

Agriculture Development in Baghelkhand Region of Madhya Pradesh: An Analysis

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Abstract:

In Baghelkhand region districts dissected terrain dominated by hills and plateaus impede the extension of agricultural development. To know the status of agricultural development data related to land use land cover was used. Data on gross cropped area, net sown area, cropping intensity, culturable land, fallow land, and area under major crops such as Wheat, Tuar, Millets, Wheat, Pulses, and Jowar has also been compiled and analysed under Rabi and Kharif crops. By making usage of the table of critical values of Doi's method, the crop combinations in Baghelkhand Region of Madhya Pradesh has been ascertained. Considering seven crops, there are only one (Shahdol) district in region had two crop combination while there are only two first ranking crop in the region. Rice and wheat crops have covered all the districts. In Satna district Wheat is in first ranking and it is only district where Gram is second ranking crop while Soyabean is only in this district exhibits fourth ranking crop combination.

Keywords: Doi's method, Agriculture Development, Crop Combination, Cropping Intensity, and Production.

1. Introduction:

Agriculture accounts for the largest share of the world's economically dynamic populace. Agriculture is a significant contributor to the national income in various developing countries. It is accountable for a minor proportion of the gross domestic product and employs less than 10 percent of the employed population in the developed countries. But it is the main user of land and between 20-30 percent of the disposable income goes on food (Grigg, 1981). Farming sector is the backbone of the Indian economy for the reason that it provides employment a huge portion of the population and helps in livelihood generation. It provides livelihood to not less than half a billion people by employing to 52 percent of the labour force. Its share in the country's gross domestic product was virtually 13.9 percent in 2011-12 (Anonymous, 2013). It is a significant means of raw material and demand for several industrial goods, mainly agrarian equipment, chemical fertilizers, insecticides and pesticides, and a range of consumer goods. This sector is also significant for meeting the demand for foodstuff and livelihood safety of the general public. It attempts to fetch about rational dissemination of earnings and wealth in the countryside and urban areas and reduce poverty which in turn, improves the eminence of life. Development in agriculture has a maximum surging bearing on other segments, leading to the blowout of benefits over the whole economy and the major section of the populace. Further lately this has been labelled as the rural-urban-continuum (Alagh, 2013).

In Baghelkhand region districts dissected terrain dominated by hills and plateaus impede the extension of irrigation facilities. Rapid expansion of medium and minor irrigation scheme in districts. Number of tube wells and pumping sets increase very rapidly during plan periods. In region districts, tube wells irrigation has developed largely at the personal initiative of the farmers for which consolidation of land holdings and availability of large urban market is responsible to a large extent farmer also have access to advance technology. This maximizes the benefit of irrigation. Most of these districts, particularly of western part predominantly produce such Rabi crops which require less water. Whatever irrigation is done it is by private means among which wells and tube wells are worth mentioning. As result of this, density of irrigation wells and pumping sets is very high in these districts. But their number and capacities could not be raised rapidly. Consequently, growth of irrigated area remains moderate in comparison to districts which have been provided several government sources of irrigation, including canals. Baghelkhand districts are poor in political consciousness. In these districts very low rate of growth depends on backwardness of tribal population, undulating and dissected topography and dense forest, this impedes the extension of irrigation. In region irrigation received a good fillip due to the augmentation of water supply in the main canal system and reservoir. Highly irrigated area extends over mainly districts. (Western part). These districts with markedly low rainfall grow dominantly such Rabi crops as wheat and Jowar. Rewa district, recording highest increase in irrigated area, had only 0.2 per cent of total cropped area under irrigation. It has good fertile alluvial soils and comparatively level lands. In Sidhi (1.8) and Shahdol (1.2 percent) irrigation has not started in real sense. In short, the Baghelkhand plateau, Rewa plateau fail even to employ such basic input as irrigation. In these district negligible developments of irrigation is due to the undulating and highly dissected topography covered with dense forests, deep and sporadic location of sizable aquifera exploitation of which is beyond the economic means of the individuals and has investment capability of the farmers due to their small and less productive farms. On livelihoods dependent on agriculture, the quality and productivity of land has a significant effect. The productivity of agricultural land is at the heart of income earning opportunities, and the well-being of the people is dependent on the yield from agriculture. If we look at the figure 5 on agriculture productivity it gives a fairly good idea of the regional dimensions of the strengths of agriculture, a surrogate measure for basic well-being of those working in farm activities. There are identifiable districts of low agricultural productivity in the state. In the case of major Kharif crops, the low productivity belt is largely concentrated in the Rewa and Shahdol divisions. In the case of major Rabi crops too, there is a well-defined low productivity belt, which is, however, slightly different from the low productivity belt defined for Kharif crops. In Rabi, the districts at the bottom in terms of yield per hectare fall entirely in the Rewa and Shahdol division. The implication of continuing low productivity in the eastern region of the state is that income earning opportunities from agriculture would be limited. There is a need to bring this region into focus and look at ways of making a concerted effort to increase irrigation intensity, as well as undertake watershed development in a big way. Nearly forty percent of the agriculture labourers are concentrated in districts of Rewa, Sidhi, Shahdol and Satna of region.

Study Area

Baghelkhand region of Madhya Pradesh extends between the latitudes 22° 50' to 25° 28' North and the longitudes 80° 20' to 82° 58' east. It is in the central part of the peninsular 'foreland' and situated between the alluvial stretch of the northern Great Plains and the Deccan. It naturally presents a transitional zone incorporating the Vindhyanal. The very name of the region is derived from the combination of physical and cultural complex (Fig. 1). The region's northern boundary touch with Allahabad and Chitrakoot district of Uttar Pradesh and north-east part touch with Mirzapur district. Sarguja (Baikunthpur), Jabalpur and Dindori district come to east and south of the region. Western limits of the region touch through Panna district (Singh, 1971).

