Comparative Study of Quantitative and Cartographic Techniques of Banana Crop Concentration in Raver Tehsil of Jalgaon District (M.S., India)

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Abstract

Jalgaon district is located near the heartland of India which is famous as '*Golden City*', because of huge transaction of gold metal and production of banana *(Yellow Gold)*. Both, gold metal and banana have raised the importance of Jargon district in Maharashtra State. This district ranks first in India in the production of banana and cultivated area under it. Periyar district in Tiruchirapally is a weak second in rank in the country. In Maharashtra state Parbhani is on second position. It's all India rank is 15th. These comparisons fully bring out the outstanding position of Jalgaon district with respect to banana production both in the state as well as in the country. There must be certain physical and human conditions most favourable for the cultivation of banana in this district.

The main intension of this research paper is to display the concentration of banana cultivation with the help of quantitative and cartographic methods. The viability of both methods is assessed by comparing with each other. In the quantitative techniques, crop concentration method suggested by Sham S. Bhatia and proportion are considered. While in cartographic method dot, isopleth, demarcation of agricultural region and spatial distribution etc techniques are taken into consideration. This research paper is based on villagewise authentic agricultural data from which banana crop is selected as a personification. Banana is only one crop observed in all villages of Raver tehsil. In the present paper comparative scenario of quantitative method suggested by Bhatia and cartographic method suggested by researcher is given. Both methods of crop concentration have their own status and different characteristics. On the basis of their characteristics an attempt is made to entitle them as relative and absolute crop concentration method.

Keywords: concentration, absolute, relative, banana, cartographic, satpura

1. Introduction

The Tapti rift valley itself has created depressed area which through a long historic process is filled up with alluvium. Favourable climatic conditions have promoted the growth of agriculture. The piedmont belt along the inward scarps on opposite sides of the valley bottom assumes significance as an intermediary belt between highlands and valley flats. The natural habitat of banana is a humid tropical climatic area. The daily average temperature in summer months is 42^0C. Range of temperature is about 12.54^0C. It is clear that the region is quite hot in summer months. Winter months are not very cool. In the study region climatic condition, in fact is not optimum for the production of banana. It is semiarid. The human efforts have made good use of soil and underground water.

Jalgaon district comprises 15 tehsils out of which Raver tehsil ranks first in the state regarding the production of banana. The study area is a north-eastern part of Jalgaon district having the characteristic of piedmont plain, located between 21°02' N & 21°22' N. Latitudes and 75°44' E & 76°10' E. Longitudes, (Figure 1) consisting 117 villages. In the study region about 682.69 sq. km area is under cultivation out of which about 22739 hectares of land is found under banana crop (33.31% to cultivated land). The study area is rich in respect of soil fertility, gentle slope; availability of ample ground water resources became favorable for banana cultivation. Satpura

upland has covered the northern part of study region which is clothed with forest and dotted by springs. In between the Satpura upland and Tapi river there is monotonous flat plain characterized by piedmont.
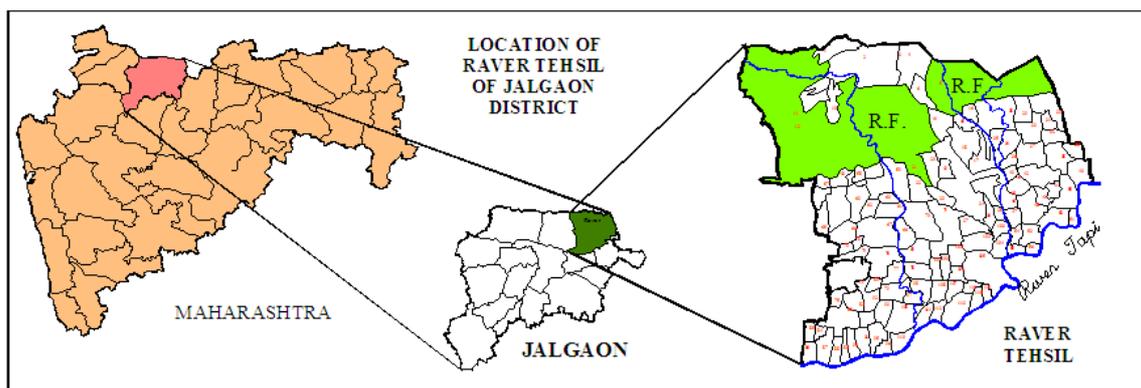

