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Agricultural Productivity of Purba Medinipur district, West Bengal — a geospatial case study

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Abstract

In the present paper an attempt has been made to examine variations in agricultural productivity in Purba Medinipur district, West Bengal. Using methodology of agricultural Productivity Index the paper examines the crop productivity variations of 14 major crops (grouped under cereal, pulses, oilseeds and cash crops) grown in the district of the region on 2010-11. Agricultural productivity is influenced by physical, socio-economic, and other factors. Thus, agricultural productivity is a function of interaction of physical and cultural variables and it reveals itself through per hector productivity and total volume of production.

Introduction

"Agricultural Productivity' has been defined by several scholars with reference to their own views and disciplines. Agriculturalists, agronomists, economists and geographers have interpreted it in different ways. Agricultural productivity is defined in agricultural geography as well as in economics as "output per unit of input" or "output per unit of land area", and the improvement in agricultural productivity is generally considered to be the results of a more efficient use of the factors of production, viz. physical, socio-economic, and institutional technological. Singh and Dhillion (2000) suggested that the "yield per unit" should be considered to indicate agricultural productivity. Many scholars have criticized this suggestion pointing out that it considered only land as a factor of production, with no other factors of production. Therefore, other scholars have suggested that agricultural productivity should contain all the factors of production such as labor, farming experiences, fertilizers, availability and management of water and other biological factors. As they widely accept that the average return per unit does not represent the real picture, the use of marginal return per agricultural unit was suggested.

Productivity of land is a very important factor of agriculture because it is the most permanent and fixed factor among the three categories of input; land, labor and capital. Basically, land as a unit basis articulates yield of crop in terms of output to provide the foodstuff for the nation and secure employment opportunities for the rural community. Productivity of land may be raised by applying input packages consisting of improved seeds, fertilizers, agro- chemicals and labour intensive methods (Fladby, 1983). And also it could be raised by applying crop diversification/ multi cropping in a season on the same land as practiced by the farmers of Mahaweli system 'H' area (Dharmasiri, 2008)[4] and by adopting year round mix- cropping system on the same land as done by vegetable farmers of Nuwaraeliya district (Dharmasiri, 2010). Another initiative that can have the effect of raising land productivity involves ruminants, such as cattle, sheep and goats. Although rangelands are being grazed to even exceeding the carrying capacity, there is a large unrealized potential

for feeding agricultural residues to ruminants, which have a complex digestive system that enables them to convert roughage, which humans cannot digest into animal protein.

Spatial analysis of agricultural productivity is very significant because it can highlight the structure and problems of production relations on which basis suitable policies can be suggested by the policy framers. The concept of agricultural productivity has been comprehensively used to explain the spatial organization and pattern of agriculture. Productivity is generally considered from two directions; (a) productivity of land and (b) productivity of infrastructure engaged in agriculture. Productivity of land is closely linked with the productivity of infrastructure.

Objectives

The present research paper thus addresses to the issues of emerging areal pattern of agricultural productivity in the Purba Medinipur district. The others objectives are:

a. To analyse the measurement of agricultural productivity.
b. To find out the relation between economic development and agricultural productivity.
c. To check out the degradation of bio-diversity for the agricultural productivity change.
d. To examine variations in agricultural productivity and relative changes that have occurred in agricultural production.
e. *To perform* a comparative analysis of agricultural productivity in different farming areas.
f. To recommend some ways to increase agricultural productivity in terms of development economics.

Study Area

Purba Medinipur district is a part of the Lower Ganga Plain (Coastal Belt on the Bay of Bengal), West Bengal, India and its geographically located between 21° 36' 35"N to 22° 02' 23"N and 87° 22' 48"E to 88° 01' 12"E. It covers an area of 4295.00 sq km and is surrounded by Paschim Medinipur and Howrah in the north, Bay of Bengal in the south, South24 Parganas and Howrah in the east and Orissa state in the west. It has a total population of about 5,094,238 with a density of 1076 persons /km^2 (Census, 2011). This district comprises of 25 CD Blocks and 5 Municipalities (fig-1).

Topographically, the district can be divided into two parts. (a) almost entirely flat plains on the east, and west and north. (b) the Contai coastal plain on the south. Rupnarayan, Kasai-haldi, Keleghai,Chandia and Rosulpur are the main revers of the district. The elevation of the district is within 10 m. from m.s.l. The vast expanse of land is formed of alluvium and is composed of younger and coastal alluvial (entisols). Coastal alluvial is saline and saline-alkali nature. The climate of Purba Medinipur district if Monsoon type . The annual rainfall varies from 1400 mm. to 1600 mm. Contai littoral part receives high rainfall which gradually decreases towards the north-west. The average annual temperature is about 26.5^0 C.

