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MEASUREMENT OF REGIONAL DISPARITIES IN AGRICULTURAL OUTPUT IN ROHILKHAND (U.P.)

INTRODUCTION

THE AREA situated on the eastern edge of central upland of the vast alluvial plain of northern India is known as Rohilkhand. It lies in between Deccan plateau in the South and the Himalayas in the North. Rohilkhand is an important part of Ganga-Ghaghra tract, comprising about 30,946 sq. km. (27° 25′—30° 7′N and 78° 9′—80° 35′E). The area incorporates 90 Community Development Blocks (CDBs) of 32 tahsils, which are administratively parts of 7 districts.

It is a plain area, which gently slopes from north-west to south-east for a distance of 350 kms. where the contours vary from 270 to 140 metres i.e. about 37 cm. for every km. Ramganga and its tributaries Dojora, Bhagaul, Deoha and Sarda drain this area (Fig. 14.1).

As regards climatic conditions of Rohilkhand, which is a

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part of northern plain of India, the movement of monsoons and cyclones are guided by climatic phenomena such a temperature, pressure gradient and wind direction, which vary during the three prevailing seasons of winter, summer and rainy. (a) Winter season prevails from November to mid-March and is characterised by low temperatures (10°-12°C in Dec. and Jan.), high atmospheric pressure (995.4 mb.), less rainfall (15 mm. monthly mean) and moderate humidity (60-70%). (b). Summer season extends from mid-March to mid-June, when temperatures are as high as 40° C, low atmospheric pressure (980.3 mb.), negligible rainfall (less than 20 mm.) and very

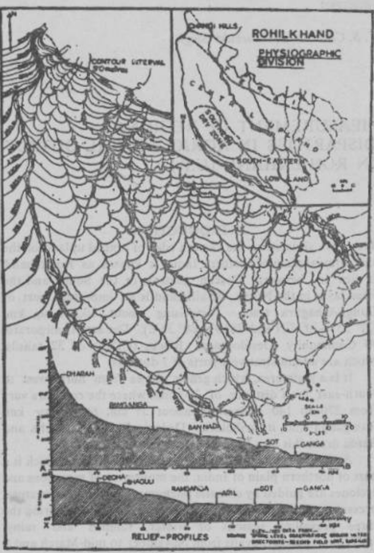

FIG. 14.1 : *Rohilkhand—Contour Map*

low humidity (10-15%) are common characteristics. (c) Rainy season starts from mid-June and ends in October. Since it follows the Summer season, temperatures are usually high (30°-37°C) and atmospheric pressure is generally low

(979-985 mb.). As the name signifies maximum rainfall (average for July 300 mm.) is received during this season. The general land use characteristics and percentage of total land (given under brackets) are forests (5.1), Barren and Uncultivated land (3.69), Land put to non-agricultural use (3.36), Cultivable waste (4.38), Permanent pastures and other grazing ground (0.31), Land under miscellaneous tree crops and groves (I.31), Fallow land (5.53) and Net Area Sown (76.32). Food crops are important in agriculture of the region. These occupy more than three-fourths of Gross Cultivated Area (76.7) in kharif as well as rabi seasons. Only sugarcane is the commercial crop grown. Thus, the first six main crops grown in order of importance are wheat, paddy, sugarcane, millets, gram and maize. In 1971 as many as 2,509 tractors, 4,439 sprayers for sprinkling insecticides and 17,644 power threshers, 59,000 tons of chemical fertilizers were used and 59,000 ha. was under green manures.

EARLIER ATTEMPTS

To assess agricultural output, a number of techniques have been used earlier. Ranking coefficient of yield of main crops per unit area was used to assess Productive Efficiency by Kendall (1937). The same method was applied in the study of 20 countries of the world by Stamp (1960) and on Uttar Pradesh in India by Shafi (1960). It may be visualised that by this method the ranking of crops' yield is done merely with the help of per ha./acre production without considering agricultural output as a whole.