Figure 1. Location of Raver Tehsil of Jalgaon District

Table 1. Proportion of villages having significant banana cultivated land

No of Villages	% Banana area to Total Cropped Land	Status of villages on the basis of %	% Villages to Total
6	70	Very High	8.96
9	60	High	13.43
16	50	Significant	23.88
21	40	Medium	31.34
15	30	Low	22.39
67			100.00

Source: Tehsil Office of Raver

Table 1 is showing proportion of villages having significant banana cultivation in the study region. This table makes it clear that there are 6 villages those have cultivated more than 70% area under banana cultivation. It is to note that in the region about 8.96 % villages have very high concentration of banana crop (>70% total cropped land). Villages having more than 50% of land under banana are 31 (46.27%). In the study region more or less all villages are producing banana, however out of the total villages about 65% villages have cultivated more than 30% of land under banana. This is the core region of pioneer banana belt in Jalgaon district of Maharashtra state, exporting banana to other countries. Ample ground water, rich alluvial soil with high content of potash and nitrogen, monotonous flat plain etc are available in the study region. Owners of banana farms always prefer to work on their farms instead of services and business. Their family members also look after the banana farms personally. In the study region capacity of farmers to work hard, favorable physical and social conditions etc became suitable for banana cultivation.

1.1 Objectives

1) To display villagewise concentration of banana cultivation in Raver tehsil.
2) To delimit the banana belt in the study region.
3) To identify village wise concentration of banana cultivation by Bhatia's method.
4) To define the limitations of Bhatia's method.
5) To introduce cartographic method of (Absolute) concentration.
6) To compare both quantitative and cartographic methods of banana concentration.
7) Entitling the concentration methods according to their characteristics.

1.2 Hypothesis

Cartographic method of crop concentration is most accurate, reliable and specific than the quantitative method of crop concentration suggested by Bhatia.

2. Research Methodology

2.1 Data Base

To find out the concentration of banana cultivation, secondary data of T.F.20 record having villagewise area under banana and all crops in the study region is collected from Govt. Tehsil Office of Raver. Talathi is a govt. officer maintaining the record of cropping pattern of a particular village. Circle office of the tehsil is collecting such data from all villages. Data obtained from circle officer is analysed systematically with the help of M.S. Excel. To filter the data *Advanced Filter* command is used. *IF Condition* equation is designed to classify the data into different groups. To prepare the maps and data analysis GIS software is used. Layer by layer all maps are prepared to display overlay view of cartographic and quantitative concentration of banana cultivation.

2.2 Cartographic Techniques

Figure 2 showing concentration of banana in Raver tehsil is prepared layer by layer in GIS software as below.

    i)   Villagewise dot map is prepared showing spatial distribution of banana crop on first layer

    ii)   On this dot map per sq. km grids are superimposed (second layer).

    iii)   Dots in every grid are counted and counted figures are placed in respective grids (third layer).

    iv)   Considering the value of dots, isopleths are drawn (4th layer).

