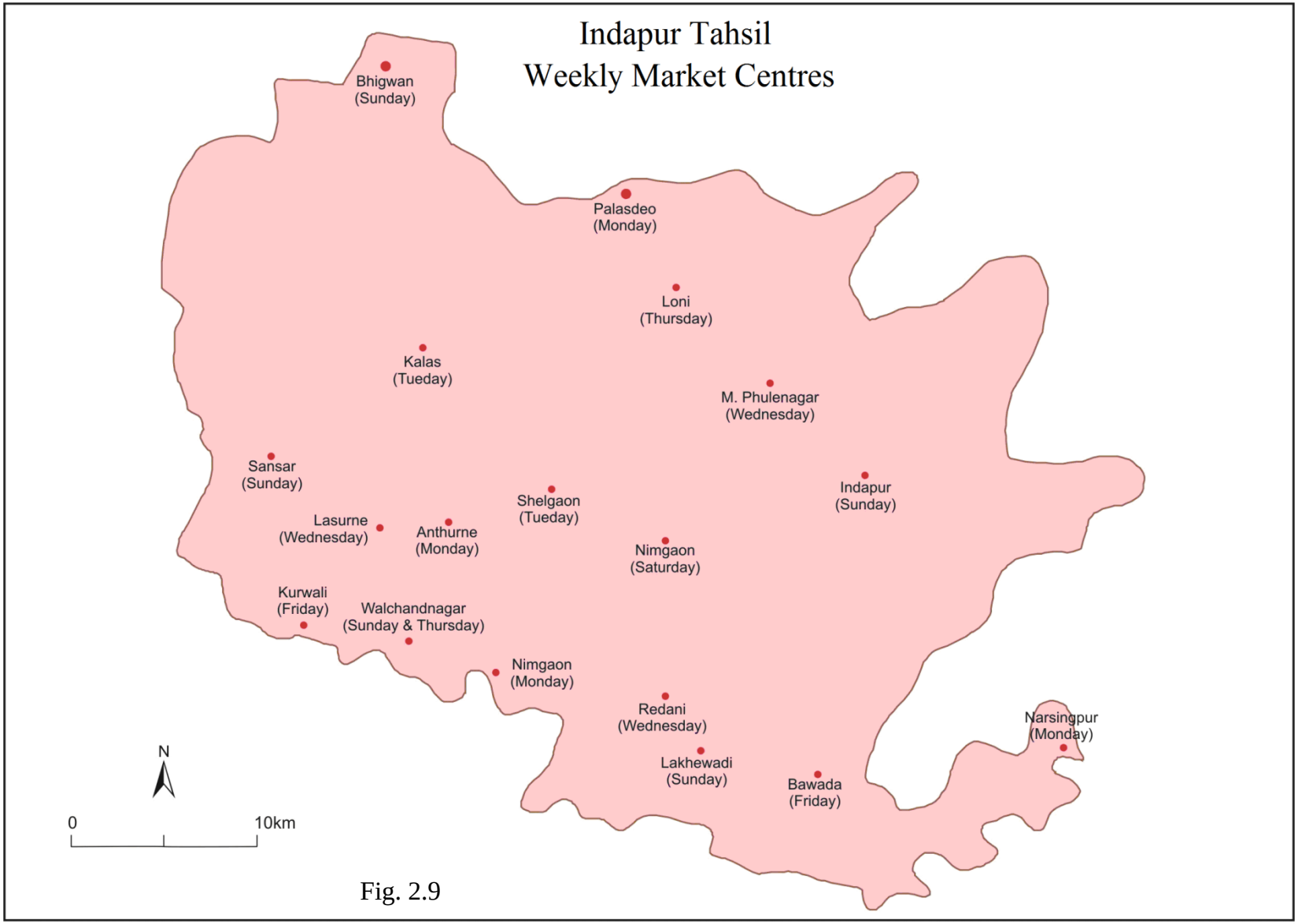

Indapur Tahsil
Weekly Market Centres
Bhigwan
(Sunday)
Palasdeo
(Monday)
Loni
(Thursday)
Kalas
(Tueday)
M. Phulenagar
(Wednesday)
Sansar
(Sunday)
Shelgaon
(Tueday)
Indapur
(Sunday)
Lasurne
(Wednesday)
Anthurne
(Monday)
Nimgaon
(Saturday)
Kurwali
(Friday)
Walchandnagar
(Sunday & Thursday)
Nimgaon
(Monday)
Redani
(Wednesday)
Narsingpur
(Monday)
Lakhewadi
(Sunday)
Bawada
(Friday)
N
0
10km

Fig. 2.9

Table-2.5: Occupational Structure in Indapur Tahsil

Sr. No.	Years	Cultivators	Agricultural Labours	Other Workers	Marginal Workers
1	1991	15.84	15.41	7.8	4.65
2	2001	15.09	11.68	9.04	7.42
3	2011	19.71	15.13	10.78	8.78

Source: Pune District Census Handbook and CD, Pune.

Note: Figures are given in percent.

A marginal worker means those who work for some time but not for entire year. Other workers consist of those who engaged in livestock, forestry, fishing, hunting, plantation, orchard, mining, quarrying, manufacturing, processing, servicing, construction work, trade and commerce and other services. The population engaged in various occupations is shown from 1991 to 2011 in study region with help of pie-diagram.

It is clear from this figure that cultivators and agricultural labours have declined from 15.84 percent to 15.09 percent and 15.41 percent to 11.68 percent from 1991 to 2001 years respectively. But in 2011 cultivators and agricultural labours have inclined from 15.09 percent to 19.71 percent and 11.68 percent to 15.13 percent from 2001 to 2011 years respectively. Other workers and marginal workers show a steady increase during 1991 to 2011. The other workers increased by 2.98 percent and marginal work increased to 4.13 percent in study area. The reason of growth in cultivators, agricultural labours is that the area of fallow land has been changed in to the net sown area. Means that the net sown area has been increased and at the same time fallow land area has been decreased

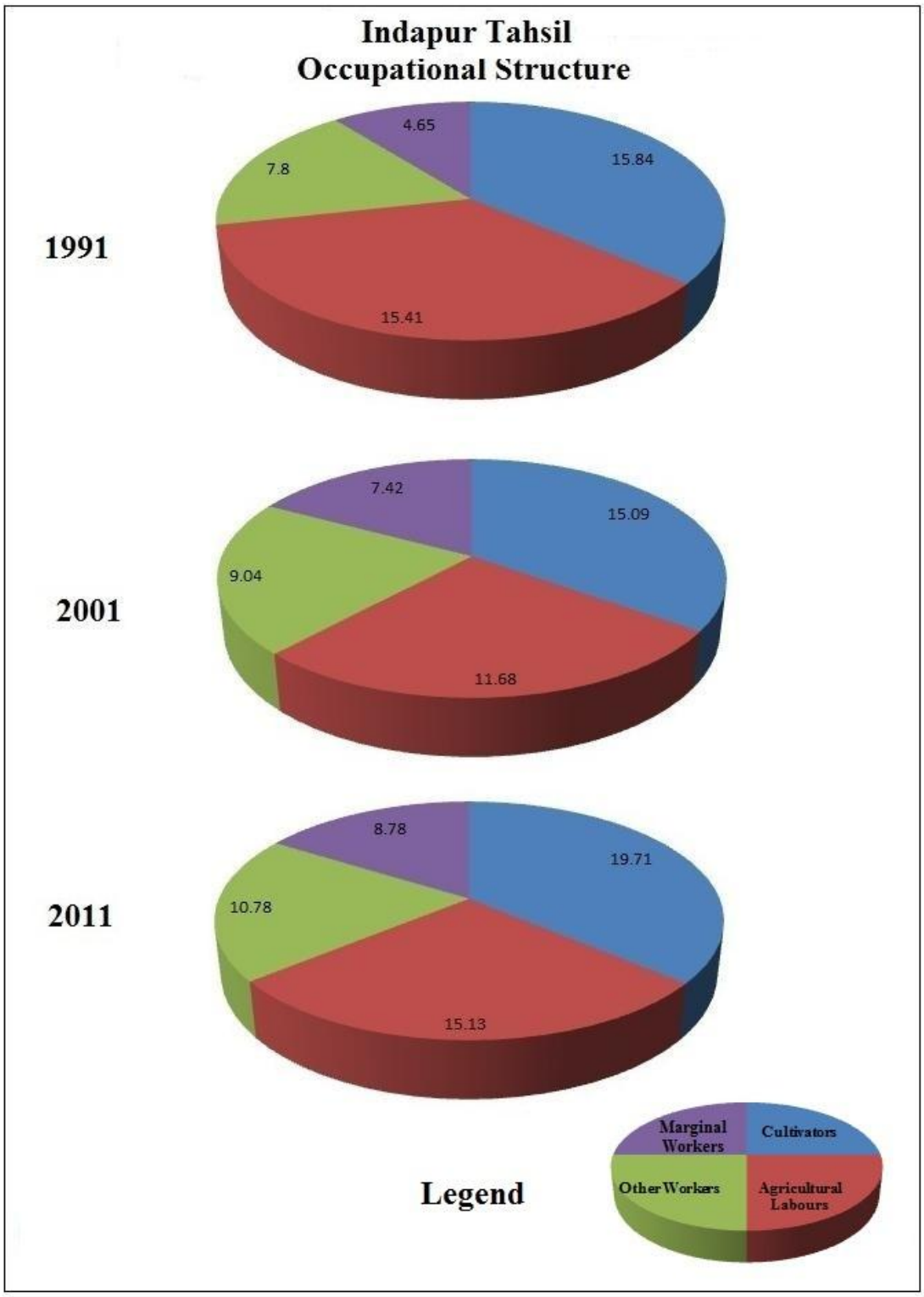

Indapur Tahsil
Occupational Structure
1991
4.65
15.84
7.8
15.41
2001
7.42
15.09
9.04
11.68
2011
8.78
19.71
10.78
15.13
Legend
Marginal Workers
Cultivators
Other Workers
Agricultural Labours

Fig. 2.10

2.12 Resume

The overall background of the study region is discussed and physiography, drainage, climate, soils, irrigation, transportation, population, occupational structure and weekly markets have explained. The study region is flat surface covering 1552.93 square kilometre area and has 143 settlements besides three urban settlements. The region belongs to Bhima and Nira catchment area. Light brown, medium deep black and deep black soil is found in the study region. Deep black appear soil is found along Nira bank side and this soil is suitable for the cultivation of sugarcane, wheat, corn, fodder and vegetables in study region. April experiences maximum temperature (40.03^0centigrades). Monsoon rainfall is prime source of receiving rainfall. June receives highest rainfall. Lift, well, canal and bore well are the sources irrigation.

Within twenty years (1991-2011), there has been tremendous change is observed in irrigated area. The south and the north part in Indapur has highest irrigation, resulting more area has brought under cultivation. Ujani dam is the main source of water; this dam has built on Bhima River. One national highway, four state highways, major district road, other district road and village roads provide transportation. The population density in the study area is influenced by both physical and socio economic factors. According to 2011 Census, study region has 384941 persons (93.80 percent rural and 6.20 percent urban population) and has 31.25 percent agricultural cultivators and agricultural labours in study region. The eighteen market centres are located either on national and state highway or major district roads and village roads in study area. In 2011 cultivators and agricultural labours have inclined from 15.09 percent to 19.71 percent and 11.68 percent to 15.13 percent from 2001 to 2011 years respectively. The reason of growth in cultivators, agricultural labours is that the area of

fallow land has been changed in to the net sown area. Means that the net sown area has been increased and at same time fallow land area has been decreased

CHAPTER - III

GENERAL LANDUSE PATTERN

3.1 General Introduction

Land is the most important resource for any nation because it supports teeming population. Land resource plays significant role in the economy of nation. It is very essential for human life existence. It is the fundamental utility of land for satisfying the human needs like food, clothing and shelter. The most populace country likes India having higher growth of population and result in more demands for food and raw materials. And, therefore, agriculture forms the backbone of our economy. From this point it is necessary to make proper use of each and every piece of land. Thus, there is needed to go for systematic study of types of both general and crop land use.

The study of changing patterns of regional land use is essential for the micro level planning for the development of region. The change in land use helps to find out causal relationship and it indicates physical, technological, socio-economic factors involvement in changing land use. Therefore, it becomes the prime necessary of this study. Kellong (1980) has pointed out the need to clear the identification of land classes or classification which could be foundation or base for successful planning for the regional development. The main objective of this chapter is to assess the spatial as well as temporal changes in general land use and to suggest the possible ways and remedies to improve the landuse of the study region.

Therefore, the study of general landuse pattern of Indapur Tahsil is selected to examine both temporal and spatial landuse. This chapter is devoted to the study of spatio- temporal analysis of general landuse in the study region. The general landuse pattern has been classified into five groups, normally; net sown area, land not available for cultivation, fallow land, cultivable waste and forest cover. The data regarding crops have been

obtained from 1991 and 2011. The data were obtained at village level and then it was converted into percentage to total geographical area. This percentage was further categorized into various groups and interpreted in text.

3.2 Classification of General Landuse

Land can be divided into different categories according to a set of factors. It is controlled by climatic factors, soil characteristics, slope of land, and degree of erosion, water supply, drainage and similar environmental conditions. Land Record Department, Government of India has officially classified land under following categories such as :

(a) Reported area for land cultivation purposes

(b) Forests

(c) Barren and uncultivable land

(d) Land put to non-agricultural uses: (i) cultivable waste (ii) Permanent pasture and other grazing land

(e) Land under miscellaneous trees, crops and groves not included in net area sown: (i) Current fallows (ii) Other follow land

(f) Net sown area

(g) Area sown more than once and

(h) Total cropped area.

These twelve categories are finally grouped into five classes such as:

(a) Forest land

(b) Net sown area

(c) Land not available for cultivation

(d) Cultivable waste and

(e) Fallow land.

For the present study these five categories have been studied by assessing temporal and spatial landuse in study area.

3.3 Temporal Variation in General Landuse

The general landuse of any area undergoes change in any given period of time. The temporal variation in landuse pattern of study area has studied for the period of twenty years (1991 to 2011) with an objective to find out the trend in general landuse and to identify possible causes responsible for these changes. The temporal variation in general landuse for the study area is given in Fig. 3.1 and Table-3.1 from 1991 to 2011. In 1991 total net sown area was 89465.56 hectares accounting 59.61 percent to total area. After twenty years in 2011 it was recorded 119653.42 hectares (77.31 percent).

Table- 3.1: Temporal Variation in General Landuse Pattern

Sr. No.	Landuse Pattern	Years				
		1991	1996	2001	2006	2011
1	Net Sown Area	59.61	61.95	63.28	65.05	77.31
2	Land not available For cultivation	11.81	12.45	13.12	13.35	11.82
3	Cultivable Waste	2.54	3.82	4.4	4.89	3.54
4	Fallow Land	20.72	16.75	14.28	11.88	2.57
5	Forest	5.32	5.03	4.92	4.83	4.76

Source: i) Socio-economic Abstract, Pune District,

ii) Talathi Revenue Record, 2006.

Note: Area is given percentage

Land not available for cultivation has observed little increase in study area from 1991 to 2011 (0.01 percent). The land under this category in 1991 was 11.81 percent that has increased to 11.82 percent (Fig.-3.1) Land under cultivable waste in study area was 2.54 percent to total geographical area (1991).

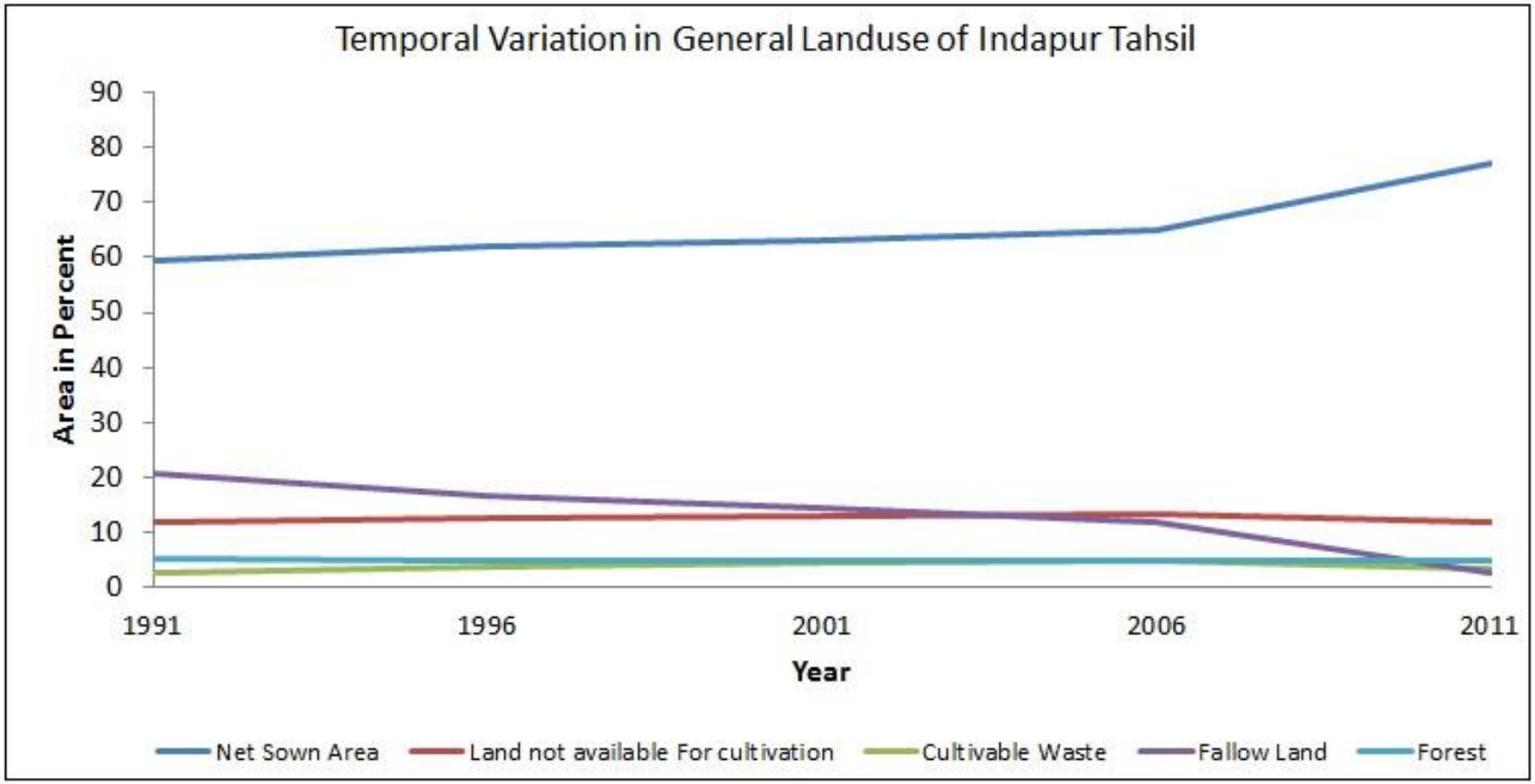

Temporal Variation in General Landuse of Indapur Tahsil
Area in Percent
90
80
70
60
50
40
30
20
10
0
1991
1996
2001
2006
2011
Year
Net Sown Area
Land not available For cultivation
Cultivable Waste
Fallow Land
Forest

Fig. 3.1

In later years from 1991 to 2011 it is increased by 1.00 percent. The area under fallow land is 20.72 percent in 1991. It is decreased in 2011 that is 2.57 percent. This indicates that there is a tendency of farmers to bring more land under cultivation. Forest in study area was accounting 5.32 percent to total geographical area in 1991. Forest shows decreasing trend from 1991 to 2011 (4.76 percent) (Appendix-C and D)

3.4 Spatial Variations in Landuse Pattern

The spatial variation in general landuse of the study area is the result of socio-economic, physical and cultural environment as well as climatic factors such as receiving amount of rainfall and its distribution. The spatial variation has studied for five categories, namely, net sown area, land not available for cultivation, cultivable waste, forest and fallow land (Table-3.2).

Table-3.2: General Landuse in Indapur Tahsil

Sr. No.	Types of Landuse	Years		Volume of Change
		1991	2011	
1	Net Sown Area	59.61	77.31	+ 17.70
2	Land not available for Cultivation	11.81	11.82	+ 0.01
3	Cultivable waste	2.54	3.54	+ 1.00
4	Fallow Land	20.72	2.57	-18.15
5	Forest	5.32	4.76	- 0.56

Source: Land Revenue Record, Indapur Tahsil, Indapur.

Note: Area in percent

3.4.1 Net Sown Area

The net sown area includes the land actually under the food, cash and fodder crops. In 1991 the net sown area in Indapur Tahsil was 89465.56 hectares accounting 59.61 percent. In 2011 net sown area has increased by

17.70 due to irrigation facility in study region. In 1991, net sown area in study area shows steady decline towards central and north parts due to lack of irrigation. Fig.3.2/A shows spatial distribution of net sown area in study region for 2011. In the south and east parts in study region villages have dominant net sown area due to irrigation facility and fertile soil. The highest net sown area is recorded at Pawarwadi (90.16 percent) in the south west part in study region due to deep black soil and irrigation facility whereas the lowest net sown area is identified at Ajoti (1.36 percent). In study region more than 80 percent of area under net sown area is found in sixteen villages. In this region, soil is found deep black and irrigation has added the crop cultivation. Plmpri Kh, Surwad, Pitkeshwar, Indapur, etc. villages in study area has more than 80 percent land under cultivation in 1991, whereas fifty eight villages (Fig.3.2/A) have 60 to 80 percent of net sown area. These villages are found in the south part in study region. Forty four villages have 40 to 60 percent net sown area. Seventeen villages have identified less than 40 percent area, these villages are found in central part of study region.

In 2011 total area under this landuse category was 119653.42 hectares accounting 77.31 percent land under net sown area. Seventy three villages in study area have more than 80 percent area under this category due to deep black and plain topography with gentle slopes. Increasing irrigation has added the crop cultivation. The highest net sown area is recorded at Kalthan No. 2 (99.89 percent) in north central part and the lowest at Nirgude (19.18 percent). There are forty three villages have 60 to 80 percent area under net sown area (Fig.3.2/B), and these villages have distributed all over the study area. Nine villages having 40 to 60 percent net sown area found in patchy pattern. Less than 40 percent net sown area found in five villages these villages found in north part of study region whereas transport and irrigation facilities are developed. The study area shows an increase of 17.70 percent net sown area during 1991 to 2011

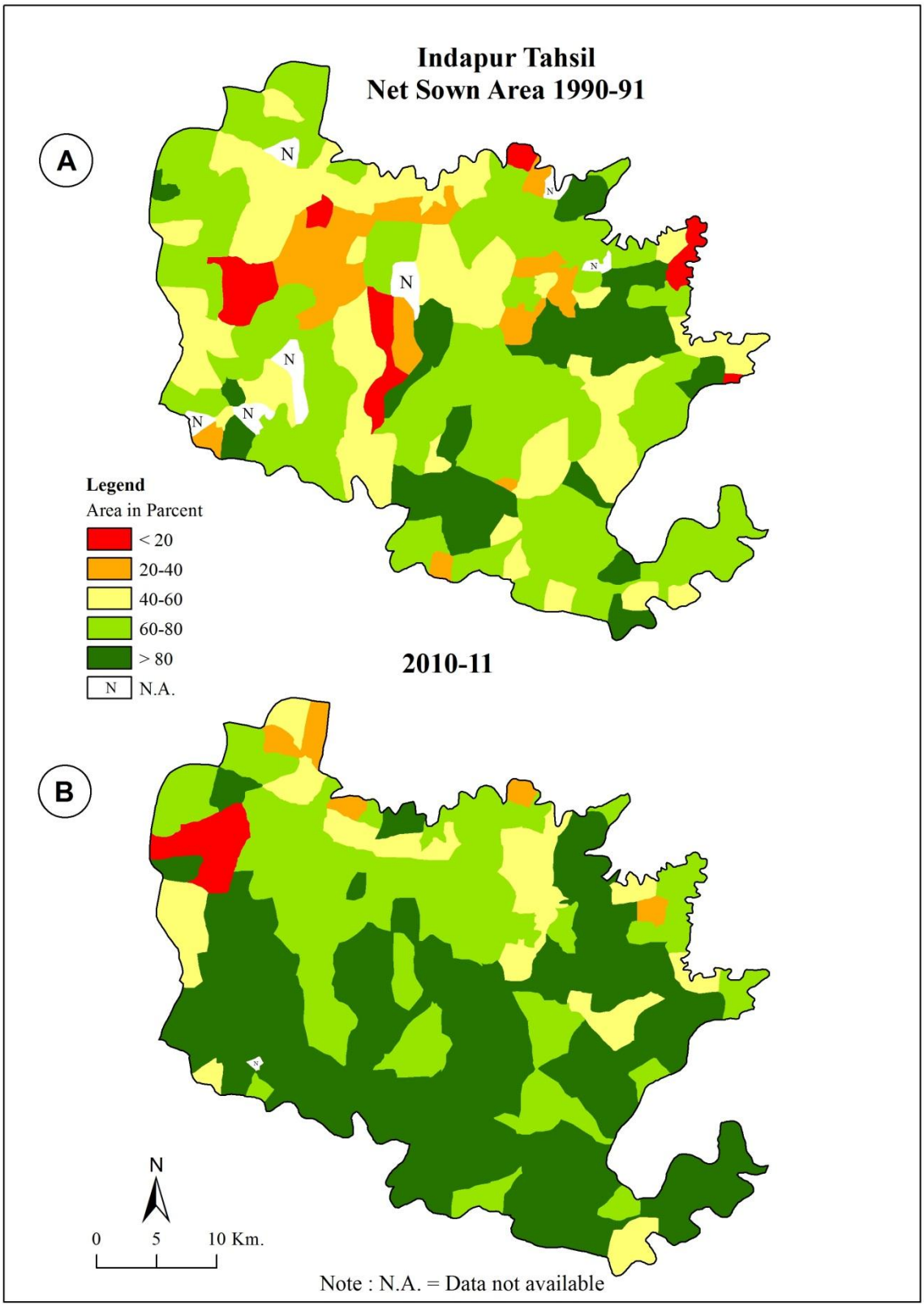

Indapur Tahsil
Net Sown Area 1990-91
A
Legend
Area in Parcent
< 20
20-40
40-60
60-80
> 80
N
N.A.
2010-11
B
N
0
5
10 Km.
Note : N.A. = Data not available

Fig. 3.2

3.4.2 Land not Available for Cultivation

This category is divided into two types, namely, land put to non-agricultural uses and barren and uncultivable land. The land put to non-agricultural use includes land under settlement Gaonthan, roads, streams, canals and rivers. The land not available for cultivation in Indapur Tahsil for 1991 was 11.81 percent to total geographical area. The distribution of this land varies within study area. The dominant of this category lies in east and north parts in study area (Fig.3.3/A). The high concentration of more than 45 percent land under this category has recorded at Ajoti lying northeast part in study region. Land more than 45 percent under this category found in four villages having patchy distribution. These patches are located in east and north parts in Indapur Tahsil. 30 to 45 percent land not available for cultivation has found in six villages and these villages appear in five identical belts. Nineteen villages have 15 to 30 percent land not available for cultivation. These villages are mainly concentrated in north part in Indapur Tahsil. Less than 15 percent land under land not available for cultivation is observed in one hundred and six villages in study area.

In 2011, the category of land not available for cultivation occupies 18295.46 hectares accounting 11.82 percent area in study area. The high concentration of land more than 45 percent land under this category has recorded at Takrarwadi (61.93) lying northwest part in study region (Fig.3.3/B). Shaha village in study area have more than forty five percent land not available for cultivation. Three villages are found in east and one village found in northwest part of study area. Fifteen villages have land not available for cultivation between 30 to 45 percent consisting of seven patches. Twenty nine villages have 15 to 30 percent area under land not available for cultivation. Less than 15 percent land not available for

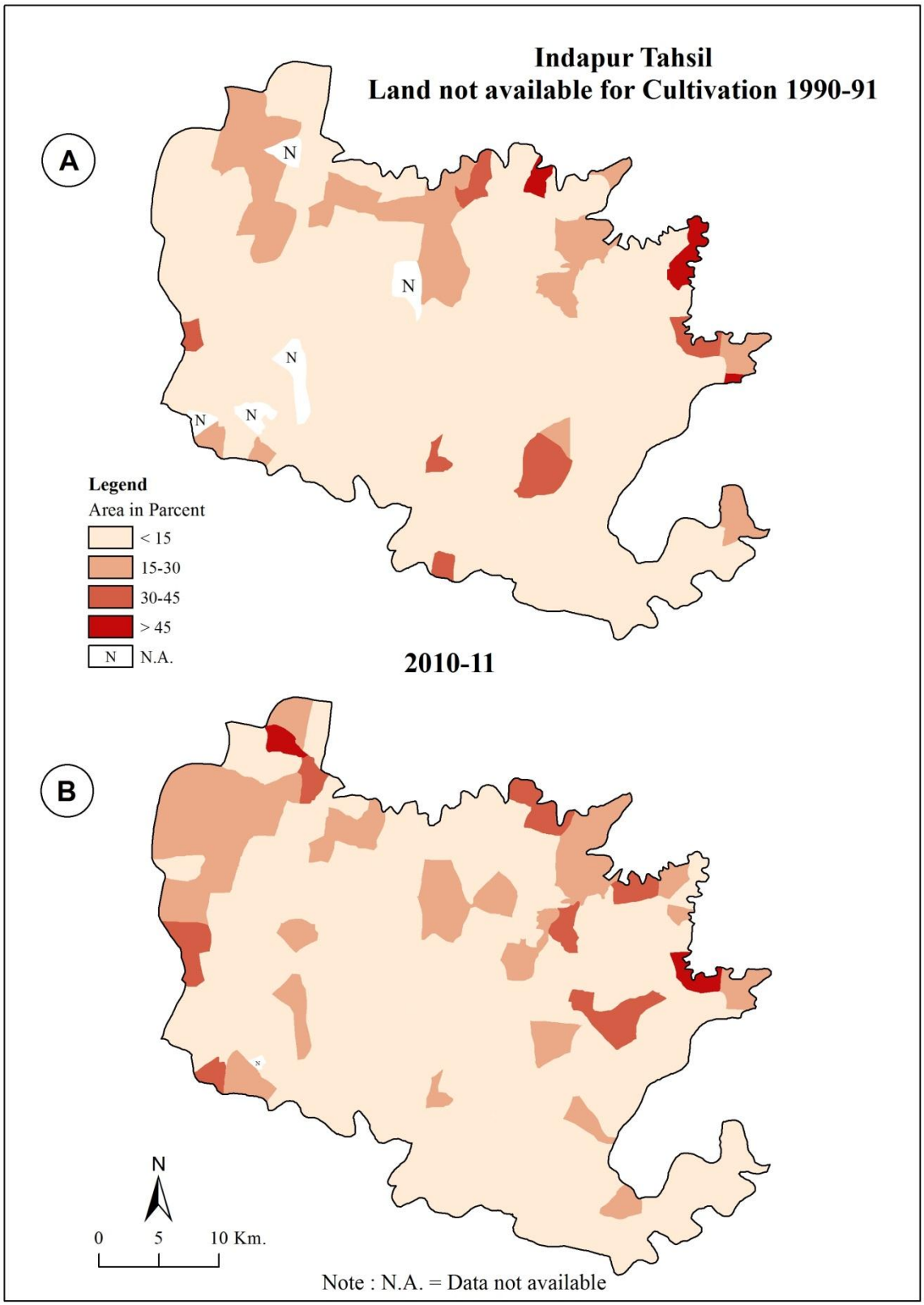

Indapur Tahsil
Land not available for Cultivation 1990-91
A
N
N
N
N
N
Legend
Area in Parcent
< 15
15-30
30-45
> 45
N
N.A.
2010-11
B
N
0
5
10 Km.
Note : N.A. = Data not available

Fig. 3.3

cultivation found in one hundred two villages and these villages are lying throughout the study area.

3.4.3 Cultivable Waste

The cultivable wasteland includes other uncultivated land excluding fallow land. This category is divided into three groups, namely, permanent pastures and other grazing miscellaneous tree crops and groves. The spatial distribution of cultivable waste has found patchy in nature in study area. The total increase under this category is 1.30 percent during the span of twenty year. This increase is due to increasing pressure of population on existing land. Total cultivable waste area has occupied 2.54 percent in 1991 in study area. Seven villages, namely, Karewadi, Bandewadi, Bhigvan, Kadbanwadi, have recorded more than 10 percent cultivable waste. (Fig.3.4/A). The highest cultivable waste has found in Bijwadi (17.28 percent). Less than 10 percent cultivable waste land has found in eighty nine villages in study area. Forty villages have no cultivable waste in study area.

The land under cultivable waste in Indapur Tahsil covers 3.54 percent in 2011. In study region have five patches lying east, south, and central parts (Fig.3.4/B). More than 30 percent area under cultivable waste was found in two villages in study area. Nirgude has recorded the highest cultivable waste and Lasurne has recorded the lowest cultivable waste in study region. Nirgude is found in west part of Indapur Tahsil. One hundred thirty eight villages have no cultivable waste in study area. The area of 20 to 30 percent cultivable waste is recorded in four villages in study area, Whereas Less than 10 percent is noted in north and south part in study area.

