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Measurement of Food Crops Productivity in Bharatpur and Deeg District of Rajasthan as per Bhatia's method

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Abstract

This study examines food crop productivity across thirteen tahsils in Bharatpur and Deeg districts of Rajasthan using Bhatia's Agricultural Efficiency Index method. The analysis incorporates triennium average data (2020-21 to 2022-23) for six major food crops: Bajra, Jowar, Wheat, Barley, Gram, and Pulses. Bhatia's method calculates productivity by integrating both yield and area magnitude, providing efficiency indices for each tahsil. Results reveal significant spatial variations, with Nagar tahsil achieving the highest efficiency index (137.61), followed by Pahadi (111.07) and Deeg-Januthar (107.06), collectively representing 20.29% of the study area. Six tahsils demonstrate medium productivity (52.74% area), while four tahsils show low productivity (26.90% area). The study concludes that substantial productivity disparities exist within the region, indicating potential for agricultural improvement through targeted productivity enhancement measures.

Keywords: *Agricultural productivity, Bhatia's method, efficiency index, Food crops, Yield index, Spatial variation, Crop Productivity regions*

Introduction

Most of the countries of the world are facing the problem of overpopulation. Due to over population arises the problem of food; only solution of food problem is to increase the production of food grains. The production of food grains is possible either by increase the area of food crops or by increase in the productivity of food crops. To increase in the area of food crops is impossible because the land is limited. The only solution to increase the production of food grains is by increasing the productivity of food crops.

Bharatpur and Deeg district are located in the eastern part of Rajasthan. Bharatpur is called the eastern gate of Rajasthan. The economy of both the districts is based upon agriculture. Bharatpur and Deeg district is bordered by Haryana (north), Uttar Pradesh (east) and other districts like Alwar, Jaipur and Dhaulpur (west–south). Bharatpur is known for Keoladeo National Park. The area of Bharatpur and Deeg district spans from 26°22′ to 27°50′ north latitudes and 76°53′ to 79°19′ east longitudes.

The area of both districts is 5070 square km and the population density is 503 person per km according to the census of 2011. Total population of both districts is 25,89,462. There is a ban on the spreading of industries in Bharatpur and Deeg districts because of Keoladeo National Park and TTZ (Taj Trapezium Zone). So, agriculture is the base for the economy of both districts.

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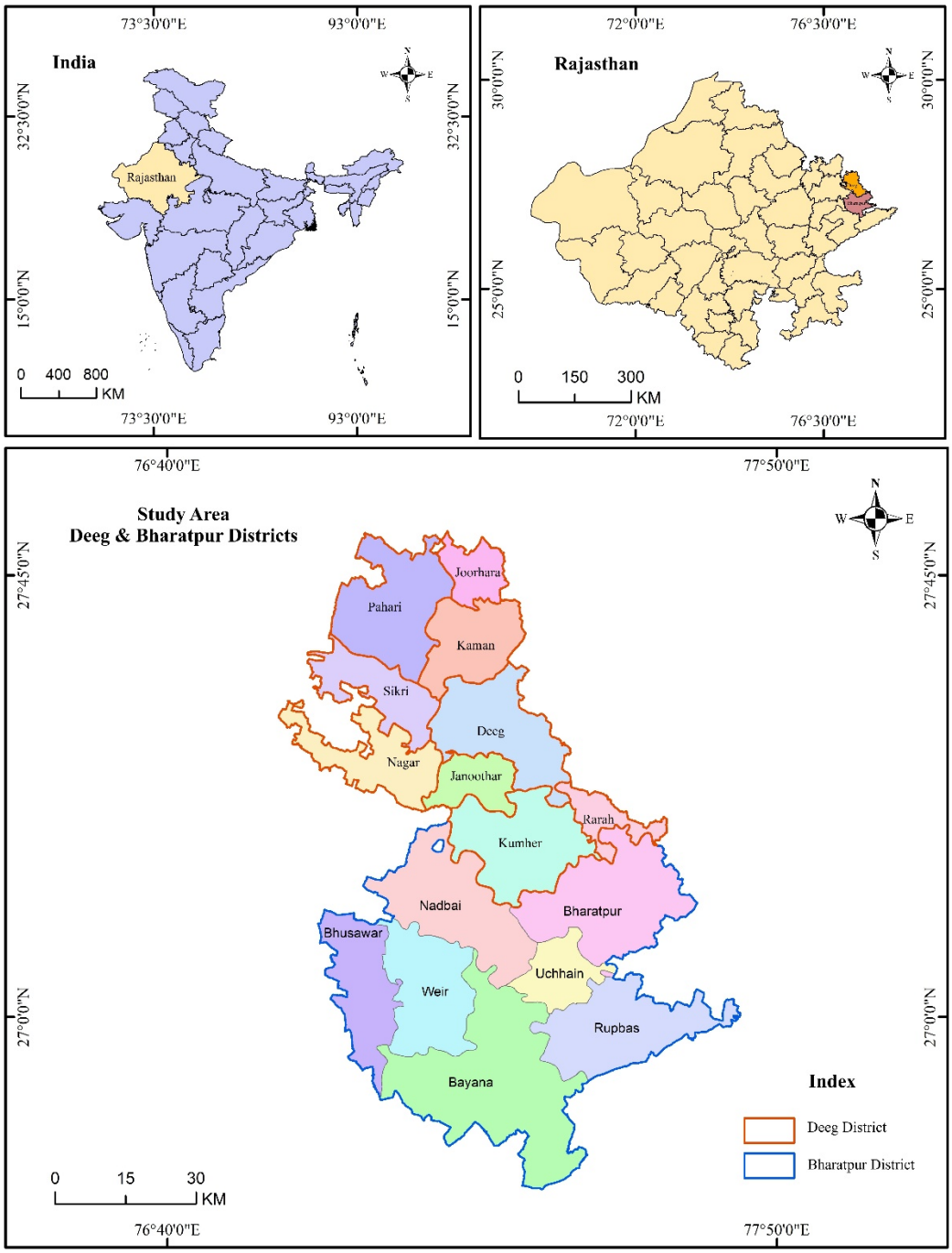
Map 1: Location Map of Study Area