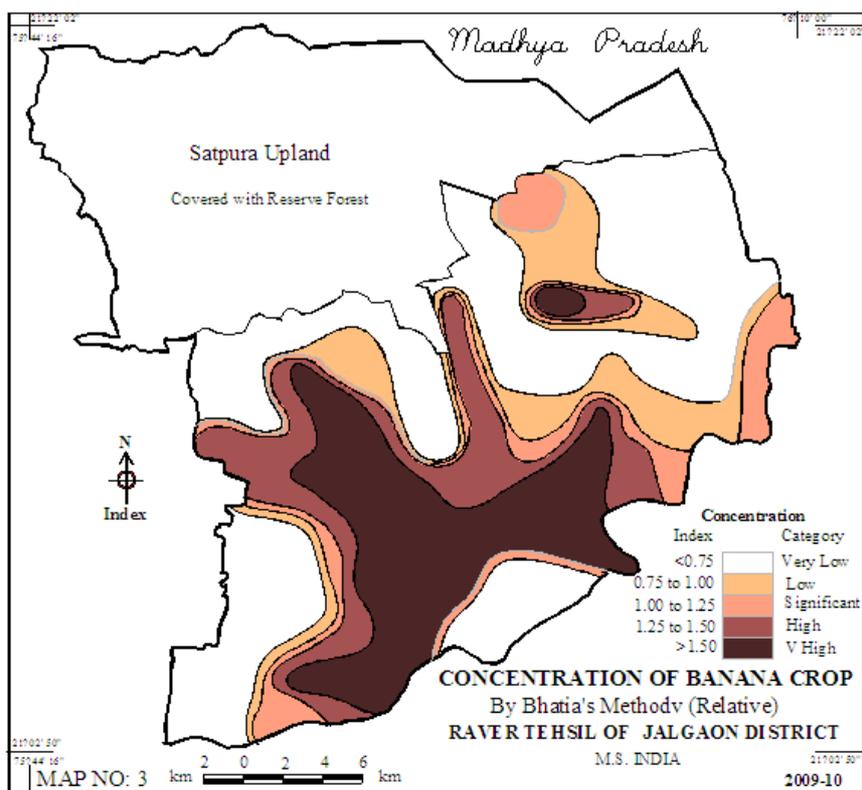Thus Figure 2 is prepared showing concentration of banana cultivation in Raver tehsil.

Figure 2. Concentration of Banana crop by Bhatia's method (Relative)

2.3 Quantitative Techniques

To calculate the concentration of banana cultivation, Shaym S. Bhatia's method of concentration is used as below.

$$\begin{bmatrix} Index\ of\text{determin}ing \\ concentration\ of\ crop \end{bmatrix} = \frac{\begin{bmatrix} \dfrac{\text{Area of crop x in component areal unit}}{\text{Area of all crops in the component unit}} \end{bmatrix}}{\begin{bmatrix} \dfrac{\text{Area of crop X in component areal unit}}{\text{Area of all crops in the component unit}} \end{bmatrix}}$$

Considering the above equation, villagewise concentration of banana cultivation is calculated. Figures of concentration Index are placed in respective villages. Then Isopleths are interpolated showing equal index values. Thus with the help of quantitative method map showing concentration of banana cultivation is prepared. Both cartographic and quantitative methods are compared with each other with the help of overlay map and findings are drawn.

3. Discussion

In cartography, technology has continually changed in order to meet the demands of new researchers and map makers. The first maps were manually constructed with brush and cartographic point pens therefore, varied in quality and were limited in distribution. Advances in electronic technology in the 20th century ushered in another revolution in cartography. Ready availability of computer programs for visualization, image processing, spatial analysis, and database management, have democratized and greatly expanded the making of maps. The ability to superimpose spatially located variables onto existing maps created new uses for maps and new industries to explore and exploit these potentials. These days most commercial-quality maps are made using software that falls into one of three main types: CAD Map, GIS and specialized illustration software. These tools lead to increasingly dynamic, interactive maps that can be manipulated digitally.