3.4.4 Fallow Land

The term fallow land is applied to land not under cultivation at the time of reporting. Generally, two types of fallow land viz., current fallow land

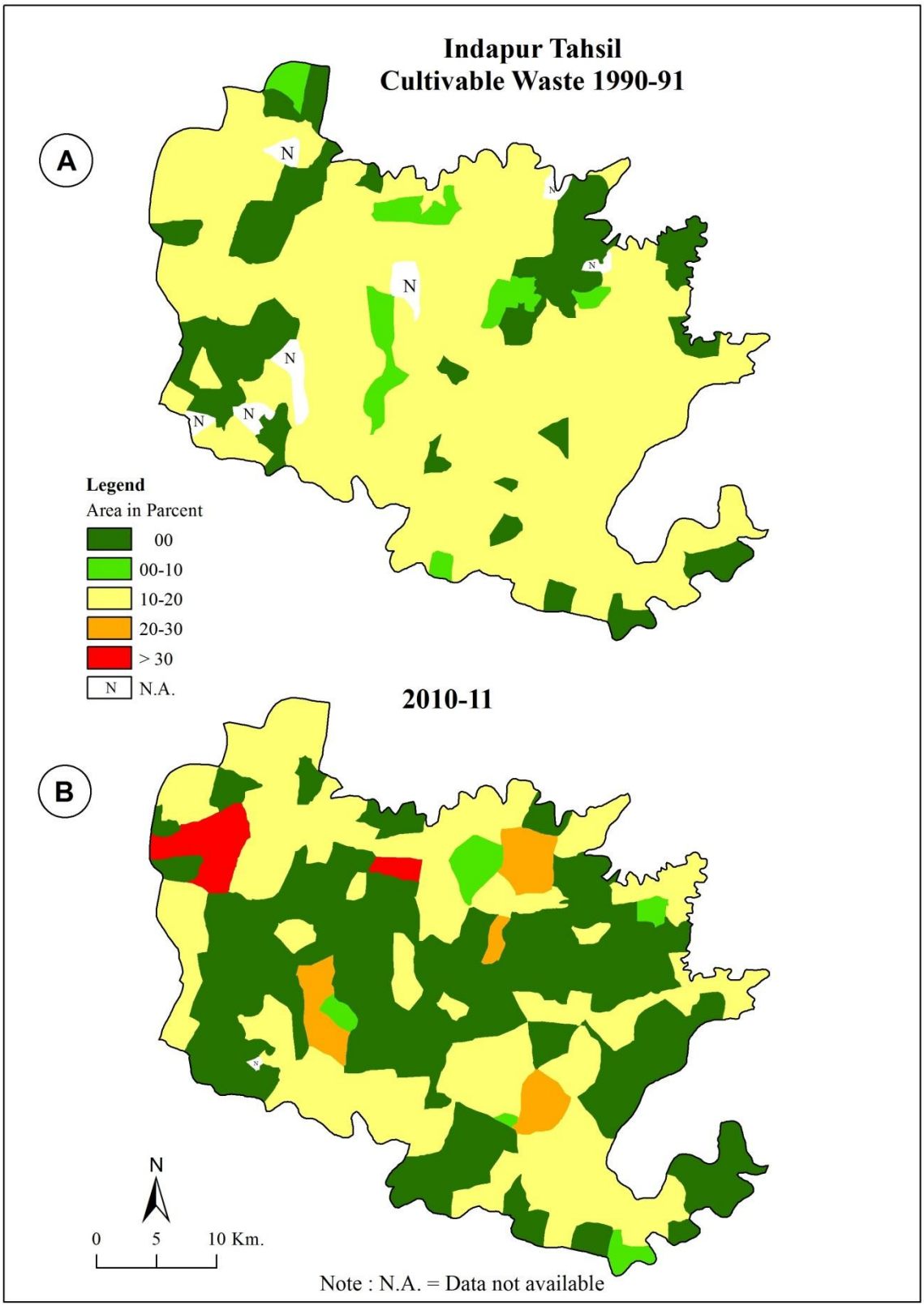

Indapur Tahsil
Cultivable Waste 1990-91
A
N
Legend
Area in Parcent
00
00-10
10-20
20-30
> 30
N
N.A.
2010-11
B
N
0
5
10 Km.
Note : N.A. = Data not available

Fig. 3.4

and other fallow land. The study area has recorded 20.72 percent area under fallow land accounting 31093.51 hectares in 1991. This land declined to 2.57 percent in 2011 with total decline of 18.15 percent (Table.-3.2). In 1991 fallow land has occupied 20.72 percent to total geographical area. The spatial distribution of follow land is shown in Fig.3.5/A. The highest fallow land was recorded at Pilewadi (78.64 percent) lying north west part and the lowest was recorded at Sugaon in east having 0.81 percent land under this category. More than 45 percent of area under fallow is observed in seven villages, namely, Shelgoan, Lakhewadi, Nimbodi and Kalas these villages observed in east and central parts in study region. Twenty three villages have 30 to 45 percent fallow land distributing thirty patches in south and central parts in Indapur Tahsil. The soil of these villages is less fertile hence 30 to 45 percent land is observed as follow land. The fallow land having 15 to 30 percent appeared in 45 villages and these villages are distributed mainly in east and west parts in Indapur Tahsil. Less than 15 percent fallow land is identified in fifty eight villages. These villages are found all over study region.

The study area has recorded 2.57 percent area under fallow land accounting 3975.46 hectares in 2011. The highest fallow land was recorded at Diksal (54.58 percent) lying northwest part and the lowest was recorded at Chandgao in north part accounting 0.17 percent land under this category. (Fig.-3.5/B) More than 30 percent of area under fallow is observed in Diksal. There are thirty four villages in study area of less than15 percent fallow land. Nanty eight villages have observed no fallow land in Indapur Tahsil and these villages are distributed all over the study region. Due to irrigation facilities these patches have developed in study region and has more land under cultivation is found in Indapur Tahsil. This indicates that there is a tendency of farmers to bring more land under cultivation

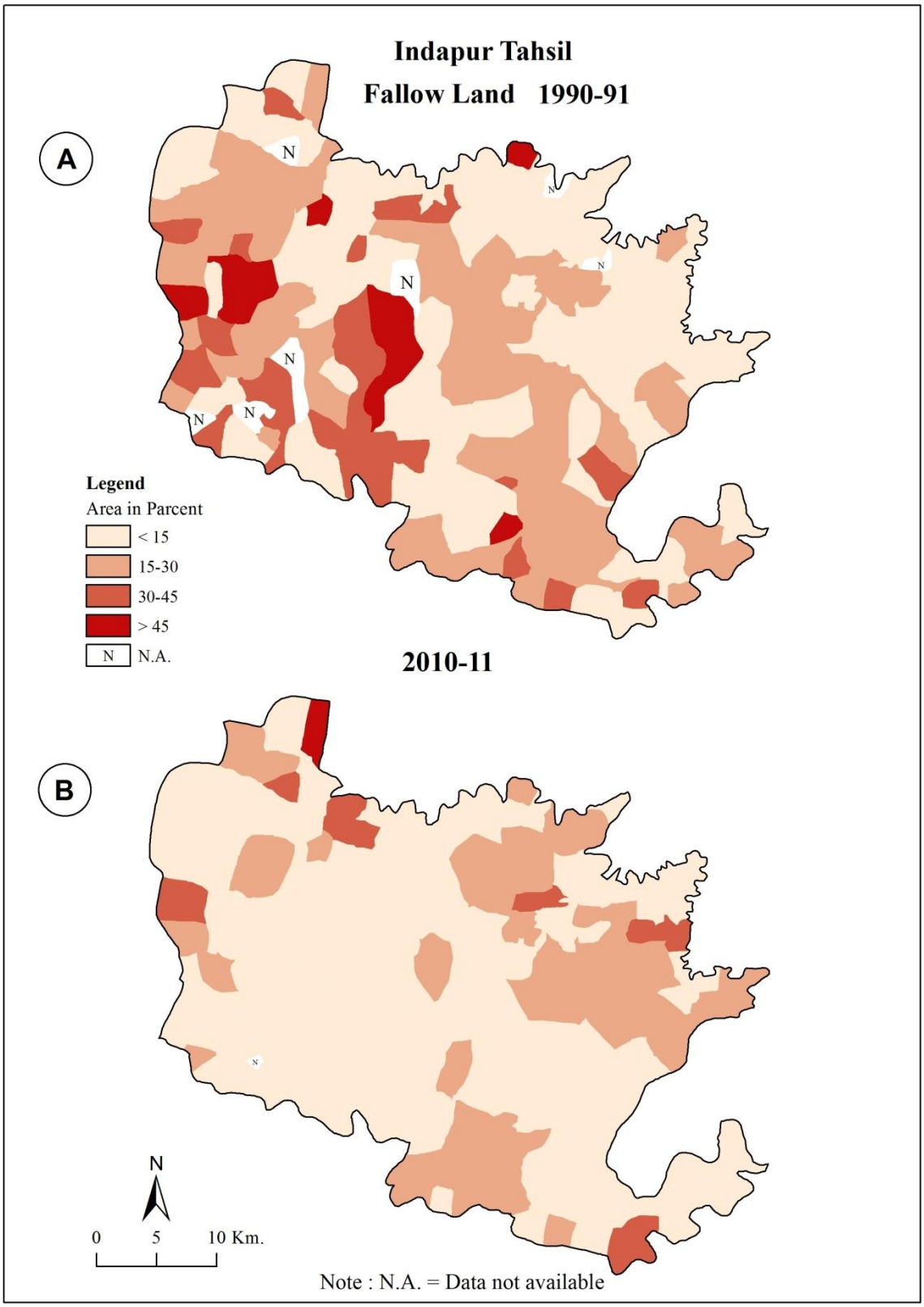

Indapur Tahsil
Fallow Land 1990-91
A
N
Legend
Area in Parcent
< 15
15-30
30-45
> 45
N
N.A.
2010-11
B
N
0
5
10 Km.
Note : N.A. = Data not available

Fig. 3.5

3.4.5 Forest

Forest cover in 1991 was occupied 5.32 percent to the total area and it declined to 4.76 percent in 2011. The total decline is 0.56 percent due to increasing more land under cultivation. Two villages, namely, Gagargaon, and Kazad have accounted more than 30 percent land under forest in study area. The highest area under forest is seen at Kazad in northwest part (35.37 percent) and the lowest land has observed at Tarangwadi lying the east part in study area (0.13 percent). It has observed from Fig 3.6/A that sixty villages in study region do not have forest land in 1991. Eleven villages have 15 to 30 percent forest land lying north part in study region. Less than 15 percent forest land has identified in sixty three villages and these villages are distributed all over study area.

In 2011 forest land in Indapur Tahsil has declined due to cultivation and deforestation. But Bendewadi, Pondkulwadi, Dalaj No.1 and Rajwadi are the villages have increased forest land because of different programmes, introduced by Grampanchayat, Companies Colleges, and Government. Six villages have 15 to 30 percent forest land namely, Kuthali, Padasthal, Chandgaon, Bijwadi, Malwadi No.2 and Tardgaon. Less than 15 percent area under forest is identified in sixty one villages (Fig 3.6/B). There are sixty eight villages in study region do not have forest land in 2011.

3.5 Resume

The discussion in above-mentioned text indicates the spatio-temporal distribution of general landuse in the study area. The total area in study region covers 77.31 percent net sown area in 2011. In 1991, net sown area in study area shows steady decline towards central and north parts due to lack of irrigation but in 2011 the net sown area has increased due to fertile soil and irrigation facility. From 1991 to 2011 the total net sown area increased by 17.70 percent. Land not available for cultivation shows 0.01 percent

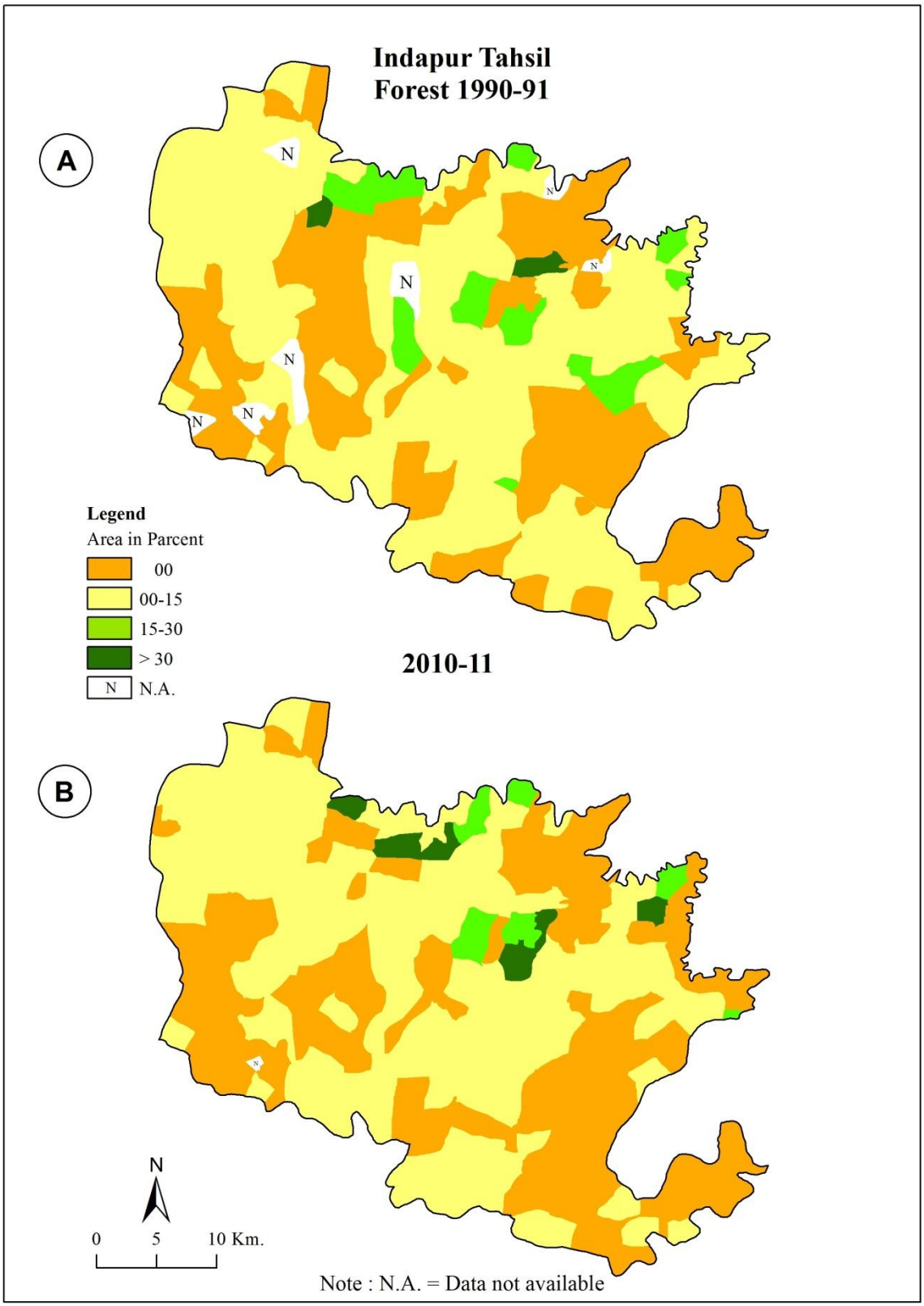

Indapur Tahsil
Forest 1990-91
A
N
N
N
N
N
N
Legend
Area in Parcent
00
00-15
15-30
> 30
N
N.A.
2010-11
B
N
0
5
10 Km.
Note : N.A. = Data not available

Fig 3.6

increase during the study period. Increase in land not available for cultivation is found in north parts in study area. Cultivable waste in Indapur Tahsil shows increase in area and the total increase under this category is 1.00 percent during the span of twenty year. This increase is due to increasing population pressure on existing land. Fallow land indicates declining trend by 18.15 percent in study area. Due to irrigation facility more land has brought under cultivation. Forest cover has declined slowly by 0.56 percent to total area. But Bendewadi, Pondkulwadi, Dalaj No.1 and Rajwadi are the villages have increased forest land because of different programmes, introduced by Grampanchayat, Companies Colleges, and Government.

CHAPTER-IV

AGRICULTURAL LANDUSE PATTERN

4.1 General Introduction

After examining general landuse in Indapur Tahsil, it is necessary to evaluate the agricultural landuse. Agricultural landuse means cultivation of crops during the agricultural year on a certain piece of land. This is a result of socio-economic, physical as well as climatic conditions of study region. The farmers' decision is generally associated with their socio-economic condition, purchasing power and price fluctuation in markets both local and regional. The present chapter focuses on spatial distribution of agricultural crops in Indapur Tahsil.

The spatial distribution and their temporal variations have been studied for the period from 1991-2011. The data regarding crops of 143 villages have collected from agriculture office. The collected data was then converted into percentage to net sown area. Later on, these crops percentage were arranged into different groups and finally, spatial distribution was studied for ten crops in study area. The study of temporal variation of crops in study region was computed for 20 years (1991-2011).

Due to lack of data every year in study area the present study relies on the latest data available for 2010-2011 and therefore, spatial distribution of ten crops have studied only for one time point (2011). Kharif and Rabbi are two major agricultural seasons in study area. Kharif season begins in the month of June or July and ends in September. Jowar, sunflower are the major kharif crops in Indapur Tahsil. Rabbi season commences from September or October and ends in March or April. Wheat, Jowar and Corn are the major rabbi crops grown in study region. Sugarcane and vegetables are sown both in kharif and rabbi seasons. Sugarcane is the main crop in study area and it requires a long duration for maturing (15 to 18 months). This crop needs hot and humid climate during the growing period.

4.2 Temporal Variations in Agricultural Landuse Pattern

The cropping pattern is a result of rainfall, irrigation, use of high yielding variety seeds, technical knowledge and availability of agricultural inputs viz. capital, fertilizer, pesticides etc. Table-4.1 and Fig. 4.1 display temporal variations of ten crops in study region from 1991 to 2011. The cropping pattern undergoes changes in response to the changing physical and cultural environment. For an appreciation of temporal variations in study area fifteen years have been taken into account.

Table-4.1: Temporal Variations in Agricultural Landuse Pattern

Sr. No.	Crops	Years				
		1991	1996	2001	2006	2011
1	Jowar	45.26	41.57	40.57	30.85	26.62
2	Sugarcane	20.70	21.54	22.60	25.00	30.94
3	Wheat	9.67	8.54	6.98	11.90	8.83
4	Fodder Crops	2.01	2.01	5.24	6.95	4.93
5	Bajara	6.89	7.58	9.67	8.02	5.74
6	Corn	5.16	5.24	5.71	7.58	9.44
7	Oil seed	3.90	4.51	3.05	3.63	1.46
8	Pulses	4.77	6.74	3.24	2.80	1.28
9	Vegetables	1.25	1.10	2.63	2.04	1.68
10	Fruits	0.39	0.96	0.31	1.23	9.10

Source: Agriculture Office, Indapur
Note: Area in percent

Jowar occupies 31659 hectares in 2010-2011 accounting for 26.61 percent of net sown area in Indapur Tahsil. This crop shows decreasing trend for twenty years in Indapur Tahsil. Sugarcane is cash crop covers 30.94 percent to net sown area. Due to irrigation facility sugarcane is

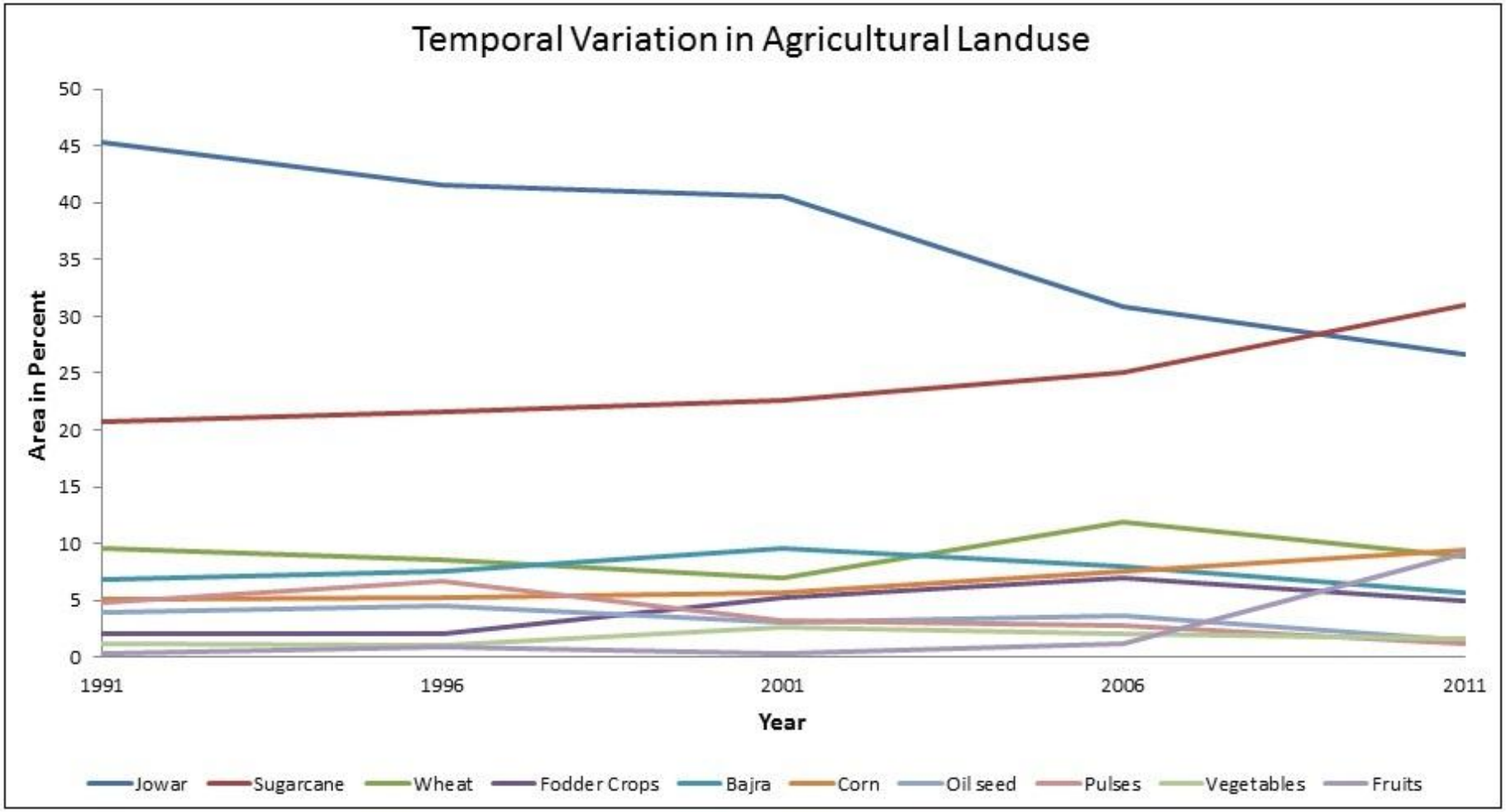

Temporal Variation in Agricultural Landuse
Area in Percent
50
45
40
35
30
25
20
15
10
5
0
1991
1996
2001
2006
2011
Year
Jowar
Sugarcane
Wheat
Fodder Crops
Bajra
Corn
Oil seed
Pulses
Vegetables
Fruits

Fig. 4.1

grown extensively in study region. Wheat is cultivated in Rabbi season and it requires four months for its maturity. Traditionally, this crop is a main crop grown in study region. The area under wheat is found 11.90 percent in 2006 where as in 1991 it was grown on 9.67 percent in study region. But its area under net sown area is decreased in 2011. Bajara is known as Perl millet or bulrush millet. It requires rainfall between 40 to 50 cm and dry weather condition. Bajara accounts 5.74 percent to net sown area in 2011. It is decreasing trend form 2001. Bajara have 6.89 percent area to the net sown area in 1991. Corn occupies 9.44 percent area in Indapur Tahsil in 2011. Corn has shown increasing trend during study period. A fodder crop includes maize, kadwal and green grass.

Indapur Tahsil witnesses increase of area under fodder crop during 1991 to 2006 by 4.94 percent. But it is decreased in 2011. This crop occupies 4.93 percent area in study region in 2011. Oilseed comprises sunflower soyabin and groundnut in study region. This crop accounts for 1.46 percent in study region in 2011. Oilseed shows fluctuated condition for twenty years in Indapur Tahsil. Pulses are cultivated on 1.28 percent area in Indapur Tahsil. It was 4.77 percent in 1991. This crop decreased by 2.00 percent. Vegetables contribute 1.68 percent in study region. It is produced in study area by farmers to fulfil their limited family requirements and very less products are sold in markets. The study region has shown less increase under vegetables from 1991 to 2006 by 0.79 percent. But it deceased by 0.36 percent 2006 form 2011. Indapur Tahsil has found significant increased area (9.09 percent) under fruit crop it was 0.39 percent in 1991 which increased by 8.70 percent in 2011. There is assurance in local markets for fruits crops in Indapur Tahsil. In study area sugarcane, corn and fruits have increased their acreage in study region. But

Jowar, oilseed and pulses have declined percent in this Tahsil during study period.

4.3 Spatial Distribution of Agricultural Landuse

The agricultural landuse means the cultivation of crops on a certain piece of land during agricultural year. Agricultural landuse is thus, the reflection of physical, social, economic and climatic condition in study area.

Table-4.2: Agricultural Landuse in 2010-11

Sr. No.	Crops	Area	Net Sown Area
1	Jowar	31659.0	26.62
2	Sugarcane	36800.0	30.94
3	Wheat	10502.0	8.83
4	Fodder Crops	5867.3	4.93
5	Bajara	6827.0	5.74
6	Corn	11224.0	9.44
7	Oil seed	1735.4	1.46
8	Pulses	1525.8	1.28
9	Vegetables	1998.0	1.68
10	Fruits	10813.9	9.10

Source: Agriculture Office, Indapur

Note:i) Area in hectares;

ii) Net sown area is given in percent

This study has attempted to assess the spatial distribution of agricultural crops in study area. Jowar, wheat, sugarcane, fodder crops,

pulses, fruits, vegetables and other crops are mainly grown in study region. (Table-4.2 and Appendix-E).

4.3.1 Distribution of Jowar

Jowar as staple food crop is grown in both Kharif and Rabbi seasons throughout the study region. This crop occupies 31659 hectares area in 2011. The highest area under Jowar has found at Mhasobachiwadi lying west part in Indapur Tahsil accounting 75.77 percent whereas lowest is at Rajwadi situated in northeast (1.66 percent). (Fig.4.2). Eleven villages in Indapur Tahsil have witnessed more than 50 percent net sown area under Jowar. Theses villages appear into four patches lying central parts in Indapur Tahsil. 40 to 50 percent net sown area under Jowar is identified in eleven villages identifying in three patches among them one larger patch of seven villages found in central. Nineteen villages under Jowar have 30 to 40 percent net sown area in study region. These villages have distributed all over the study area. Thirty five villages under Jowar have 20 to 30 percent net sown area in study region. Less than 10 percent net sown area under Jowar is identified in thirty four villages in study area where the inadequacy of irrigation.

4.3.2 Distribution of Sugarcane

Sugarcane a perennial crop is cultivated on clay to loamy soil. It can tolerate moderate acidity and alkalinity. Soil rich in 'Phosphorus' and 'Calcium' are suitable for better product. The temperature between 20^{o} and 26^{o} centigrade is essential for its better growth. This crop is grown on 36800 hectares area in study area (Table-4.2 and Fig.4.3). More than 50 percent area under sugarcane is found in twenty three villages. Sansar, (71.46 percent) and recorded as highest sugarcane area lying southwest part in study area. Vyhli (0.19 percent) has recorded lowest area under sugarcane locating in south in study area due to lack of irrigation. Forty to

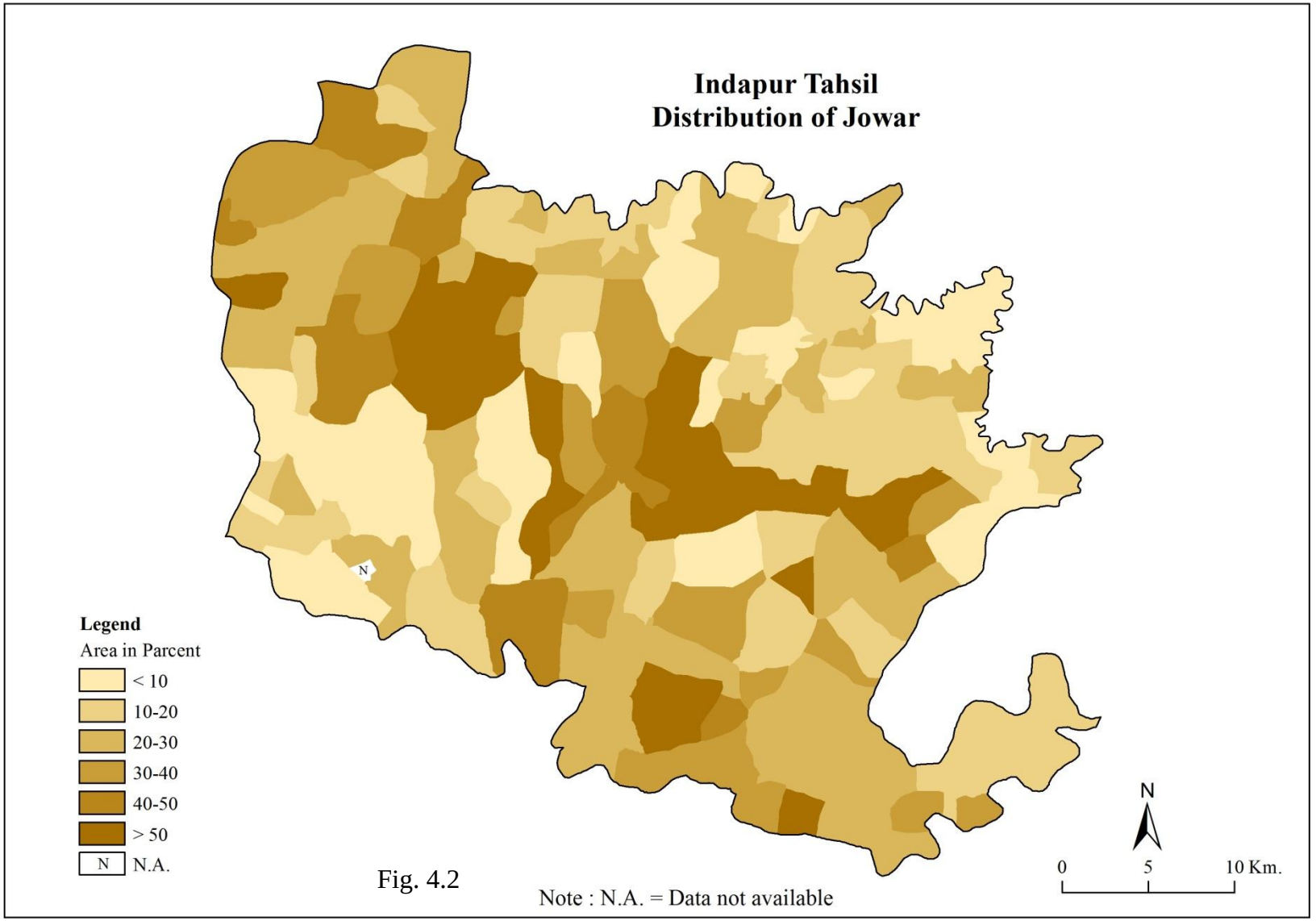
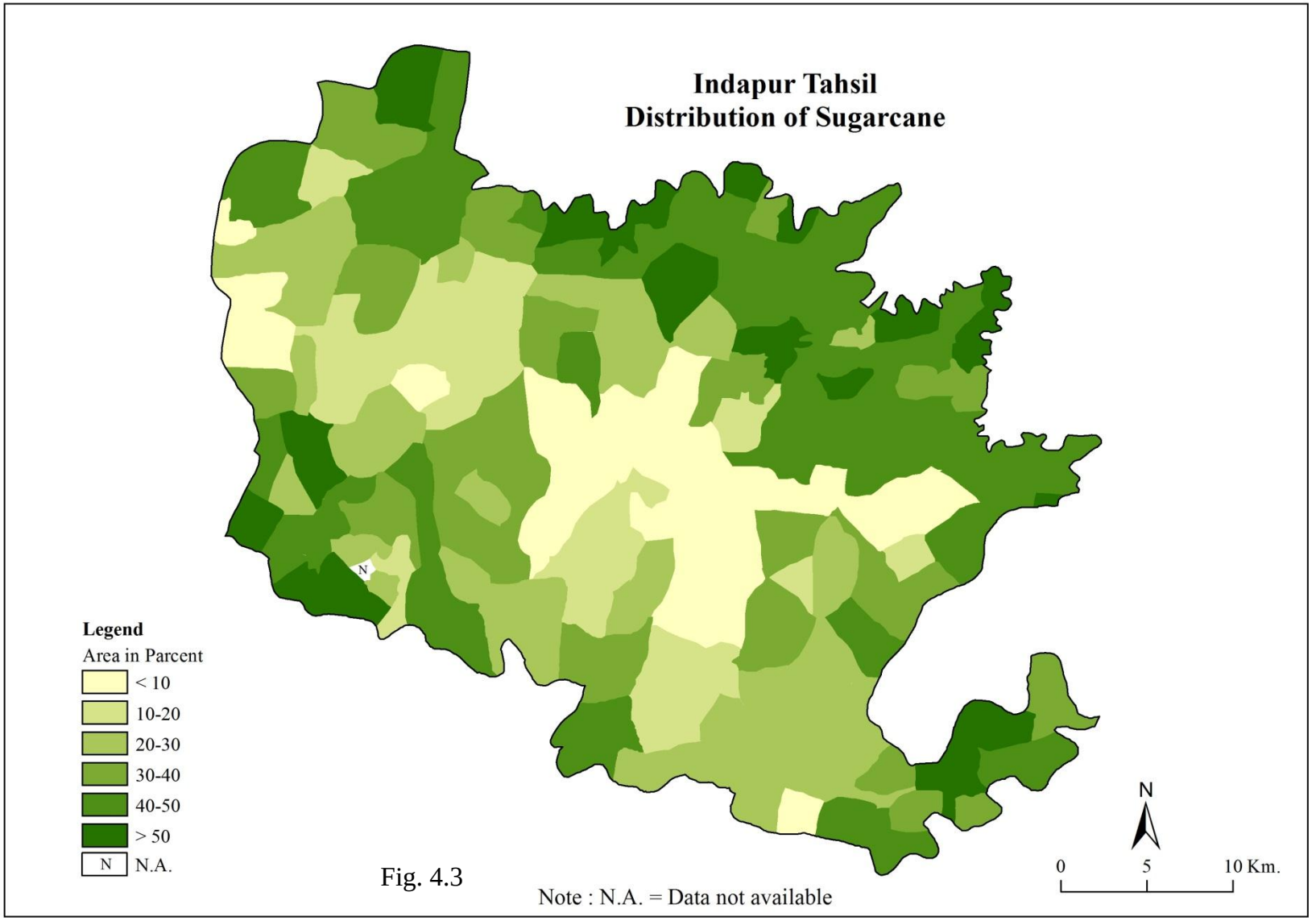

Indapur Tahsil
Distribution of Jowar
Legend
Area in Parcent
< 10
10-20
20-30
30-40
40-50
> 50
N
N.A.
N
0
5
10 Km.
Note : N.A. = Data not available

Fig. 4.2


Indapur Tahsil
Distribution of Sugarcane
Legend
Area in Parcent
< 10
10-20
20-30
30-40
40-50
> 50
N
N.A.
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0
5
10 Km.
Note : N.A. = Data not available

Fig. 4.3

fifty percent area under sugarcane has observed in thirty nine villages, namely, Udhat, Hingangaon, Jankshan, Kalamb, Bhabhulgaon, Sapkalwadi etc. The concentration of sugarcane is mainly associated with canal and left irrigation besides transport means. Twenty two villages have 30 to 40 percent area under sugarcane to net sown area. These villages have isolation and patchy nature. Twenty six villages have witnessed of 20 to 30 percent area under sugarcane cultivation. These villages are mainly found in central and west parts in study region.

Fifteen villages account between 10 to 20 percent area under sugarcane. These villages have found well-spread in all parts in study area. Less than 10 percent area under sugarcane is found in sixteen villages. The distribution of these villages distributed into three patches. Among these, one patch lie in West and two patches lie in central in study region.

4.3.3 Distribution of Corn

In Indapur Tahsil corn is grown as a cash crop. Corn covers 9.44 percent land in Indapur Tahsil. The highest land under this crop is seen at Galndwadi No. 2 (38.89 percent) and the lowest is at Taratgaon (1.20 percent). Galndwadi No. 2 is located in north and Taratgaon lying in east part in Indapur Tahsil. The distribution of corn is shown in Fig.-4.4. Nine villages in study region of more than 20 percent land under corn are observed at central and northwest parts in study region. Seventeen villages have observed 15 to 20 percent land under corn cultivation. Ten to fifteen percent area under corn has observed in forty two villages in Indapur Tahsil. Medium deep soil, irrigation and nearness to weekly market centres are responsible for corn cultivation in this region. Fifty one villages have between 5 to 10 percent area under corn. These villages are well distributed all over the study region. Less than 5 percent area under corn has found in twenty two villages in west and northwest part of Indapur Tahsil.