Another method was used for measuring agricultural productivity in the Ganga Valley of India by Ganguli (1938). An index of agricultural efficiency was prepared by multiplying the percentage of crops' share with percentages of crops' yield in an areal unit and later averaging them into one. Sapre and Deshpande (1964) prepared a modified Kendall's equation by multiplying ranking of crops with that of crop land share divided by the total of crop land share.

Bhatia (1967) applied the index prepared by Sapre and Deshpande with slight modification. He used Ganguli's percentage yield of crops, instead of yield ranking of individual crops. P. Sen Gupta (1968) also used the same index as prepared by Bhatia for studying agricultural efficiency in India as a whole.

The Food and Agricultural Organisation (FAO) of the United Nations (1960) also prepared an International Grain Equipment Index assessing different crops in relative price value of wheat. Relative importance of grains was also used for preparing crop equivalents by changing them into caloric significance by Stamp (1960) and Shafi (1972).

At another place Bhat and Learmonth (1968) considered agricultural prices and their regional variations, which influenced the cropping patterns and yields, for assessing agricultural productivity per unit area. Hussain (1976) also formulated an useful index for calculating agricultural productivity of Sutlej-Ganga plains, by changing the production in money value per areal unit with the ratio of whole of the region.

SIGNIFICANT INDICES FOR MEASURING AGRICULTURAL OUTPUT

The above discussion points out the fact that earlier studies took into consideration the Gross Cultivated Area (GCA). As a matter of fact, the emphasis should be on Net Cultivated Area (NCA) for considering agricultural productivity, as the relationship of NCA and GCA is not the same in all the areal units. Besides, it can be suggested that a three dimensional assessment of agricultural output with the help of yield, crop-equivalent and cropping intensity indices will be more useful in place of a single or double dimensional efforts. Yield, of course, is an important measure for considering agricultural output while crop-equivalents identify the relative importance of crops and the assessment of cropping intensity reduces the whole operation of agricultural output confined in a physical unit area. Such a three dimensional technique was also used by Singh and Chauhan (1977) for measuring agricultural productivity in Uttar Pradesh. Thus, to arrive at a composite index of agricultural production per ha. of NAS, the following three indices be considered :

Standardized Yield Index (I_{syi})

It follows the Bhatia's index of agricultural efficiency (E_i) as such. He used the percentage of crop yields corresponding with regional average weighted with their percentage share of crops land. Hence, it may be expressed as—

$I_{sf}=E_i$. . . . . (1)

Weighted Crop-equivalent Index (I_{wei})

To utilise such an index for measuring crop importance, three profiles, namely commercial (crop market rates per unit of quantity), income (trade importance and Government income) and caloric significance of crops (health importance of the grains) may be considered. The coefficient values of crops may be calculated per ha. by multiplying the crop yields with their values and changing them on the basis of the amount of the most usually consumed crop of wheat (Table 14.1).

TABLE 14.1

Crop-equivalent Coefficients on the Basis of Three Crop Profiles

Name of the crops	Crop rates	Equivalents based on National income	Caloric significance	Mean
1. Wheat	100.0	100.0	100.0	100.0
2. Paddy	42.7	141.5	79.3	87.8
3. Sugarcane (gur)	440.6	412.4	437.2	430.1
4. Gram	40.5	73.3	99.5	77.1
5. Millets	22.7	43.7	75.7	47.4
6. Pulses	89.3	95.9	176.1	117.1
7. Groundnuts	93.7	110.0	108.0	104.6

Sources : (a) Average crop price list for the year 1970-71 is used. (b) State income from grains received from National Income Unit of C.S O. (c) Caloric significance per 100 gms. are used from Aykroyd, W.R. in Gopal, C. and Balasubramaniam: Nutritive Value of Indian Foods and the Planning of Satisfactory Diets; New Delhi, *Indian Council of Medical Research* (1966), pp. 51-86.