In studying the agricultural crop distributions, geographers have frequently made use of quantitative and cartographic techniques. Quantitative techniques involving ratio between two units of measurement in the same area, as for instance, the ratio of cropped area to total area or the ratio of 'x' crop area to total cropped area in an areal unit. It does not furnish the ratio of 'x' crop to cropped area in various component areal units (villages) compares to similar ratio for the entire tehsil or region. In order to determine the regional concentration of crops (the location quotient) is calculated by Shyam S. Bhatia. Some geographers are using GIS and computer techniques to investigate the variations in the distribution and density of crops.

In the present paper an attempt is made to compare the concentration of crops calculated by Bhatia's method and concentration displayed with the help of cartographic method. To compare both methods, banana cultivation in Raver tehsil is considered as a personification.

Table 2. Proportion of villages having concentration of banana in Raver Tehsil of Jalgaon District (Bhatia's Method)

Concentration of Banana	Concentration Index	Total No of Villages	% To Total No of Villages
Very High Concentration	> 1.50	30	25.64
High Concentration	1.49 To 1.25	15	12.82
Significant Concentration	1.24 To 1.00	15	12.82
Low Concentration	<0.99	57	48.72
Total No of Villages		117	100.00

Source: TF20 Record of Cropping Pattern, Tehsil Office, Raver & Index of Concentration is calculated by Bhatia's Method

Table 2 is showing proportion of villages having concentration of banana crop. In the study region more than 25% villages have very high concentration of banana crop which is 1.5 times more than that of the total concentration of banana crop in the region (Tehsil). The share of high to significant concentration is observed in 25.64% villages. It is clear that out of the total number of villages in the tehsil, bout 51.28% villages have the

concentration of banana more than the concentration of the study region. If the index value is greater than unity, the component areal unit accounts for a share larger that it would have had, if the distribution were uniform in the entire country and therefore, the component areal unit has a concentration of agricultural distribution under study.

Bhatia has developed the equation to calculate crop concentration as below.

$$\text{Crop Concentration} = \frac{s/t}{S/T}$$

Bhatia has given complicated process to calculate index of crop concentration as below.

1) Any one has to calculate the ratio of 'x' crop and total cropped area in small region.

2) Then calculate the same ratio between the total area of 'x' crop and total cropped land in large region.

Figure 3 is showing spatial distribution of banana concentration by Bhatia's method. Considering the method of Shyam Bhatia, five categories of concentration are shown in the map ranging between <0.99 and >1.5 (low to very high). This map clears that the area covered by high to very high concentration is extensive, covering about 50% area of cultivable land. The shape of area having very high concentration is very peculiar extending north south trend (from the foot of Satpura to the bank of Tapi river), while another belt of concentration is detached, located near the foot of Satpura upland which is immediately below the Abhore and Mangrul dams constructed is Satpura upland.
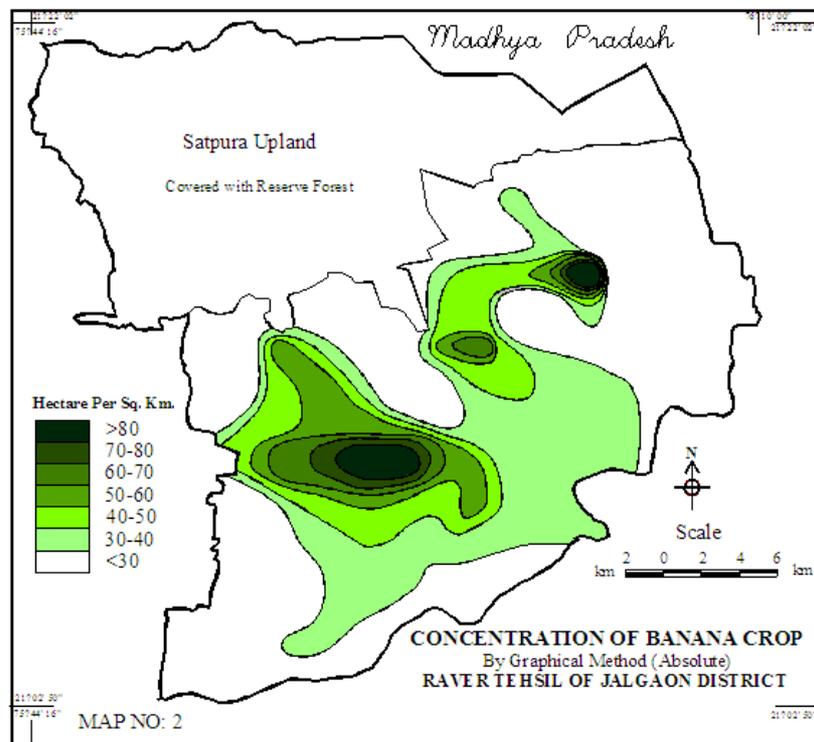