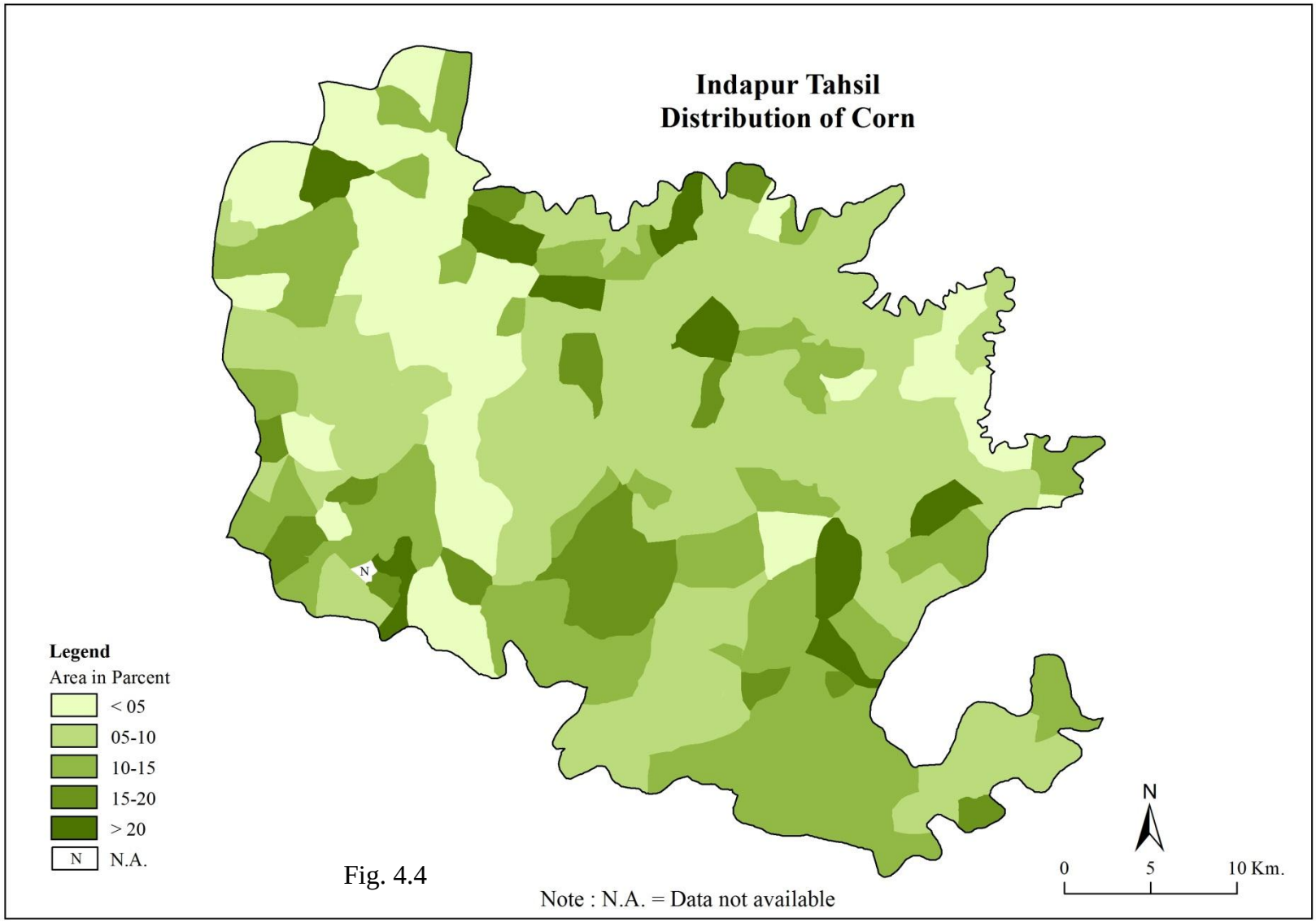

Fig. 4.4

Note : N.A. = Data not available

4.3.4 Distribution of Wheat

Wheat is an important cereal crop cultivated in Rabbi season in study area. This crop requires 110 to 140 days for harvesting. 10o to 15ocentigrade's temperature requires during growing and 21o to 27ocentigrade's during harvesting. This crop is generally sown in November and is harvested in March. Wheat covers 10502 hectares area in study region. The highest area under wheat is registered at Kalthan No.2 (27.38 percent) lying north part where is deployment in lift irrigation and lowest is at Vyahli (0.19 percent) lying south part in study region where is scarcity of water. Wheat occupies fifth position after sugarcane, Jowar, corn and fruit and in study area. More than 20 percent area under wheat has found in eight villages namely, Lasurne,(26.50) Kalthan No.1(25.21), Shaha(24.08), Kalashi(23.66), Ajoti(21.08), Pimpri Bk(20.72).and Tartgoan (20.10), (Fig.-4.5) located in southwest and northeast parts. Forty two villages have 10 to 20 percent area to net sown area under wheat cultivation. These villages are found in north east and south parts in study area. Ninety one villages in study area have less than 10 percent area under wheat. The Northwest part in Indapur Tahsil has less percent in wheat cultivation due to shallow soil. Hence, wheat percentage is restricted upto less than 10 percent and it appears in whole study region.

4.3.5 Distribution of Bajara

Bajara is drought resistant crop. This crop is grown on less amount of rainfall ranging between 25 to 45 centimetres. For the growth of Bajara less amount of rainfall is required during its growing period. Bajara is sown on 6827 hectares accounting 5.74 percent to net sown area in study region. The distribution of this crop is influenced by rainfall amount, terrain and soil types. The spatial distribution of Bajara is exhibited in Fig. 4.6. Agoti No. 1 village has the highest area (23.50 percent) under

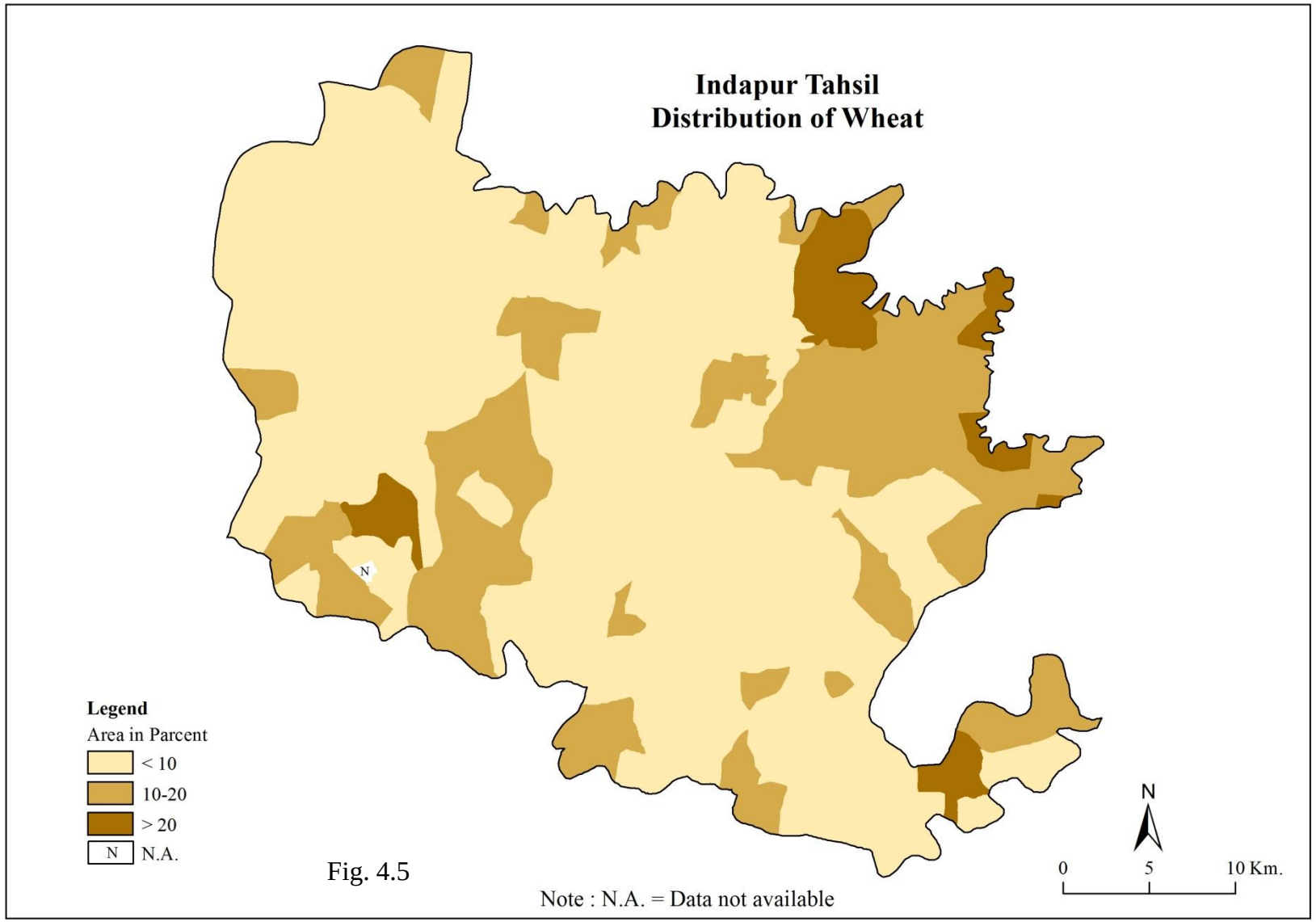
Indapur Tahsil
Distribution of Wheat
Legend
Area in Parcent
< 10
10-20
> 20
N
N.A.
N
0
5
10 Km.
Note : N.A. = Data not available

Fig. 4.5

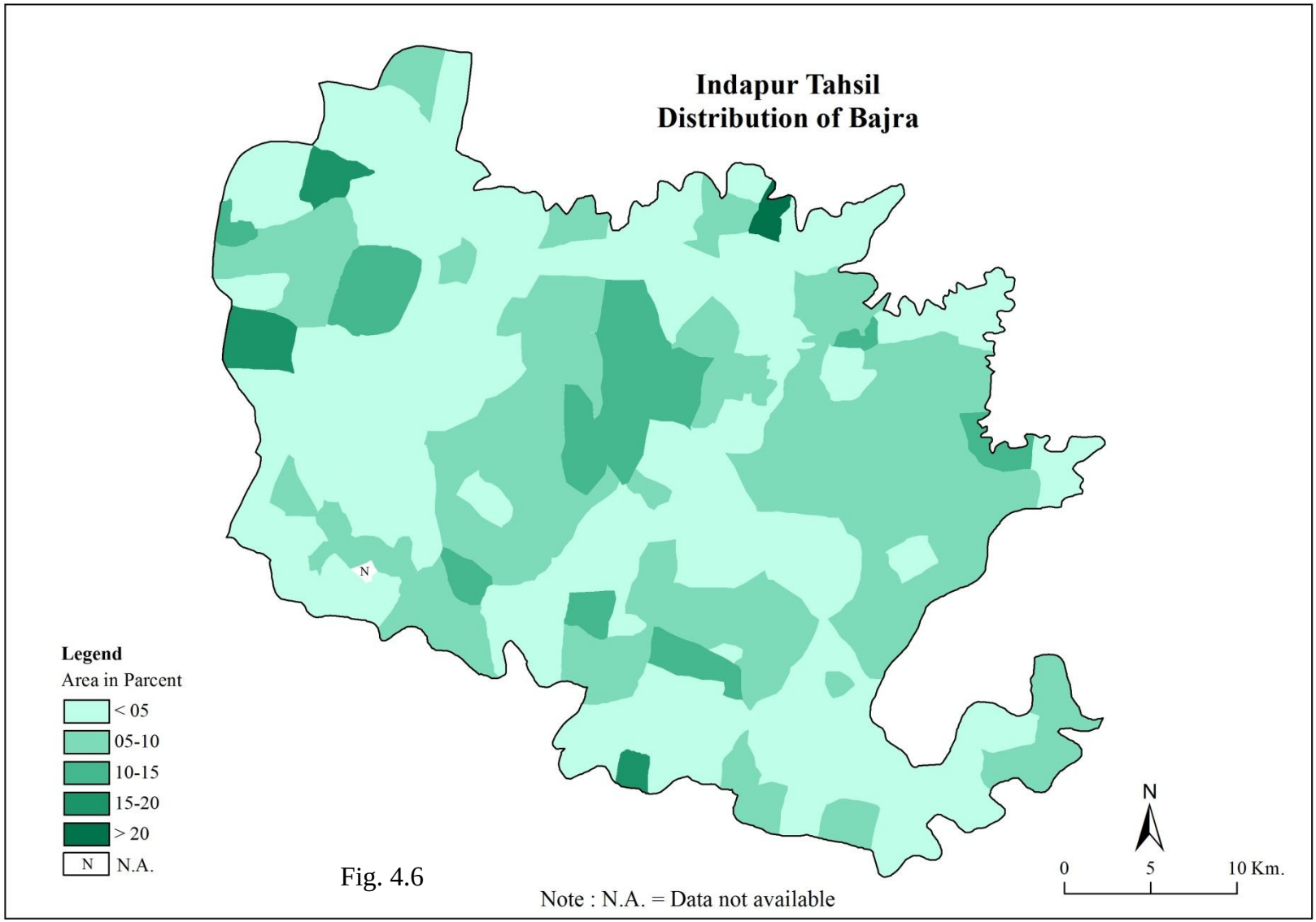

Fig. 4.6

Note : N.A. = Data not available

Bajara in north and the lowest in Gotandi (0.15percent) in central part in study area. Three villages, namely, Lakdi (17.79 percent), Boratwadi (15.73 percent), and Pimpale (15.53) have 15 to 20 percent under Bajara. These villages are in north and south parts in Indapur Tahsil. Ten to fifteen percent area under Bajara has registered in twelve villages in Indapur Tahsil. These villages are in central and west parts in study area. Forty nine villages have 5 to 10 percent area under Bajara cultivation. Less than five percent area under fodder crops is found in seventy six villages. The highest area is observed in this class. These villages are found mainly in central and west parts in study area where irrigation facility is available and as a result farmers are cultivating cash crops. One major patch lies in east part in Indapur Tahsil on less fertile soil and remaining six patches are found in east parts in study area.

4.3.6 Distribution of Fodder Crops

The fodder crops in Indapur Tahsil include kadwal, green grass and maize. These fodder crops are grown with Jowar, Bajara and wheat. The highest percent under these crops are in Dalaj No. 1 village (24.00 percent) in west part in study and the lowest is at Nimgaon Ketaki (0.79 percent) in central part in study area. More than 15 percent area under fodder crops has noticed in six villages, namely, Nimbodi, Padasthal, Pimpri Kh. Lakdi, Dalaj No. 2, and Chikhali (Fig.-4.7). Sixteen villages in study area have witnessed fodder crops between 10 to 15 percent to net sown area. This distribution is found in five patches. Out of these three patches have located in west and one is in east. Another patch of fodder crops is in east part in study area. Five to ten percent area under fodder crops has found in forty seven villages. Less than five percent area under fodder crops is found in seventy one villages. These villages are distributed throughout the study area. North and west part in study area is dominating for dairy farming hence here has found more land under fodder crops.

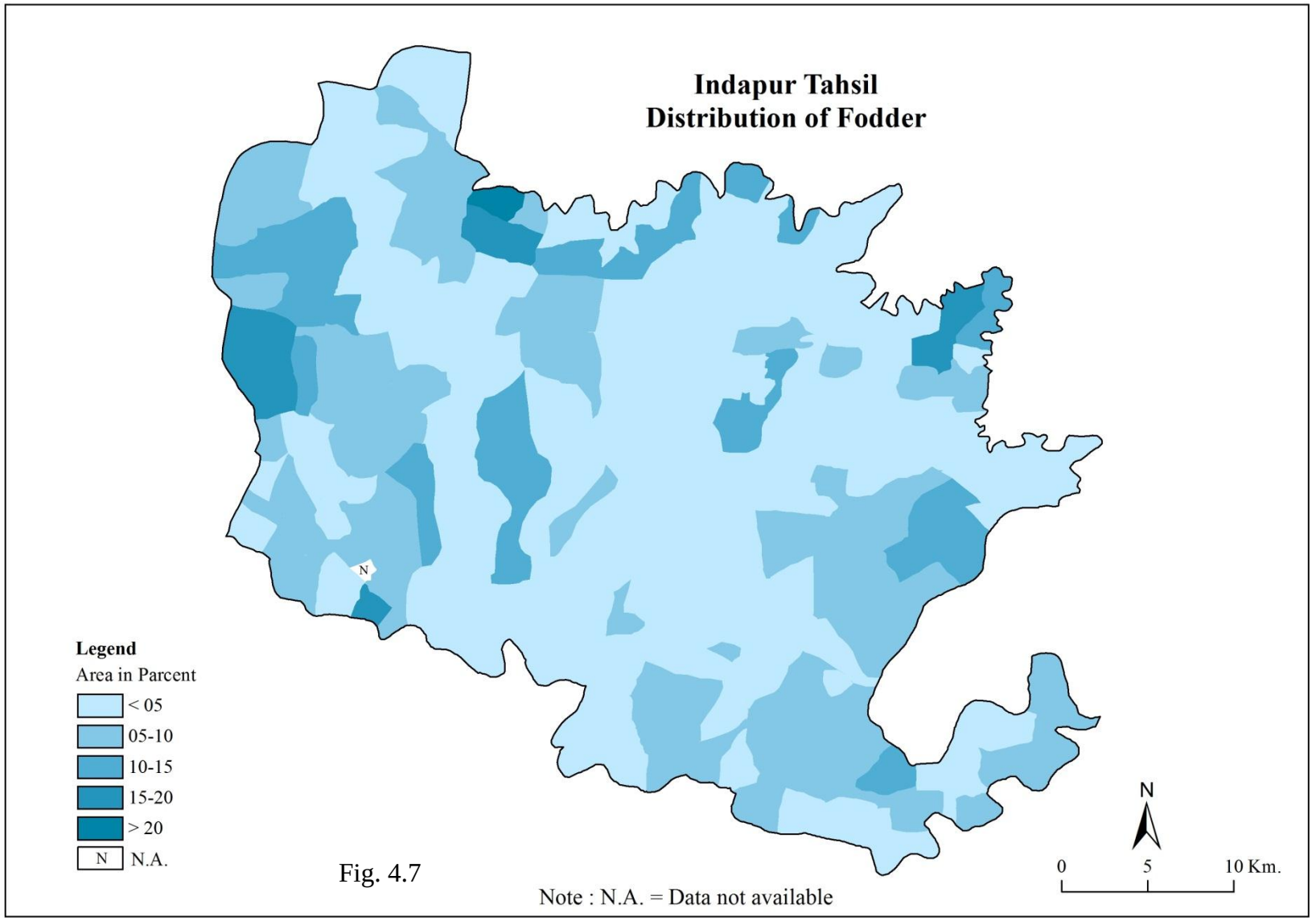

Fig. 4.7

Note : N.A. = Data not available

4.3.7 Distribution of Oilseeds

Oilseeds consist of groundnut, sunflower, soybean and safflower. In 2011, oilseeds are sown on 1735.4 hectares area accounting 1.46 percent to the total cropped area. The highest percent area under oilseeds is found at Pimpale (7.91 percent) in northwest and the lowest in south part in study area at Pandharwadi having 0.09 percent area. (Fig.-4.8). More than five percent area under oilseeds have witnessed in six villages. These villages have located north, northwest and south west parts in study area. Ninety one villages have less than 05 percent area under oilseeds cultivation is distributed all over the Indapur Tahsil. There is absence of oilseeds area in forty four villages in study area. (Fig.-4.8). Oilseed cultivation has less acreage due to larger coverage by sugarcane, corn and jowar in study region.

4.3.8 Distribution of Pulses

Pulses consist of gram, tur, udid, moong and chavali in study area. It is cultivated on 1525.8 hectares (1.28 percent) to net sown area. The highest percent under pulses is found in Paritwadi (10.34 percent) lying southwest part and lowest having 0.09 percent at Malwadi No.1 (Fig.-4.9). This crop is mainly cultivated in north part at Nhavi, south part at Jadhavwadi and southwest part at Gholapwadi villages where pulses are grown on 04 to 06 percent. Two to four percent area under pulses has registered in twenty five villages in Indapur Tahsil. These villages are distributed in five patches. These patches are observed in north and west parts of Indapur Tahsil. Less than two percent area under pulses is identified in one hundred and ten villages. These villages are found in all parts in the study area. The concentration is found in south part in study area. The pulses enrich fertility by adding nitrogenous content and provide protein to soil and support to increase the sugarcane productivity.

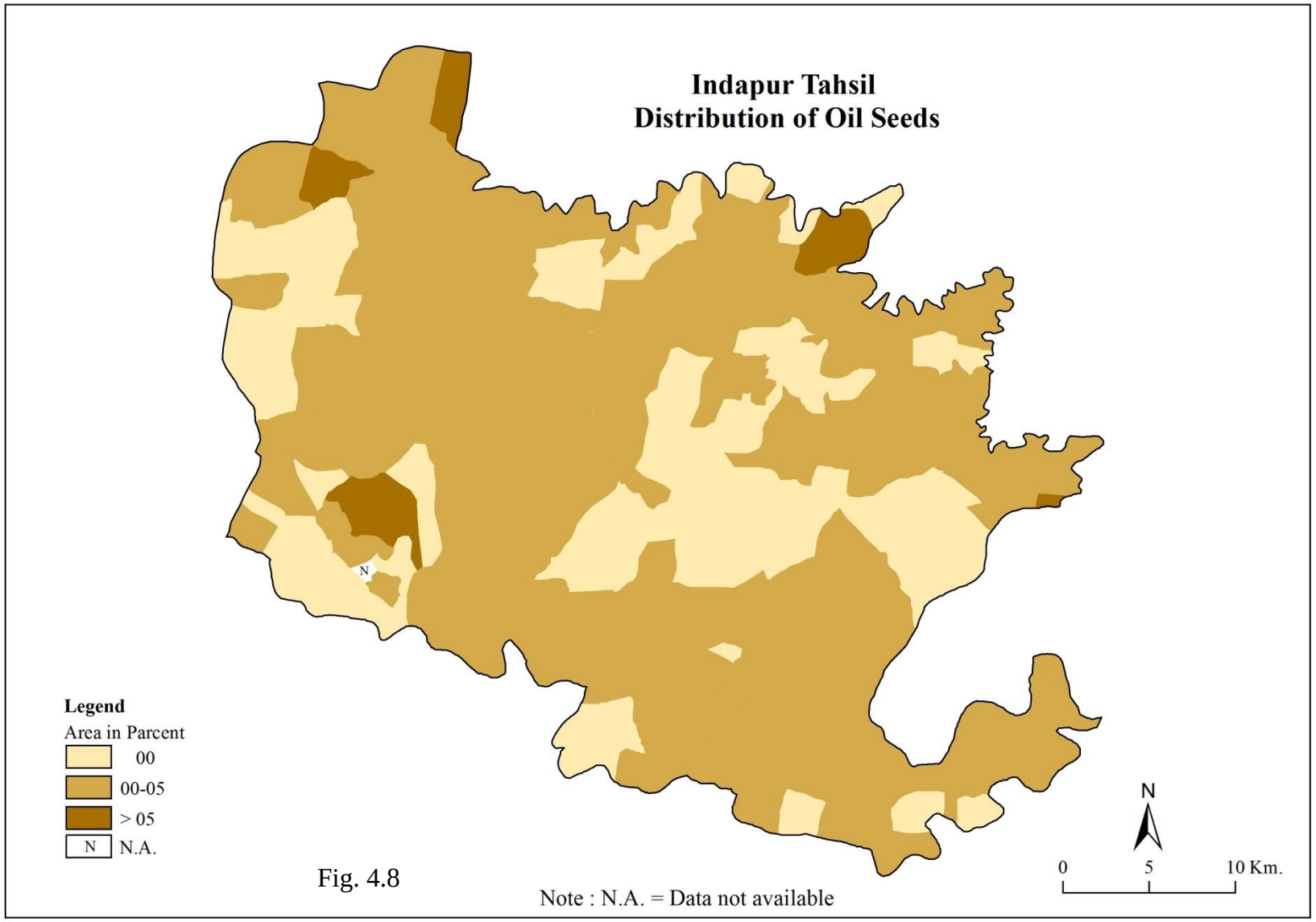

Fig. 4.8

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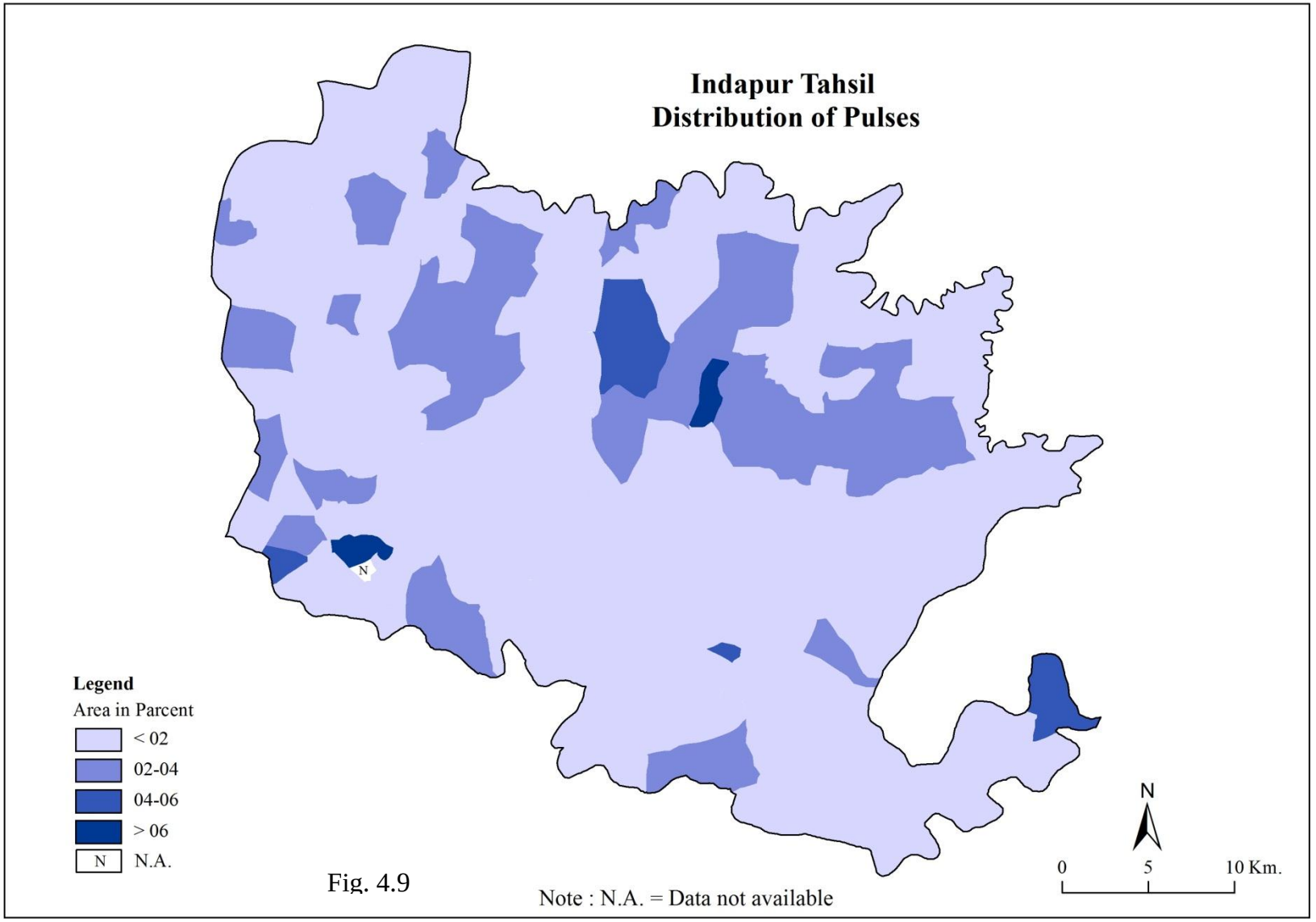

Fig. 4.9

Note : N.A. = Data not available

4.3.9 Distribution of Vegetables

The distributional pattern of vegetables cultivation in study region is influenced by market, irrigation and road accessibility in Indapur Tahsil. Indapur Tahsil accounts 1.68 percent area under vegetables to net sown area. Pilewadi (9.41 percent) village has the highest percentage under vegetables lying west part in Indapur Tahsil. (Fig. 4.10) There are three villages in Indapur Tahsil cultivating vegetables more than six percent to net sown area. Among these two villages are found in southwest and one in northwest parts in study area. Twelve villages of 04 to 06 percent area under vegetables show patchy distribution in study area. Two to four percent area under vegetables has found in thirty eight villages. These villages have identified into four patches. These patches are located near the market centres, and remaining eighty eight villages of less than 2 percent area under vegetables. These villages have spared throughout the study area. Vegetables are mainly grown close to the weekly market centres in study area.

4.3.10 Distribution of Fruits

Fruit crops account 9.09 percent to net sown area in Indapur Tahsil, in that the area under grapes and pomegranate has increased. The highest land under fruit crop is registered at Varkute Kh. (65.14) village lying north and the lowest of Babhulgaon (0.08) in east part of study area. (Fig.-4.11). Seven villages have more than 30 percent area under fruit crop namely Barnewadi, (52.51) Bori, (43.07), (34.64) Shelgaon, (33.43) Zagdewadi, (31.63) and Kati (30.17) Among these, Kati, Shelgaon, Zagdewadi, Barnewadi and Gotandi villages are found in central part, and Bori has identified in west part of study area. Six villages have 20 to 30 percent area under fruit crop. These villages are mainly distributed central part in study area. Ten to twenty percent area under fruit crop is found

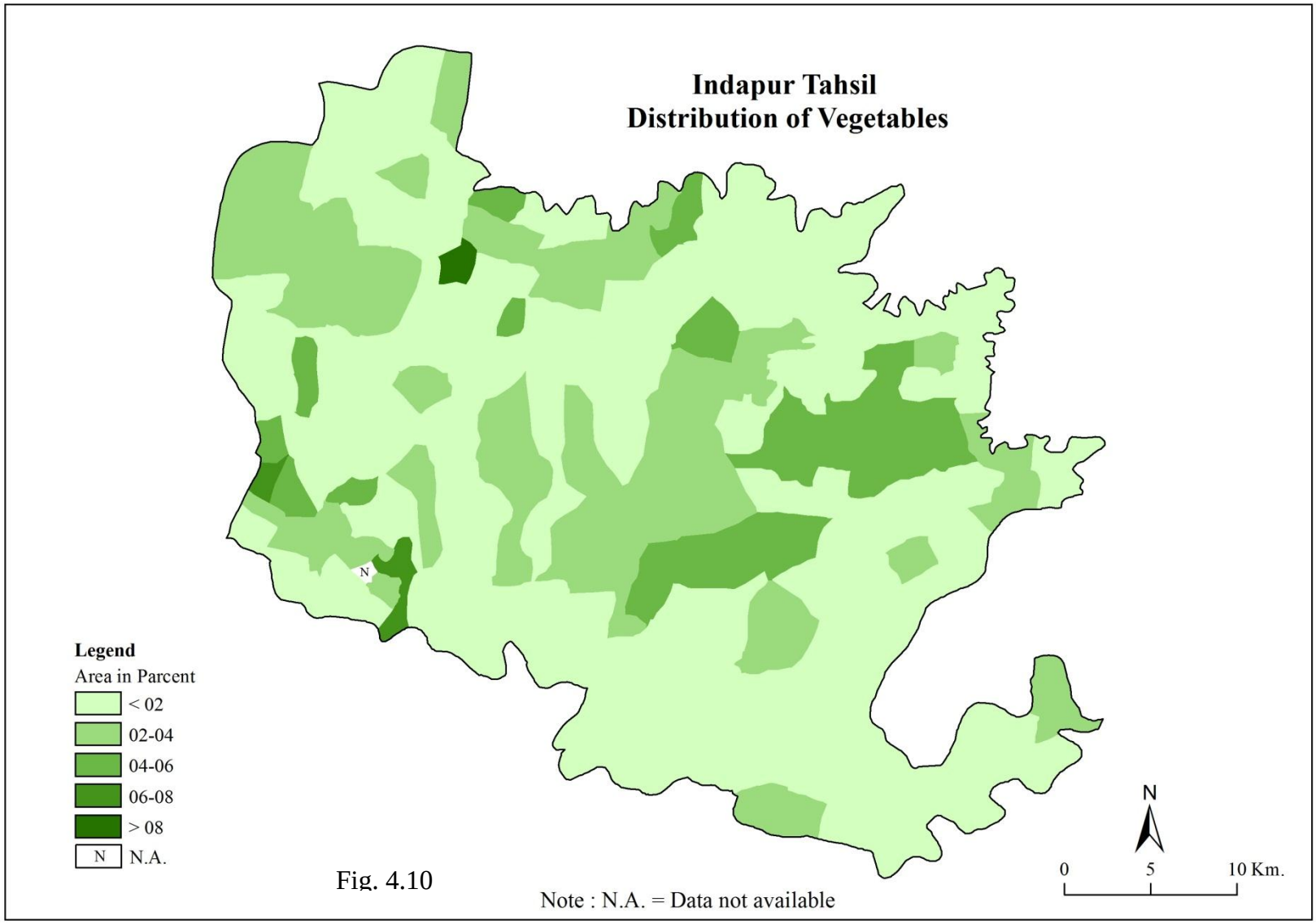
Indapur Tahsil
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Fig. 4.10

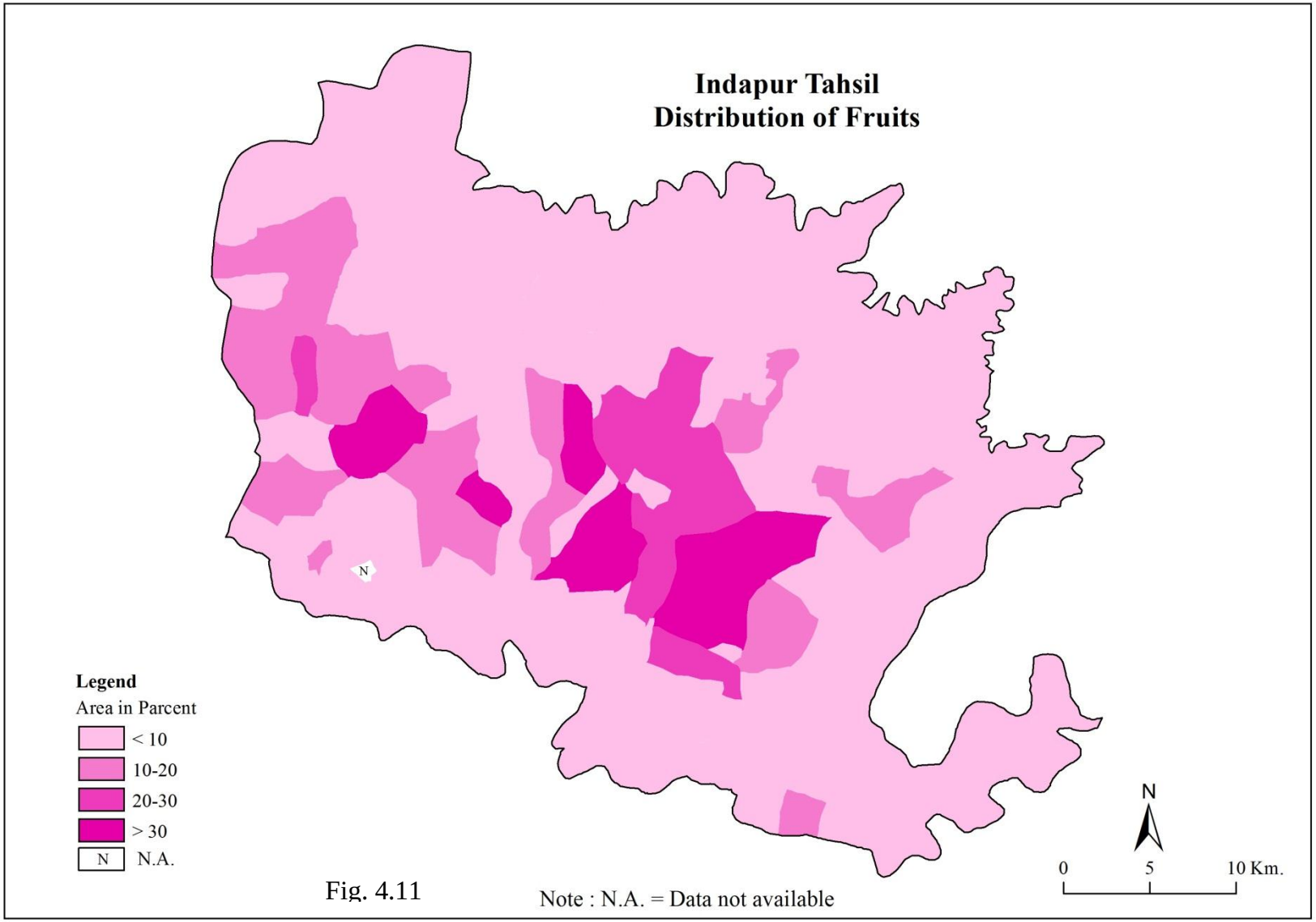

Fig. 4.11

Note : N.A. = Data not available

eighteen villages. Remaining one hundred and ten villages are having less than ten percent area under fruit crop. These villages have spared throughout the study area. It is found that progressive farmers are producing fruit crops as they afford high input cost. Fruits are cultivated by drip irrigation due to scarcity of water in central part of study area. Light brown shallow soil and medium deep black soil is batter for fruit cultivation in Indapur Tahsil.