Source: Source of administrative boundaries, Survey of India, Government of India and created by the researcher.

Productivity is commonly used to express the power of agriculture in a particular region to produce crops without regard to whether that power is due to the bounty of nature or to the efforts of man. Many attempts have been made to define the concept of productivity and a considerable amount of literature exists on this subject.

1. Devet (1966) "Productivity expresses the varying relationship between agricultural output and one of the major inputs like land or labour or capital, other complementary factors remaining the same. It may be borne in mind that productivity is physical rather than value concept."

2. Pandit A. D. (1967) "Productivity is defined in economics as the output per unit of input. The act of securing an increase in output from the same input or of getting the same output from a smaller input."

Review of literature

There is a marked difference in agricultural productivity from one region to region. The measurement of agricultural productivity is quite complicated and possesses many problems of definitions and approaches. Geographers are not of the same opinion on the measurement of agricultural productivity. Many geographers and agricultural scientists tried to measure agricultural productivity.

The description of the work of some of them are as below –

1. Kendall (1939) treated it as a problem of mathematics and initiated a system of four coefficients:

   (i) Productivity coefficient

   (ii) Ranking coefficient

(iii) Money value coefficient

(iv) Starch equivalent or energy coefficient

To determine the productivity of England, Kendall took the acre yields of ten leading crops of forty-eight counties and by calculating the ranking coefficient he determined the productivity of England.

2. Stamp (1952) by using the ranking coefficient method of Kendall determined the productivity of 20 counties of Europe.
3. Shafi (1960) taking the per acre yield of eight crops of forty-eight districts of Uttar Pradesh determined the agricultural productivity of Uttar Pradesh by the same method of Kendall.
4. Sapre and Deshpande (1964) determined the agricultural productivity of Maharashtra by using the Kendall's method with some modifications.
5. Enyedi (1964) while describing geographical types of agriculture in Hungary refers to a formula for determining agricultural productivity:

$$\frac{Y}{Y_n} : \frac{T}{T_n}$$

Where,

Y = Total yield of respective crops in the unit area.

Y_n = Total yield of crops at the national level.

T = Total area of the unit.

T_n = Total cropped area at the national level.

6. Bhatia (1967) used Agricultural Efficiency Index method to determine the agricultural productivity of Uttar Pradesh.

7. Shafi (1972) uses the formula of Enyedi to determine the agricultural productivity of Uttar Pradesh but the results are not good, so he made some modification in that formula.

Buck (1967), Clark and Haswell (1967), Jasbir Singh (1982), Husain (1976) also suggested some methods for measuring agricultural productivity.

Objectives

- To measure the food crops productivity in the study area.