Figure 3. Concentration of Banana crop by Graphical method (Absolute)

In the area of Satpura upland Mangrul, Abhore and Suki dams are constructed. Immediate to the south of these dams, on piedmont plain, concentration of banana is found significant. Therefore, the belt of concentration is stretching north-south direction. Hatnur dam is constructed on Tapi River. It is observed that very high concentration of banana cultivation is found immediate to the north of Hatnur dam. The shape of this belt is also found north-south direction.

It is clear to note that, considering the shape of banana concentration belt, all water projects are recharging ground water level in north-south direction. Banana is water loving crop requires continuous supply of water, hence, banana concentration is found high to very high.

4. Cartographic Techniques of Concentration

Figure 2 is showing concentration of banana crop (per sq.km), which is outcome of dot map showing spatial distribution of banana cultivation. On this map, one sq. km grids are superimposed. Then numbers of dots in each grid are counted. Then counted figures are placed in respective grids. Considering the equal values of dots, isopleths are drawn. Thus, map showing per sq. km density of banana crop is prepared. This map reveals that main belt of high concentration of banana crop having more than 80 hectares of land in one sq. km. (>80% of geographical area) is observed in the central part of piedmont plain. The area of high to very high concentration is found very small as compare to the area shown in the Figure 3 (Bhatia's method). There are three belts of concentration detached from each other. This map is giving more reliable and accurate information about concentration of banana in relation with geographical area.

5. Comparative Scenario of both Methods

Both methods have their own characteristics. In Bhatia's method, ratio of area under banana & total cropped area in the villages and ratio of total area under banana crop & total cropped land in the tehsil are taken into consideration. In this method concentration in small unit is calculated in relation with the index of region. Therefore this method should be considered as '*Relative Concentration*' method.

While cartographic method is showing the crop concentration in a particular geographic area. This method is furnishing actual maximum concentration of banana in relation to geographical area. Therefore this method should be considered as '*Absolute Concentration*' method.
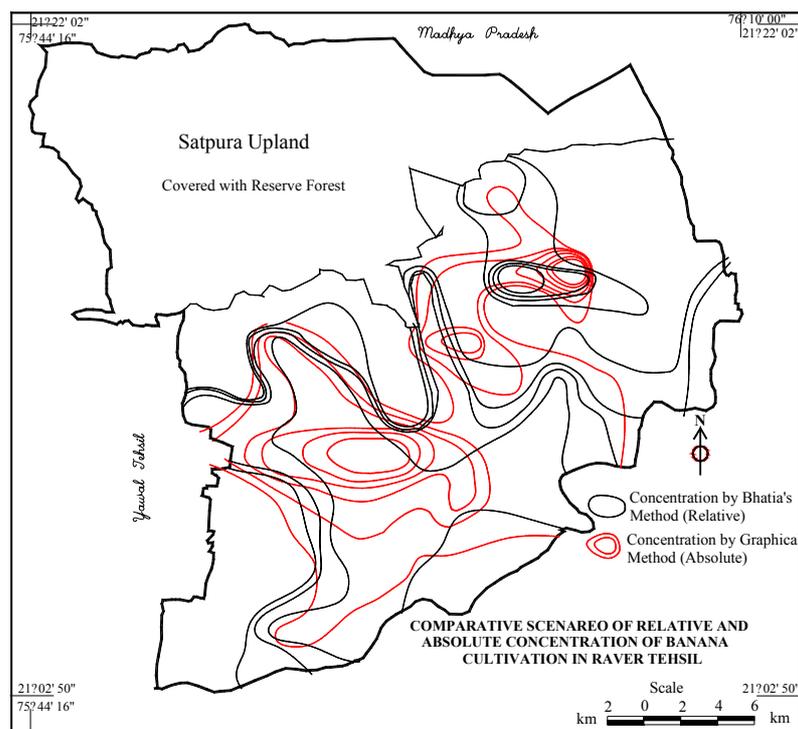