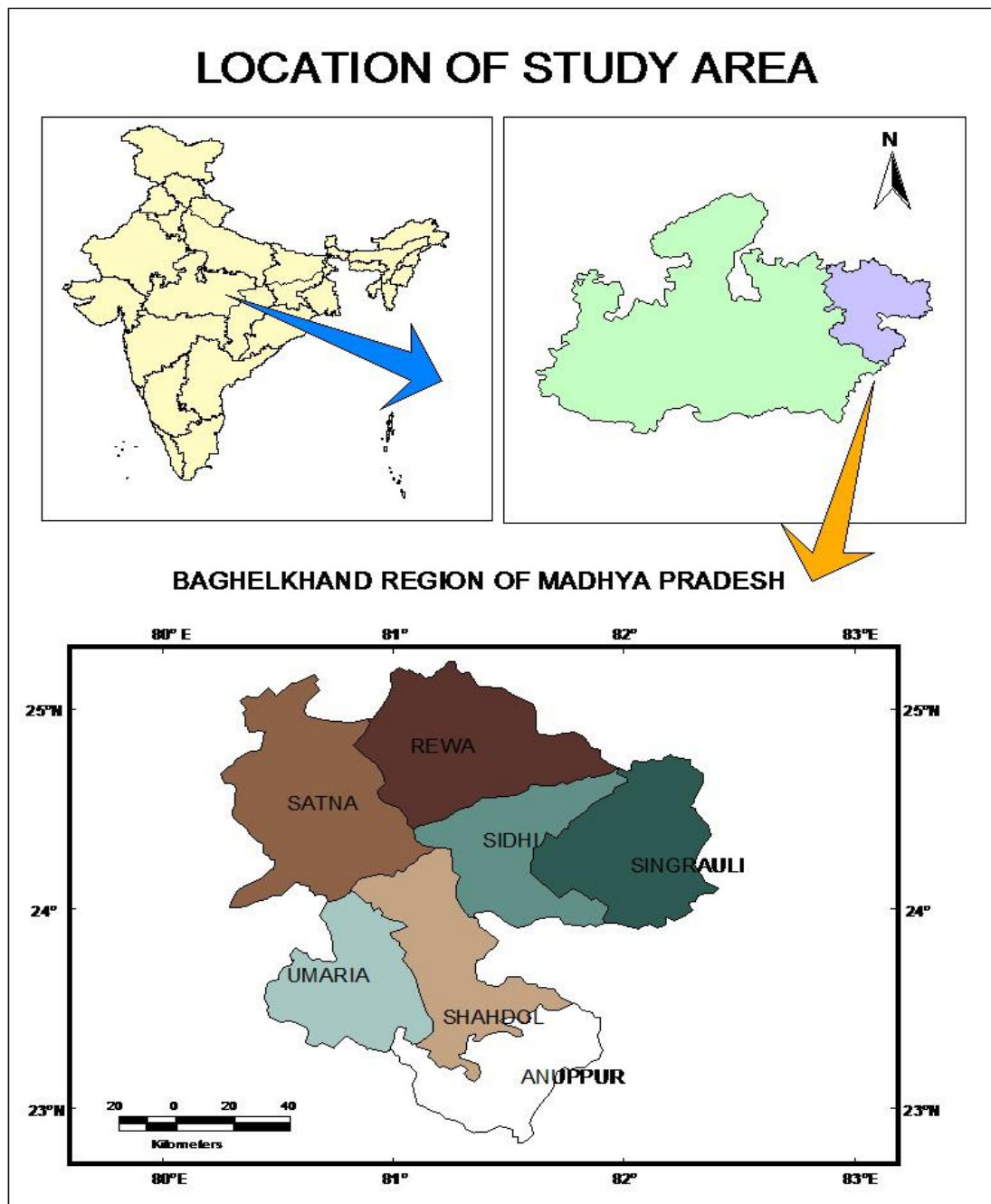


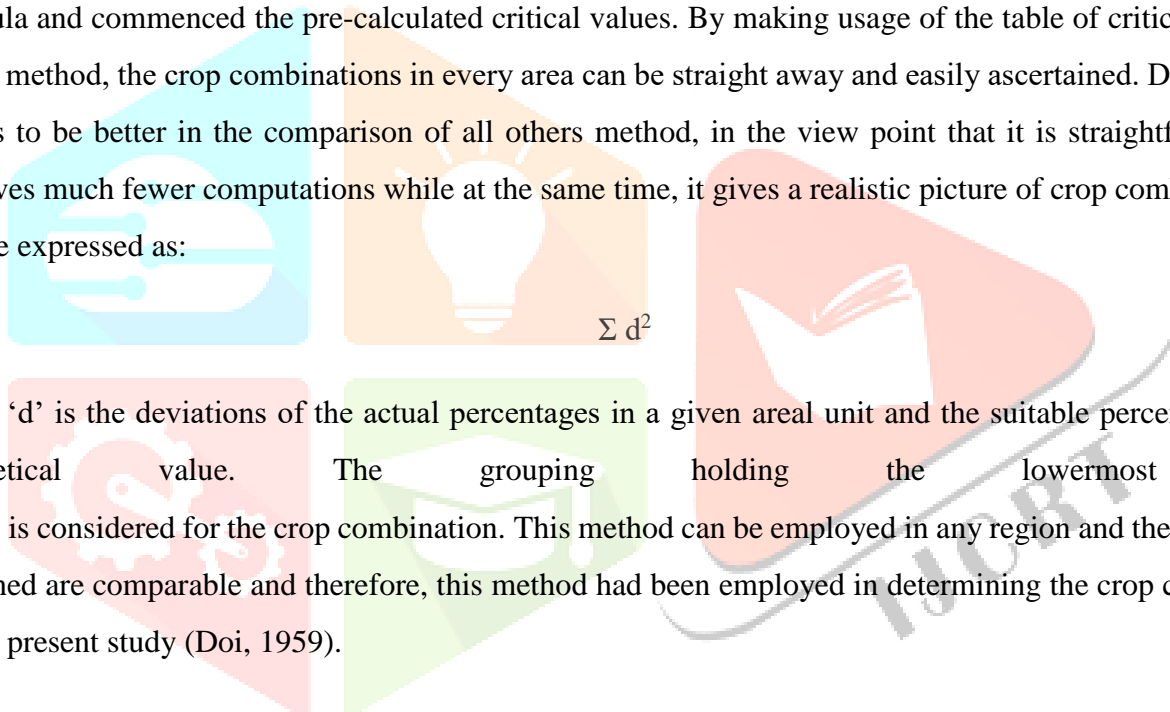
Fig. 1. Location map of the study area.

2. Data Source and Methodology

Data related to land use land cover have been compiled from various government department. Data on gross cropped area, net sown area, cropping intensity, culturable land, fallow land, and area under major crops such as Wheat, Tuar, Millets, Wheat, Pulses, Wheat, and Jowar has also been compiled and analysed under Rabi and Kharif crops.

To identify crop combinations and crop regions, many non-quantitative and quantitative methods has been used. Non-quantitative methods are generally subjective, approximate and arbitrary. Quantitative statistical techniques are more exact, scientific and objective. Weaver's minimum deviation method (1954) was the initial endeavour to ascertain the crop combination regions in the mid-West of the U.S.A. This technique was unsuccessful to ascertain crop combinations and showed anomalies in certain cases.

Doi (1959) went along Weaver's process but escaped the cumbersome computations without 'N' from the formula and commenced the pre-calculated critical values. By making usage of the table of critical values of Doi's method, the crop combinations in every area can be straight away and easily ascertained. Doi's method seems to be better in the comparison of all others method, in the view point that it is straightforward and involves much fewer computations while at the same time, it gives a realistic picture of crop combinations. It can be expressed as:



Here, 'd' is the deviations of the actual percentages in a given areal unit and the suitable percentage in the theoretical value. The grouping holding the lowermost value (Σd^2) is considered for the crop combination. This method can be employed in any region and the results thus obtained are comparable and therefore, this method had been employed in determining the crop combination in the present study (Doi, 1959).

3. Growth of Cropped Area and Landuse Pattern

Table 1 gives the trends in gross and net cropped area in the region. In region Net sown area has continued to growing till the late 1990s touching the figure of 41 percent of total geographical area in 1996-97 but in next decade net sown area still declining up to year of 2006-07. While according to report of Madhya Pradesh Krishi Kalyan Samiti report of 2010, in Baghelkhand Net Sown Area has been increasing which is good sign for agriculture growth. Thus, the area expansion was a source of agriculture growth in region till the 1990s. The expansion in NSA has taken place by converting uncultivated areas and cultivable wasteland into cropland.