4.4 Resume

The spatio-temporal analysis of ten selected crops has been studied in this chapter. Crop cultivation mainly depends on fertile soil and irrigation. In study area sugarcane, corn and fruits have increased their acreage in study region. But jowar, oilseed and pulses have declined percent in this Tahsil during the study period. The variation in agricultural landuse relates with the extent of these ten crops with soil characteristics, irrigation and market centres. Sugarcane is identified as first ranking crop occupying 30.94 percent to net sown area. Sugarcane was cultivated on 20.70 percent in 1991 which is increased by 10.24 percent in 2011 due to fertile soil and irrigation by canal lift, well, etc. In Indapur Tahsil, corn is grown as a cash crop. Corn occupies 9.44 percent to net sown area. Medium deep soil, irrigation and nearness to weekly market centres are responsible for corn cultivation in study region. Wheat covers 8.83 percent net sown area in study region in 2011. Wheat concentration appears in central, north and south parts on deep black soil. Fodder crops occupies 4.93 percent net sown area in north part in study area of dairy dominating area hence this crop is observed more land under fodder crops. Bajara is drought resistant crop. It covers 5.74 percent net sown area in west part on less rainfall region in Indapur Tahsil. Oilseeds are cultivated on 1.46 percent net sown area in study region. Oilseeds cultivation has less acreage due to larger coverage under sugarcane, corn and jowar in study region. Vegetables

contributed 1.68 percent in study region. It is grown close to weekly market centres. Pulses occupy very less percent in study region accounting 1.28 percent. Indapur Tahsil has found significant increased area (9.09 percent) under fruit crop. It was 0.39 percent in 1991 which increased by 8.70 percent in 2011. There is assurance in local markets for fruits crops in Indapur Tahsil. It is found that progressive farmers are producing fruit crops as they afford high input cost. Fruits are cultivated by drip irrigation due to scarcity of water in central part of study area. Light brown shallow soil and medium deep black soil is batter for fruit cultivation in Indapur Tahsil

CHAPTER-V

AGRICULTURAL REGIONS

5.1 General Introduction

After unfolding the spatio-temporal study of general and crop landuse of study area in previous chapters, it is essential to assess the crop regions in study area. The geographical factors, namely, soils, irrigation, nature of relief, use of chemical fertilizers, pesticides, proximity to sugar factory, price fluctuation and attitude of farmers are influencing cropping pattern in study area. Keeping these considerations in mind, it is necessary to make exhaustive study of crop regions. The crop cultivation within the region indicates strength and weakness of crop regions. Individual crop of the region gives a realistic picture. Crop ranking, crop combination and crop diversification methods show the relative strength of areal extent of crop. For computing crop ranking, secondary data for ten crops of 143 villages for the year 2010-2011 have used. These data have obtained from Talathi, Revenue Office in Indapur, Agriculture Office, and District Census Handbook of Pune District and then it was interpreted on the basis on interviews and spot visits. The obtained data of ten crops have converted into percent to net sown area and these percent of crops have then used for computing crop ranking to evaluate relative strength of individual crop in Indapur Tahsil.

5.2 Crop Ranking

Ranking of crop reveals the relative strength of ten crops at village level and is taken into consideration for computing crop ranking. These ten crops are, namely, sugarcane, wheat, jowar, fodder crops, oilseeds, vegetables, pulses, fruits, corn and bajara (Table-5.1).

Table-5.1: Crop Rank Frequency

Sr. No	Crops	Crops Ranks and Number of Villages									
		1	2	3	4	5	6	7	8	9	10
1	Sugar Cane	89	29	4	6	5	2	2	2		2
2	Jowar	41	49	21	13	9	3	1	4		
3	Corn	4	21	42	37	21	11	5			
4	Fruits	7	14	10	14	13	16	20	17	12	18
5	Wheat		19	35	23	14	11	14	17	8	
6	Fodder		6	15	26	32	31	20	7	3	1
7	Bajara		3	14	18	29	29	24	10	9	5
8	Pulses				1	3	11	10	29	50	37
9	Vege-tables				2	7	19	27	28	25	33
10	Oil Seeds				1	8	8	18	27	34	45

Source: Computed by Researcher

The cultivation of these crops is the result of soil types and irrigation besides farmer's decision in study area. The ranking obtained for ten crops show the relative significance of individual crop in cropping pattern. The obtained ranking crops and number of village have shown in Table-5.1.

5.2.1 First Ranking Crops

Four crops have identified as first ranking, namely, Jowar, Sugarcane, Corn and Fruit in the study area. Table-5.2 displays first ranking crops, villages and area in study region. Sugarcane is main crop ranking first in study region. Irrigation facility and fertile soil are responsible for growing sugarcane in north and southwest parts in Indapur Tahsil. This crop is grown on 28719 hectares area accounting 55.10 percent in 89 villages.

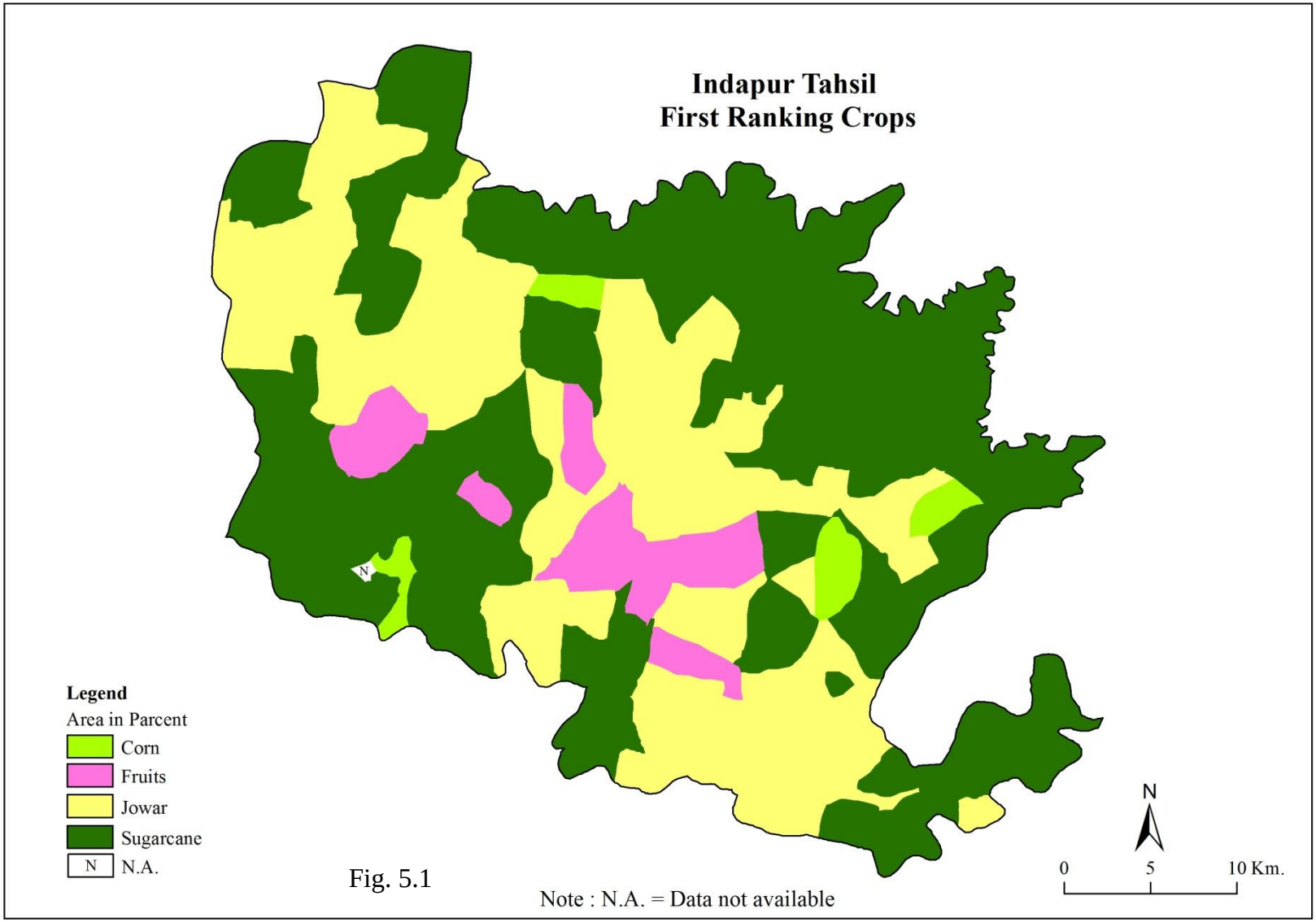

Fig. 5.1

Note : N.A. = Data not available

Jowar is identified as second crop in first ranking in study area and it is grown in 41 villages (29.08 percent) lying northwest, central and southeast parts in study region covering 18661 hectares area (Fig.5.1). Corn has identified as first ranking crop on grown 647 hectares in four (2.84) villages namely Maradwadi, Thoratwadi, Galndwadi No.2 and Vadapuri lying east, north and south part in study region. Fruit is observed as first ranking on grown on 4096.8 hectares area (7.86 percent) in seven villages lying in central part of study area. This is mainly drip irrigated area in Indapur Tahsil.

Table- 5.2: Crops, Villages and Area in First Ranking

Sr. No.	Crops	Number of Villages	Percent of Total Villages	Area in Hectares	Percent Total Area
1	Sugar Cane	89	63.12	28719	55.10
2	Jowar	41	29.08	18661	35.80
3	Fruits	7	2.84	4096.78	7.86
4	Corn	4	4.96	647	1.24
	Total	141	100	52123.78	100

Source: Computed by Researcher

5.2.2 Second Ranking Crops

The second ranking crop presents relatively large number of crops than those of first ranking. Sugarcane jowar, corn, fruit, wheat, fodder crop and bajara, have ranked second in study region. Table-5.3 displays second ranking crops, villages and area in study region. Jower is identified as second ranking in forty nine villages (34.75 percent) spreading all over the study area in north and east parts in study area. Sugarcane has identified as

second ranking crop practiced on 6604 hectares (26.16 percent to total area) in study region. This area is distributed mainly in west and south parts. Twenty three villages have found into three patches one is in northwest, another lies in south and third is in central part. This crop is associated with medium and deep black soil types and irrigation in study region. (Fig. 5.2).

Corn is cultivated as cash crop in study region. Twenty two villages have corn as a second ranking crop. These villages are found in central and west part of study area. Fruits have identified second rank in fourteen (9.93) villages having 2968.2 hectares area. These villages found in central and west parts in study area. Wheat is second ranking crop in nineteen (13.48) villages, and covered 3669 hectors area in study region. A fodder crop includes maize, green grass and kadwal and ranks as second crop in six villages.(4.26 percent).

Table- 5.3: Crops, Villages and Area in Second Ranking

Sr. No.	Crops	Number of Villages	Percent of Total Villages	Area in Hectares	Percent total Area
1	Sugar Cane	29	20.57	6604	26.16
2	Jowar	49	34.75	9868	39.08
3	Corn	21	14.89	1447	5.73
4	Fruits	14	9.93	2968.2	11.76
5	Wheat	19	13.48	3669	14.53
6	Fodder	6	4.26	391	1.55
7	Bajara	3	2.13	302	1.20
	Total	141	100	25249.2	100

Source : Computed by Researcher

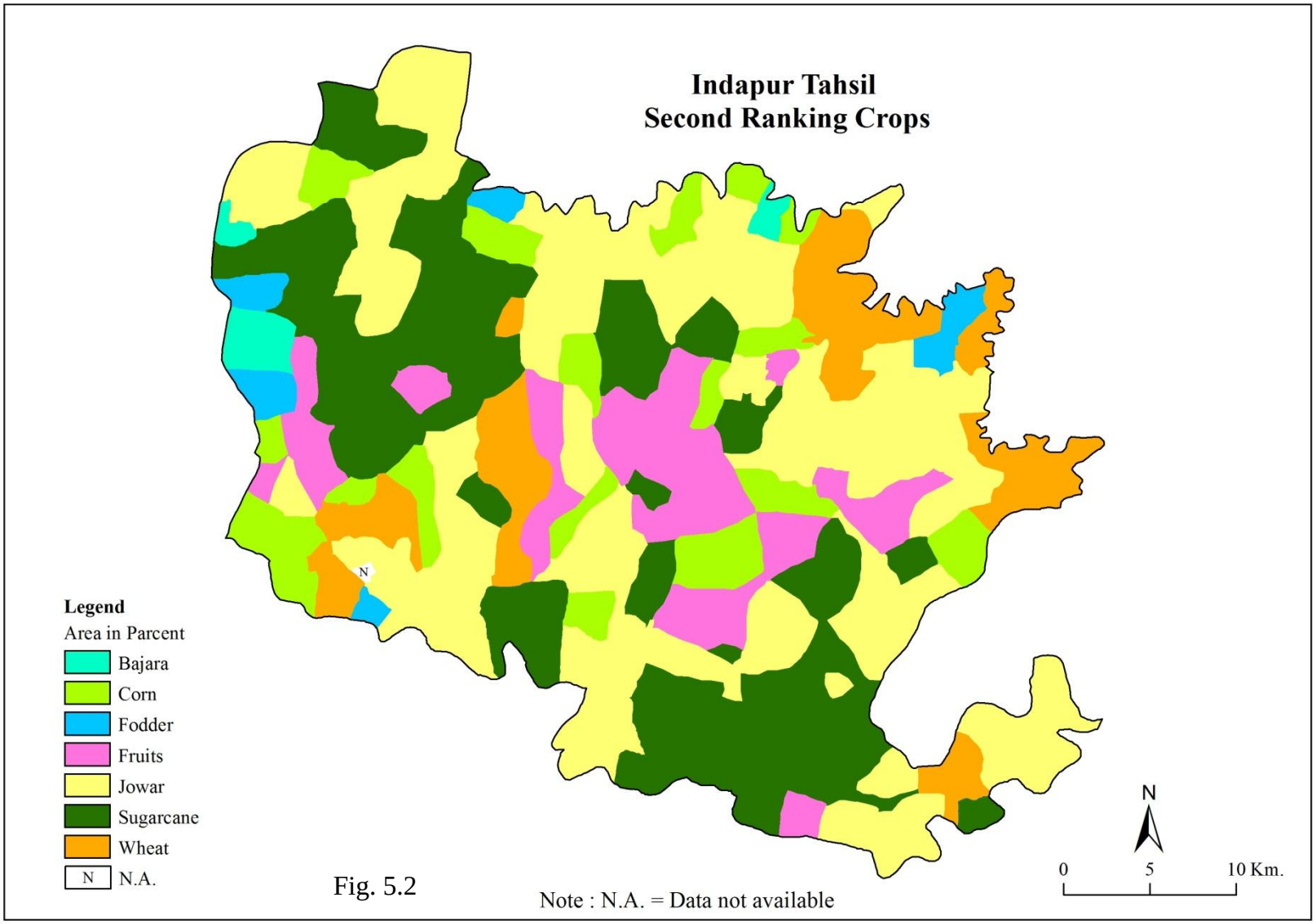

Fig. 5.2

Note : N.A. = Data not available

Fodder crop cultivation has confined in Nimbodi, Chikhali, Padsthal, Pimpri Kh. Dalaj No. 1 and Mhasobachiwadi.Bajara has ranked as second in three villages covering 302 hectares. These villages are found in all parts in study region. This crop is cultivated on coarse shallow soil.

5.2.3 Third Ranking Crops

Seven crops have entered in third ranking in Indapur Tahsil. (Fig.-5.3, Table-5.4). These crops are, namely sugarcane jowar, corn, fruit, wheat, fodder crop and bajara. Corn holds rank third in forty two villages (29.79 percent of total villages). The distribution of corn in study area is found in six patches. The largest patch of sixteen villages lies in east part in study region. Another patch of thirteen villages have found in central part in Indapur Tahsil. The other patches have observed in west and north parts in study region. Hence, corn cultivation has found increased in study region. Wheat stands as third rank in thirty five villages covering 3679 hectares (26.25 percent of total area). These villages are distributed north and south parts in study area. These villages cultivate crops by total benefit of available irrigation besides fertile soil. Fodder crop ranks as third and it is found in fifteen villages over 862 hectares (6.15 percent of total area). Its concentration appears in central and northwest part in dairy dominating area. Six villages having fodder crops are located in east part in study area. These villages are, namely, Gondi, Bhatnimgaon, Bedshinge, Galndwadi No.2, Rajwadi and Ajoti. Fourteen villages having fodder crops as third ranking crops are distributed east part of Indapur Tahsil.

Jowar is found as third crop in twenty one villages on 2205 hectares (15.73 percent of total area). One major patch consists of six villages is found in west part in Indapur Tahsil and reaming fifteen villages namely Pimpri Bk. Vadapuri, Hingangoan, etc. distributed east part in Indapur Tahsil. Bajara stands as third rank in fourteen villages covering 1812

hectares (12.13 percent of total area). One dominant patch has observed in central part in study area consisting of three villages, namely, Vyahali, Kauthali and Shelgaon, other eleven villages are identified in north and east part in study area.

Table- 5.4: Crops, Villages and Area in Third Ranking

Sr. No.	Crops	Number of Village	Percent of Total Village	Area in Hectares	Percent total Area
1	Sugar Cane	4	2.84	251	1.79
2	Jowar	21	14.89	2205	15.73
3	Corn	42	29.79	4353	31.05
4	Fruits	10	7.09	855.5	6.10
5	Wheat	35	24.82	3679	26.25
6	Fodder	15	10.64	862	6.15
7	Bajara	14	9.93	1812	12.93
	Total	141	100	14017.5	100

Source: Computed by Researcher

Sugarcane ranks third in Indapur tahsil in four villages. These villages are not uniformly distributed within study region. These four villages are found in north and south part in study area where the irrigation facility is developed and sugarcane factory located. Fruit stand third position in crop ranking in Indapur Tahsil in ten villages, in these villages seven laying in west part of Indapur Tahsil and three villages are found in east part of Indapur city.

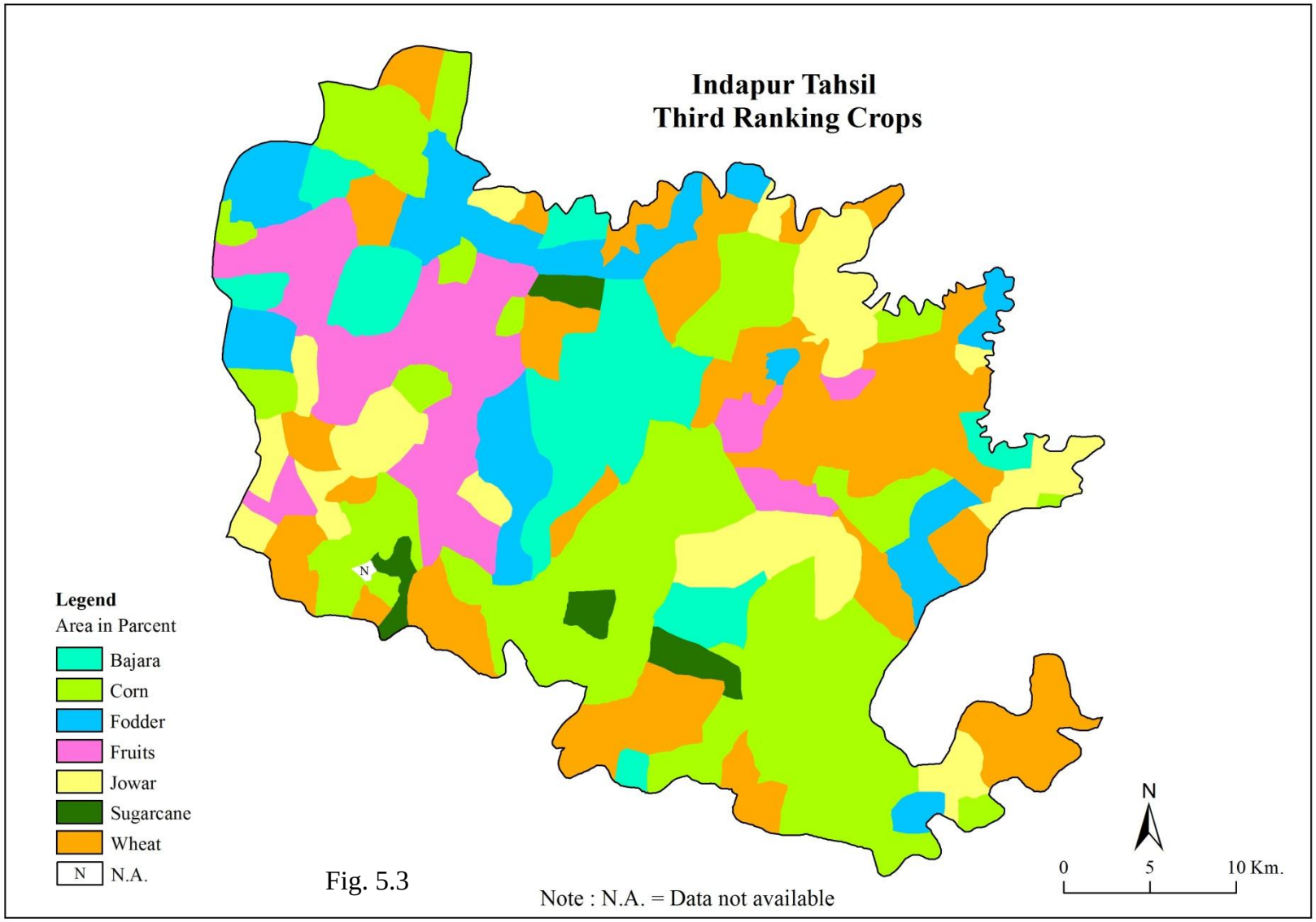

Fig. 5.3

Note : N.A. = Data not available

5.2.4 Forth Ranking Crops

All ten crops have entered in fourth rank namely, sugar cane, wheat, Bajara, fodder crop, corn, oilseeds jowar, fruit, pulses and vegetables Bajara is grown in eighteen villages on 1566 hectares (16.36 percent of total area) Major patches are observed in north and northeast part in Indapur Tahsil where the bajara as forth rank. Wheat ranks fourth position in twenty three villages on 1566 hectares in study area. (Fig.5.4 and Table-5.5).

Table- 5.5: Crops, Villages and Area in Forth Ranking

Sr. No.	Crops	Number of village	Percent of total village	Area in hectares	Percent total Area
1	Sugar Cane	6	8.82	844	8.82
2	Jowar	13	5.70	546	5.70
3	Corn	37	27.03	2587	27.03
4	Fruits	14	9.80	937.8	9.80
5	Wheat	23	16.29	1559	16.29
6	Fodder	26	15.11	1446.2	15.11
7	Bajara	18	16.36	1566	16.36
8	Pulses	1	0.47	45	0.47
9	Vege-tables	2	0.28	27	0.28
10	Oil Seeds	1	0.15	14	0.15
	Total	141	100	9572	100

Source : Computed by Researcher

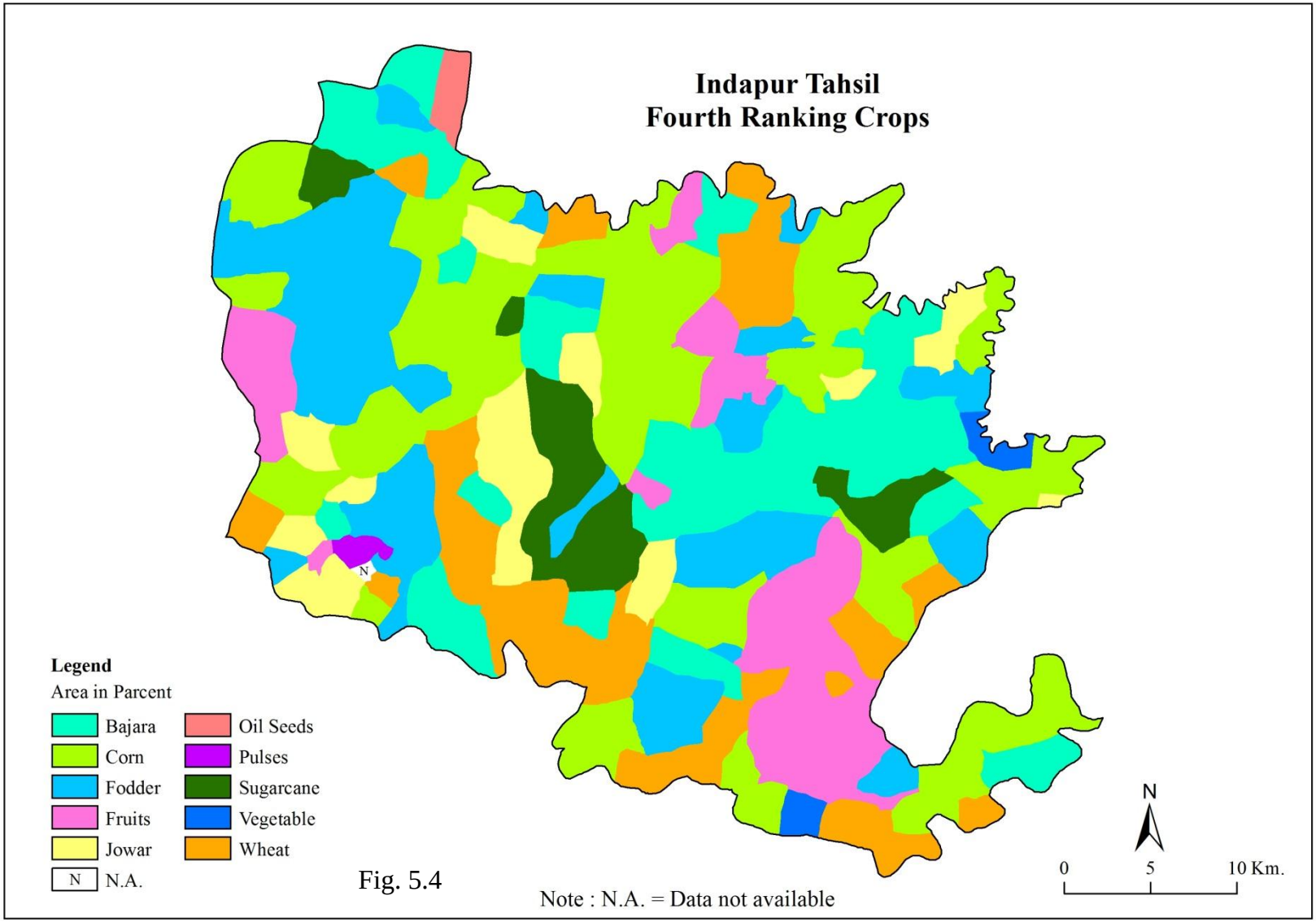

Fig. 5.4

Note : N.A. = Data not available

The cultivation of wheat is mainly observed in south and southeast part on deep black soil. Fodder crops are grown in twenty six villages on 1446.2 hectares. Two patches are found in west part and two patches in east part in study area. These crops support milk production. Corn is cultivated as a cash crop in study area. Corn ranks fourth in Indapur Tahsil in thirty seven villages. These villages are observed in all parts in study region. Vegetables are ranked as fourth ranking in Shaha and Kacharwadi. Jowar has ranked fourth in Sugaon, Bijwadi, Pondkulwadi and Tartgaon lying in east part in study area. Fruits are entered in forth ranking in Indapur Tahsil in fourteen villages. Pulses and Oilseeds have identified as forth rank in one village respectively. Sugarcane and jowar have found as forth rank in six and thirteen villages respectively.

5.2.5 Fifth Ranking Crops

Fodder crops, corn, bajara, oilseeds, wheat, jowar, pulses, vegetables, oil seeds and sugarcane have entered in fifth ranking in study area. Among these crops, fodder crop stands first in fifth ranking crop. (Table-5.6 and Fig.5.5) Fodder crops are grown in thirty two villages (22.7 percent of total villages) on 11.88.2 hectares. These villages are distributed all over the study region. Corn is in the third position in ranking twenty one villages have identified in this ranking and are distributed in four patches. Two patches having fourteen villages found east part in study area and remaining two patches are observed in west part in Indapur Tahsil. seven villages have observed corn as a fifth rank lying in central part in study region Bajara is found ranking as fifth in twenty nine villages on 1489 hectares and these villages are found scatter distribution in south east, southwest and north part in Indapur Tahsil. Oilseeds ranks fifth position in eight villages on 368 hectares in study area.

Table- 5.6: Crops, Villages and Area in Fifth Ranking

Sr. No.	Crops	Number of village	Percent of total village	Area in hectares	Percent total Area
1	Sugar Cane	5	3.55	230	3.42
2	Jowar	9	6.38	217	3.23
3	Corn	21	14.89	1549	23.03
4	Fruits	13	9.22	685.07	10.18
5	Wheat	14	9.93	672	9.99
6	Fodder	32	22.70	1188.2	17.66
7	Bajara	29	20.57	1489	22.13
8	Pulses	3	2.13	97	1.44
9	Vege-tables	7	4.96	232.1	3.45
10	Oil Seeds	8	5.67	368	5.47
	Total	141	100	6727.37	100

Source : Computed by Researcher

Three villages are identified west part in study area. Remaining five villages, namely, Nurtwadi, Kandalgaon, Kachrewadi, GalandWadi No. 1 and Lumewadi lie in east part in Indapur Tahsil. Wheat stands as fifth ranking in fourteen villages in study area. Wheat is mainly concentrated in part in study region. In three villages, jowar has fifth rank crop in 217 hectares area. These villages appear in north part in Indapur Tahsil. Northeast part in study area, three villages have found pulses as fifth rank crop. Sugarcane is stand tenth position in two villages in Indapur Tahsil.

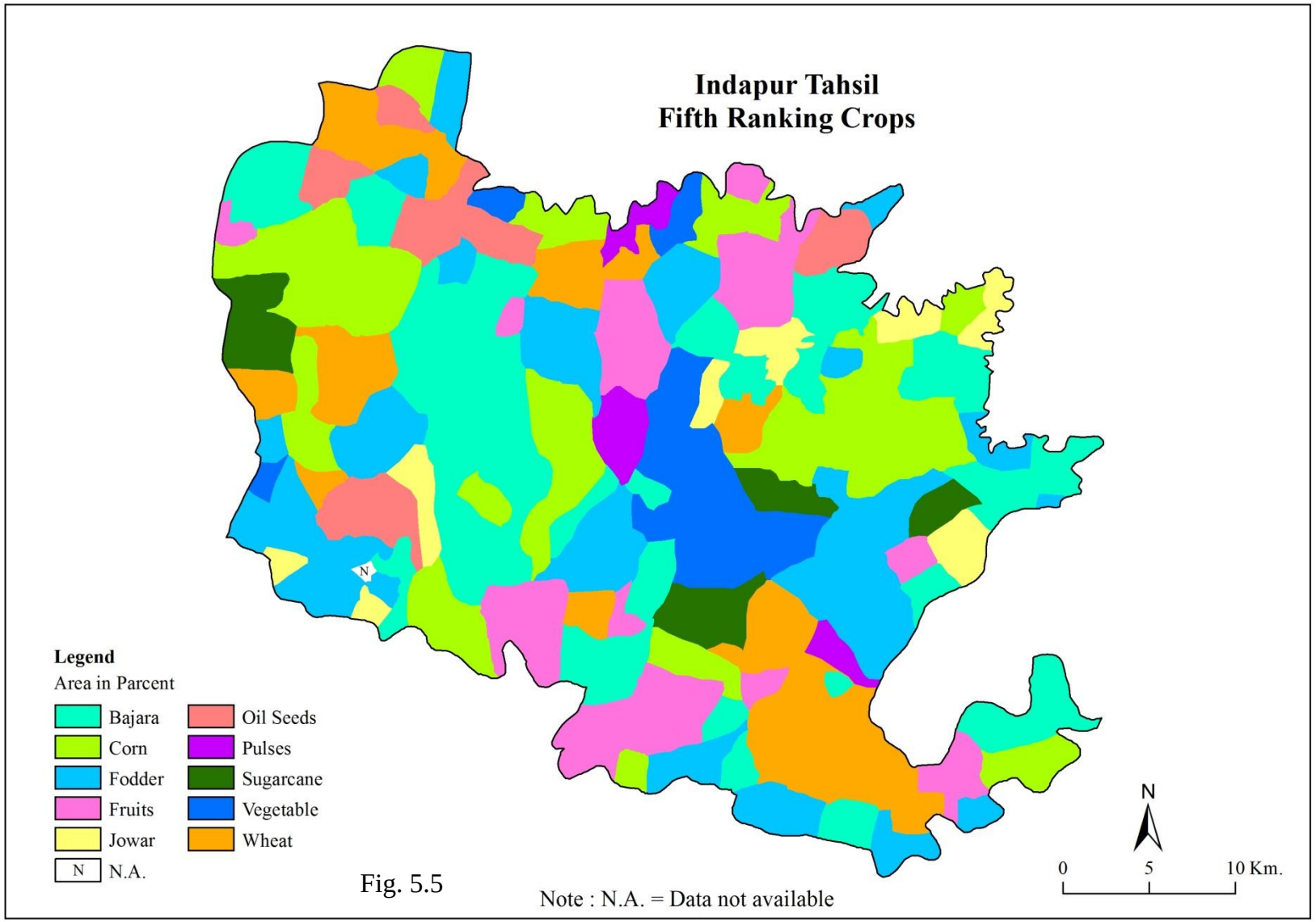

Fig. 5.5

Note : N.A. = Data not available

5.2.6 Sixth Ranking Crops

Ten crops have entered in sixth ranking, namely, corn, fodder crops, bajara, oilseeds, pulses vegetables, wheat, fruit, sugarcane and jowar. Corn stands as sixth rank in eleven villages covering 231 hectares (4.87 percent of total area) and have appeared into five patches. One major patch of five villages is found in central part in study area. Other four patches have observed in southeast, northeast and west part in Indapur Tahsil**.** (Fig. 5.6) Fodder crop ranks as sixth and is found in thirty one villages over 1199.1hectares (25.27percent of total area).