Figure 4. Comparative scenareo of relative and absolute concentration of Banana cultivation in Raver Tehsil

Figure 4 is showing comparative scenario of relative and absolute concentration of banana cultivation in the study region. This map is clearly displaying the concentration calculated by Bhatia's method and the method suggested by researcher (Absolute), vary from place to place. The size, shape and location of concentration zones are also different cited as below:

1)   In the north east of the study region high intensity zone of relative concentration is located 3 km westward from the intensive zone of absolute concentration of banana cultivation.

2)   In the west, large area is covered by high intensive zone of relative concentration. But concentration shown by absolute method is having small concentric zones of banana cultivation.

3) In the south, relative concentration is found intensive, where absolute concentration is very insignificant.

4) In central part of the study region, there is third small belt of banana concentration demarked by absolute method which is not observed in relative concentration method.

5) Intensity of banana concentration is calculated by both methods. It is observed that the area having very high relative concentration is more or less two times more than that of the area of banana concentration calculated by absolute method. In all classes of concentration area under banana is varying.

6) It is also to note that total area covered by banana cultivation in both methods is different.

Table 3. Comparative Scenario of area covered by relative & absolute concentration of banana cultivation

Classes of Concentration	Relative Concentration Method (ha)	Absolute Concentration Method (ha)
V High	9676 26	5161.81
High	2850.16	4514.45
Significant	3255.99	4507.17
Low	6976.63	8555.61
Total	13082.78	22739.04

Relative concentration method is based on total cultivated land and area under banana cultivation. Total cultivated land is the sum of area used for both rainy and winter crops. Obviously, it might be more than that of the geographical area or net sown area. While in case of absolute concentration, actual area under banana crop and geographical area (per sq. km.) are taken into consideration. Therefore absolute concentration method is very close to reality. This method display real distribution and aerial association of banana crop.

6. Conclusion

Raver tehsil ranks first in the state regarding the area under banana crop. Piedmont plain, ample source of ground water, enrich soil, gentle slope became suitable for the concentration of banana cultivation. Satpura upland is clothed with forest and doted by perennial springs. In the south of the region Hatnur dam is constructed on Tapi river, helps to recharge the ground water. It is to note that almost all villages are producing banana. Out of them about 65% villages have more than 30% area under banana crop. It is concluded that the study region is outstanding example of banana cultivation.

Banana crop concentration index calculated by Bhatia's method reveals that out of total villages about 51.28% villages have index more than 1.0. Area covered by high concentration villages is also large. Map showing absolute concentration of banana clears that very small geographical area is covered by high concentration. Both maps (showing relative and absolute concentration of banana) have different size, shape and location of concentration zones.

First method is showing low to high concentration while cartographic method is showing per sq. km concentration of banana in a particular geographical area. Therefore cartographic method of crop concentration is giving detailed information than that of the quantitative concentration Index.

It is concluded that the method of concentration suggested by Shyam Bhatia is a Relative Concentration method while cartographic method of crop concentration is an Absolute Concentration method. Both methods have their own characteristics. The first method is characterized by comparative ratio of cropped land in the whole region and small units. While cartographic method is characterized by geographical area.

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