Total Net Sown Area increased from 14.83 lakh hectares in 1991-92 to 15.79 lakh hectares in 1996-97 and 15.88 lakh hectares in 1999-2000. During the 2000-01 to 2006-07 the rate of growth of net sown area has declined considerably due to low rainfall. In 1996-97 regions have 2.84 lakh hectare lands under non

agriculture land while in 2006-07 it has increased up to 4.26 lakh hectares, whether on other hand net sown area has been declining in this duration. It shows that cultivable land of region is converting into culturable wasteland. Hence, Baghelkhand region has potential to increase agricultural area by the regenerating or rectifying land which is unproductive (Table 1).

Table 1.: Gross and net cropped area of region, 1991-92 to 2010-11 (In, 000 hectare)

Years	Net Sown Area	NSA/Total Geographical area (percent)	Area More than once or Double Cropped Area	Gross cropped Area	Cropping Intensity (percent)
1991-92	1483.2	38.66	292.3	1775.6	119.71
1996-97	1579.8	41.17	444.3	2024.1	128.12
2001-02	1518.0	39.5	434.5	1952.6	128.62
2006-07	1485.5	39	463.7	1949.2	131.00
2007-08	1470.2	38.3	453.3	1923.5	131
2008-09	1472	38.4	475.4	1947	132.2
2010-11	1550	40.40	573	2123	136

Source: GoMP (Various Departmental Reports)

The net sown area is declined up to 2007-08 end while the agriculture production is increasing in this period, it shows that some factor has affecting to agriculture development in this period of time while rainfall is much lower at that time while due to increases of Irrigation, fertilizer and HYV consumption pretending agriculture production. The Rewa and Satna district has highest proportion net sown area in region while Umaria and Shahdol district has less. The high proportion of net sown area is due to some factor which is given below:

- The maximum percentage of land is plain.
- Soil texture (especially Black and red mixture soil).
- Irrigation facilities are highest in both of district in region such as density of Tube well irrigation source.
- High and very high density of rural population.

After 2001-02 the Net sown area percentage had decline and Anuppur and Umaria district have slow growth due to undulating hilly and forested area, where expansion is physically not possible even after the development of irrigation or they have highly developed their potential land. In Rewa, Satna and Sidhi districts the least change of net sown areas take place because of most of the cultivable area has been under plough in these areas since long, due to, dense population therefore, net sown area did not increase in this region. The cropping intensity grew steadily from 120 percent in 1991-92 to 131 percent in 2006-07. By this perspective intensive cultivation is increasing so, the (Table 1) shows double cropped area and cropping intensity has increasing which focused to the intensive farming pattern and this process takes to develop maximum number of irrigation capacity. The cropping pattern is intended to increase productivity of a fixed area by expending more capital and labour (Bilas, 1988).

Cultivable waste land denotes land considered by present judgment as cultivable but actually not cultivated on account of physical, agronomic, socio-economic and demographic constraints. Cultivable wasteland is important for future expansion in cultivation (Singh, 1974, p 116). In 1998-99 total cultivable waste land was 4 percent which increase to 5 percent of total area in 2007-08 (figure 3). There are two reasons for this increase first, area of waste land increased due to removal of crippled forests and second, is due to the practice of lying fallow for longer period (Jain, 1988).

High proportion of culturable waste lands is in the Kaimur and Satpura hills, Baghelkhand Plateau and upper son valley. These areas are hilly with undulating terrain, poor fertility of soil and poor irrigation facilities. Anuppur districts of all Blocks record very high proportion of cultivable wastelands. Sohagpur and Jaisinghnagar (Shahdol), Teonthar (Rewa), Unchera and Majgawan (Satna) and Kusmi (Sidhi) blocks of region also, beside low fertility of soil and non-availability of fertility improving cheap technology, sparse population also favours such situation. Districts with low and very low proportion of cultivable waste cover most of the area of the region. It is note that in densely settled areas yield-raising inputs are used to keep land under cultivation rather than leaving it as fallow for long period. Use of irrigation is important among them (Jain, 1988).

All lands which were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years are called fallow lands (Sharma, 1991). Fallow lands in region were increased 8 percent in 1998-99 to 9 percent in 2007-08 on proportional of total area (Figure 3.). The high percentage of fallow lands comprise in Anuppur district while Satna consist low percentage. High percentage of fallow lands incorporates in some blocks of the region such as Pusprajgarh (Anuppur), Bandhavgarh (Umaria) and Mauganj (Rewa). Actual reason is that, in these blocks high proportion is due to undulating topography, poor soils, and unavailability of adequate irrigation facilities and poverty of farmers.

Area sown more than once is increasing throughout the years this category of land account for that area on which crops are raised more than once during the current agriculture year. Double crop area was raised from 16 percent in 1991-92 to 23 percent 2007-08, as Satna and Sidhi districts had high percentage of double cropped area while Shahdol was lesser in 2007-08. Proportion of double cropped is much higher on specific blocks rather than insignificant in other parts. Naigarhi and Jawa (Rewa), Rampur-Baghelan and Gangev (Satna) blocks have higher proportion of double cropped area due to level of land, fertile soils, and availability of irrigation facilities and pressure of rural population. The two peaks are in graph (Figure 2) showing changes of proportion of double cropped area and also refer the high increase in 1996-98 and 2005-06. This growth is so similar to map of rainfall increment in those years. So we can say that the additional rainfall positively affected the increasing of double cropped area. Shahdol district had lowest double cropped area under consideration due to little irrigation facilities as well as low pressure of rural population.

3.1. Changes in Cropping Pattern

Along with the expansion of area under cultivation in the 2010-11, the cropping pattern also underwent a major change. Though food crops still account for a sizeable proportion of the cropped area, their share has

come down sharply from 91.6 per cent in 1991-92 to 85 per cent in 2010-11. The main reason for this was the shift away from cereals, most notably wheat and Jowar, towards oilseed and pulses, mainly Tuar and Soyabean. As we shall see later, the pace of this move away from food crops differed from districts to districts. While food crops continued to dominate the cropping pattern in the Rewa, Satna, Sidhi and Umaria districts of region. Rewa is the only district in region in terms of most prominent crop cover of oilseed, mainly linseed and Soyabean crop and its cover 2 and 6 per cent respectively of total gross cropped area, while major area of Niger (Ramtil) is in southern part of region especially in Anuppur and Umaria districts.