Material and Methods

The present study is based on secondary sources of data obtained on 2010-11. The data were collected from the published records of the Directorate of Agriculture, Govt. of W.B. and Bureau of applied Economic & Statistics, Govt. of W.B. Several scholars have attempted to quantify agricultural productivity. Kendall introduced Ranking coefficient for measuring agricultural productivity in 1939.

Stamp (1958) also used Kendall's ranking coefficient for international comparisons. In 1964, Enyedi devised new techniques for determining an Index of productivity coefficient of agriculture. J.L. Buck developed a new technique, which related to grain equivalents per head of production. The index was known as Grain equivalents index. It was further modified by E.de Vries in 1967 (Quoted in Singh and Dhillion, 2000). Bhatia introduced a Productivity evaluation index in 1967[12]. He considered that all physical and human factors join in to produce the agricultural crops. Sapre and Deshpande (1964) have introduced a Weighted rank index for measuring agricultural productivity.

Agricultural productivity coefficient index was introduced by Shafi in 1984 by using calorie values relating to each crop. In 1972, Jasbir Singh attempted to introduce a new technique for calculating agricultural efficiency by expressing the per unit area carrying capacity. Hussain also developed a technique to measure agricultural productivity in 1976 (Hussain 1976). He converted agricultural production into monetary values of a regional unit in production. Kawagoe and others have used a method of Production function approach for measuring agricultural productivity among different countries (Kawagoe et al. 1985).

In 2005, Vanloon, Patil and Hugar developed an indicator for measuring crop productivity by using primary product yield or conventional yield[18]. These are some of the methods for measuring agricultural productivity. They have devised different formulae with different components. Each model has different data requirements and is suitable for addressing different questions and has strengths and weaknesses. The present study is entirely based on secondary data and major source of data is District Statistical hand book of Purba Medinipur district 2010-11. The present study is an attempt to analyse the inter-block variations in agricultural productivity. For this purpose agricultural productivity has been calculated separately at block level. The productivity is measured by the output per hectare and is computed by using the following formula.

Data Base and Techniques of Analysis

The present study is based on secondary sources of data obtained on 2010-11. The data were collected from the published records of the Directorate of Agriculture, Govt. of W. B. and Bureau of applied Economic & Statistics, Govt. of W. B. Several scholars have attempted to quantify agricultural productivity. Kendall introduced Ranking coefficient for measuring agricultural productivity in 1939. Stamp (1958)[7] also used Kendall's ranking coefficient for international comparisons. In 1964, Enyedi[8] devised new techniques for determining an Index of productivity coefficient of agriculture. J. L. Buck developed a new technique, which related to grain equivalents per head of production. The index was known as Grain equivalents index. It was further modified by E. de Vries in 1967 (Quoted in Singh and Dhillion, 2000). Bhatia introduced a Productivity evaluation index in 1967. He considered that all physical and human factors join in to produce the agricultural crops. Sapre and Deshpande (1964) have introduced a Weighted rank index for measuring agricultural productivity. Agricultural productivity coefficient index was introduced by Shafi in 1984 by using calorie values relating to each crop. In 1972, Jasbir Singh attempted to introduce a new technique for calculating agricultural efficiency by expressing the per unit area carrying capacity. Hussain also developed a technique to measure agricultural productivity in 1976 (Hussain 1976). He converted agricultural production into monetary values of a regional unit in production. Kawagoe and others have used a method of Production function approach for measuring agricultural productivity among different countries (Kawagoe et al. 1985). In 2005, Vanloon, Patil and Hugar developed an indicator for measuring crop productivity by using primary product yield or conventional yield. These are some of the methods for measuring agricultural productivity. They have devised different formulae with different components. Each model has different data requirements and is suitable for addressing different questions and has strengths and weaknesses. The present study is entirely based on secondary data and major source of data is District Statistical hand book of Purba Medinipur district 2010-11. The present study is an attempt to analyse the inter-block variations in agricultural productivity. For this purpose agricultural productivity has been calculated separately at block level. The productivity is measured by the output per hectare and is computed by using the following formula—

$$Y_i = (\sum Q_i / \sum A_i)$$

where, Yi = agricultural productivity, Qi = agricultural production of various crops and Ai = area under production of various crops

Results and Discussion

Taking into account the crop-area and crop-yield of 14 principal crops of Purba Medinipur district and applying equation (1) as given above, agricultural productivity in rupees per hectare of gross cropped land was calculated for each block 2010-11. Calculated productivity values were grouped into five categories for the sake of convenience and to show its general pattern (Table - 1).