Further, the above discussed crop-equivalent coefficients are weighted with the percentage of land share of crops in a particular areal unit for identifying the weighted crop equivalent index (I_{wei}) which may be formulated as :

$$I_{wei}=\frac{G_{e1}\,.\,C_1+G_{e2}\,.\,C_2+G_{e3}\,.\,C_3+\ldots+G_{en}\,.\,C_n}{C_1+C_2+C_3+\ldots+C_n} \quad \ldots (2)$$

Cropping Intensity Index (I_{ci})

For expressing the results of agricultural output per unit area (per ha. of N.A.S.), the cropping intensity index (I_{ci}) is prepared dividing the percentage of total cropped land with regional average of the same ratio and multiplying it with hundred (100) for converting the figures in percentage. It may be expressed as :

$I_{ci} = (t/T) \cdot 100$ . . . (3)

(where 't' is percentage of total cropped area to N.A.S. in the i^{th} component areal unit and 'T' is regional average of the same ratio).

COMPOSITE INDEX OF AGRICULTURAL OUTPUT

By multiplying all the above three indices of agricultural output and dividing them by ten thousands (10^4) for reducing the results in percentages, a single index is composed, i.e. called the composite index of agricultural output (I_{ci}) which determines the agricultural production per ha. of N.A.S. It may be formulated as :

$I_{ci} = (I_{syi} \cdot I_{wei} \cdot I_{ci})/10^4$ . . . (4)

(The notations are the same as given above).

REGIONAL DISPARITIES IN AGRICULTURAL OUTPUT

The values of the indices are calculated for the seven crops, viz. wheat, paddy, sugarcane, gram, millets, pulses and groundnuts for each of the 90 CDBs of Rohilkhand. It is difficult to interpret the regional pattern of production with the help of these indices. The first two indices, standardised yield index and weighted crop-equivalent index, are generally related with each other.

The yield and prices of crops are highly influenced by climate (rainfall) and human (irrigation and mechanisation) factors. The distribution of these indices is also related with pedology and population factors. On account of such influencing factors the higher degree of Standardised yield index and Weighted Crop-equivalent. Index are well marked in *tarai* and upper parts of Ganga-Ramganga *Doab*, where economy depends on paddy, and the commercial crop of sugarcane. On the other hand, the low index values are generally concentrated in the middle, southern and south-eastern parts of Rohilkhand (Fig. 14.2)

The distribution pattern of agricultural output (equation 4), calculated by combining together all the three indices,

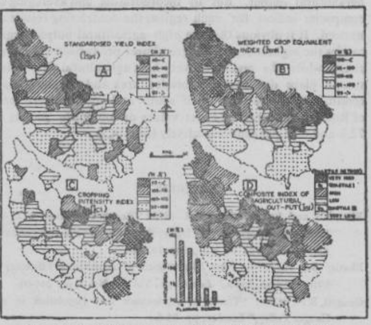

FIG. 14.2 : *Indices for Assessing Agricultural Output*

produces an interesting result by ranking the composite index values on the quartile basis for each CDB. The four groups, viz. very high, high, low and very low agricultural output and two transitional areas between high and low groups are conveniently determined (Table 14.2)

TABLE 14.2
Ranks and Index Values of various Agricultural Output Groups

Degree of agricultural output	Rank	Index values
1. Very high agri. output	1-22	365.34-137.58
Quartile I	23	135.08
2. High agri. output	24-45	134.74-111.65
3. Low agri. output	46-67	110.71-80.84
Quartile III	68	78.50
4. Very low agri. output	60-90	76.53-44.83

The regional disparities in agricultural output are quite clear from the instances that the areas of *tarai* conditions and heavy loam soils carry very high and high degree of agricultural output, while the areas of lower *khadar* and sandy loam carry low agricultural output. But by incorporating and averaging the composite indices for each region, the contrasting results are noticed. It is obvious that the high agricultural output region carries the highest degree of agricultural production (143.5 per cent), while the region of very high agricultural output finds second place due to more forested area and marshy climatic conditions. The two regions of south and south-eastern parts of Rohilkhand carry the lower values of composite indices as 72.1 and 69.5 per cent respectively (Fig. 14.2).

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