Spatial patterns of food crops productivity as per Bhatia's method

The purpose of this method is to assess productivity by incorporating both yield and magnitude of area in the unit area of study in relation to the entire region. He suggests that the contribution of each crop to agricultural efficiency is in relation to its share in the crop land.

The average production of all crops in entire region is first calculated. Second, we calculate the average production in the counting unit. After calculating average production in entire region and average production in counting unit, we calculate yield index by this formula:

$$IYa = \frac{Y_c}{Y_r} \times 100$$

Here

IYa = yield index of crop a

Yc = average yield in county unit

Yr = average yield in entire region

After calculating yield index, yield index is multiplied by the percentage of area under that crop. Thus, we calculate efficiency index by this formula:

$$EI = \frac{IYa \times CA + IYb \times CB + \cdots + IYn \times Cn}{CA + CB + \cdots + Cn}$$

Here:

EI = Efficiency Index

IYa = yield index of crop a

CA = percentage of area under crop a

IYb = yield index of crop b

CB = percentage of area under crop b

To calculate the food crops productivity in the study area Bharatpur and Deeg district of Rajasthan, we take Tahsil as a country unit and six food crops i.e. Bajra, Jowar, Wheat, Barley, Gram and pulses.

To calculate the food crops productivity, we take the data of food crops production and area triennium average from 2020–21 to 2022–23.

Table 1: Food crops production Tri year average from 2020–21 to 2022–23 in Bharatpur and Deeg district (Hectare/Quintal)

Tahsil	Crops					
	Bajra	Jowar	Wheat	Barley	Gram	Pulses
Bharatpur	13.73	6.90	33.82	26.77	17.57	8.20
Nadbai	14.82	7.14	32.37	30.00	10.00	15.00
Bayana	18.27	15.02	40.00	40.00	41.32	20.00
Weir	16.53	13.24	48.73	40.97	37.02	12.50
Bhusawar	17.86	9.55	34.38	32.51	20.00	11.43
Rupwas	14.51	10.00	39.99	30.01	26.41	14.49
Uchchain	14.90	10.00	39.80	40.00	0	0

Kumher-Rarah	19.85	9.94	37.00	29.27	14.80	10.65
Deeg-Januthar	24.42	9.57	34.14	29.29	9.94	20.00
Nagar	26.89	15.51	39.92	40.00	14.86	7.98
Sikari	20.00	9.99	39.54	30.02	15.00	10.52
Kaman-Jurhara	19.66	9.73	39.82	30.00	20.00	0
Pahadi	26.46	9.93	39.51	30.24	10.53	14.89
Entire region	78.04	10.36	38.20	32.05	14.48	12.52

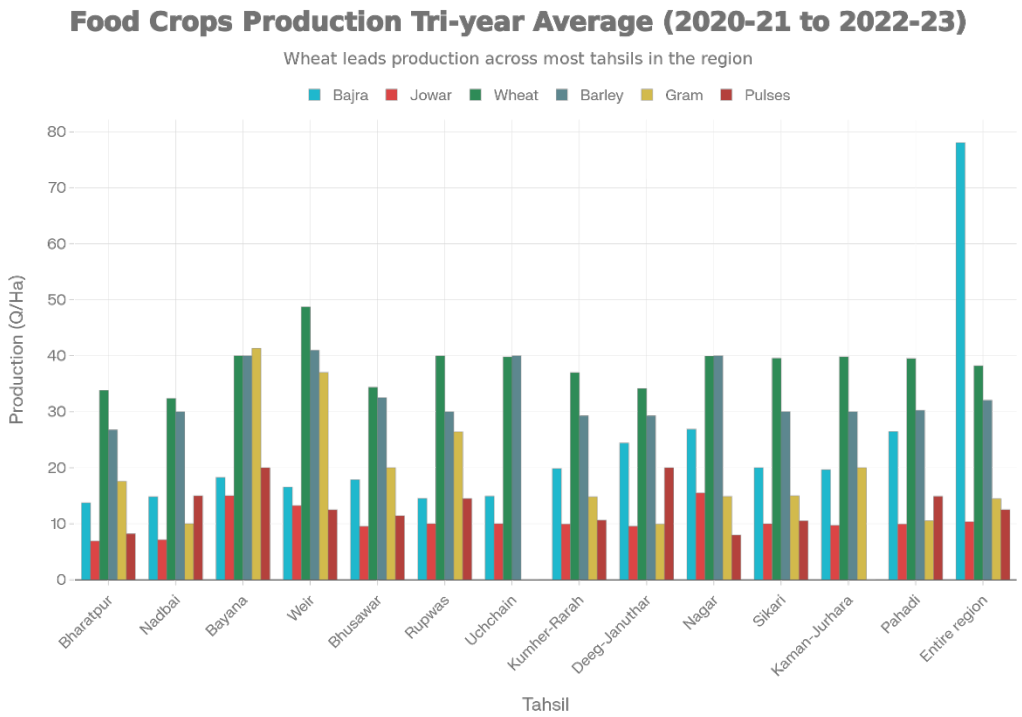


Table 2: Percentage of area under food crops Tri year average from 2020–21 to 2022–23 in Bharatpur and Deeg district