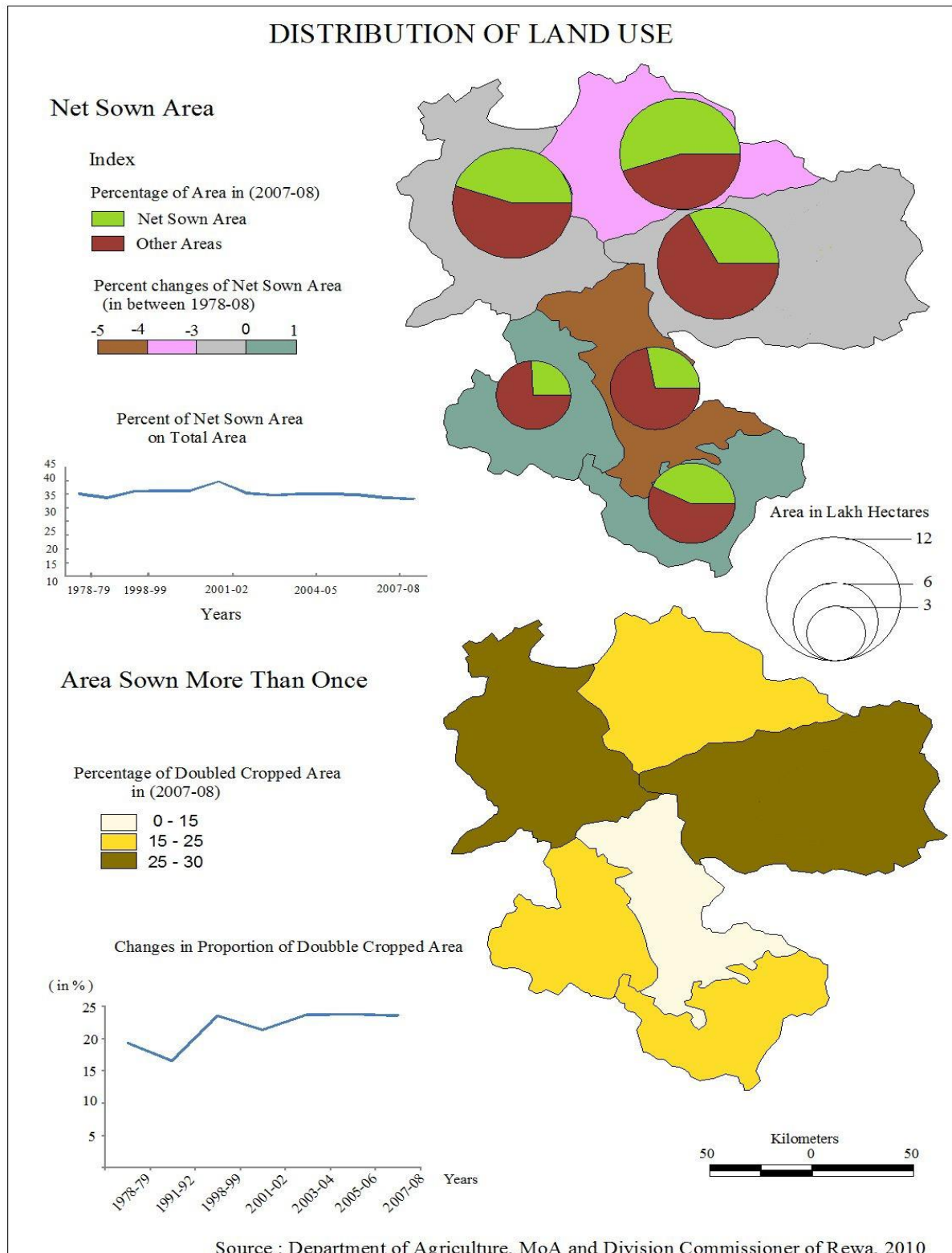


Figure 2: Landuse Pattern

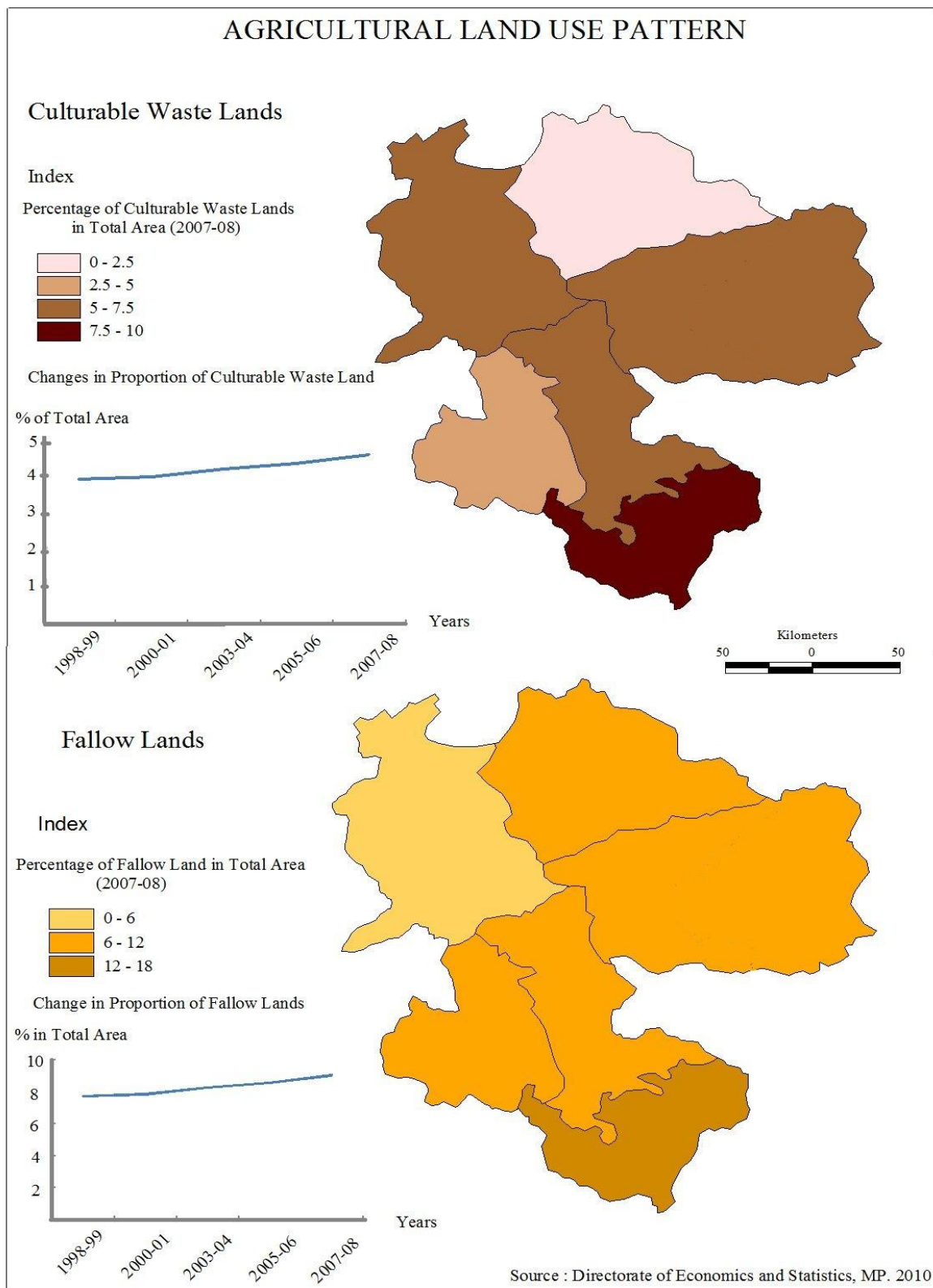


Figure 3: Agricultural Landuse

Table 2.: Area under Major Crops in Region, 1991-92 to 2010-11 (In per cent)