Table- 5.7: Crops, Villages and Area in Sixth Ranking

Sr. No.	Crops	Number of Villages	Percent of Total Villages	Area in Hectares	Percent total Area
1	Sugar Cane	2	1.42	70	1.48
2	Jowar	3	2.13	66	1.39
3	Corn	11	7.80	623	13.13
4	Fruits	16	11.35	466.57	9.83
5	Wheat	11	7.80	231	4.87
6	Fodder	31	21.99	1199.1	25.27
7	Bajara	29	20.57	954	20.11
8	Pulses	11	7.80	280	5.90
9	Vege-tables	19	13.48	670.8	14.14
10	Oil Seeds	8	5.67	184	3.88
	Total	141	100	4744.47	100

Source : Computed by Researcher

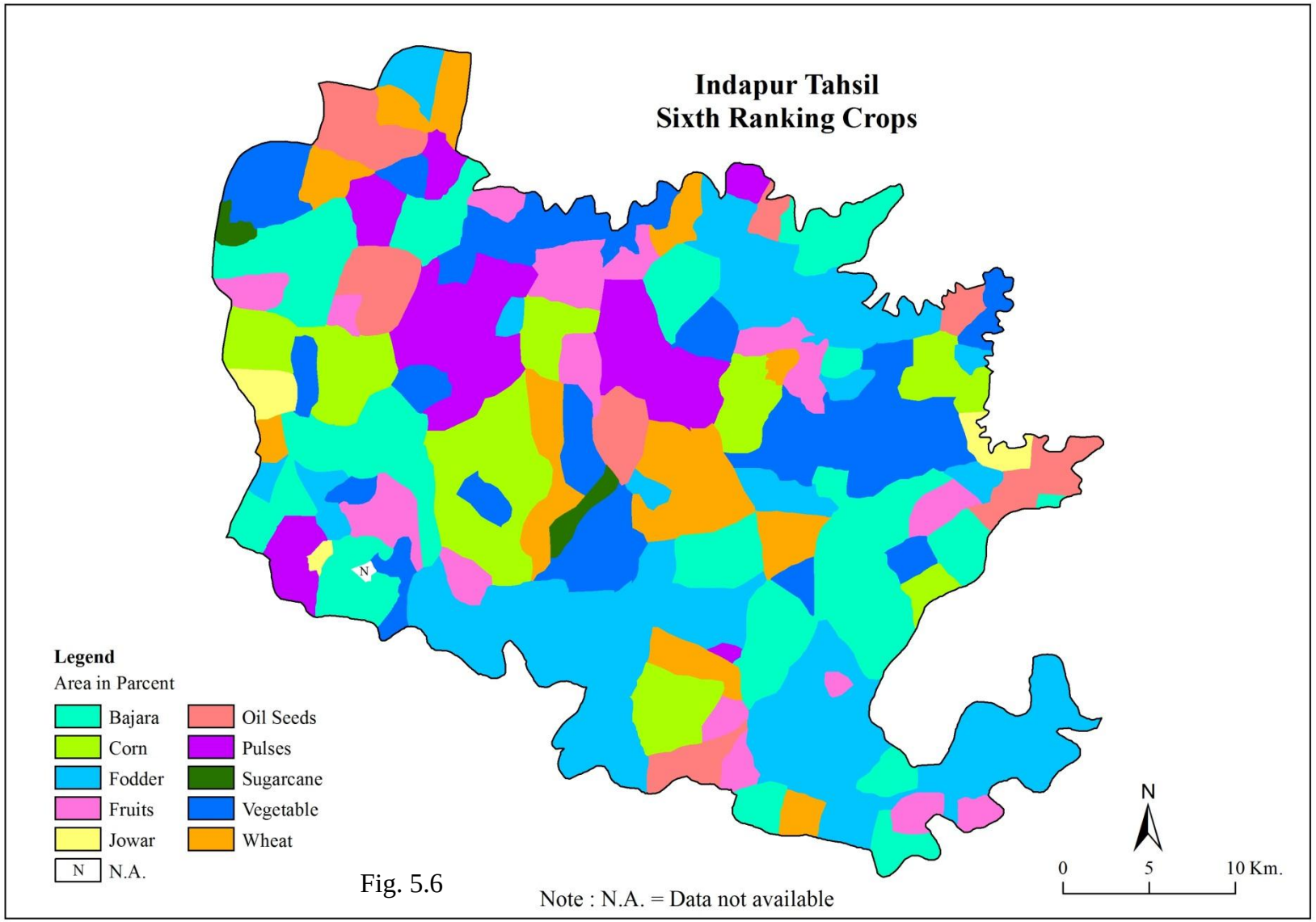

Fig. 5.6

Note : N.A. = Data not available

These villages are distributed all parts in study area. Bajara stands as sixth rank in twenty nine villages (20.57 percent to total villages) Bajara is drought resistant crop and is distributed throughout study area. Oilseeds rank sixth in eight villages. These villages are observed in central and east part in Indapur Tahsil. Pulses are found in eleven villages as sixth rank. These villages have spreaded all over parts in study area. Vegetables are observed as sixth ranking crop in study area in nineteen villages, namely, Diksal, Vaysewadi, Dalaj No. 3, Pilewadi, Udhat, and Surwad. These villages have found in west part in study area. Eleven villages of wheat show the sixth rank of Indapur Tahsil. Fruits are identified as sixth ranking crop in study area in sixteen villages. These villages found in north part of study region. Hagarewadi and Lamjewadi cultivate sugarcane as sixth rank crop and these villages are observed in central part one village in northwest part of study region. Shaha, Nimbodi and Mankarwadi cultivate jowar and these villages are located in northwest and east parts.

5.2.7 Seventh, Eighth, Ninth and Tenth Ranking

The crops, namely, vegetables, bajara, fodder crops, oilseeds, and fruit are major crops have entered in seventh ranking in one hundred nine villages in Indapur Tahsil. (Fig.- 5.7). These crops are distributed in all parts in study area. Pulses, oilseeds, vegetables, wheat and fruits are included in eighth ranking crops in one hundred eighteen villages. The distributions of these crops in study region are patchy in nature. Fig 5.8 displays the distribution of eighth ranking crops. In ninth ranking vegetables, pulses and oilseeds are the major crops. Pulses have found highest area under ninth ranking crops. (Table-5.8 and Fig.5.9). Oil seeds are cultivated in forty five villages as tenth ranking crop. Vegetables and pulses stand tenth position in thirty three and thirty seven villages respectively in Indapur Tahsil. (Table-5.8 and Fig.5.10)

Table - 5.8: Crops and Villages in Seventh, Eighth, Ninth and Tenth Ranking

Sr. No.	Crops	Rank Order							
		VII Rank		VIII Rank		IX Rank		X Rank	
		Number of Villages	Percent of Total Villages	Number of Villages	Percent of Total Villages	Number of Villages	Percent of Total Villages	Number of Villages	Percent of Total Villages
1	Sugar Cane	2	1.42	2	1.42		0.00	2	1.42
2	Jowar	1	0.71	4	2.84		0.00		0.00
3	Corn	5	3.55		0.00		0.00		0.00
4	Fruits	20	14.18	17	12.06	12	8.51	18	12.77
5	Wheat	14	9.93	17	12.06	8	5.67		0.00
6	Fodder	20	14.18	7	4.96	3	2.13	1	0.71
7	Bajara	24	17.02	10	7.09	9	6.38	5	3.55
8	Pulses	10	7.09	29	20.57	50	35.46	37	26.24
9	Vege-tables	27	19.15	28	19.86	25	17.73	33	23.40
10	Oil Seeds	18	12.77	27	19.15	34	24.11	45	31.91
	Total	141	100	141	100	141	100	141	100

Source : Computed by Researcher

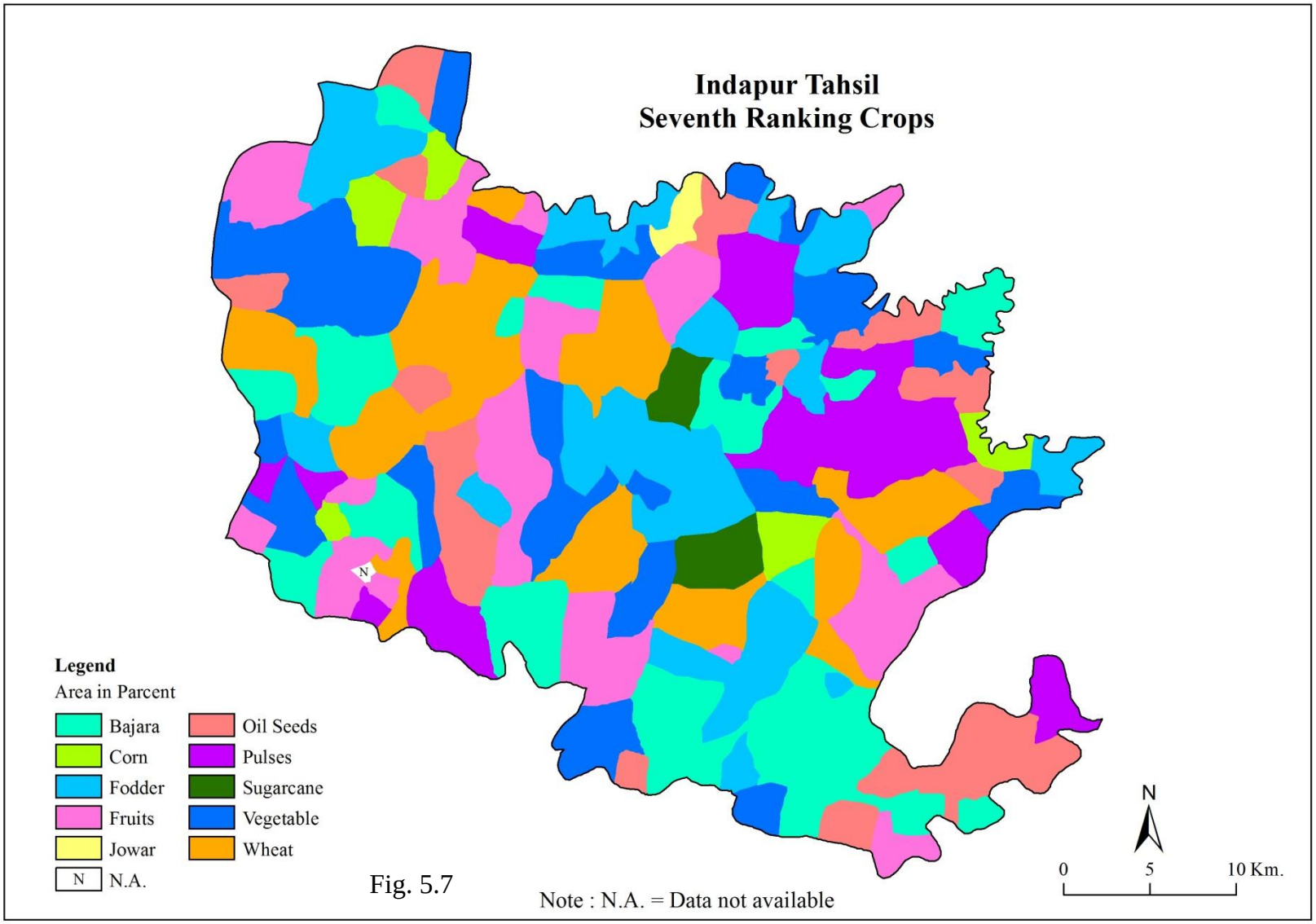

Fig. 5.7

Note : N.A. = Data not available

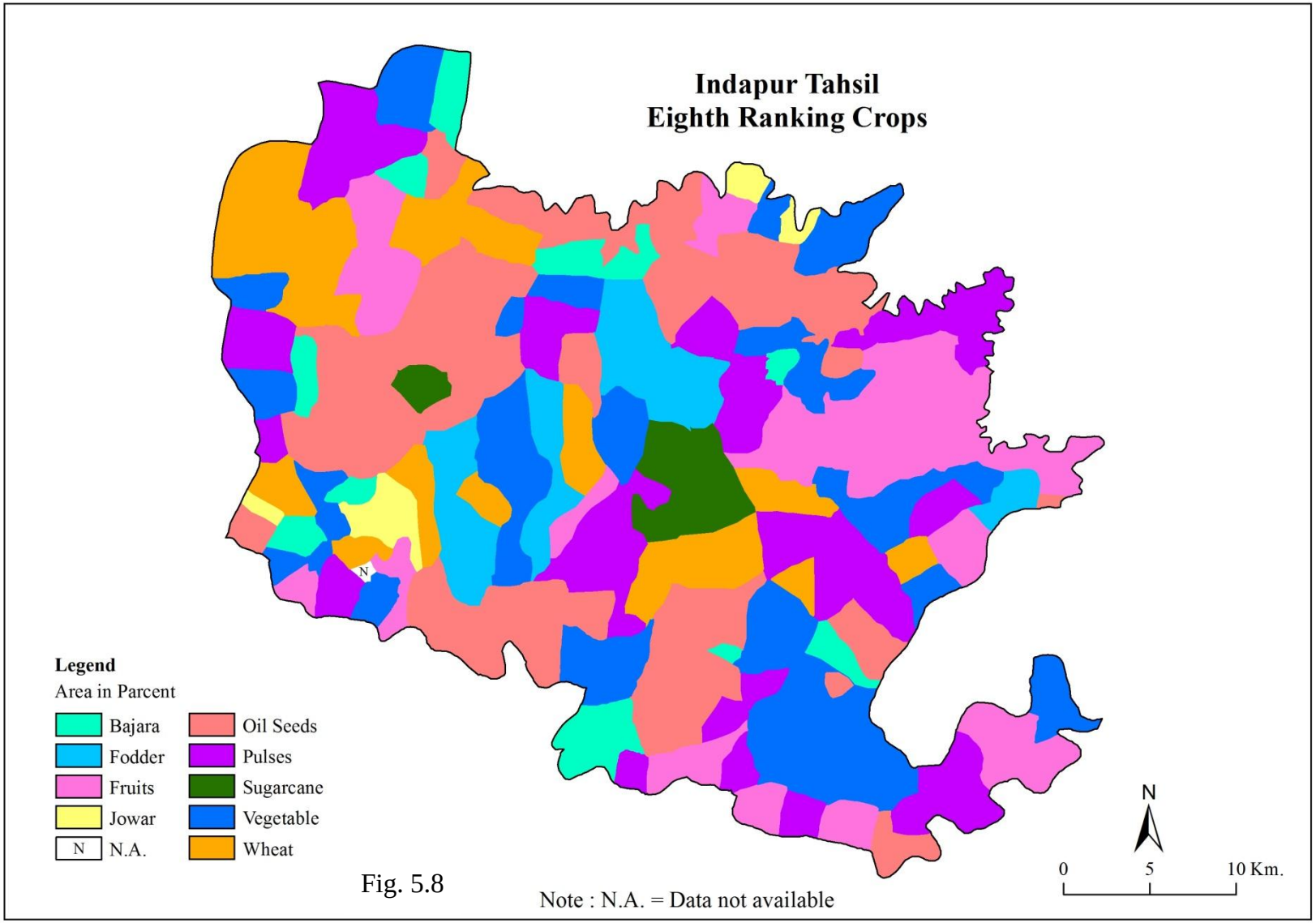

Fig. 5.8

Note : N.A. = Data not available

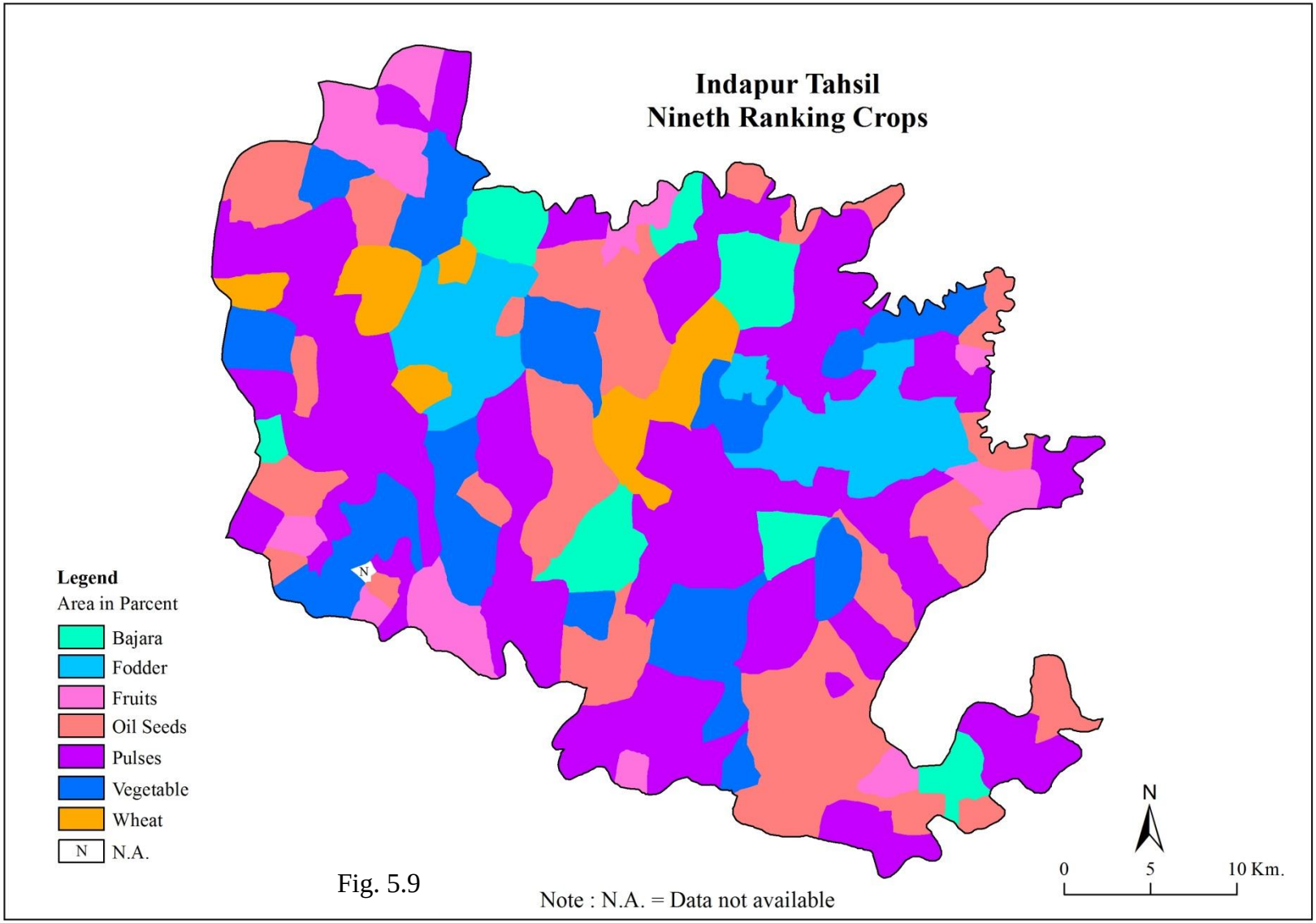

Fig. 5.9

Note : N.A. = Data not available

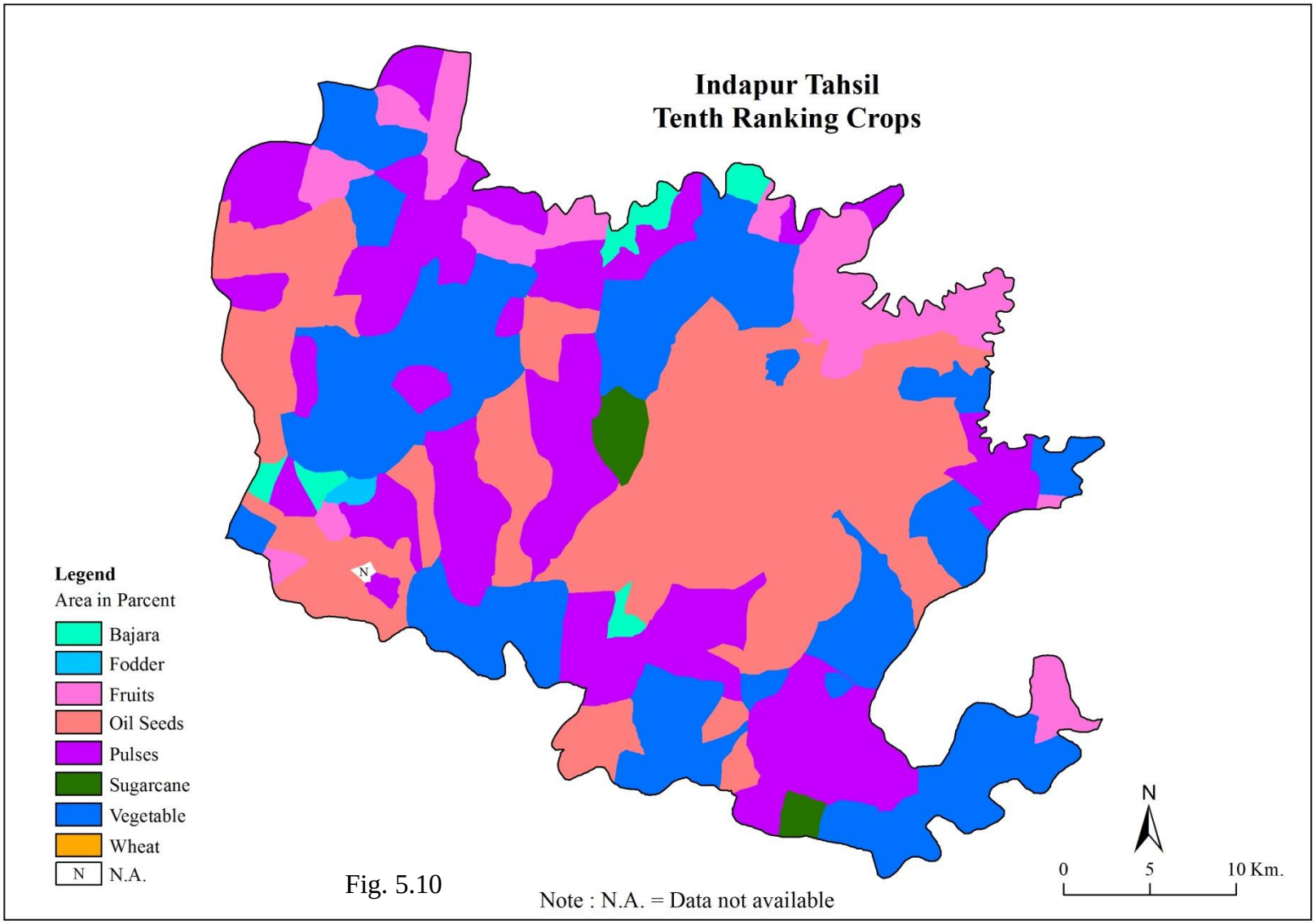

Fig. 5.10

Note : N.A. = Data not available

5.3 Crop Combination Regions

The combination analysis was initially introduced in geography by Weaver in 1954 for computing crop combination for Midwestern United States. In addition, the technique can also be applied to identify and locate areas sharing a significant proportion of a single agricultural element or crop at higher rank. The principal of combination analysis is, thus, promises to be an important tool of statistical studies in various fields of geography particularly in agricultural geography.

Crops are generally grown in combinations (Weaver, 1954). The study of crop combination of any region has gained importance in geographical study. It gives us the relative position of crops on regional scale. Farmers grow crops in varied physical and cultural conditions. The pattern of crop combination gives rise to spatial predominance of certain crops or combination result in the emergence of crop regions. Such analysis would ultimately minimize the change of oversimplified generalization. Crop combination study in geography is fruitful in many ways; firstly it provides an adequate understanding of an individual crop. Secondly, combination is itself an integrative reality that demands definition and distribution analysis, and finally, crop combination regions are essential for the construction of more complex structure of vivid agricultural region.

The study of crop combination, thus, forms an integral part in agricultural geography. A number of quantitative and qualitative methods have been introduced for determining crop combination regions. The crops are arranged and ranked in hierarchical order and then crop combinations are obtained. The ease of these methods is the simplicity in calculation. Moreover, these quantitative techniques are more precise, accurate and scientific than qualitative methods. Weaver has made first attempt to

delineate agricultural regions for Middle-east Countries in 1954. Later on, many methods have introduced. Thomas in 1963 has modified Weaver's formula by including all crops with zero percent theoretical values in each step of the method and crop combination has studied in Wales but it did not yield different results than obtained by Weaver's method. The Weaver's technique was subsequently modified by Doi in 1959 wherein he supplied one sheet table required only for summing up of actual percentages under different crops instead of finding differences between actual percentage and theoretical distribution. Looking at this weakness, Rafiullah in 1965 has modified Weaver's method and introduced a new method known as "Maximum Positive Deviation Method" by applying same statistical procedure in different format.

The modified formula of Rafiullah is as below:

Formula- $d = \sqrt{\frac{\sum D_p^2 - D_n^2}{N^2}}$

Where

d = deviation

N = number of crops

D_p = Positive difference

D_n = Negative difference

The statistical technique adopted by Rafiullah is more accurate and rational and therefore it is quite popular for delineation of crop combination regions. According to this method percent of all crops have arranged in descending order for 143 villages. The crops having area less than 5 percent were omitted from the calculation and maximum positive deviation of variance was obtained. For monoculture medial value was considered at 50 percent for two crop combination it is 25 percent, three crop combination the value is 16.7 percent, for four it is 12.5 percent and for five crop it is 10 percent and so on. In present study area, 10 crops were considered for computation of crop combination region. The obtained

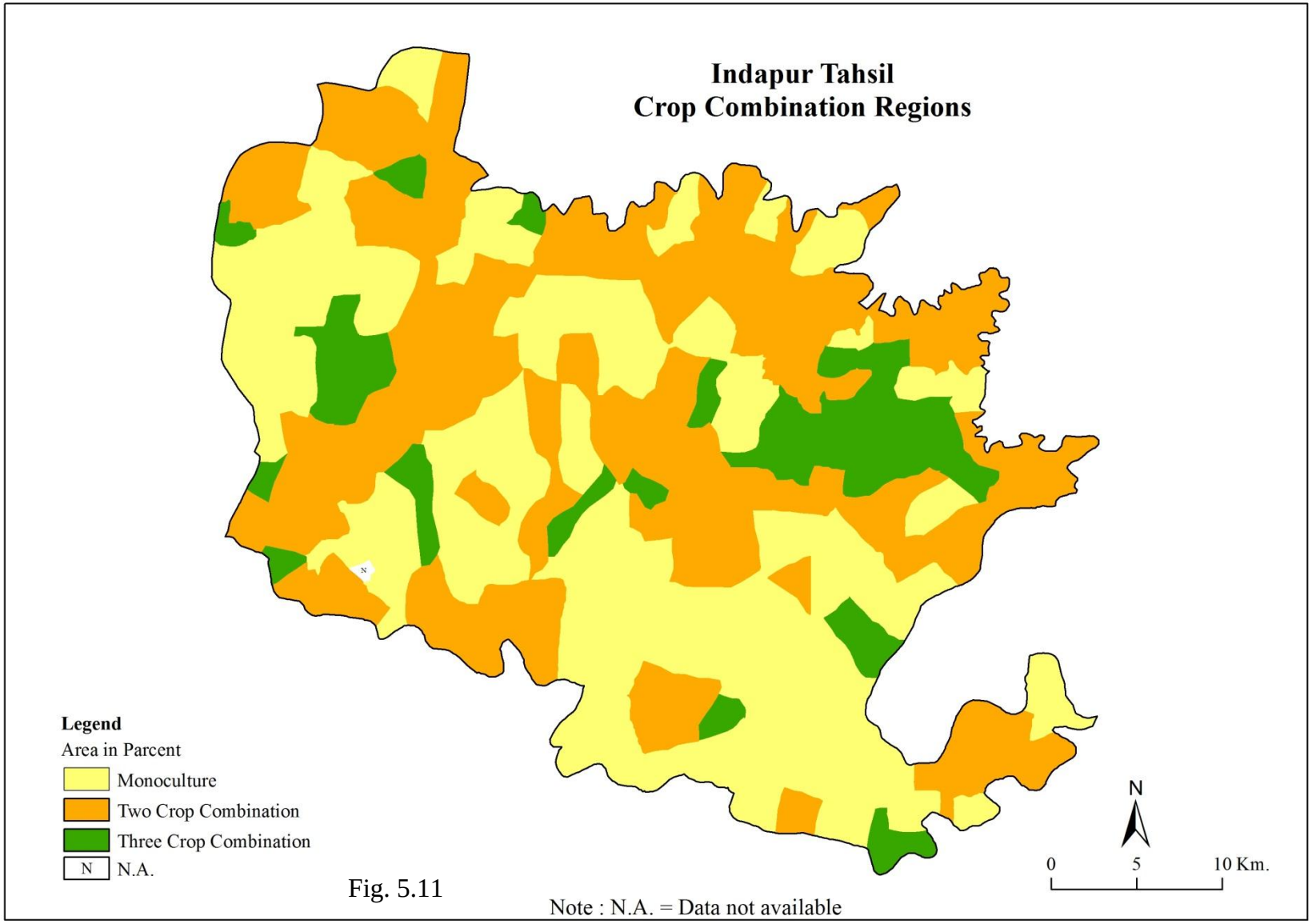

Fig. 5.11

Note : N.A. = Data not available

results of crop combination have shown in Fig.5.11and Table-5.9. Three crop combination regions have been identified in Indapur Tahsil by applying Rafiullah's method.

Table-5.9: Crop Combination Regions

Sr. No.	Types of Crop Combination	Number of Villages	Percent to Total Villages
1	Monoculture	61	43.26
2	Two crop Combination	63	44.68
3	Three crop Combination	17	12.06
	Total	141	100

Source: Computed by Researcher

5.3.1 Monoculture

Jowar, sugarcane, corn and fruits crops have identified as monoculture in Indapur Tahsil (Fig. 5.12). These four crops are sown in sixty one villages (43.26 percent to total villages). Among these four crops sugarcane is leading crop cultivating the highest coverage in thirty three villages (Table 5.10).

This crop is grown on 9308 hectares area. Irrigation and fertile soil are major factors for growing sugarcane along the bank of Bhima and Nira rivers. These villages are lying in central, east, north and south parts in study region on deep soil and irrigation. Dalaj No. 1, Dalaj No. 2, Sarafwadi, Kalthan No. 2 Malwadi No 1 etc. villages in north part and Sarathi, Gondi, Nasingpur, etc. villages found in east part of Indapur Tahsil.

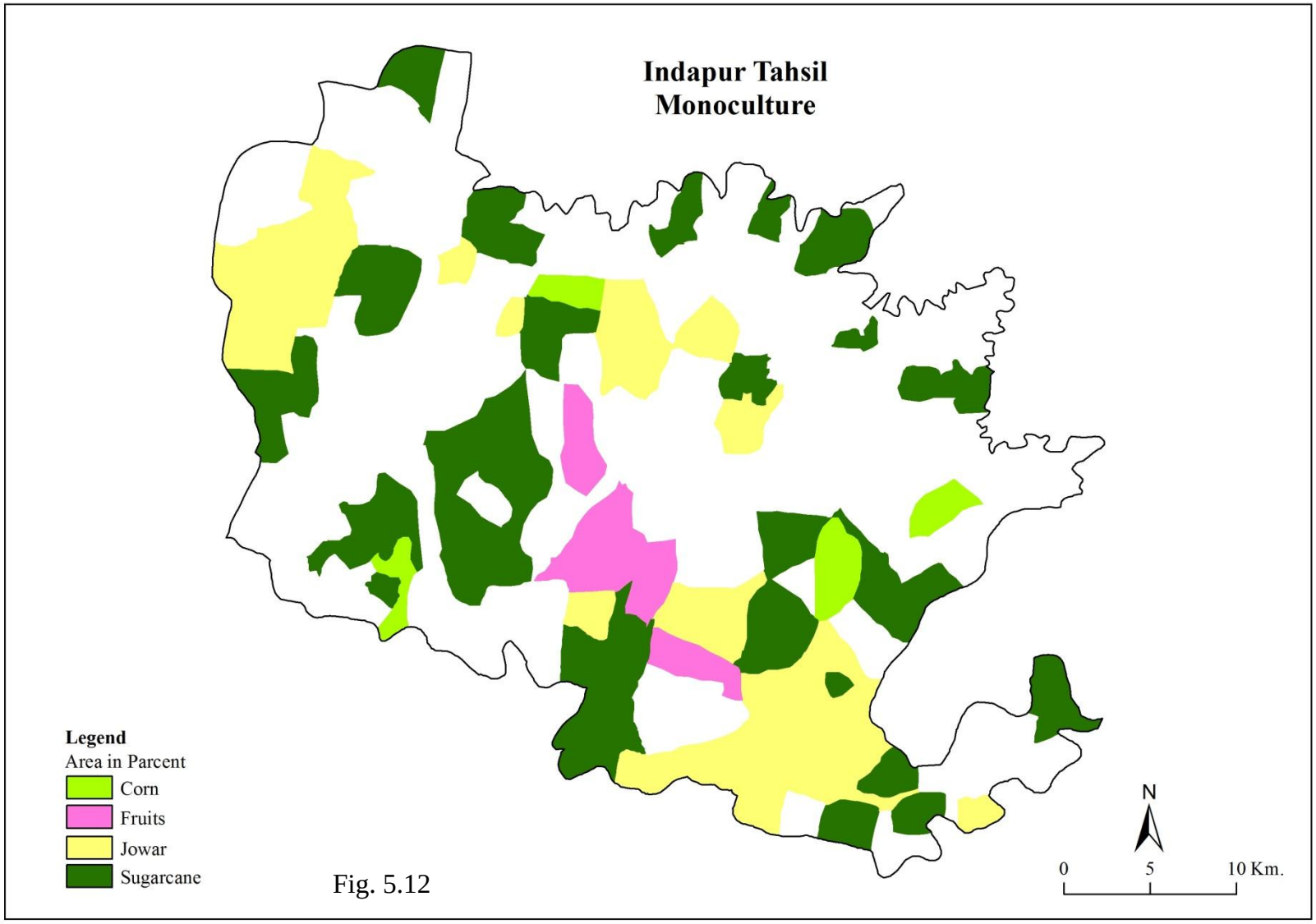
Indapur Tahsil
Monoculture
Legend
Area in Parcent
Corn
Fruits
Jowar
Sugarcane
N
0
5
10 Km.

Fig. 5.12

Table-5.10: Crop Combination Regions and Crops

Crops Combination Regions	Crops in Combination	No. of Villages	Percent to Total Village	Area in Hectares	Percent of Area
Monoculture	S	33	54.10	9308	53.20
	J	20	32.79	5587	31.93
	F	4	6.56	1955.4	11.18
	C	4	6.56	647	3.70
Two crop	SJ	24	38.10	18117	45.78
Combination	SW	12	19.05	6246	15.78
	SC	10	15.87	2756	6.96
	JFO	7	11.11	6714.9	16.97
	SF	5	7.94	3217.18	8.13
	SFO	3	4.76	696	1.76
	CFO	1	1.59	1007	2.54
	JC	1	1.59	818	2.07
Three Crop	SJC	5	29.41	2816	28.17
Combination	SJW	4	23.53	4824	48.26
	SJF	2	11.76	1090.19	10.91
	SCW	2	11.76	285	2.85
	SCF	1	5.88	186.8	1.87
	SJB	1	5.88	170	1.70
	JCW	1	5.88	436	4.36
	JCB	1	5.88	188	1.88

Source : Computed by Researcher

Note : J = Jowar S = Sugarcane B = Bajara W = Wheat

C = Corn F = Fruit FO = Fodder crops

Khorochi, Zagadewadi etc. villages are identified in south part in study area as a monoculture of sugarcane crop. Jowar is identified as monoculture in twenty villages. Jowar belt is concentrated in southeast, north and west parts in study region. Ozare, Chakati, Kati, Lakadi etc. villages laying in southeast part of study area. Pimpale, Nirgude, and Mhasobachiwadi villages have jowar as a monoculture due to this part of study area has light brown shallow soil and scarcity of water.