Tahsil	Crops					
	Bajra	Jowar	Wheat	Barley	Gram	Pulses

Bharatpur	52.30	12.13	35.20	0.11	0.13	0.11
Nadbai	68.57	5.63	25.76	0.02	0.007	0.006
Bayana	71.80	0.28	27.62	0.06	0.14	0.008
Weir	74.23	2.59	22.92	0.086	0.156	0.11
Bhusawar	74.70	0.78	23.70	0.066	0.73	0.02
Rupwas	65.40	0.93	31.75	0.367	1.01	0.54
Uchchain	68.19	1.4	30.15	0.26	0	0
Kumher-Rarah	34.54	27.88	36.22	0.17	0.98	0.21
Deeg-Januthar	38.06	21.92	38.23	0.31	1.43	0.04
Nagar	42.37	32.18	24.17	0.15	0.73	0.40
Sikari	33.64	30.66	35.56	0.06	0.04	0.05
Kaman-Jurhara	38.60	24.08	37.20	0.07	0.04	0
Pahadi	24.37	36.58	38.06	0.28	0.26	0.44

First of all, we calculate productivity index of each crop in each Tahsil. As we take example of Bajra crop in Bharatpur Tahsil.

B. Productivity Index = IYa = $\frac{Y_c \times 100}{Y_r}$

Productivity index of Bajra in Bharatpur Tahsil = $\frac{13.73 \times 100}{18.04} = 76.1$

After calculating productivity index of each crop in each Tahsil we calculate the efficiency index of each Tahsil by Bhatia's formula. For example, we calculate the efficiency index of Bharatpur Tahsil:

$$EI = \frac{76.1 \times 52.73 + 66.64 \times 12.13 + 88.5 \times 35.22 + 83.5 \times 0.11 + 59 \times 0.13 + 65.5 \times 0.11}{52.73 + 12.13 + 35.22 + 0.11 + 0.13 + 0.11}$$

$$= \frac{7931.83}{99.98} = 79.33$$

The efficiency index of Bharatpur Tahsil is 79.33.