Crop/crop group	1991-92	1996-97	2001-02	2006-07	2010-11
Paddy	16.4	19.9	31.0	31.4	26.8
Wheat	24.1	24.2	24.3	23.0	20.2
Jowar	2.5	2.1	2.0	1.9	1.8
Maize	3.8	3.2	3.7	3.7	3.8
Total cereals	74.5	69.6	69.9	68.9	57.6
Gram	8.5	8.9	10.8	10.2	9.7
Tuar (arahar)	3.6	3.2	3.7	3.9	7.2
Total pulses	21.2	17.4	21.1	22.5	27.5
Rape & Mustard	1.2	-	1.7	-	2.5
Soyabean	1.1	-	1.1	-	5.9
Total oilseeds	8.3	12.0	7.8	9.3	13.7
Fruit and vegetables	0.8	0.8	1.0	1.1	1.1
Total Food crops	91.6	87.9	92.1	91.4	85.0
Total non-food crops	8.4	12.1	7.9	9.5	15.0
Gross cropped area	100.0	100.0	100.0	100.0	100.0

Source: Government of Madhya Pradesh (Various departmental reports)

Niger (Ramtil) is grown on 19.6 thousand hectare or 1 per cent of total cultivated area. It is a crop of hilly tract, as is the sesamum. Sesamum occupies nearly 49 thousand hectares of land. It is significant crop in the north-eastern part of the region, mainly Sidhi and Singroli districts. The Sesamum has 2.3 percent in total cropped area while Singroli districts has highest proportion (6.8 per cent of total cropped area) under sesame in the district followed by Sidhi (6 per cent). Soyabean now occupies as much as 5 per cent of the cropped area in the north, displacing traditional crop like Jowar and Tuar (Table 2).



Picture 3.1: Horticulture in Majhgawan, Satna **Picture 3.2:** Irrigation tool and pond in Patni

Table 3.: Changing cropping Pattern from 1991-92 to 2010

Districts	Crops whose area Decreased over the years	Crops whose area increased over the years
Rewa	Wheat	Gram and Lentil pulses
	Jowar and Tuar	Soyabean
Satna	Millets	Soyabean
	Wheat	Pulses (Masoor, Peas)
Sidhi	Pulses	Oil seeds (Soyabean)
Singroli	Wheat	Oilseeds
Shahdol and Umaria	Jowar	Maize and oilseeds

3.2. Present Regional Variation of Major Sown Crops and Their Changes in Yield Rate

The cropping pattern in the Region is dominated by the food grains. As much as 91 percent of the total cropped area is under these crops (in 2008-09). In the analysis of agricultural pattern only those crops have been selected which are highly cropped in the Region. These crops are such as Rice, Wheat, Maize, Jowar, Soyabean and Gram, while for lack of data availability rest of crops has not been taken in account (Table 3).

Rice

Rice is the first ranking crop in the Region. It occupies largest proportion (32 percent, 602 thousand hectares) of total cropped area in the Region. It is grown in all Blocks in the region; among them area under rice ranges from only 19 percent of the total cropped area in Satna district to as high as 54 percent in Shahdol district. Its distribution is very uneven as is clear from very high value to low value area under rice. There are two portion of region where rice crop is highly concentrated First, is Southern part which has high concentration of rice crops comprising all blocks of Shahdol, Umaria and Anuppur districts. Second is Eastern part consist Sidhi and Rewa district. The high concentration occurs from high rainfall cover average (1200-1400 mm) yearly and Red Yellow Soil with low water retentive capacity. Therefore, they can be cultivated in rainy seasons only. While medium concentration of rice is due to rainfall and soil but most important is the dependency of high density of rural population. The Yield of rice is growing slowly from 600 kg/ha. in 1991-92 to 840 kg/ha. in 2008-09 while Umaria district has low 540 kg/ha. and Shahdol consist 946 kg/ha. of rice production (Figure 4).

Wheat

Wheat is the second most important crop in the region. It occupies 441 thousand hectares of 23 percent of total cultivated area in 2008-09. Wheat is grown in almost every block; however, core of the concentration is in the northern part of the region, where highest percentage of net sown area is devoted. Two districts, Rewa and Satna cover 62 percent of wheat cropped due to fertile soils, level of land and the use of modern inputs. The reason of low cropped in region is due to cultivation of other Rabi crops while soil and least uses of modern inputs. The low cropped area comes under in Anuppur and Shahdol districts. The raising of other Rabi

crops is gram and oilseeds. In region the yield rate of wheat was 953 kg / ha. in 2008-09. Wheat area, production and yield has declined from 2001-09. Northern part is dry for wheat cultivation while hilly land with poor and low moisture content of the soils are not suitable for the cultivation of wheat in the southeast where rice is dominant.

Gram

Gram is the principal food pulse crop and third most important crop in the region. It occupies 201 thousand hectares (10.34 percent) of total cropped area. It is a significant source of nutritive, livestock food particularly for draught force which takes a fair proportion of the produce. Gram is grown throughout the region, but its concentration is in the north and north-eastern parts where low and moderate rainfall condition and medium black soil are available. Major producer of gram is Satna (19.64 percent) district and follows by Rewa (12.24 percent) district. Total area of gram crop has been increased up to 50 thousand hectares between 1991-09, while yield rate increment from 550 kg/ha in 1991-92 to 600kg/ha in 2008-09 (Figure 5).

Soyabean

Soyabean crop have now became one of the major crop of a region. It occupies 80 thousand hectares (4.12 percent) of total cropped area in 2008-09. Satna district has highest concentration which consist 10 percent followed by 5.08 percent in Rewa district. Yield rate was 660 kg/ha. in 1991-92 to 586 kg/ha. in 2008-09.

Maize

Maize ranks fifth among Total food and non-food crop covers 70 thousand hectare or 3.61 percent of cropped area in 2008-09. In the southern part of Shahdol, Anuppur and Umaria district are important maize growing districts. In fact, this crop requires sufficient water in Kharif season so, southern part of region received highest amount of water though, and mainly southern part of region produces maize crops. But the yield rate of crop has decreased 1200 kg/ha. in 1991-92 to 972 kg/ha. in 2008-09 due to raising of another Kharif crops (Figure 6).

Jowar

Jowar is sixth important crop of Baghelkhand region. It is mostly taken as a Kharif crop. There are 38 thousand hectares or 2 percent of cropped area in 2008-09. In Rewa and Sidhi Jowar has highest percentage of crop cover while these areas have more remunerative crops, like wheat, Soyabean (particularly in Rewa) and gram which occupy considerably larger area, have reduced the area under Jowar (Figure 6).