Corn and fruits are both crops have monoculture in four villages. Corn is found in central part of study area as monoculture in villages namely Vadapuri, Galndwadi No.2, Thoratwadi and Mradwadi. Fruits are identified monoculture in Gotandi, Shelgaon, Pitkeshwar and Reda villages have 1955.4 hectors (11.18 percent) area in Indapur Tahsil.

5.3.2 Two Crop Combination Regions

Six crops have entered in two combination of sugarcane, jowar, wheat, corn, fodder and fruits. Fig. 5.13 and Table–5.10 reveals two crop combination regions in Indapur Tahsil. Sugarcane has largest area entering in this combination with jowar, wheat, corn and fruits. Twenty four villages in study area have combination of sugarcane with jowar located in central and north parts in Indapur Tahsil. Hingangoan, Kandalgoan, Ajoti, Sugaon, GalandWadi No. 1 and Taratgaon lying central and east parts and are entered in combination of sugarcane with wheat. Bori, Bharnewadi, Sansar, and Jachakwasti are lying in southwest and Rajwadi lying in east parts have found two crop combination of sugarcane and fruit crops.

Chikhali, Padasthal and Pimpri Kh. villages are dairy dominating area in Indapur Tahsil having combination of sugarcane and fodder crops. Jowar and corn crop combination appeared in Tarngwadi, lying in east part

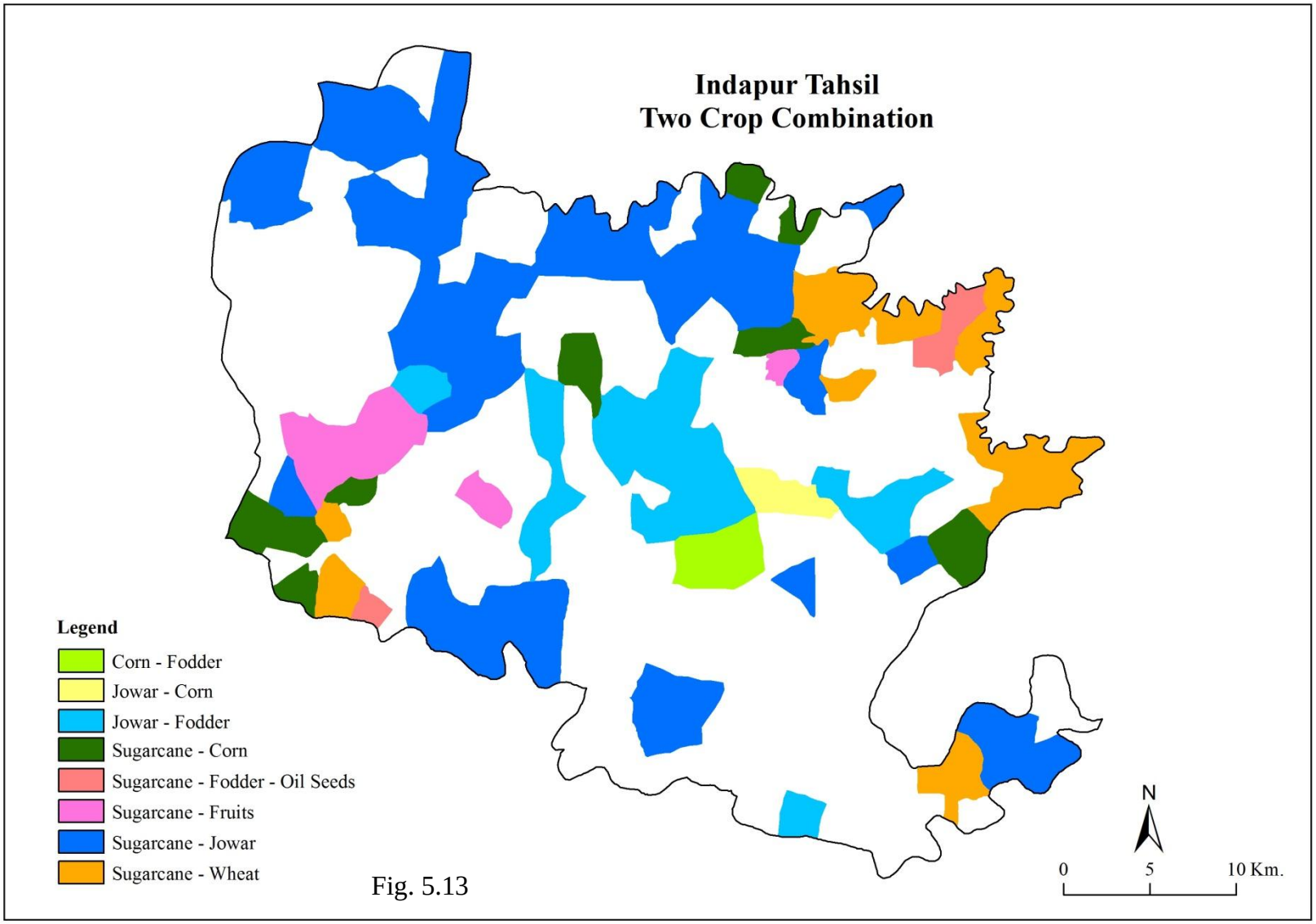
Indapur Tahsil
Two Crop Combination
Legend
Corn - Fodder
Jowar - Corn
Jowar - Fodder
Sugarcane - Corn
Sugarcane - Fodder - Oil Seeds
Sugarcane - Fruits
Sugarcane - Jowar
Sugarcane - Wheat
N
0
5
10 Km.

Fig. 5.13

have two crop combination. Varkute Kh. has combination of corn with fodder crops found in east part of study area. Jowar with fodder crops combination found in seven villages in central part of study area.

5.3.3 Three Crop Combination Regions

Three crop combination covers 9995 hectares of area in Indapur Tahsil (Fig. 5.13). In this combination namely, sugarcane, jowar, wheat, bajara, fruit, and corn have entered. Four villages have found three crop combination of sugarcane combined with jowar and wheat. Indapur, Sardewadi, Narutwadi and Dalaj No. 3 villages are lying on deep black soil in north and east part. Kazad and Sapklawadi have found three crop combination where sugarcane combined with jowar and fruits. Jowar combined with sugarcane and corn at Lakhewadi, Kacharwadi, Bhandgarwadi, Bhandgoan, and Lumewadi lie in southeast on deep black soil area in study region. Bajara has combined with sugarcane and jowar in Vaysewadi lie in west part on medium light shallow brown soil in study area. Karewadi and Gholapwadi have three crop combination and here sugarcane is entered with wheat and corn. Fruits have entered with sugarcane and corn in Jankshan in southwest part in Indapur Tahsil. Jowar and corn combine with bajara and wheat in Lamjewadi and Hagarwadi respectively.

5.4 Crop Diversification Regions

The term crop specialization indicates cultivation of fewer numbers of crops and crop diversification implies rising a variety of crops form the soil. The keener the competition the higher the magnitude of diversification and lesser the diversification the grater will be the trend towards specialization or monoculture farming where emphasis is on one or two crops. Diversification means the raising a variety of crops. The cultivation

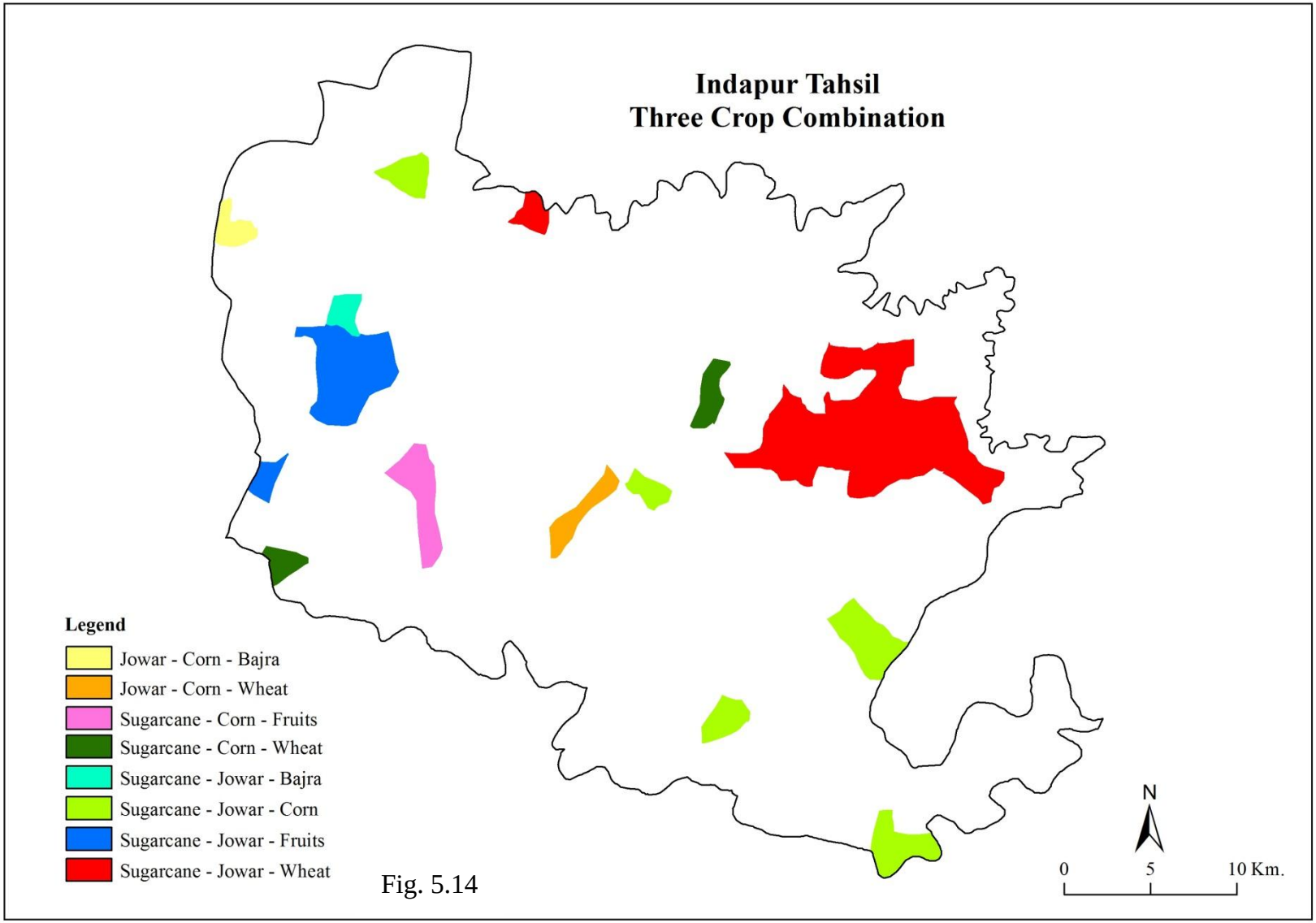
Indapur Tahsil
Three Crop Combination
Legend
Jowar - Corn - Bajra
Jowar - Corn - Wheat
Sugarcane - Corn - Fruits
Sugarcane - Corn - Wheat
Sugarcane - Jowar - Bajra
Sugarcane - Jowar - Corn
Sugarcane - Jowar - Fruits
Sugarcane - Jowar - Wheat
N
0
5
10 Km.

Fig. 5.14

of crop depends on physical and socio-economic variables. Crops are diversified in the field due to erratic nature of rainfall and insufficient irrigation. Farmers grow many crops in order to sustain. Many geographers and economists have applied diversification concept in different sense. Initially this concept was applied in manufacturing field to obtain the degree of diversification by Cleann (1930), Tree (1938), Florence (1942) and Rainwald (1949).

Gibbs Martin has applied diversification concept for computing measurement of diversification of employment in industry. Bhatia (1965) has computed crop diversification in India to understand crop combination in the region. This formula is later on, modified by Jasbir Singh in 1976 and Ayyer in 1969. According to Bhatia crop diversification means the land occupying for variety of crops which occupy at least one percent to gross cropped area. The study of crop diversification is essential to understand the competition of crops in any region. In order to identify the crop diversification, Gibb's Martin's Index has applied for 141 villages in Indapur Tahsil. This formula is as follows:

Formula-

$$\textbf{Index of Diversification} = 1 - \frac{\sum X^2}{(\sum X)^2}$$

Where

X = Percentage of total cropped area occupied by each crop or hectare age under individual crop.

If the total cultivated area in region is devoted wholly to one crop showing specialization, the index value will be zero (Singh, 1984).

Crop Diversification Regions

Fig. 5.15 presents crop diversification pattern in Indapur Tahsil. The maximum crop diversification appears in Paritwadi (0.86) located in

the southwest and lowest at Mhasobachiwadi (0.42) in west parts in study area. It is seen that whole study area is divided into three crop diversification regions fallows as:

1. Area of high crop diversification
2. Area of moderate crop diversification, and,
3. Area of low crop diversification

It is observed that the smallest area appears in the low crop diversification covering 0.71 percent villages in Indapur Tahsil. Low crop diversification is observed in one village it is Mhasobachiwadi (0.42) which lying in west part in Indapur Tahsil.

Table-5.11: Crop Diversification Regions

Sr. No.	Types of Diversification	Value	No. of Villages	Percentage of Villages	Gross Cropped Area	Area in Percent
1	High Diversification	0.70 to 1.00	92	65.25	73256.4	61.58
2	Moderate Diversification	0.35 to 0.70	48	34.04	44495.0	37.41
3	Low Diversification	0.00 to 0.35	1	0.71	1200.9	1.01

Source: Computed by Researcher

Moderate diversification is found in forty eight villages which are observed in six patches. Among these six patches one dominating patch of five villages namely, Shetphalgade, Madanwadi. Kumbhrgaon, Takrarwadi, Akole and Kalewadi have identified in the northwest part of study area. Another five patches are found in south and east part in Indapur Tahsil. Crops in this diversification are less in number than the high diversification due lack of the irrigation.

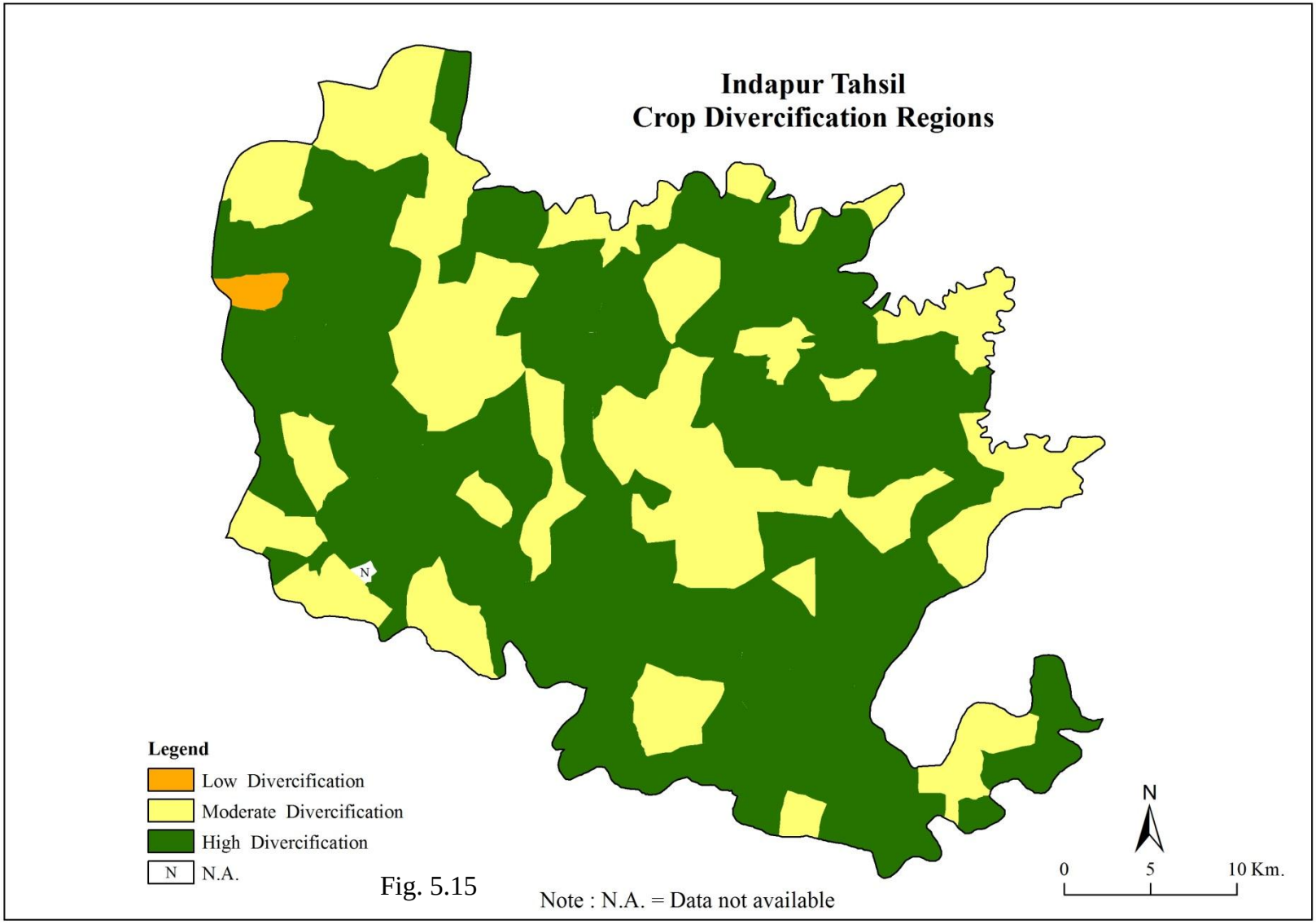

Fig. 5.15

Note : N.A. = Data not available

The area of high crop diversification is visible from Fig 5.15 ninety two (65.25 percent) villages come under this region and largest numbers of crops are found in high degree of crop diversification. The index value ranges 0.70 to 0.90. These villages are found in north, west and south parts in study region.

5.5 Resume

In order to attempt an exposition of agricultural land use pattern in Indapur Tahsil, village has considered as unit for studying crop ranking, crop combination and diversification. Sugarcane, jowar corn and fruits are found as the first ranking crops. Sugarcane covers the largest areal extent followed by Jowar. Sugarcane is main crop ranking the first in the study region. Irrigation facility and fertile soil are responsible for growing sugarcane in north and southwest parts in Indapur Tahsil. This crop is grown on 28719 hectares area accounting 55.10 percent in 89 villages. Jowar is identified as the second crop in first ranking in study area and it is grown in 41 villages (29.08 percent) Corn has identified as the first ranking crop grown on 647 hectares in four (2.84) villages. Fruit is observed as first ranking grown on 4096.8 hectares area (7.86 percent) in seven villages lying in central part of study area. This is mainly drip irrigated area in Indapur Tahsil. The second ranking crop presents relatively large number of crops than those of first ranking. Sugarcane jowar, corn, fruit, wheat, fodder crop and bajara, have ranked second in the study region. Seven crops have entered in the third ranking in Indapur Tahsil. All the ten crops namely sugarcane, jowar, corn, fruit, wheat, fodder crop, bajara, oil seeds, pulses and vegetables are enter in the fourth ranking crops in Indapur Tahsil.

Three crop combinations are found in study area. Monoculture has appeared in sixty one villages having sugarcane, jowar, corn and fruits

entered in this combination. Sugarcane is identified as monoculture in thirty three villages. Jowar is cultivated in twenty villages in study area. Two crop combination is found in sixty three villages whereas three crop combination in seventeen villages.

Ninety two villages have high diversification and forty eight villages have moderate diversification on fertile soil and irrigated area. The high diversification of crops is observed on 61.58 percent of gross cropped area. Low diversification is confined on light brown shallow soil in west part in Indapur Tahsil.

CHAPTER-VI

AGRICULTURAL PRODUCTIVITY AND DEVELOPMENT

6.1 General Introduction:

The previous Chapter-V "Crop Combination and Diversification" explained crop regions by taking into account the area under crops in Indapur Tahsil. The present chapter is fully dedicated to focus on the production aspect and development in the study area. The knowledge of existing levels of productivity is necessary for better planning and management for the development of backward areas. The population has been rapidly growing and as result it land needs to be managed properly. Here an effort has been made to identify the agricultural productivity regions and agricultural developed regions of Indapur Tahsil and the factors involved in it. Hence, it is crucial to make a detailed study of each crop and its production. It is also difficult to study the agricultural development of all villages. Therefore to study agricultural productivity and agricultural development of Indapur Tahsil, one village has selected as a sample by simple random method from each Agricultural Circle namely Bhigwan, Palasdev, Loni devkar, Indapur, Bawada, Kati, Anturane and Sansar. The questioner survey was carried out in selected sample villages to fill up questioners by farmers of the villages. (Appendix-F) Data regarding agricultural productivity and agricultural development has been collected.

6.2 Agricultural Productivity:

It is the term 'Productivity' which is regarded as the mensuration of production. Rao and Jasbir Singh (1981) considered "Productivity as the degree at which the economic, cultural, technical and organizational

variables can exploit the biotic resources of the area for agricultural production".

Agricultural Productivity is a relationship of a large number of factors such as environmental, socio-economic and technological factors. Agricultural efficiency is a ratio between the achievements in terms of agricultural production and the actual potential of the productivity. Agricultural efficiency is a physical concept rather than a value concept and it describes the changing relation between output and one of the major inputs like land, labour and capital. Bhatia (1967) defined Agricultural efficiency as "the aggregate performance of different crops in regard to their output per acre". Singh (1979) defined Agricultural Productivity as "The quality of returns from arable land". He argued that quantity of produce shows its intensity and the spatial expansion. Agricultural Productivity is a multi-dimensional concept which includes technological advancement, effective management of available resources and organizational set up for the agricultural production. Therefore, the study of Agricultural Productivity is necessary for differentiating and confining the areas whose performance and attainments are deviated and also it is helpful for formulating a future oriented plan of action for agricultural planning.

Singh and Dillon (2000) suggested that the "Yield per Unit" should be considered to reveals Agricultural productivity. This may be defined as "Ratio of index of local agricultural output to the index of total input utilized in farm production" (Shafi, 1984). It is, therefore, a measure of efficiency with which the inputs are used in production, if other things are equal.

Agricultural productivity here refers to the returns from arable land or cultivable land unit. Productivity of labour is important as a determinant

of the income of the population involved in agriculture. In general, it may be expressed by the man hours or days of work needed to produce a unit of production.

Agricultural Productivity is generally regarded from two directions:

(a) Productivity of land.

(b) Productivity of infrastructure engaged in Agriculture.

Productivity of land is closely linked with the productivity of infrastructure. So in this study area, efforts have been made to assess the spatial differences.

- **Enyedi's Productivity Index:**

Enyedi, G.Y. (1964) while describing geographical types of agriculture in Hungary refers to his formula of productivity index for deciding Agricultural Productivity. Shafi (1972 and 1974) also adopted this approach to decide the productivity indices in respect of twelve food crops in India. Enyedi's Productivity Index is used for this research work. His formula for evaluating productivity co-efficient involved the spatial distribution of productivity for major crops and later mapping and interpreting it by utilising Enyedi's Index.

$$\text{Productivity Index} = \frac{Y}{Y_n} \div \frac{T}{T_n} \times 100$$

Where

Y = Production of selected crop in a unit area

Y_n = Total production of selected crop in entire region

T = Area under selected crop in a unit area

T_n = Area under selected crop in entire region

6.2.1 Productivity of Jowar

The spatial distribution of productivity of jowar is shown in Table 6.1 and Fig. 6.1. It is observed that local topography, soil type and irrigation influence the productivity of jowar. Least productivity is recorded in the three region of study region. These regions are, Loni Deokar (65.85), Indapur (74.09), Palasdev (65.85) and Bhigwan (82.32), agricultural circle where maximum area is under sugarcane cultivation and corn cultivation and jowar mix crop cultivation in this area. Jowar crop requires less amount of water. It is a drought resistant crop.

Table 6.1 Productivity of Jowar

Agricultural Circle	Area (Hector)	Production in Quintal/Hector	Total Production (Quintal)	Index of Productivity
Anthurne	159	18	2862	148.17
Bawada	830	13	10790	107.01
Bhigwan	147	10	1470	82.32
Indapur	840	9	7560	74.09
Kati	650	15	9750	123.48
Loni	98	8	784	65.85
Palsdev	19	8	152	65.85
Sansar	40	11	440	90.55

Source: Computed by Researcher

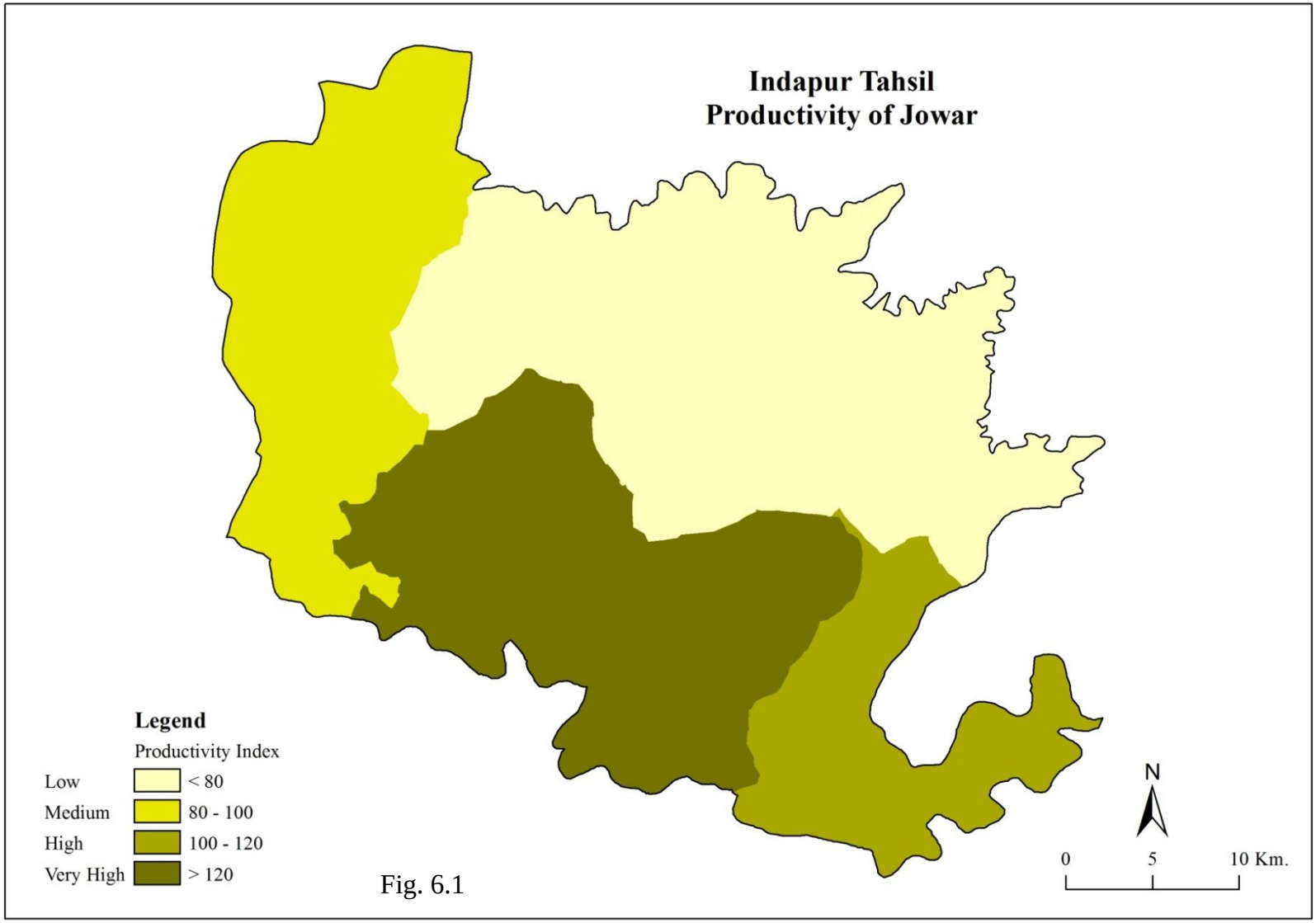
Indapur Tahsil
Productivity of Jowar
Legend
Productivity Index
Low
< 80
Medium
80 - 100
High
100 - 120
Very High
> 120
N
0
5
10 Km.

Fig. 6.1

Anthurne (148.17), Bawada (107.01) and Kati (123.48) agricultural circle shows high productivity of jowar due to plane topography, medium black soil and irrigation. These regions are situated south west, central and south part of Indapur Tahsil

Index of productivity of jowar from 80 to 120 is occupies maximum area of Indapur Tahsil. The productivity pattern of Jowar has decreasing trend towards north-west and south-east from central pocket of high productivity (Table-6.1 and Fig. 6.1). Variation of soil type, local relief and irrigation changes in productivity in the west and east part.

6.2.2 Productivity of Sugarcane

Sugarcane is a long duration crop grown in medium black and deep black soil with assured supply of irrigation (Singh and Dillon). The spatial distribution of sugarcane productivity is shown in Fig. 6.4. The highest productivity of sugarcane is observed in Bawada agricultural circle (124.33) situated in the south-east and east part along the bank of river Bhima and Nira followed by Loni (111.89) and Indapur (105.68) of the study region (Table-6.2 and Fig. 6.2). The Lowest productivity of sugarcane is observed in centre, south and north part of study region. These agricultural circles are Anthurne (49.73), Kati (52.84) and Palasdev (77.70). In southeast and east part of study region, sugarcane productivity is high.

Anthurne region has also lowest productivity of sugarcane due to less irrigation facility. Moderate productivity of sugarcane is observed in Bhigwan (99.46) and Sansar agricultural circles of Indapur Tahsil.

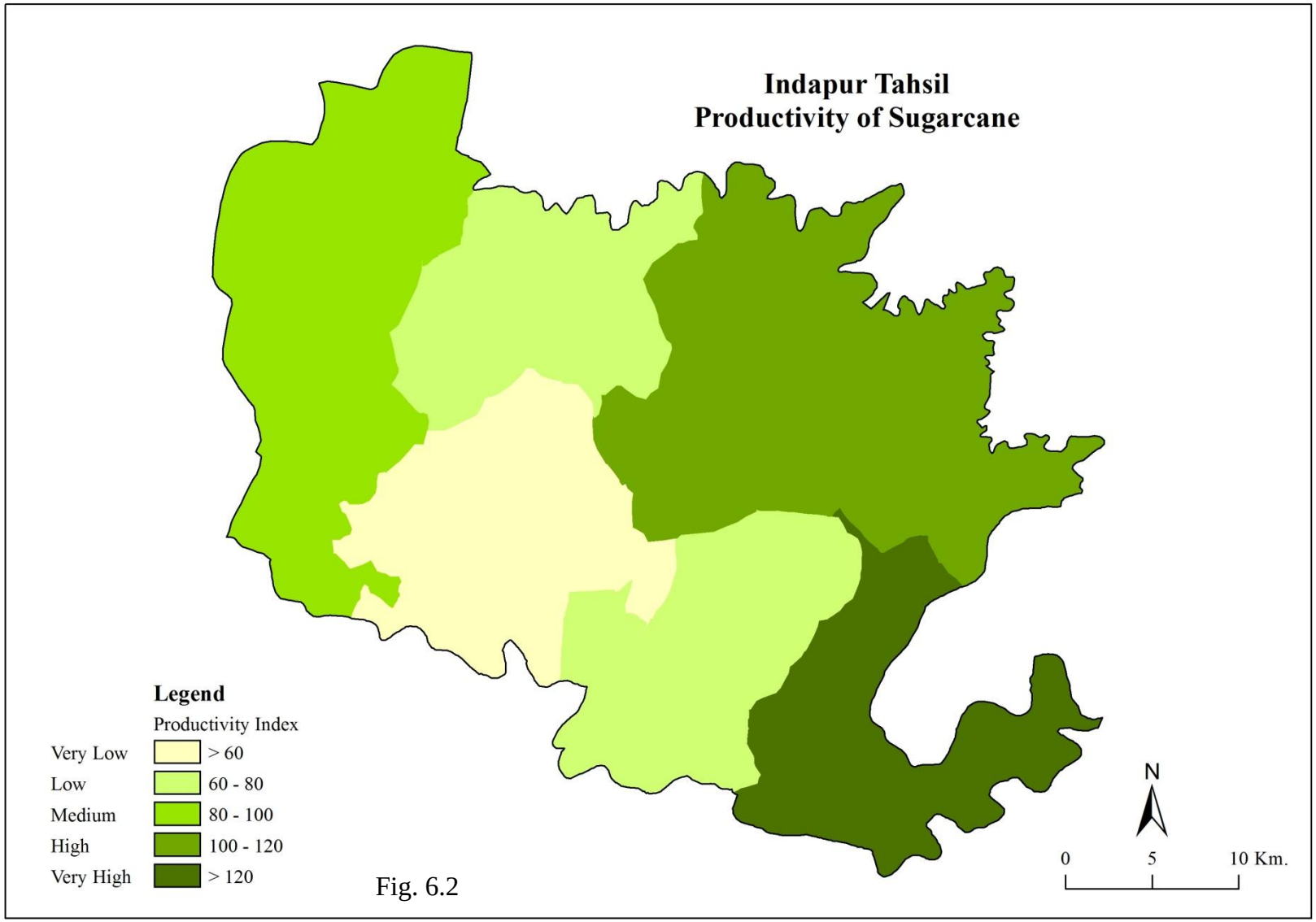
Indapur Tahsil
Productivity of Sugarcane
Legend
Productivity Index
Very Low
> 60
Low
60 - 80
Medium
80 - 100
High
100 - 120
Very High
> 120
N
0
5
10 Km.

Fig. 6.2

Table 6.2 Productivity of Sugarcane

Agricultural Circle	Area (Hector)	Production in Tonnes/Hector	Total Production (Tonnes)	Index of Productivity
Anthurne	280	80	22400	49.73
Bawada	717	200	143400	124.33
Bhigwan	393	160	62880	99.46
Indapur	1771	170	301070	105.68
Kati	75	85	6375	72.84
Loni	646	180	116280	111.89
Palsdev	125	125	15625	77.70
Sansar	759	130	98670	80.81

Source: Computed by Researcher

Towards the southeast part of the Tahsil productivity increases due to availability of water from River Nira and left Nira canal and medium black to deep black soil.