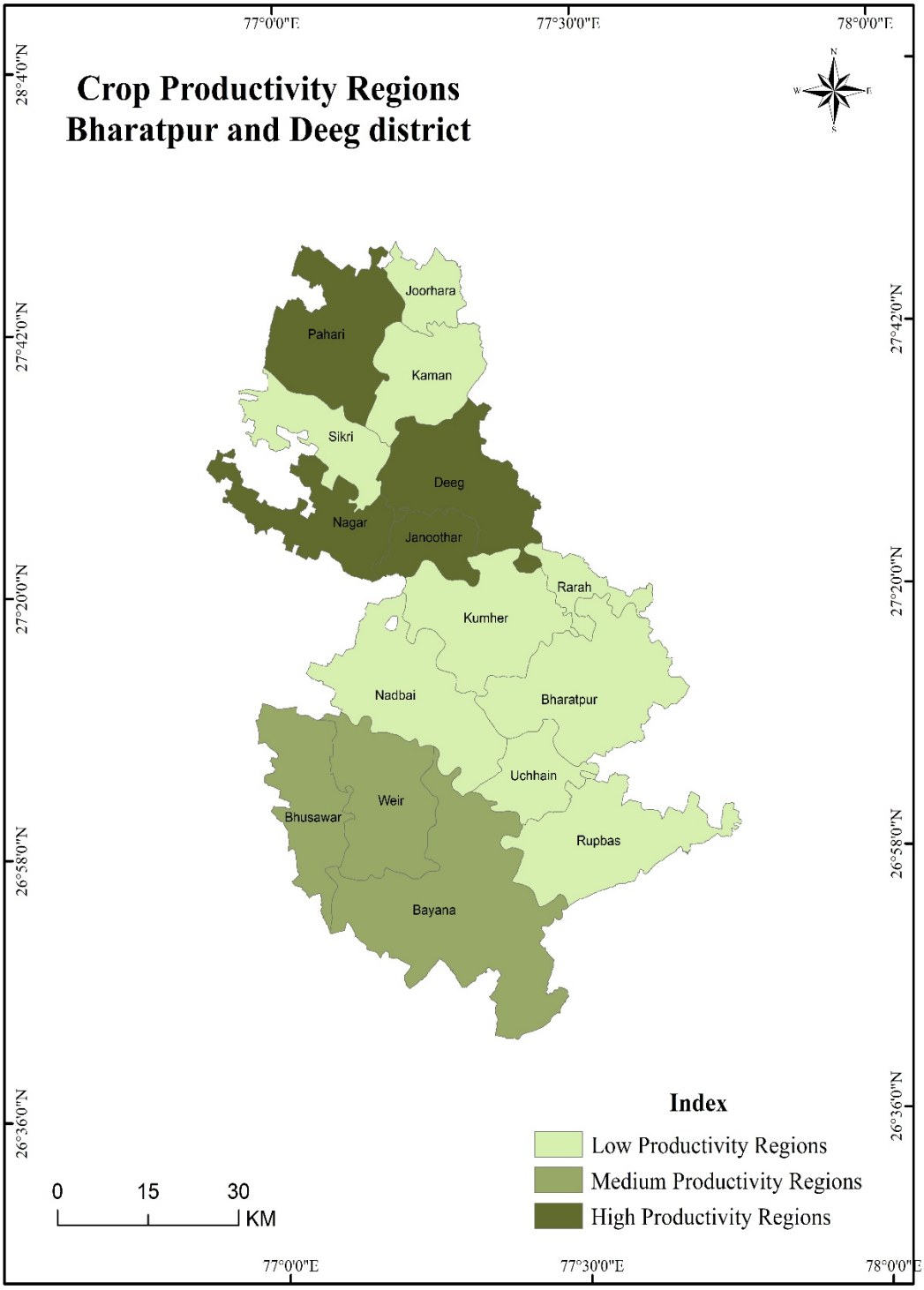
Table 3: Efficiency index of Tahsils of Bharatpur and Deeg districts

Tahsil	EI
Bharatpur	79.33
Nadbai	82.32
Bayana	103.65
Weir	104.85
Bhusawar	96.38
Rupwas	89.13
Uchchain	89.41
Kumher-Rarah	100.95
Deeg-Januthar	107.06
Nagar	137.61
Sikari	103.78
Kaman-Jurhara	103.55
Pahadi	111.07

According to efficiency index method of S. S. Bhatia, Bharatpur and Deeg district is divided into the following food crop productivity regions:

Productivity region	Efficiency index	Tahsil	Area (%)
High	105 >	Nagar, Pahadi, Deeg-Januthar	20.29
Medium	95 to 105	Weir, Sikri, Bayana, Kaman-Jurhara, Kumher-Rarah, Bhusawar	52.74
Low	95 <	Uchchain, Rupwas, Nadbai, Bharatpur	26.90

Map 2: Crop Productivity Regions, Bharatpur & Deeg Districts



Source: Created by the researcher

Conclusion

There is a marked variation in food crops productivity in Bharatpur and Deeg district. According to Bhatia's efficiency index method the food productivity of Nagar Tahsil is the highest. The food productivity efficiency index of Nagar Tahsil is 137.41; second is Pahadi and third position is of Deeg Tahsil. The area of these three Tahsils is 26.29% of the total food crop area in study area.

Weir, Sikri, Bayana, Kaman–Jurhara, Kumher–Rarah and Bhusawar fall in medium productivity region. The area of these eight Tahsils is 52.74% of total food crop area.

Four Tahsils i.e. Uchchain, Rupwas, Nadbai and Bharatpur fall in low food crop productivity region. The area of these four Tahsils is 26.5% of total food crop area in study region.

From the above description it is clear that there is a marked difference in the food crop productivity in the study region. It is clear that the food crop productivity can rise by using measures to increase food crop productivity

Keywords

(i) T.T.Z. Taj Trapezium Zone: A 10,400 sq km area around the Taj Mahal, established by Supreme Court to protect Taj from pollution by restricting heavy industry and coal use.

(ii) Productivity: Productivity may be defined as the ratio of the value of total agricultural output to the index of total input used in farm production.

(iii) Yield index: Ratio of average yield of a country unit to entire study region.

(iv) Efficiency index: S. S. Bhatia's productivity index.

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