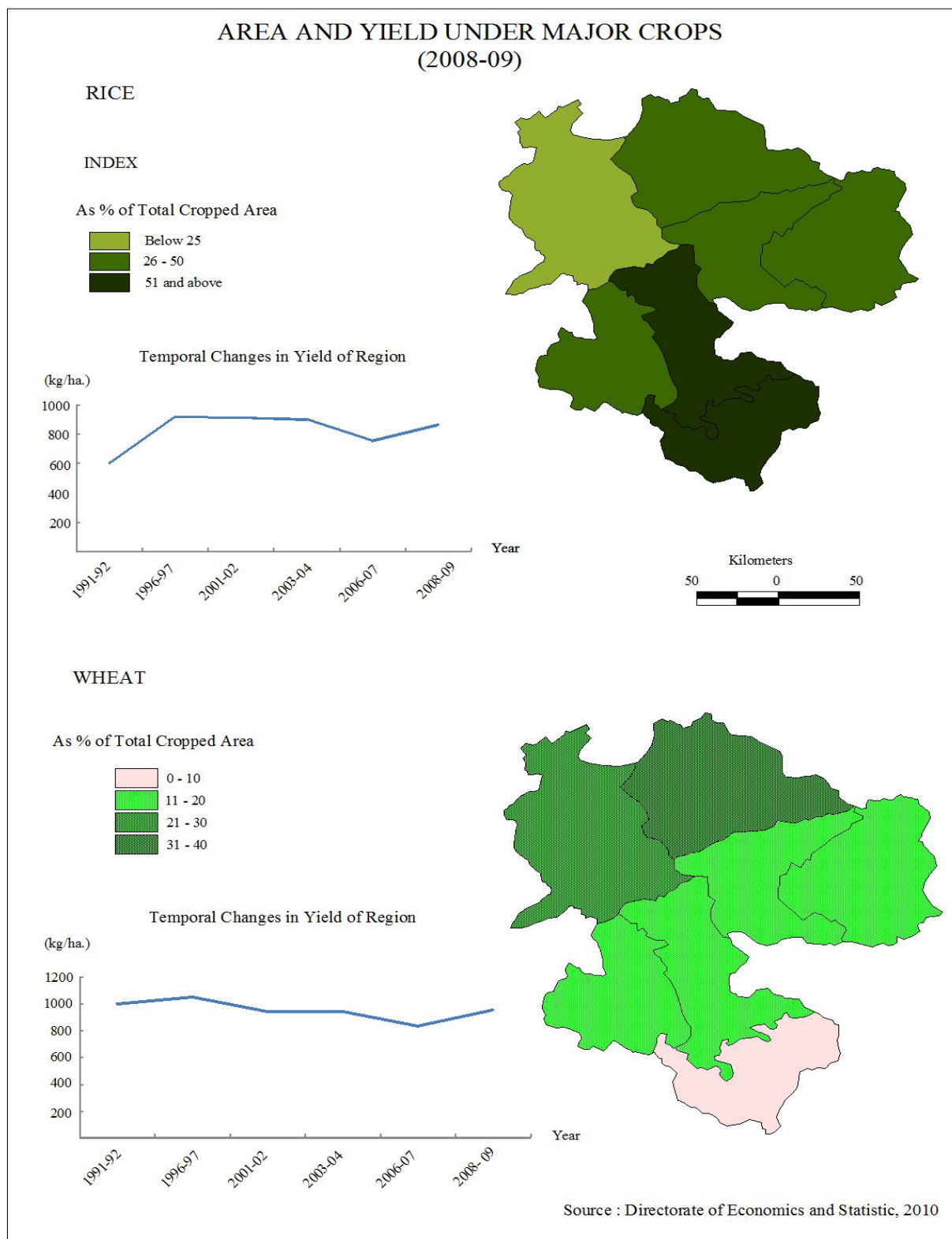


Figure 4: Area and Yield Under Rice and Wheat

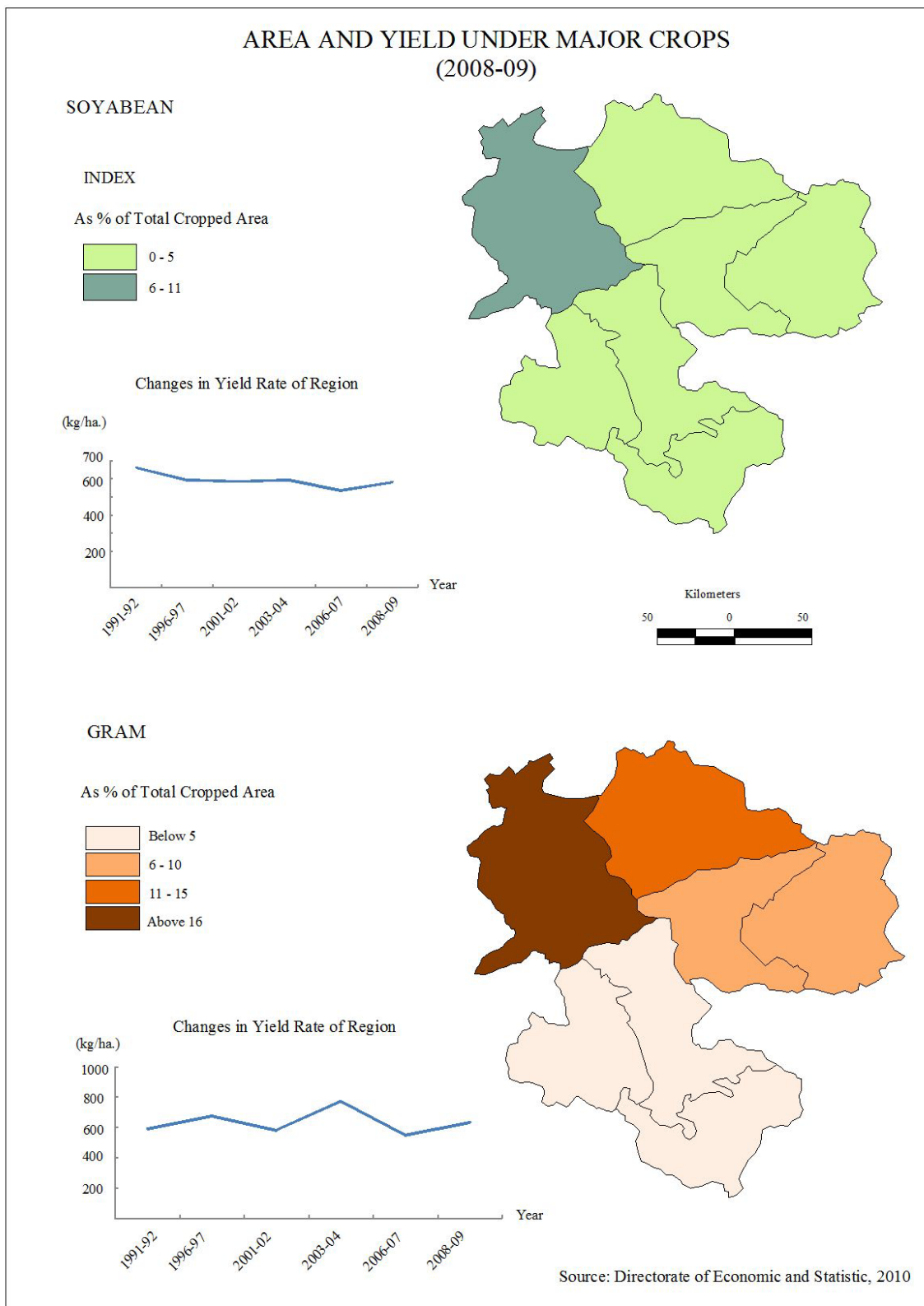


Figure 5: Area and Yield Under Soyabean and Gram

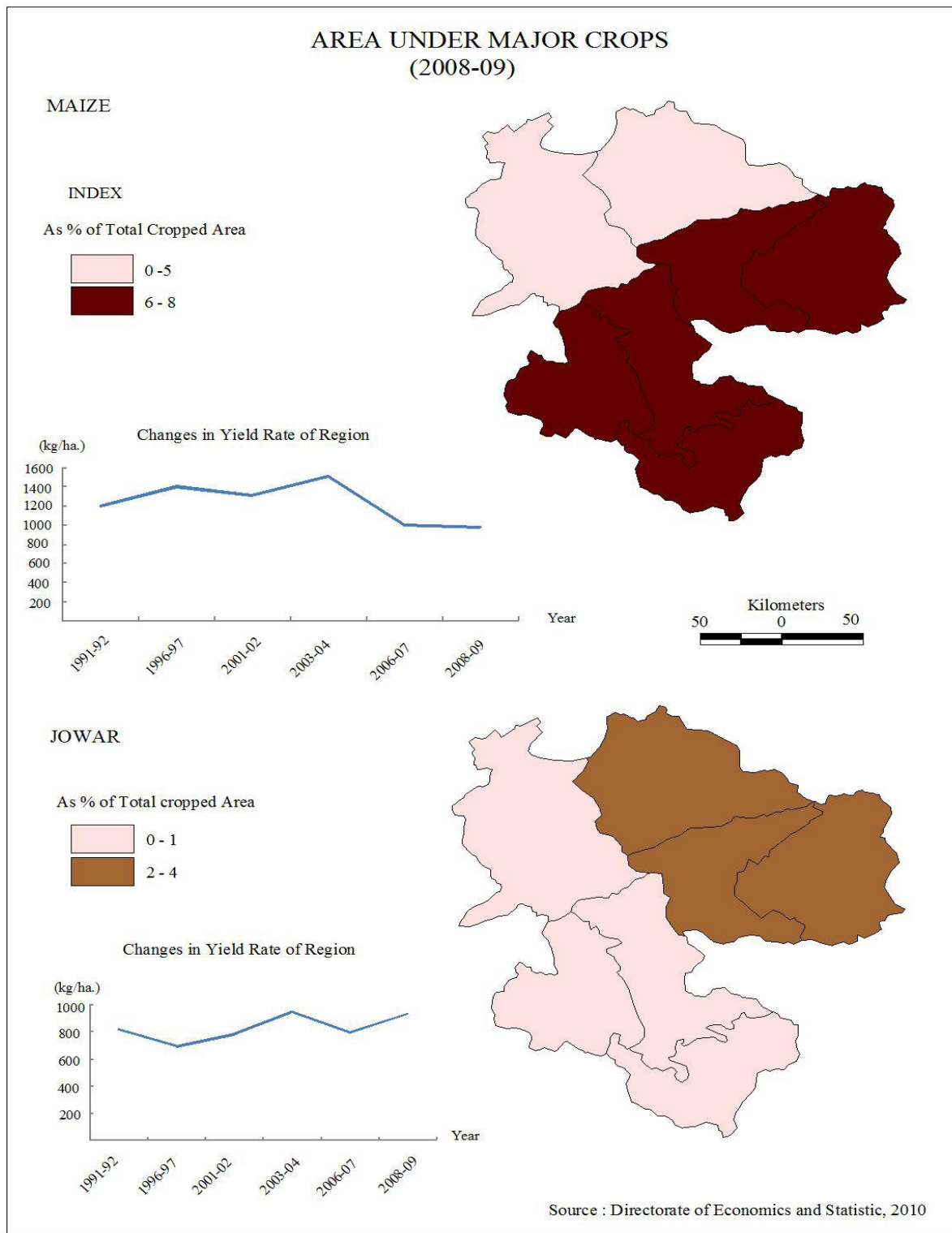


Figure 6: Area and Yield Under Maize and Jowar

Expansion in irrigated area has been accompanied by a substitution of relatively less water consuming local varieties of seeds with hybrids and high-yielding varieties have completely replaced unirrigated varieties of wheat in the region.

4. Crop-Combination and Crop-Regions

Crop combination indicates the group of important crops in the component areal unit. Crop combination technique was developed by Weaver (1954). In this analysis K. Doi (1957) formula has been used and he did not divide the sum of squares of differences by the number of crops involved as Weaver did.

A general understanding of the combinations of crops and the relative importance of each in area may be helpful in interpreting some aspects of the social and economic geography of the region and may bring out the significance of the individual crop (Sharma, 1991, pp-8).

The case of Rewa districts shows for example to demonstrate the procedure in figure 7. Wheat 32.27, Rice 28.39, Gram 12.21, Soyabean 5.08, Jowar 3.2, Tuar 2.79 and Maize 0.20. In figure 8 seasonal wise and two points of years crop combination method has been estimated with the help of DoI's method Therefore, suitable combination for Rewa district comprises three crops, viz. wheat, Rice and Gram. This method is used for all districts like same as above has done.

Considering seven crops, there are only one (Shahdol) district in region had two crop combination while there are only two first ranking crop in the region. Rice and wheat crops have covered all the districts. Rice is important in southern part while wheat is in northern part. In Satna district Wheat is in first ranking and it is only district where Gram is second ranking crop while Soyabean is only in this district exhibits fourth ranking crop combination.