6.2.3 Productivity of Wheat

Wheat as a rabbi crop is cultivated over medium to deep black soil with subsoil moisture and hence hardly requires irrigation facility. The spatial distribution pattern of wheat productivity is shown in Fig. 6.3

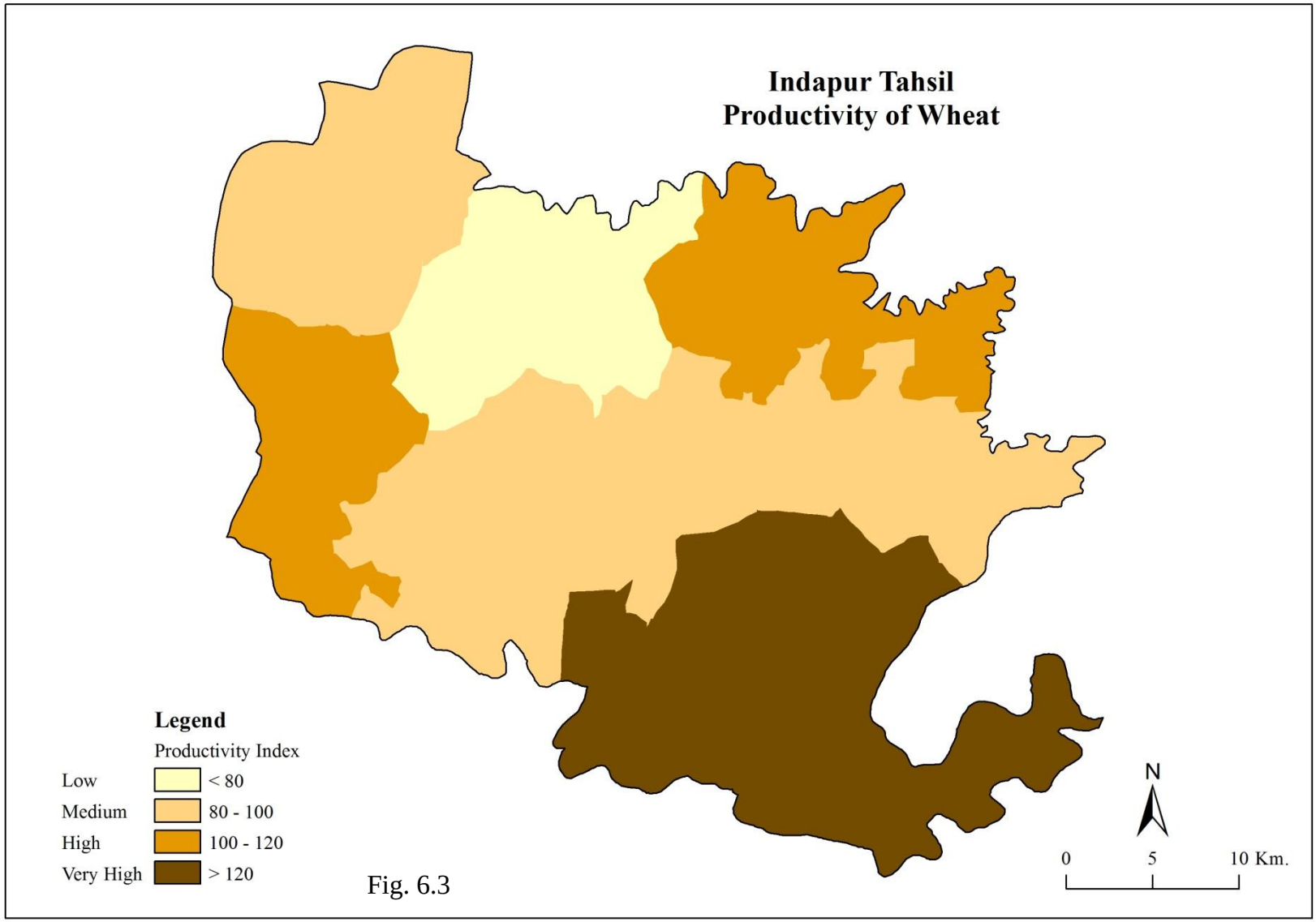
Indapur Tahsil
Productivity of Wheat
Legend
Productivity Index
Low
< 80
Medium
80 - 100
High
100 - 120
Very High
> 120
N
0
5
10 Km.

Fig. 6.3

Table 6.3 Productivity of Wheat

Agricultural Circle	Area (Hector)	Production in Quintal/Hector	Total Production (Quintal)	Index of Productivity
Anthurne	95	20	1900	89.63
Bawada	223	33	7359	147.89
Bhigwan	87	18	1566	80.67
Indapur	624	19	11856	85.15
Kati	43	28	1204	125.48
Loni	98	23	2254	103.08
Palsdev	18	15	270	67.22
Sansar	59	24	1416	107.56

Source: Computed by Researcher

The highest productivity of wheat is observed in Bawada (147.89) in the south-west and followed by Kati (125.48) central part of study region (Table-6.3). The lowest productivity is recorded in Palasdev (67.22) situated in the north part followed by Bhigwan (80.67) and Indapur (85.15). The productivity of wheat is decreased in central and increased towards west and eastern part due to salinization and more sugarcane cultivation area. Moderate productivity between 80 and 100 is observed in Anthurne, Loni and Sansar agricultural circles.

6.1.4 Productivity of Corn

Crop corn is cultivated in rabbi and kharip season in the study region as a cash crop. Corn is cultivated between two sugarcane seasons because there is a gap of four to five months between two

Table 6.4 Productivity of Corn

Agricultural Circle	Area (Hector)	Production in Quintal/Hector	Total Production (Quintal)	Index of Productivity
Anthurne	35	27	945	94.37
Bawada	355	32	11360	111.85
Bhigwan	19	35	665	122.34
Indapur	230	27	6210	94.37
Kati	140	23	3220	80.39
Loni	90	30	2700	104.86
Palsdev	33	29	957	101.36
Sansar	38	22	836	76.90

Source : Computed by Researcher

sugarcane cultivation. The spatial distribution pattern of corn productivity is shown in Fig. 6.4. Highest productivity of corn is observed in Bhigwan (122.34) in the north-west part of study region (Table-6.4). The lowest productivity is recorded in Sansar (76.90) situated in the southwest part. The productivity of corn is decreasing towards north and eastern part due to

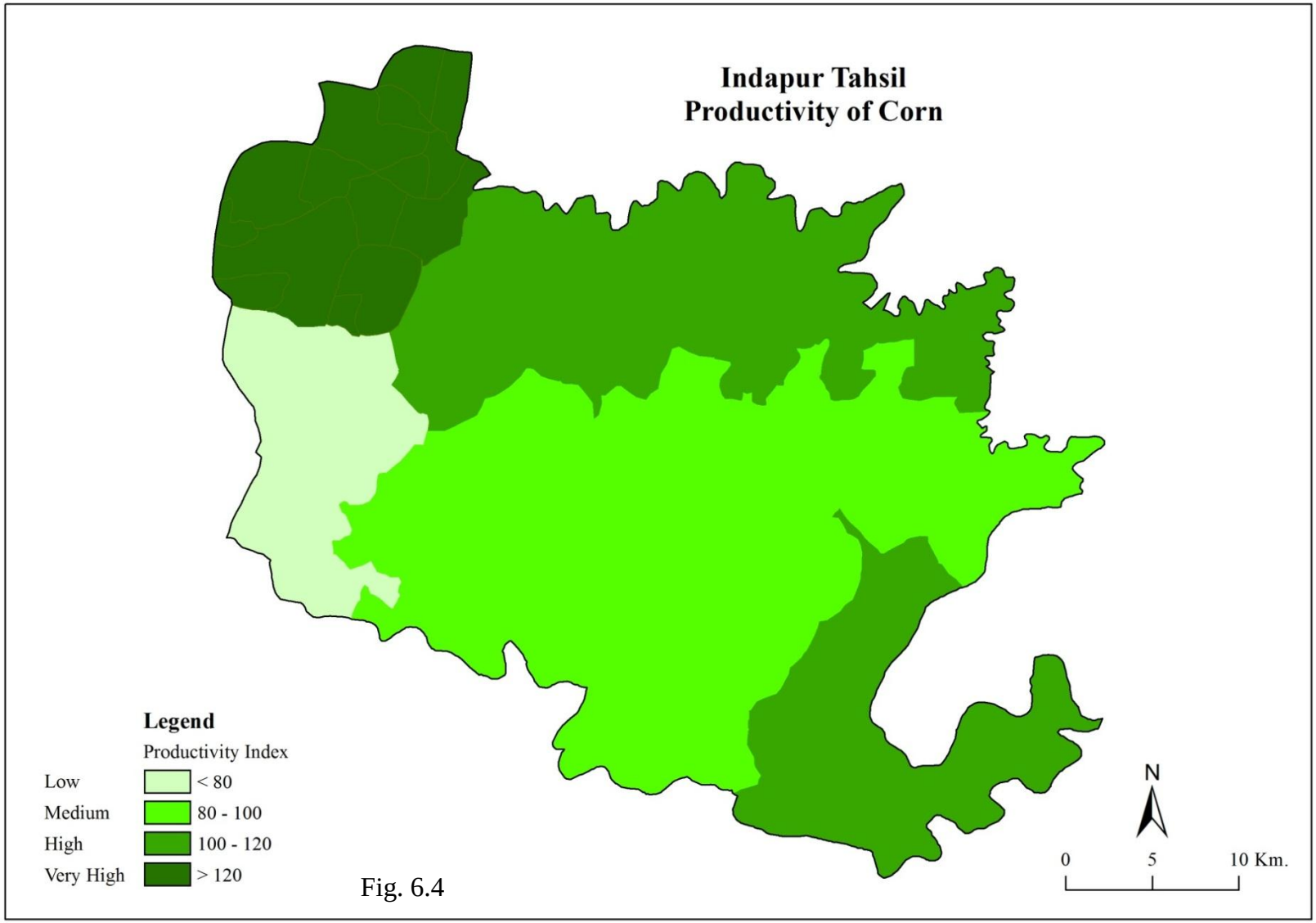
Indapur Tahsil
Productivity of Corn
Legend
Productivity Index
Low
< 80
Medium
80 - 100
High
100 - 120
Very High
> 120
N
0
5
10 Km.

Fig. 6.4

salinization and more sugarcane cultivation area. Moderate productivity between 80 and 100 is observed in Kati (80.39), Indapur (94.37) and Anthurne (94.37) part of study region. High productivity of corn is observed in Bawada (111.85), Loni (104.86) and Palasdev (101.36) of study region. High productivity of corn is observed in Bawada (111.85), Loni (104.86) and Palasdev (101.36).

6.3 Agricultural Development

In the present study, the variation in Indapur Tahsil is determined with the help of six variables viz. Net sown area, Irrigated area, Agricultural labours, Number of Gramin Bank and Productivity of Yield Index of Jowar, Corn, Wheat and Sugarcane. Besides this, the development of Indapur Tahsil is taken in with their respective categories i.e. high, medium, and low on the basis of scores of composite standard score. The present analysis has been carried out from the data related to four variables using Z-score to get the composite scores. On the basis of this composite score, the Tahsil has been classified into three development categories i.e. high, medium, and low. Agricultural development indicates the equality of agricultural system of the region. It is a multi-dimensional concept which mainly includes real strength development of cropped area, farming system, irrigation, high yielding improved varieties of seeds, chemical fertilizers, insecticides, pesticides, specialization and commercialization of agriculture (Mohammed, 1986). The changing scenario of agro-economy drew attention of researcher on distribution of technological development in agricultural. Majority of the Indian population depends on agricultural produce and for them it is the only source of livelihood. Due to rapid increase in population, the existing traditional methods of agriculture cannot meet the growing demand. As a result, new techniques have to be adopted to develop agro-economy.

To determine the level of Agricultural development, different indicator variables have been used such as Net sown area, Irrigated area, Agriculture labours, Number of Gramin bank and Crop Productivity Yield Index of the different crops such as Jowar, Corn, Wheat, and Sugarcane. For calculation of overall levels of Agricultural development and its even distribution, the data of all variables have been transformed using Z-score technique. The formula is:

Formula - $Z_i = \frac{X_i - \bar{X}}{SD}$

Where

Zi = standard score for the i^{th} observation,

X_i = original value of the i^{th} observation,

$\bar{X}$ = mean of the value of X variable,

SD = standard deviation of X variable.

The result of the standard score obtained for different indicators were aggregated by Composite Standard Score (CSS), so that the regional inconsistencies in the levels of development of the study area may be evaluated and studied on a common scale.

The Composite Standard Score may be algebraically expressed as:

$$CSS = \frac{\sum Zij}{N}$$

Whereas,

CSS = Composite Standard Score

Zij = Z Scored of an Indicator j in the Tahsil.

N = Number of Indicators.

In order to classify the circles according to the magnitude of development, the composite score were divided into three classes that are high medium and low.

List of the selected indicators/variables:

X1- Net sown area.

X2- Irrigated area

X3- Agricultural labours

X4- Gamin Banks

X5- Crop Productivity Yield Index of the crops.

X5a- Jowar

X5b- Sugarcane

X5c- Corn

X5d- Wheat

Agricultural development is a multi-dimensional activity and key to which is crop productivity. It is one of the vital aspects of rural development. The objective of Agricultural development is to increase the growth of Agricultural output so as to provide livelihood to the growing population.

To assess the level of agricultural development in Indapur Tahsil of District Pune, all the eight variables have been aggregated. The Z-score value of eight variables were transformed and combined with the help of Z-score and development index was prepared. The development index ranges from -0.673 (lowest) in Palasdev agricultural circle to 1.116 (highest) in Bawada. (Table 6.5) Bawada is the most developed agricultural in Indapur Tahsil and Palasdev is at bottom. On the basis of development index, the agricultural circles have been categorized into three classes' viz. high, medium and low (Fig. 6.5) which clearly shows the spatial variation in level of agricultural development in Indapur Tahsil.

Table 6.5 Standard Score for Agricultural Development

Agricultural Circle	X1	X2	X3	X4	X5				CSS
					X5a	X5b	X5c	X5d	
Anthurne	-0.771	-0.211	0.075	-0.150	1.813	-1.398	-0.258	-0.429	-0.166
Bawada	0.888	2.162	2.179	-0.749	0.418	1.341	0.889	1.801	1.116
Bhigwan	-0.824	-0.792	-0.612	-0.150	-0.418	0.428	1.578	-0.772	-0.195
Indapur	2.076	0.111	-0.262	2.247	-0.697	0.656	-0.258	-0.600	0.409
Kati	-0.053	-0.360	0.349	-0.150	0.976	-1.284	-1.176	0.943	-0.094
Loni	-0.523	-0.032	-1.051	0.449	-0.976	0.884	0.430	0.086	-0.092
Palasdeo	-0.255	-1.189	-0.756	-0.749	-0.976	-0.371	0.201	-1.286	-0.673
Sansar	-0.537	0.311	0.079	-0.749	-0.139	-0.257	-1.406	0.257	-0.305

Source: Computed by Researcher.

On an aggregate, three agricultural circles namely, Bawada (1.116), Indapur (0.409) and Loni (0.302) which ranges their development index above 0.100 highly developed circles while majority of the circle fall under medium category having their development index ranging from -0.200 to 0.100. This category covers three agricultural circles namely Bhigwan (-0.195), Anthurne (-0.166) and Kati (-0.094).

Table: 6.6 Level of Agricultural Development in Indapur Tahsil

Development Index	Level of Agricultural Development	No. of agricultural circles	Name of the Agricultural Circles
0.100 <	High	03	Bawada, Indapur, Loni
0.100 to -0.200	Medium	03	Kati, Anthurne, Bhigwan
<-0.200	Low	02	Palasdev, Sansar

Source : Computed by Researcher

Only two agricultural circles having their development index below -0.200 fall under low level of agricultural development and these are Palasdev (-0.673) and Sansar (-0.305) that show the low level of agricultural development.

This present study reveals that the spatial distribution of variables and agricultural development is not uniform in Indapur Tahsil. It provides in Indapur Tahsil of District Pune. The study highlight that the majority of the Tahsil come under the medium and high category of agricultural development, seen in circle lying in centre, east and north west part of the study region, while the circle lying on the east and north part of the

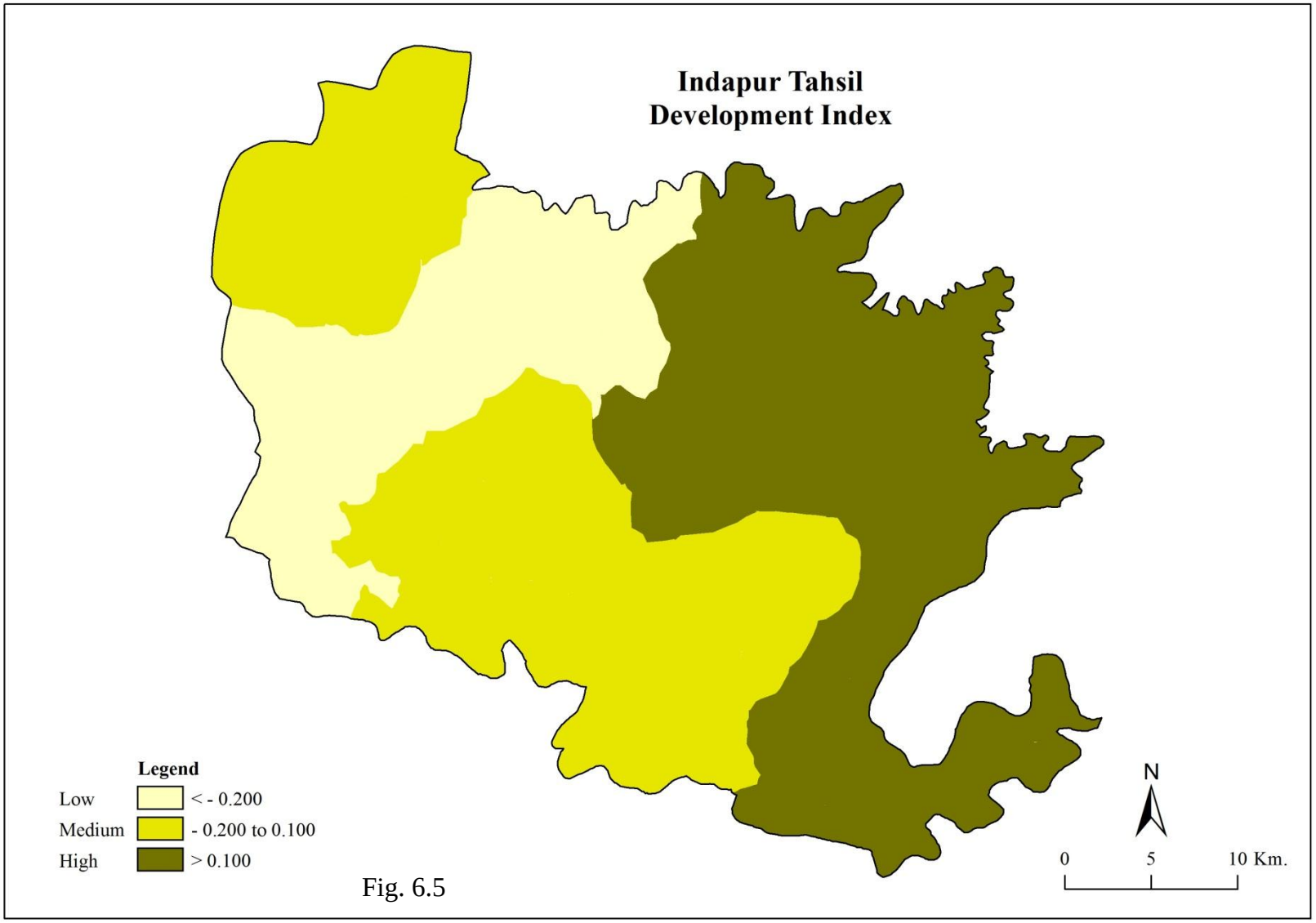
Indapur Tahsil
Development Index
Legend
Low
< - 0.200
Medium
- 0.200 to 0.100
High
> 0.100
N
0
5
10 Km.

Fig. 6.5

Tahsil (Palsadev and Sansar) are agriculturally less developed because of low net sown area, less irrigation facility, less agricultural labour, low area under jowar, sugarcane, and wheat crops. For development, there is a need for restructuring of the agriculture which has to be done within certain limits of economic, social and political factors, as well as the national goal; and to making the agricultural society more dynamic. The study highlights the impact of location and spatial input on the agricultural development planning in Indapur Tahsil.

6.3 Resume:

The knowledge of existing levels of productivity is necessary for better planning and management for development of backward areas. The population has been rapidly growing and as result it needs to be managed properly. Hence, it is crucial to make a detailed study of each crop and its production. Here an effort has been made to discover the crop productivity regions of Indapur Tahsil and the factors involved in it. There are eight sample selected by purposive sample method form the study area. In study region there are eight agricultural circles which are selected as sample namely, Anturne, Bawada, Bhigwan, Indapur, Kati, Loni, Palsdev and Sansar. Enyedi's Index is used for agricultural productivity for sugarcane, jowar, corn and wheat crops. Z score technique is used to measure the agricultural development. The index of productivity of jowar is high in Anturane agricultural circle. The index of productivity of sugarcane is very low Anturane agricultural circle. The productivity of wheat is decreased in central and increased towards west and eastern part due to salinization and more sugarcane cultivation area. The productivity of corn is decreasing towards north and eastern part due to sugarcane cultivation.

The agricultural development is not uniform in Indapur Tahsil. High development index (more than 0.100) is observed in Indapur, Loni and Bawada agricultural circle. Only two agricultural circles having their development index below -0.200 fall under low level of agricultural development and these are Palasdev (-0.673) and Sansar (-0.305) that show low level of agricultural development. These two circle are agriculturally less developed because of low net sown area, less irrigation facility, less agricultural labour, For development, there is a need for restructuring of the agriculture.

CHAPTER-VII

SUMMARY AND CONCLUSION

7.1 Summary

The present study is concerned broadly with a changing agricultural landuse in Indapur Tahsil, Pune district. The study period from 1991 to 2011 was selected. The Indapur Tahsil is one of the Tahsils in Pune district consisting of 143 villages and three urban settlements. Geographically, this area extents from 17° 53′ to 18° 15′north latitudes and 74° 35′ to 75° 8′east longitude. Indapur Tahsil lies in southeast of Pune district. The geographical area of study area is 1552.93 square kilometres according to 2011 Census. According to 2011 Census the area has 384149 population, out of which 199213 are males and 183887 are females and the density of population is 247 per square kilometre. Secondary data have obtained for 143 villages from Agriculture Department of Indapur Tahsil. Primary data obtained through questionnaires, interviews from selected sample villages. The data collected was then converted into percentage. Rafiullah's crop combination technique was applied to compute crop combination regions. Gibb's Martin Index had been applied for the Crop Diversification; Enyedi's Method was chosen to compute crop productivity and 'Z' score for measure agricultural development of the region for selected villages of Indapur Tahsil.

The region belongs to Bhima and Nira catchment area. Light brown, medium deep black and deep black soil is found in the study region. Deep black appear soil is found along Nira bank side and this soil is suitable for the cultivation of sugarcane, wheat, corn, fodder and vegetables in study region. April experiences maximum temperature (40.03^0centigrades).

Monsoon rainfall is prime source of receiving rainfall. June receives highest rainfall. Lift, well, canal and bore well are the sources irrigation.

Within twenty years (1991-2011), there has been tremendous change is observed in irrigated area. The south and the north part in Indapur has highest irrigation, resulting more area has brought under cultivation. Ujani dam is the main source of water; this dam has built on Bhima River. One national highway, four state highways, major district road, other district road and village roads provide transportation. The population density in the study area is influenced by both physical and socio economic factors. According to 2011 Census, study region has 384941 persons (93.80 percent rural and 6.20 percent urban population) and has 31.25 percent agricultural cultivators and agricultural labours in study region. The eighteen market centres are located either on national and state highway or major district roads and village roads in study area. In 2011 cultivators and agricultural labours have inclined from 15.09 percent to 19.71 percent and 11.68 percent to 15.13 percent from 2001 to 2011 years respectively. The reason of growth in cultivators, agricultural labours is that the area of fallow land has been changed in to the net sown area. Means that the net sown area has been increased and at same time fallow land area has been decreased.

The total area in study region covers 77.31 percent net sown area in 2011. In 1991, net sown area in study area shows steady decline towards central and north parts due to lack of irrigation but in 2011 the net sown area has increased due to fertile soil and irrigation facility. From 1991 to 2011 the total net sown area increased by 17.70 percent. Land not available for cultivation shows 0.01 percent increase during the study period. Increase in land not available for cultivation is found in north parts in study area. Cultivable waste in Indapur Tahsil shows increase in

area and the total increase under this category is 1.00 percent during the span of twenty year. This increase is due to increasing population pressure on existing land. Fallow land indicates declining trend by 18.15 percent in study area. Due to irrigation facility more land has brought under cultivation. Forest cover has declined slowly by 0.56 percent to total area. But Bendewadi, Pondkulwadi, Dalaj No.1 and Rajwadi are the villages have increased forest land because of different programmes, introduced by Grampanchayat, Companies Colleges, and Government.

Crop cultivation mainly depends on fertile soil and irrigation. In study area sugarcane, corn and fruits have increased their acreage in study region. But jowar, oilseed and pulses have declined percent in this Tahsil during the study period. The variation in agricultural landuse relates with the extent of these ten crops with soil characteristics, irrigation and market centres. Sugarcane is identified as first ranking crop occupying 30.94 percent to net sown area. Sugarcane was cultivated on 20.70 percent in 1991 which is increased by 10.24 percent in 2011 due to fertile soil and irrigation by canal lift, well, etc. In Indapur Tahsil, corn is grown as a cash crop. Corn occupies 9.44 percent to net sown area. Medium deep soil, irrigation and nearness to weekly market centres are responsible for corn cultivation in study region. Wheat covers 8.83 percent net sown area in study region in 2011. Wheat concentration appears in central, north and south parts on deep black soil. Fodder crops occupies 4.93 percent net sown area in north part in study area of dairy dominating area hence this crop is observed more land under fodder crops. Bajara is drought resistant crop. It covers 5.74 percent net sown area in west part on less rainfall region in Indapur Tahsil. Oilseeds are cultivated on 1.46 percent net sown area in study region. Oilseeds cultivation has less acreage due to larger coverage under sugarcane, corn and jowar in study region. Vegetables contributed 1.68 percent in study region. It is grown close to weekly

market centres. Pulses occupy very less percent in study region accounting 1.28 percent. Indapur Tahsil has found significant increased area (9.09 percent) under fruit crop. It was 0.39 percent in 1991 which increased by 8.70 percent in 2011. There is assurance in local markets for fruits crops in Indapur Tahsil. It is found that progressive farmers are producing fruit crops as they afford high input cost. Fruits are cultivated by drip irrigation due to scarcity of water in central part of study area. Light brown shallow soil and medium deep black soil is batter for fruit cultivation in Indapur Tahsil

The knowledge of existing levels of productivity is necessary for better planning and management for development of backward areas. The population has been rapidly growing and as result it needs to be managed properly. Hence, it is crucial to make a detailed study of each crop and its production. Here an effort has been made to discover the crop productivity regions of Indapur Tahsil and the factors involved in it. There are eight sample selected by purposive sample method form the study area. In study region there are eight agricultural circles which are selected as sample namely, Anturne, Bawada, Bhigwan, Indapur, Kati, Loni, Palsdev and Sansar. Enyedi's Index is used for agricultural productivity for sugarcane, jowar, corn and wheat crops. Z score technique is used to measure the agricultural development. The index of productivity of jowar is high in Anturane agricultural circle. The index of productivity of sugarcane is very low Anturane agricultural circle. The productivity of wheat is decreased in central and increased towards west and eastern part due to salinization and more sugarcane cultivation area. The productivity of corn is decreasing towards north and eastern part due to sugarcane cultivation.

The agricultural development is not uniform in Indapur Tahsil. High development index (more than 0.100) is observed in Indapur, Loni and

Bawada agricultural circle. Only two agricultural circles having their development index below -0.200 fall under low level of agricultural development and these are Palasdev (-0.673) and Sansar (-0.305) that show low level of agricultural development. These two circle are agriculturally less developed because of low net sown area, less irrigation facility, less agricultural labour, For development, there is a need for restructuring of the agriculture.

7.2 Findings and Suggestions

The current research work mainly focus on changing landuse pattern which is responsible to change agriculture productivity and development in Indapur Tahsil. The net sown area has been increasing in study area. At the same time the area under fallow land has been decreasing, means that, it is good for agricultural productivity of crops and agricultural development in present and future.

The cultivation of sugarcane crop should slowly change or replaced by sugarbeet as the sugarbeet processing facility is available in Tahsil. By replacing sugarcane the problem of soil salinity can be overcome and more income can be generated form saline-alkali soil by growing newly introduced sugerbeet.

Floriculture activity should be introduced in study region due to increasing demand of flowers throughout the year in Indapur, Bhigwan, Baramati city and Pune metropolitan region.

Agro-based activities like dairy farming and poultry should be intensified in the north part iof study area. This would help to provide jobs for youth in rural area.

Farmers are facing problems of irrigation due to electricity load shading. If the electricity supply will provide continually then the crop production will increased.

The village roads should be constructed in northeast part of study region for mobilizing agricultural products. Indapur Tahsil is emerging as a sugarbeet processing hub with a unique and single of its kind industry, operated in private sector on newly introduced sugarbeet in Maharashtra state.

Baramati, a the nearest city to the most of villages in this Tahsil is emerging as an industrial area for wine production through grapes which would be the best option for sugarcane and it has certainly a great scope for providing raw material to newly wine park industry introduced at Baramati.

The area under pomegranate and grapes fruits has been increasing. It will help to develop pomegranate and grapes agro based industries.

Palasdev and Sansar Circle are agriculturally less developed because of low net sown area, less irrigation facility, less agricultural labour, low area under jowar, sugarcane, and wheat crops. For development, there is a need for restructuring of the agriculture.

7.3 Concluding Remarks

Indapur Tahsil belongs to rain shadow zone in Pune district, receiving rainfall between 400 to 500 mm. The fertile soil and irrigation have added to increase production of sugarcane. If the sugarcane cultivation continues in study area it may be serious for soil fertility. New industries like Wine Park and Sugarbeet Processing Plant at Kalas would be additional dimension in study region. The farmer's innovative ideas and availability

of capital for better land use may result in rational land use. Such study may attract the attention of planners, agriculturists, farmers and administrators to look into this sector by planning based on local resources for proper landuse and yield. Thus, there is an ample scope for research, exploration, expansion and intensification regarding modern agricultural techniques etc.

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Appendix–A

Code No. of Villages in Indapur Tahsil

Code No.	Name of Villages	Code No.	Name of Villages
1	Shetphalgadhe	41	Bhavaninagar
2	Pimpale	42	Jachakvasti
3	Madanwadi	43	Belwadi
4	Takrarwadi	44	Sapkalwadi
5	Dikasal	45	Hinganewadi
6	Mumbhargaon	46	Tawashi
7	Bandgarwadi	47	Pawarwadi
8	Poundhawadi	48	Kardanwadi
9	Lamjewadi	49	Lasurne
10	Nirgude	50	Jankshan
11	Mhasobachiwadi	51	Thoratwadi
12	Vaysewadi	52	Paritwadi
13	Akole	53	Udhat
14	Bhadalwadi	54	Gholapwadi
15	Dalaj No. 1	55	Jamb
16	Dalaj No. 2	56	Mankarwadi
17	Dalaj No. 3	57	Chavanwadi
18	Kalewadi	58	Kuravali
19	Bandewadi	59	Chikhali
20	Palasdeo	60	Vyahli
21	Malawadi No. 2	61	Kauthali
22	Bhawadi	62	Kacharwadi
23	Loni	63	Nimgaon Keti
24	Varkute k	64	Gotandi
25	Nhavi	65	Shelgaon
26	Balpudi	66	Bhadrnewadi
27	Karewadi	67	Anthurne
28	Lakdi	68	Kadbanwadi
29	Nimbodi	69	Hangarwadi
30	Shindewadi	70	Pitkeshwar
31	Kazad	71	Varkute Kh
32	Kalas	72	Kati
33	Pilewadi	73	Jadhavwadi
34	Gosaviwadi	74	Sarafwadin
35	Maradwadi	75	Ghorpadwadi
36	Rui	76	Sirsatwadi
37	Thoratwadi	77	Ranmodwadi
38	Birungwadi	78	Nimsakhar
39	Bori	79	Nirwangi
40	Sansar	80	Chandgaon

cont.

Continue from Appendix-A

81	Agoti No. 1	113	Bedshing
82	Agoti No. 2	114	Babhulgaon
83	Gangavalan	115	Bhatnimgaon
84	Kalashi	116	Awasari
85	Kalthan No. 1	117	Shetphal Haveli
86	Shirsodi	118	Reda
87	Padasthal	119	Bhodani
88	Takali	120	Surwade
89	Ajoti	121	Bhandgaon
90	Sugaon	122	Vakilwasti
91	Pimpri Kh	123	Bawada
92	Malwadi No. 1	124	Lakhewadi
93	Kalthan No. 2	125	Redani
94	Narutwadi	126	Khorachi
95	Galandwadi No. 1	127	Boratwadi
96	Vangali	128	Chakati
97	Rajwadi	129	Pithewadi
98	Gagargaon	130	Nirnimgaon
99	Bijwadi	131	Kacharewadi
100	Pondkulwadi	132	Sarati
101	Indapur	133	Ganeshwadi
102	Shah	134	Pimpri Bk
103	Kandalgaon	135	Tannu
104	Taratgaon	136	Nirsingpur
105	Hingangaon	137	Girvi
106	Sardewadi	138	Ozare
107	Galandwadi No. 2	139	Gondi
108	Gokhali	140	Lumewadi
109	Tarangwadi	141	Bambdwadi
110	Zagdewadi	142	Kalamb
111	Pandharwadi	143	Bhigwan
112	Vedapuri		

Source : Indapur Talathi Office, Indapur.

Appendix–B

Population and Irrigation in Indapur Tahsil

Code No.	Village Name	Area	Population 2011	1991 Irrigation (In Hectare)	2011 Irrigation (In Hectare)
1	Shetphalgadhe	1895	4123	460	805
2	Pimpale	884	1337	125	175
3	Madanwadi	2247	5954	354	1146
4	Takrarwadi	268	2166	51	60.85
5	Dikasal	808	1382	281	144.95
6	Mumbhargaon	1173	1330	109	501.44
7	Bandgarwadi	282	622	na	100
8	Poundhawadi	1435	1792	202	256.1
9	Lamjewadi	373	662	141	132
10	Nirgude	2522	2095	130	467
11	Mhasobachiwadi	1472	2000	80	79
12	Vaysewadi	267	577	21	0
13	Akole	1655	3273	125	45
14	Bhadalwadi	1360	2628	77	700
15	Dalaj No. 1	615	760	50	243
16	Dalaj No. 2	867	1061	75	84.69
17	Dalaj No. 3	653	1188	25	185.92
18	Kalewadi	1787	1477	55	230
19	Bandewadi	469	342	46	64
20	Palasdeo	1776	3621	410	34
21	Malawadi No. 2	442	1818	19	280
22	Bhawadi	188	907	186	485.7
23	Loni	1574	2667	54	721
24	Varkute k	1841	2915	196	700
25	Nhavi	2157	3222	266	400
26	Balpudi	835	743	51	316.47
27	Karewadi	444	1466	125	164
28	Lakdi	1293	2547	29	75.52
29	Nimbodi	857	1922	182	17.25
30	Shindewadi	1089	1883	67	502.24
31	Kazad	1521	3139	145	716.8
32	Kalas	3769	4141	373	235
33	Pilewadi	782	1150	43	293.49
34	Gosaviwadi	1044	528	18	205
35	Maradwadi	201	571	4	45
36	Rui	2560	3232	95	252
37	Thoratwadi	320	473	NA	30
38	Birungwadi	768	1296	30	172
39	Bori	1865	2520	759	265.29
40	Sansar	1268	6632	849.66	925.09

Contd.

Continue from Appendix-B

41	Bhawaninagar	780	4011	12	91
42	Jachakvasti	394	1300	30	355
43	Belewadi	640	5056	65	436
44	Sapkalwadi	214	1305	28	203.13
45	Hinganewadi	318	2704	12	502
46	Tawashi	678	3046	616	563
47	Pawarwadi	439	2202	376	374.23
48	Kardanwadi	238	917	12	150
49	Lasurne	3811	8803	1058.42	880
50	Jankshan	301	4855	NA	230.15
51	Thoratwadi	533	812	18	311.01
52	Paritwadi	475	1245	NA	402.57
53	Udhat	365	2023	286	318.97
54	Gholapwadi	NA	7908	NA	277
55	Jamb	428	1459	117	194
56	Mankarwadi	185	986	107	154
57	Chavhanwadi	220	1062	10	199
58	Kurawali	729	2925	628	610
59	Chikhali	399	786	235	162
60	Vyahali	1305	1698	133	857.58
61	Kauthali	1501	2764	103	180.84
62	Kacharewadi	596	664	58	212
63	Nimgaon Ketki	3196	12397	868	1487.72
64	Gotandi	1781	2726	797	80
65	Shelgaon	3996	8215	572	1642
66	Bharnewadi	1723	4358	791	1028
67	Anthurne	1230	6100	681	615
68	Kadbanwadi	2766	1636	106	852
69	Hangarwadi	706	4558	18	875
70	Pitkeshwar	971	2065	410	831.4
71	Varkute Kh.	1558	4811	970	1021.9
72	Kati	1813	5353	490	526.53
73	Jadhavwadi	188	472	33	79.1
74	Sarafwadi	841	2038	341	346
75	Ghorpadwadi	521	344	359	3.3
76	Sirsatwadi	754	2100	80	535
77	Ranmodwadi	617	3468	429	498.57
78	Nimsakhar	2267	6000	1433	1961.47
79	Nirwangi	1300	3601	761	988
80	Chandgaon	590	1117	78	485

Contd.

Continue from Appendix-B

81	Agoti No.1	1044	1261	256	244
82	Agoti No.2	425	719	NA	174.1
83	Ganjewalan	720	726	102	334.57
84	Kalashi	1032	1819	242	686.4
85	Kalthan No.1	1819	2135	726	1023.3
86	Shirsadi	1113	1938	132	431
87	Padasthal	1013	1405	334	391
88	Takali	1065	NA	15	0
89	Ajoti	754	864	20	28.93
90	Sugaon	840	301	17	21
91	Pimpri Kh.	520	1380	186	293.7
92	Malwadi	1602	4263	58	944.68
93	Kalthan No.2	1748	1188	NA	600.11
94	Narutwadi	876	1331	21	712.24
95	Galand Wadi No.1	710	2031	40	357.59
96	Vangali	731	1251	123	271.6
97	Rajwadi	242	508	66	125
98	Gagargaon	769	744	140	190
99	Bijwadi	1257	2158	102	25.74
100	Pondkulwadi	284	1330	28	119.6
101	Indapur	6000	25515	2574	806
102	Shaha	1007	0	293	354
103	Kandalgaon	1529	2364	380	383.5
104	Taratgaon	323	2069	37	50.1
105	Hingangaon	975	288	167	269.1
106	Sardewadi	996	611	58	296
107	Galand Wadi No.2	876	3187	66	92
108	Gokhali	989	1921	69	332
109	Tarangwadi	1566	1564	68	100
110	Zagadewadi	664	2557	44	206
111	Pandharwadi	1176	1193	37	128
112	Vadapuri	2643	1198	342	684
113	Bedshinge	474	4401	122	109.22
114	Babhulgaon	1327	759	108	242
115	Bhat Nimgaon	827	2505	160	405.34
116	Awasari	1060	1547	63	787
117	Shetphal Haveli	1621	2011	821	668
118	Reda	923	3006	383	17.27
119	Bhodani	760	2415	36	400
120	Surwad	642	4232	37	449.71

Contd.

Continue from Appendix-B

121	Bhandgaon	1334	2993	785	1111.74
122	Vakilwasti	632	2144	18	334.6
123	Bawada	8097	10734	1616	2024.52
124	Lakhewadi	1492	4540	87	1175.81
125	Redani	1796	3938	793	880.47
126	Khorochi	1359	3637	135	774.18
127	Boratwadi	802	1642	20	41
128	Chakati	827	2968	151	1225.07
129	Pithewadi	662	1080	22	546.5
130	Nirnimgaon	660	2863	133	175
131	Kacharewadi	347	1424	34	449
132	Sarati	780	2160	120	406
133	Ganeshwadi	622	1838	26	291.4
134	Pimpri Bk.	1037	2251	39	580
135	Tannu	833	2117	102	691
136	Narsingpur	804	2231	112	667.78
137	Giravi	962	956	52	415
138	Ozare	313	639	190	170.6
139	Gondi	476	2319	153	134.39
140	Lumewadi	698	3067	328	350
141	Bambadwadi	NA	NA	NA	NA
142	Kalamb	2553	16338	1045	1383.65
143	Bhigwan	1277	7673	1004	270

Source: Indapur Tahsil Office, Indapur.

Appendix–C

General Landuse Pattern in Indapur Tahsil in 1991

Code No.	Village Name	Net Sown Area	Forest	Cultivable Waste	Area not Available for Cultivation	Follow Land
1	Shetphalgadhe	1465	64.16	65.55	247.36	52.93
2	Pimpale	523	14.52	43.16	141.69	161.63
3	Madanwadi	1402.3	175.79	13.68	450.21	205.02
4	Takrarwadi	150.36	0	0	32.90	84.74
5	Dikasal	610.6	0	0	69.57	127.83
6	Mumbhargaon	741.23	148.97	43.34	157.93	81.53
7	Bandgarwadi	NA	NA	NA	NA	NA
8	Poundhawadi	745	106.70	27.00	249.20	307.10
9	Lamjewadi	307	12.00	20	34.00	0
10	Nirgude	1548.36	4.83	15.25	374.51	579.05
11	Mhasobachiwadi	641.36	152.98	0	182.73	494.93
12	Vaysewadi	158.98	3.59	0	7.64	96.79
13	Akole	954.36	90.67	0	217.81	392.16
14	Bhadalwadi	658.45	58.47	0	340.24	302.84
15	Dalaj No. 1	450	78.00	1.77	28.00	57.23
16	Dalaj No. 2	398	175.69	1.54	168.00	123.77
17	Dalaj No. 3	365.4	135.00	0	75.00	77.60
18	Kalewadi	856	370	115.00	197.00	249.00
19	Bandewadi	104	0	55.00	128.00	182.00
20	Palasdeo	902	227.87	123.53	486.35	36.25
21	Malawadi No. 2	213	0	34.00	159.00	36.00
22	Bhawadi	556	94.45	8.35	78.53	42.67
23	Loni	1136	43.66	5.61	167.16	221.57
24	Varkute k	1436	0	44.69	87.59	272.72
25	Nhavi	1236	215.12	17.05	363.91	324.92
26	Balpudi	469	75.55	18.41	107.59	164.45
27	Karewadi	256	0	45.92	19.68	122.40
28	Lakdi	845	28.06	19.02	180.21	220.71
29	Nimbodi	378	0	1.08	75.95	401.97
30	Shindewadi	847	0	40	40	162.00
31	Kazad	954	19.75	38.82	135.08	2621.35
32	Kalas	237	537.91	97.83	438.35	209.91
33	Pilewadi	68	0	40	59.00	615.00
34	Gosaviwadi	588	0	61.00	61.00	334.00
35	Maradwadi	127	0	15.00	17.00	42.00
36	Rui	1763.72	359.09	27.88	280.57	128.74
37	Thoratwadi	NA	NA	NA	NA	NA
38	Birungwadi	542	80	8.00	10	128.00
39	Bori	1189.99	18.09	0	250.94	405.98
40	Sansar	712.83	0	0	16.41	538.76

Contd.

Continue from Appendix-C

41	Bhawaninagar	78	0	0	66.00	44.00
42	Jachakvasti	270	0	0	24.00	100
43	Belewadi	357	4.00	6.00	68.00	205.00
44	Sapkalwadi	109	0	0	26.00	79.00
45	Hinganewadi	145	0	0	36.00	137.00
46	Tawashi	457	4.38	2.40	52.97	161.25
47	Pawarwadi	395.82	0	0	30.01	13.17
48	Kardanwadi	179	0	0	6.00	53.00
49	Lasurne	2229.29	81.47	72.54	231.40	1196.30
50	Jankshan	NA	NA	NA	NA	NA
51	Thoratwadi	198	0	0	12.00	110
52	Paritwadi	NA	NA	NA	NA	NA
53	Udhat	258	0	0	54.36	52.64
54	Gholapwadi	NA	NA	NA	NA	NA
55	Jamb	157	0	20.69	70.33	179.98
56	Mankarwadi	109	0	0	12.56	63.44
57	Chavhanwadi	156	0	0	10	54.00
58	Kurawali	604.58	0	2.82	62.46	59.14
59	Chikhali	277.15	44.19	0.46	62.52	14.68
60	Vyahali	1057	48.66	32.37	47.58	119.39
61	Kauthali	856.27	287.09	5.30	123.86	228.48
62	Kacharewadi	178.36	4.70	0	19.08	144.86
63	Nimgaon Ketki	2199.69	50.73	1.69	307.64	636.25
64	Gotandi	1356	145.47	7.67	196.23	75.63
65	Shelgaon	984.89	983.51	7.29	214.19	1806.12
66	Bharnewadi	1256	212.77	1.14	187.17	65.92
67	Anthurne	854	0	55.07	102.12	218.81
68	Kadbanwadi	169	16.00	442.00	302.00	1837.00
69	Hangarwadi	587	0	48.00	40	31.00
70	Pitkeshwar	828.58	27.28	24.78	9.12	81.24
71	Varkute Kh.	1007	111.87	132.63	118.41	188.09
72	Kati	1254	53.18	18.77	101.80	385.25
73	Jadhavwadi	56	54.00	0	14.00	64.00
74	Sarafwadi	403	79.44	0	267.52	91.04
75	Ghorpadwadi	321	0	10.81	26.99	162.20
76	Sirsatwadi	408	0	32.00	40	274.00
77	Ranmodwadi	387	0	2.43	29.93	197.64
78	Nimsakhar	1269	87.66	31.81	179.06	699.47
79	Nirwangi	1056	0	7.50	90.49	146.01
80	Chandgaon	98	130.20	12.77	72.11	276.92

Contd.

Continue from Appendix-C

81	Agoti No.1	356	44.68	44.28	492.38	106.66
82	Agoti No.2	NA	NA	NA	NA	NA
83	Ganjewalan	456	0	47.39	139.16	77.45
84	Kalashi	857	0	0	104.43	70.57
85	Kalthan No.1	956	0	0	201.96	59.04
86	Shirsadi	789.54	83.16	12.65	99.49	128.16
87	Padasthal	547.98	195.10	0	109.42	160.50
88	Takali	524.37	0	0	170	370.63
89	Ajoti	10.25	78.04	0	652.33	13.38
91	Pimpri Kh.	15.23	223.80	0	594.17	6.80
92	Malwadi	460.78	4.87	6.18	6.68	41.49
93	Kalthan No.2	1258	32.00	94.00	18.00	200
94	Narutwadi	NA	NA	NA	NA	NA
95	Galand Wadi No.1	574.58	0	0	40	261.42
96	Vangali	412.87	0	106.00	14.00	177.13
97	Rajwadi	287.12	72.22	0	171.91	199.75
98	Gagargaon	110.54	31.92	0	43.69	55.85
99	Bijwadi	289.65	252.32	0	70.98	156.05
100	Pondkulwadi	850.45	0	217.21	75.33	114.01
101	Indapur	109	66.00	0	40	69.00
102	Shaha	3897	84.40	47.84	352.96	310.86
103	Kandalgaon	564	0	0	315.21	127.79
104	Taratgaon	745	229.03	22.93	323.76	208.28
105	Hingangaon	35.45	46.05	6.36	224.85	10.29
106	Sardewadi	782.09	36.33	17.50	101.54	37.54
107	Galand Wadi No.2	766	0	64.00	74.00	92.00
108	Gokhali	610	3.00	57.00	50	156.00
109	Tarangwadi	566	233.67	7.56	90.87	90.90
110	Zagadewadi	998	2.00	88.00	108.00	370
111	Pandharwadi	520	0	16.00	26.00	102.00
112	Vadapuri	498	0	0	328.00	350
113	Bedshinge	716.13	0	26.19	138.17	110
114	Babhulgaon	356	0	28.61	43.47	45.92
115	Bhat Nimgaon	829	67.35	86.22	86.96	257.47
116	Awasari	596	0	31.82	105.69	93.49
117	Shetphal Haveli	596	0	72.81	79.58	311.61
118	Reda	793	0	9.28	490.41	328.31
119	Bhodani	754.89	69.67	5.74	48.33	44.37
120	Surwad	569	0	8.00	6.00	177.00
121	Bhandgaon	548	0	16.00	4.00	74.00
122	Vakilwasti	680.24	0	7.73	83.26	562.77
123	Bawada	457.25	0	4.00	5.00	165.75
124	Lakhewadi	2381.67	21.02	44.31	200	563.23
125	Redani	698	38.00	0	62.00	694.00

…Cont.

Continue from Appendix-C

126	Khorochi	1462	12.47	19.87	76.62	225.04
127	Boratwadi	850.91	6.78	8.69	176.21	316.41
128	Chakati	302	0	114.00	262.00	124.00
129	Pithewadi	578	0	6.25	74.06	168.69
130	Nirnimgaon	391	18.00	4.00	18.00	231.00
131	Kacharewadi	457	0	47.72	50.17	105.11
132	Sarati	420	0	0	22.00	154.00
133	Ganeshwadi	513	18.00	1.00	47.00	43.00
134	Pimpri Bk.	769	0	26.82	97.60	143.58
135	Tannu	608	0	10.70	78.16	136.14
136	Narsingpur	518	0	11.29	165.40	109.31
137	Giravi	641	0	0	119.17	201.83
138	Ozare	154	22.56	1.44	46.87	88.13
139	Gondi	254	13.67	18.89	36.13	153.31
140	Lumewadi	569	6.78	0	85.14	37.08
141	Bambadwadi	NA	NA	NA	NA	NA
142	Kalamb	1598	236.00	152.00	301.00	266.00
143	Bhigwan	834	23.00	156.00	178.00	86.00

Source: Indapur Tahsil Office, Indapur.

Appendix–D

General Landuse Pattern in Indapur Tahsil in 2011

Code No.	Village Name	Net Sown Area	Forest	Cultivable Waste	Area not Available for Cultivation	Follow Land
1	Shetphalgadhe	2011	2011	2011	2011	2011
2	Pimpale	1424.05	76	10.95	384	0
3	Madanwadi	708	13.72	0	162.42	0
4	Takrarwadi	1446	162.31	75	304.96	257.73
5	Dikasal	102	0	0.41	166.59	0
6	Mumbhargaon	240	0	76.4	50.57	441.04
7	Bandgarwadi	610.39	142.77	0	419.94	0
8	Poundhawadi	153.6	22.57	5.28	43.19	56.79
9	Lamjewadi	1028	55	27	325	0
10	Nirgude	273	0	0	100	0
11	Mhasobachiwadi	483.82	4.83	1569.82	463.53	0
12	Vaysewadi	1200.03	152.98	0	118.99	0
13	Akole	246	3.59	10	7.31	0.72
14	Bhadalwadi	1319.33	90.67	21	224	0
15	Dalaj No. 1	948.36	58.47	33.87	198.84	120
16	Dalaj No. 2	187.79	226.52	17.78	64.2	118
17	Dalaj No. 3	349.56	0	23.69	235.58	258.17
18	Kalewadi	426.79	90.13	0	136.08	0
19	Bandewadi	1478.58	210.53	0	97.89	0
20	Palasdeo	220.98	216.92	4.5	26.6	0
21	Malawadi No. 2	1401.89	49.65	107.4	217.06	0
22	Bhawadi	294.51	120.37	11.72	15.4	0
23	Loni	585.98	94.45	10	89.47	0
24	Varkute k	1079.73	43.66	292.19	133.32	25
25	Nhavi	1000	0	493.04	147.31	199.85
26	Balpudi	1560	215	17	365	0
27	Karewadi	520.41	75.55	48.83	161	30
28	Lakdi	329.53	0	94.8	19.67	0
29	Nimbodi	584.79	33.96	39	292.04	343.81
30	Shindewadi	458.86	0	59.86	302.65	33
31	Kazad	1021.89	0	0	70	0
32	Kalas	1340	0	0	182.73	0
33	Pilewadi	2828.63	538	0	402.37	0
34	Gosaviwadi	521.74	0	75	129	57
35	Maradwadi	905.05	0	0.95	138	0
36	Rui	125.55	0	65	10.45	0
37	Thoratwadi	1987.8	359	0	213.2	0
38	Birungwadi	311.15	0.44	0	4.15	0
39	Bori	492.99	80	1.01	194	0
40	Sansar	1686.5	18.09	0	160.41	0

Contd.

Continue from Appendix-D

41	Bhawaninagar	108	0	7.67	72.63	0
42	Jachakvasti	358	0	0	36	0
43	Belewadi	576	0	0	64	0
44	Sapkalwadi	199	0	3.67	11.11	0
45	Hinganewadi	292.13	0	6.81	19.06	0
46	Tawashi	655.32	4.38	10.3	8	0
47	Pawarwadi	398.76	0	0	40.05	0
48	Kardanwadi	227.56	0	0	10.44	0
49	Lasurne	3388.94	85.47	0.23	336.36	0
50	Jankshan	253.33	0	0	47.89	0
51	Thoratwadi	283	0	7.54	30	0
52	Paritwadi	435	0	0	40	0
53	Udhat	318.97	0	0	46.29	0
54	Gholapwadi	112.7	0	0	14.33	1.07
55	Jamb	243.82	0	0	184.18	0
56	Mankarwadi	178.92	0	0	6	0
57	Chavhanwadi	201.83	0	0	18.17	0
58	Kurawali	612.54	0	0	116.46	0
59	Chikhali	270.68	31	0	97.32	0
60	Vyahali	1158.79	0	0	70.15	77.68
61	Kauthali	1194.83	287.09	0	19.08	0
62	Kacharewadi	287	4.7	5	25	25.28
63	Nimgaon Ketki	3020.29	51.9	0	123.81	0
64	Gotandi	1348.77	236	0	196.23	0
65	Shelgaon	3160	487	4	345	0
66	Bharnewadi	1064	212	261	186	0
67	Anthurne	782	0	306	142	0
68	Kadbanwadi	2346.98	8.02	0	411	0
69	Hangarwadi	659.62	0	0	46.38	0
70	Pitkeshwar	835.4	27.28	6	92.65	9
71	Varkute Kh.	1314.44	111.89	13.26	118.41	0
72	Kati	1645.47	53.18	12.55	101.8	0
73	Jadhavwadi	113.28	17.11	35.1	6.04	16.55
74	Sarafwadi	687	10	0	144	0
75	Ghorpadwadi	465	0	6	50	0
76	Sirsatwadi	701	0	0	53	0
77	Ranmodwadi	582.37	2.43	12.2	20	0
78	Nimsakhar	2162.21	80.79	7	17	0
79	Nirwangi	1274	0	24	2	0
80	Chandgaon	224	130.2	3	231.65	1

Contd.

Continue from Appendix-D

81	Agoti No.1	710.88	0	0	333.12	0
82	Agoti No.2	206.14	58.69	0	158.14	2
83	Ganjewalan	526	0	46	148	0
84	Kalashi	841	0	3	184	3
85	Kalthan No.1	1015	0	0	201.96	0
86	Shirsadi	575.94	83.16	16.1	437.8	0
87	Padasthal	612.2	195.1	24.5	181.2	0
88	Takali	NA	NA	NA	NA	NA
89	Ajoti	597.22	0	63.21	93.06	0
91	Pimpri Kh.	473.66		52.6	95.1	0
92	Malwadi	161	224.6	69.3	65.88	0
93	Kalthan No.2	1175.94	0	0	76.64	328.96
94	Narutwadi	1746	0	0	2	0
95	Galand Wadi No.1	869.42	0	0	2	33.32
96	Vangali	609.8		23	77.2	0
97	Rajwadi	451.65	0	0	205.35	0
98	Gagargaon	120	72.22	0	46.37	0
99	Bijwadi	446.47	31.92	6.54	59.66	225
100	Pondkulwadi	850	252.32	0	137.53	17
101	Indapur	129.69	100	0	54.31	0
102	Shaha	4207	100	0	325	61
103	Kandalgaon	490.05		24.3	492.65	0
104	Taratgaon	1201	0	4.65	245.02	74.6
105	Hingangaon	1000.35	229.03	15	58.91	17.1
106	Sardewadi	807.04	46.05	0	117.03	4.88
107	Galand Wadi No.2	832.28	36.33	60	68.89	0
108	Gokhali	774.51	4.83	0	75	21
109	Tarangwadi	566	0	7.56	367.44	48
110	Zagadewadi	1024	233.67	94	212	3
111	Pandharwadi	528.8	2.3	0	133	0
112	Vadapuri	1102.61	0	32.63	40.76	0
113	Bedshinge	833	0	65	92.5	0
114	Babhulgaon	401.42	0	0	70.74	0
115	Bhat Nimgaon	1185.74	0	0	74.26	67
116	Awasari	640	67	0	101	0
117	Shetphal Haveli	907.29	0	0	154	0
118	Reda	1207.95	0	391.87	21.18	0
119	Bhodani	837.83	0	0	63.93	21.24
120	Surwad	634	63.37	4.74	53.84	4
121	Bhandgaon	489.86	0	20.14	132	0
122	Vakilwasti	710.88	0	0	333.12	0
123	Bawada	206.14	58.69	0	158.14	2
124	Lakhewadi	526	0	46	148	0
125	Redani	841	0	3	184	3

…Cont.

Continue from Appendix-D

126	Khorochi	1250.74	0	0	83.26	0
127	Boratwadi	545.97	0	47.06	39	0
128	Chakati	2778	0	14.46	418	0
129	Pithewadi	1344.15	21.02	4.6	105.25	16
130	Nirnimgaon	1654	38	0	93.47	10
131	Kacharewadi	1138.79	12.47	0	176.21	31.53
132	Sarati	705	44	0	62	0
133	Ganeshwadi	541.66	35	73.09	82.25	95
134	Pimpri Bk.	572.5	0	0	71.5	18
135	Tannu	561.79	18	0	80	0
136	Narsingpur	509.82	0	0.58	85.6	0
137	Giravi	778	0	0	2	0
138	Ozare	495.92	18	2.86	105.22	0
139	Gondi	912.58	0	26.82	97.6	0
140	Lumewadi	754.84	0	0	78.16	0
141	Bambadwadi	698.6	NA	NA	NA	NA
142	Kalamb	842.3	0	0	119.7	0
143	Bhigwan	281.7	22.56	0	8.74	0

Source : Indapur Talathi Office, Indapur.

Appendix–E

Agricultural Landuse Pattern in Indapur Tahsil in 2011

Code No.	Village Name	Crops									
		Jowar	Wheat	Oil Seeds	Bajara	Sugar cane	Fodder	Corn	Pulses	Vege-tables	Fruits
1	Shetphalgadhe	530	16	15	37	605	98	67	7	29	21
2	Pimpale	232	36	56	110	77	24	160	7	4	2
3	Madanwadi	656	45	44	56	505	35	65	16	9	15
4	Takrarwadi	16	2	4	2	54	7	14	1	2	0
5	Dikasal	56	10	14	4	104	12	29	4	6	2
6	Mumbhargaon	159	20	10	29	296	50	17	19	10	1
7	Bandgarwadi	20	15	5	4	72	11	17	1	5	3
8	Poundhawadi	260	102	18	48	462	51	25	28	11	24
9	Lamjewadi	132	9	0	31	17	24	25	8	10	17
10	Nirgude	118	10	0	30	136	55	55	9	14	56
11	Mhasobachiwadi	910	7	10	59	40	78	52	7	9	29
12	Vaysewadi	105	5	0	25	40	25	24	5	6	12
13	Akole	546	15	27	18	543	76	55	11	12	16
14	Bhadalwadi	325	10	25	125	358	39	31	4	20	11
15	Dalaj No. 1	35	3	3	2	58	45	29	0	9	4
16	Dalaj No. 2	50	6	15	3	120	59	72	10	13	1
17	Dalaj No. 3	112	49	3	2	177	42	33	0	5	4
18	Kalewadi	198	104	15	145	858	27	85	15	28	2
19	Bandewadi	45	10	0	4	100	24	23	0	5	10
20	Palasdeo	159	146	19	18	811	26	125	45	33	19
21	Malawadi No. 2	10	14	0	0	120	44	71	0	14	21
22	Bhawadi	132	55	10	55	266	26	30	3	2	6
23	Loni	98	98	11	46	646	50	90	10	9	21
24	Varkute k	245	56	20	20	456	37	67	37	19	43
25	Nhavi	497	50	20	165	451	48	156	65	20	89
26	Balpudi	156	10	3	30	118	16	110	12	29	36
27	Karewadi	25	46	6	17	100	12	55	25	12	31
28	Lakdi	175	24	0	104	54	100	42	20	7	59
29	Nimbodi	39	55	0	3	148	88	61	2	2	60
30	Shindewadi	158	50	20	23	263	120	63	15	55	255
31	Kazad	600	104	17	51	195	115	83	15	8	153
32	Kalas	1620	89	56	99	388	56	133	94	44	249
33	Pilewadi	150	7	8	45	135	45	63	5	44	20
34	Gosaviwadi	290	155	20	55	96	65	103	12	37	72
35	Maradwadi	25	9	0	7	25	11	35	0	4	9
36	Rui	369	298	20	197	598	185	170	29	23	98
37	Thoratwadi	25	12	9	29	141	19	54	3	5	14
38	Birungwadi	270	7	9	18	8	27	39	4	18	92
39	Bori	156	40	68	38	432	85	122	12	7	726
40	Sansar	40	59	10	32	759	17	38	10	9	88

Cont.

Continue from Appendix-E

41	Bhawaninagar	10	6	1	2	44	9	18	3	6	10
42	Jachakvasti	25	9	0	0	228	8	18	7	2	62
43	Belewadi	136	17	15	38	146	53	67	6	28	71
44	Sapkalwadi	20	5	4	2	98	10	19	6	12	24
45	Hinganewadi	5	27	0	8	161	16	34	5	7	29
46	Tawashi	69	51	10	25	358	26	75	10	7	24
47	Pawarwadi	49	73	19	29	180	15	15	3	12	3
48	Kardanwadi	15	20	12	8	105	3	38	8	10	8
49	Lasurne	100	898	190	133	1198	197	456	10	33	173
50	Jankshan	15	6	0	10	125	26	31	3	7	31
51	Thoratwadi	68	15	0	20	53	25	72	5	18	7
52	Paritwadi	90	25	10	32	98	37	57	45	13	28
53	Udhat	34	35	0	4	159	16	55	7	7	2
54	Gholapwadi	8	15	0	3	51	10	18	5	2	0
55	Jamb	15	20	0	2	154	13	33	3	1	2
56	Mankarwadi	12	20	0	10	74	16	20	3	6	18
57	Chavhanwadi	45	20	4	10	56	13	38	3	4	8
58	Kurawali	33	98	0	20	358	29	49	7	5	13
59	Chikhali	15	35	0	6	140	42	22	5	3	2
60	Vyahali	473	2	23	111	2	11	85	36	3	312
61	Kauthali	615	3	0	135	14	11	95	27	35	259
62	Kacharewadi	172	4	0	3	0	7	40	2	9	50
63	Nimgaon Ketki	1801	25	0	132	21	24	300	16	79	623
64	Gotandi	356	30	0	2	135	49	259	8	42	467
65	Shelgaon	956	38	25	356	284	61	267	21	96	1056
66	Bharnewadi	110	13	10	45	270	17	20	2	18	559
67	Anthurne	159	95	16	69	280	14	35	4	12	98
68	Kadbanwadi	1225	56	16	230	215	25	126	6	28	420
69	Hangarwadi	305	59	11	54	53	56	72	10	25	14
70	Pitkeshwar	120	33	5	49	198	40	147	7	35	201
71	Varkute Kh.	98	12	0	45	24	60	151	8	60	856
72	Kati	650	43	21	154	75	44	140	11	11	497
73	Jadhavwadi	45	9	0	4	22	10	12	5	1	5
74	Sarafwadi	145	89	5	3	194	54	112	5	15	66
75	Ghorpadwadi	183	35	6	56	65	18	78	3	6	16
76	Sirsatwadi	60	125	10	56	261	85	46	14	19	26
77	Ranmodwadi	130	78	18	67	149	15	94	3	7	22
78	Nimsakhar	1020	210	15	45	452	68	237	4	2	110
79	Nirwangi	294	120	19	105	459	57	160	5	22	33
80	Chandgaon	0	5	0	0	145	27	40	2	1	4

Cont.

Continue from Appendix-E

81	Agoti No.1	125	68	19	167	278	16	30	2	4	2
82	Agoti No.2	0	26	0	2	120	24	27	0	2	5
83	Ganjewalan	139	79	0	10	245	14	28	0	4	7
84	Kalashi	120	199	45	41	345	24	54	5	7	1
85	Kalthan No.1	105	256	12	56	456	31	61	12	15	12
86	Shirsadi	25	98	8	28	362	14	40	0	0	0
87	Padasthal	45	93	20	19	297	110	27	1	0	0
88	Takali	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na
89	Ajoti	10	126	3	7	309	77	50	5	9	2
90	Sugaon	35	49	0	25	315	8	29	3	8	2
91	Pimpri Kh.	12	17	0	10	79	28	7	1	5	2
92	Malwadi	279	171	19	91	439	110	46	1	1	18
93	Kalthan No.2	378	478	28	176	463	78	130	8	5	2
94	Narutwadi	120	128	19	39	378	53	98	24	9	2
95	Galand Wadi No.1	30	92	0	12	372	17	30	1	3	52
96	Vangali	92	49	0	35	197	11	47	2	6	12
97	Rajwadi	2	0	0	0	74	14	12	0	0	19
98	Gagargaon	27	40	0	10	250	38	50	1	9	22
99	Bijwadi	135	132	12	78	299	17	49	19	28	82
100	Pondkulwadi	40	10	0	6	23	16	10	5	2	17
101	Indapur	840	624	45	250	1771	49	230	138	190	71
102	Shaha	15	118	4	57	239	16	15	3	18	5
103	Kandalgaon	157	234	15	49	567	10	153	4	2	10
104	Taratgaon	67	201	78	29	549	36	12	8	15	5
105	Hingangaon	74	146	23	52	399	10	67	3	23	10
106	Sardewadi	149	104	12	74	372	35	76	2	5	4
107	Galand Wadi No.2	235	6	0	67	48	79	301	3	0	35
108	Gokhali	302	4	0	31	37	32	55	1	3	101
109	Tarangwadi	678	6	0	65	13	12	140	4	8	98
110	Zagadewadi	76	18	0	2	178	46	11	7	23	167
111	Pandharwadi	686	10	1	12	143	23	115	9	17	87
112	Vadapuri	190	15	3	33	204	45	239	14	11	80
113	Bedshinge	196	6	0	7	56	45	42	5	12	32
114	Babhulgaon	90	132	0	71	582	130	175	4	0	1
115	Bhat Nimgaon	135	60	0	58	255	63	41	3	10	15
116	Awasari	187	104	12	69	297	75	80	18	6	59
117	Shetphal Haveli	176	97	4	68	453	50	173	14	28	144
118	Reda	187	60	15	100	108	39	80	8	10	231
119	Bhodani	194	67	4	34	139	29	98	8	2	60
120	Surwad	163	9	6	7	136	13	102	16	3	34

Cont.

Continue from Appendix-E

121	Bhandgaon	207	106	20	65	558	87	149	15	15	28
122	Vakilwasti	135	77	8	34	145	21	82	8	5	30
123	Bawada	830	223	34	109	717	196	355	34	42	239
124	Lakhewadi	588	87	2	63	367	45	132	6	5	49
125	Redani	857	129	28	70	238	116	94	16	5	102
126	Khorochi	321	145	0	15	456	36	98	7	15	45
127	Boratwadi	256	65	12	111	170	29	45	9	3	6
128	Chakati	205	53	14	13	118	36	74	11	5	13
129	Pithewadi	193	79	1	34	136	17	73	12	3	25
130	Nirnimgaon	180	75	6	40	118	47	65	2	16	12
131	Kacharewadi	227	9	3	34	84	22	65	10	18	38
132	Sarati	220	56	13	56	319	15	78	6	5	11
133	Ganeshwadi	123	29	15	23	154	66	72	2	6	5
134	Pimpri Bk.	95	189	12	5	460	20	83	6	2	40
135	Tannu	114	78	12	32	411	24	75	1	0	8
136	Narsingpur	112	96	10	56	249	45	78	28	22	2
137	Giravi	163	84	20	74	369	52	69	2	0	10
138	Ozare	102	17	0	2	88	15	50	2	0	5
139	Gondi	98	17	0	2	102	21	20	2	0	16
140	Lumewadi	93	33	8	11	175	18	62	3	0	11
141	Bambadwadi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
142	Kalamb	452	299	45	121	1190	100	117	67	10	11
143	Bhigwan	147	87	10	41	393	11	19	1	7	2

Source : Indapur Talathi Office, Indapur.

Appendix-F

QUESTIONNAIRE-I

VILLAGE INFORMATION

1. Name of the Village-

2. Tahsil- District-

3. Distance from Tahsil –

4. Population (2011) - Males- Females-

5. Number of households-

6. General Land use in hectares –

Sr. No.	Land use Categories	2011
1	Total village area	
2	Net sown area	
3	Land not available for cultivation	
4	Cultivable waste	
5	Fallow land	
6	Forest	

7. No. of Farmers - No. of Land Holdings –

8. No. of Agriculture Labours –

9. No. of Main Workers -

10. No. of Other Workers –

11. Area Under Major crops (in hectares) –

Sr. No.	Crops	Area	Sr. No.	Crops	Area
1			6		
2			7		
3			8		
4			9		
5			10		

12. Irrigation Details –

Sr. No.	Type	Area in Kharip	Sr. No.	Type	Area in Rabi
1			1		
2			2		

13. No. of Wells in the Village –

14. No. of Bore Wells in the Village –

15. No. of Lift Irrigation in the Village –

16. No. of Wells in the Village –

17. Major Implements used –

18. Major Inputs –

19. Use of Pesticides –

20. Other Facilities in Villages –

Sr. No.	Facilities	Numbers
1	Weekly market	
2	School	
3	Drinking water	
4	Agro-service centre	
5	Transport and communication	
6	Electricity	
7	Hospital	

21. Group Discussion with Villagers and Official on Following Points

1. Agricultural Practices –

2. Irrigation –

3. Soil Type –

4. Water Table –

5. Dairy and Poultry-

6. Govt. Schemes –

7. Crop Production –

8. Other Problems Faced By Farmers –

QUESTIONNAIRE-II

FARMERS INVENTORY

1. Name of the Village – Tahsil - District –

2. Name of the head of the family –

3. Family details –

Sr. No.	Name of the Person	M/ F	Relation with H.H.	Age	Educational Status	Occupation	Income
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

4. Details of Land Holding –

A. Total Land Owned by family – (Total): (Hectares)

B. Irrigated Area- Hectares

C. UN Irrigated - Hectares

5. Cropping details of the last year (2011-12)

Sr. No	Crops	Area	Use of the fertilizers	Production	House consumed	Sold
1						
2						
3						
4						

6. Name of the Agriculture Equipment's –

7. Livestock –

8. Source of irrigation –

Sr. No.	Type	Perennial Area	Seasonal Area
1	Well		
2	Canal		
3	Lift		
4	Other		

9. Agriculture Problems –

Sr. No.	Field	Problem	Solution
1	Soil		
2	Crops		
3	Irrigation		
4	Labour		
5	Employment		
6	Migration		
7	Market		
8	Transportation		
9	Govt. schemes		
10	Dairy		
11	Other		

10. Other income sources –

Sr. No.	Sources	Monthly /Yearly income(Re.)
1	Agriculture	
2	Service	
3	Dairy	
4	Poultry	
5	Self-Employment	