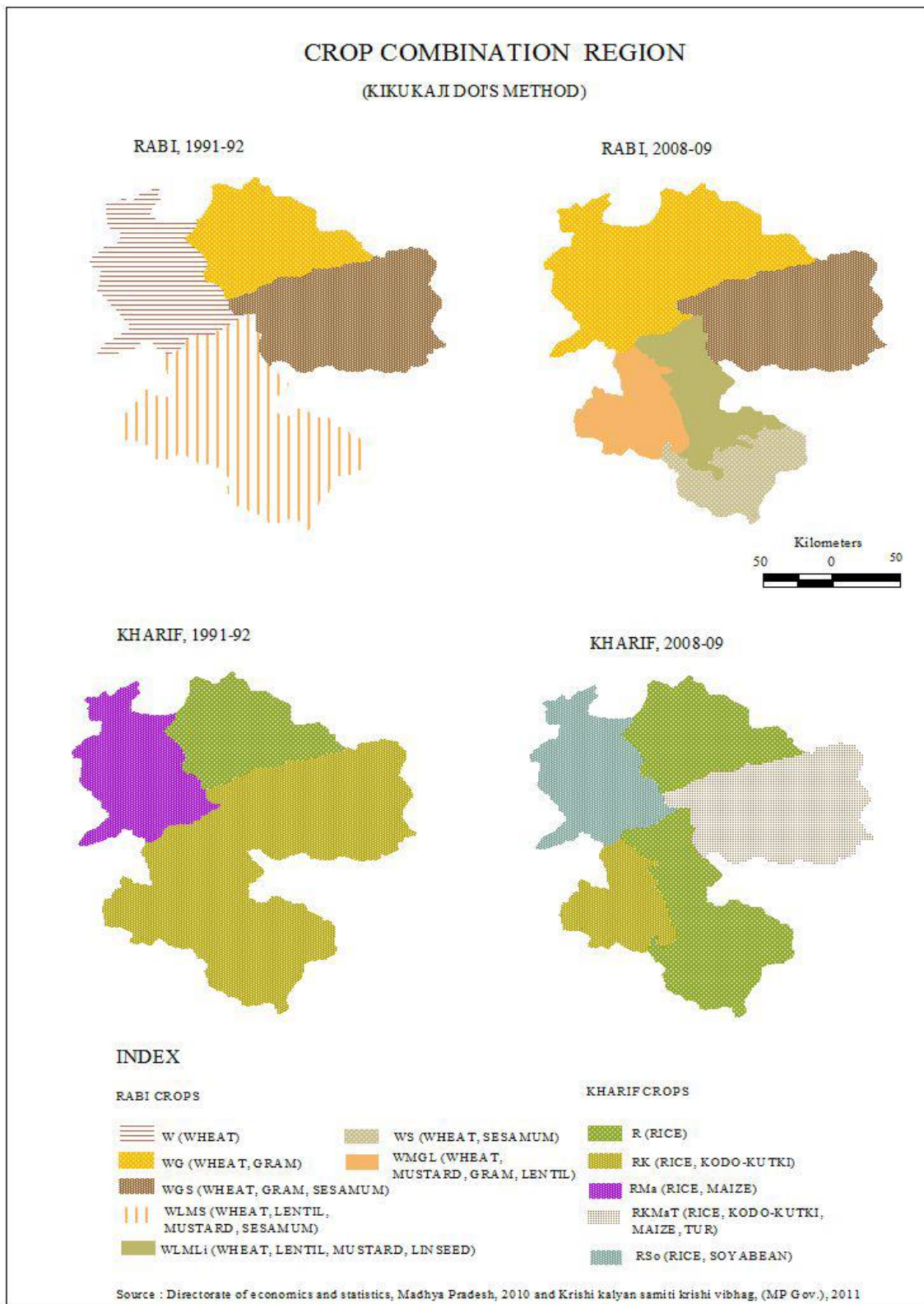


Figure 7: Crop Combination Region

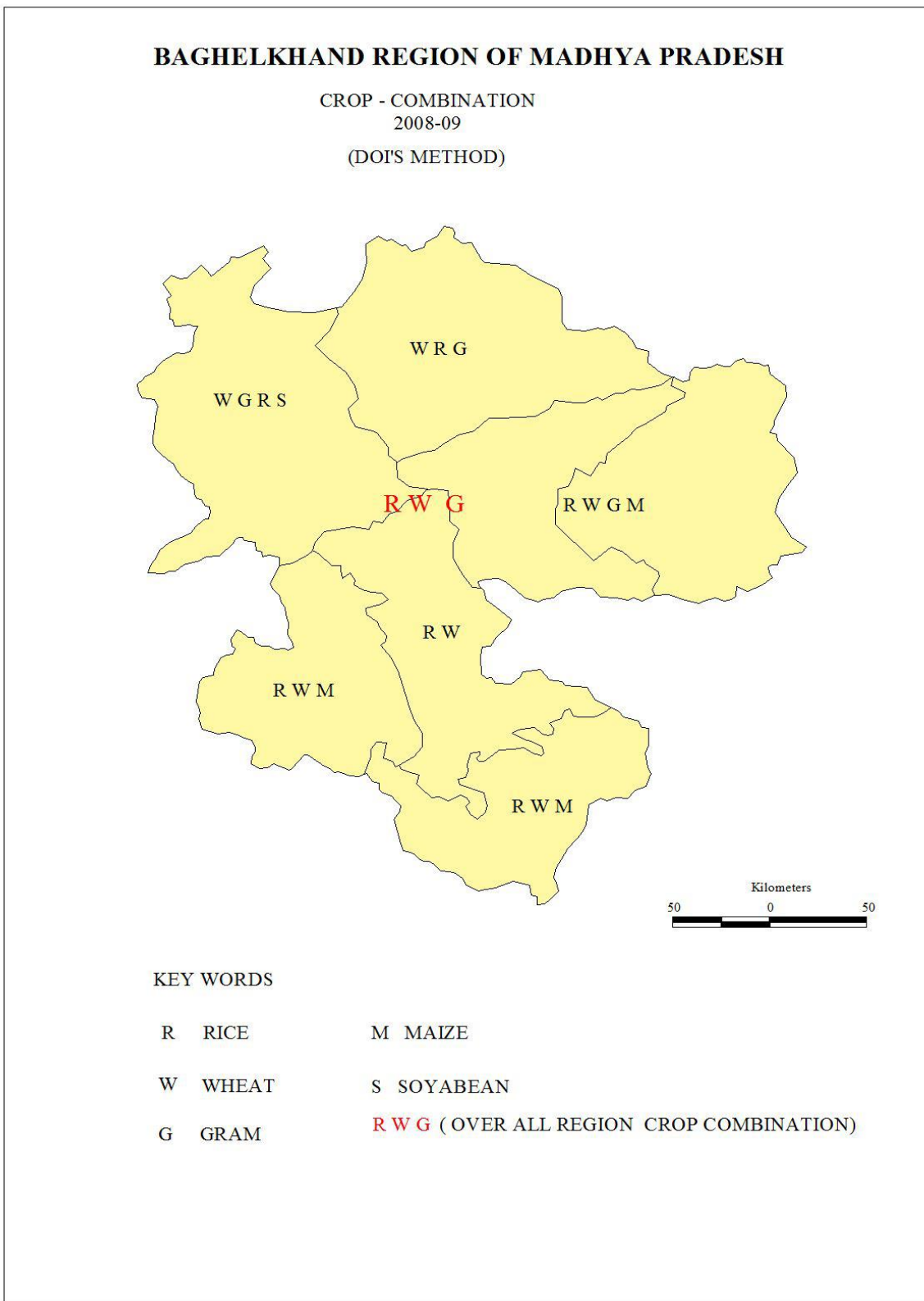


Figure 8: Baghelkhand Region Crop Comination

Thus, the cultivation in this region depends mostly on rainfall and is the victim of its vagaries. In land use pattern net sown area has static while doubled cropped area is increasing. However, most area of region come under in rainfed crop and it's also shows that irrigated area is very less and high dependency to rainfall. In region a year when less rainfall occurs than the average agricultural area and production has been affected, so we can say that the rainwater influence regions agricultural development. Horticulture crops in the region such as fruits, vegetables - vegetables, spices, flowers etc. are increasing. Pulses and oilseed crops are money

oriented crops so the increasing of these crops constitutes more dependency on commercial farming and provide more facilities to sustain livelihood.

5. Conclusion

The Rabi crops map illustrates, that the changes between 1991 and 2009 year of Rabi crops are such as gram crop. Gram crop has been increased in northern region which falls in Rewa and Satna districts while in southern part lentil, sesamum and mustard crop has been raised because of water resource infrastructure were under developed so these crops consumed less water depending upon soil moisture moreover, these crops seed are available easily and it takes less effort to cultivation. In Kharif crop map, it demonstrates that rice is a dominant crop and a kodo-kutki cereal which is famous between in tribal community (*Baiga*) as main food crop in southern and eastern part of region. The rice and kodo-kutki cereal crop combination cover four districts of region in year 1991-92 while in 2008-09 its farming only in Umaria district. Rice crop is raised on whole part of region. In Satna district rice and maize crops has been cultivated in 1991-92 while in 2008-09 Kharif map exhibits that maize crops percentage has been declined and after increase in number of water source infrastructure since 1991, this result shows that irrigated area has been increased in Satna district. Therefore, Soyabean crop has introduced in this region which had replaced maize crop. Sidhi district area falls in (RKMAT) crop combination region means beside rice and kodo-kutki, maize and Tur crops has been raised currently while in year 1991-92 only rice and kodo-kutki crops in practise. The temporal and spatial distribution of irrigated area, analyzed in the preceding paragraphs, is much localized phenomenon and restricted to certain areas. Irrigated area increased rapidly.

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