Regional Pattern of Agricultural Pproductivity

1) Very high productivity region:

It is evident from table no. 1 and figure no. 2 that very high productivity region deal with the agricultural productivity index value is more then 3567. This region covered only three block i.e. Panskura-I, Moyna and Egra-I. This block has been producing main crop like rice (Aus, Aman and Boro), jute, khesari mustard, potato etc. The cultivation pattern is mainly multi-crop type. This area has good conditions of agricultural infrastructure like fertile soil, good climate condition, irrigation system, drainage system and also market oriented area.

2) High productivity region:

Second productivity region is high productivity agricultural region and the productivity index ranging between 3226 to 3567. This region covered only three blocks i.e. Kolaghat, Mahishadal and Chandipur. This block has been producing main crop like rice (aman and boro), jute, khesari mustard, potato etc. This area has average condition of agricultural infrastructure like fertile soil, good climate condition, irrigation system, drainage system and also market oriented area.

3) Medium productivity region:

Under this range of agricultural productivity value is 2885 to 3226. This region covered six blocks i.e. Potashpur-I, Sahid Matangini, Tamluk, , Egra-II, Haldia and Nandakumar. This block has been producing main crop like rice (aman and boro), khesari, til, mustard, potato etc. This area has medium quality condition of agricultural infrastructure like fertile soil, good climate condition, irrigation system, drainage system and also market oriented area.

4) Low productivity region:

The low productivity region deals with the agricultural productivity index value range 2544 to 2885. This region covered seven block i.e. Ramnagar-II, Nandigram-II, Khejuri-I, Bhagawanpur-II, Bhagawanpur-I, Nandigram-I and Deshapran. This block has been producing main crop like rice (Aus and Aman), jute, khesari mustard, potato etc. This area has low condition of agricultural infrastructure like fertile soil, good climate condition, irrigation system, drainage system and also market oriented area.

5) Very low productivity region:

Finally there is very low productivity agricultural region and the productivity index starting from less than 2544.

This region covered six blocks i.e. Sutahata, Contai-I, Potashpur-II, Ramnagar-I, Contai-III, Khejuri-II. This block has been producing main crop like rice (aman), khesari, til, mustard, etc. This area has very bad condition of agricultural infrastructure like fertile soil, good climate condition, irrigation system, drainage system and also market oriented area. This area is located on the coastal belt of Purba Medinipur district and mainly covers alkaline coastal soil with environmental hazard (Table - 2).

Implementation Gap of Agricultural Productivity

Various constraints with reference to Implementation gap have been identified and accordingly measures have been suggested for reducing the implementation gap in Table - 3.

Research Needs in Agriculture Sector

The interventions that are necessary in the research and extension support services with respect to agriculture sector are summarized in Table - 4.

Conclusion

The conclusion reveals that many socio economic as well as physical factors are responsible for existing spatial variations in blocks of agricultural productivity. Productivity, yield / ha and per capita production of mentioned crops have increased tremendously due to the use of modern equipments, application of high yielding varieties (HYV) of seeds, new water conservation and management schemes, pesticides etc. The gross cropped area of each circle is at a substantial quantity. The area under agriculture is about approximately 65% in the study area which is a good sign of agricultural development. It is clear that the productivity is high in Panskura-I, Moyna, Egra-I Kolaghat, Mahishadal and Chandipur .The overall analysis shows that during the period of 2010-11, there were only six blocks with very low productivity, seven blocks with low productivity, six blocks with medium productivity, only three blocks with high productivity and only three blocks with very high productivity. So, agricultural productivity are medium type on the overall district. Future time get to development the agricultural productivity to take appropriate planning of agricultural and land resources.

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Table – 1: Blockwise Agricultural Productivity of Purba Medinipur district, 2010-11

Block	Agricultural Production of various Crops (kg)	Area under various Crops (ha)	Agricultural Productivity (Y) kg / ha
Tamluk	42953000	14209	3022.94
Sahid Matangini	28141000	8806	3195.66
Panskura-I	119260000	30504	3909.65
Kolaghat	68526000	20411	3357.31
Moyna	79831000	22057	3619.30
Nandakumar	63611000	21179	3003.49
Chandipur	53898000	16168	3333.62
Mahishadal	57850000	17322	3339.68
Nandigram-I	59016000	22424	2631.82
Nandigram-II	29622000	10660	2778.80
Sutahata	25488000	10057	2534.35
Haldia	20101000	6833	2941.75
Potashpur-I	88812000	27591	3218.88
Potashpur-II	61013000	25574	2385.74
Bhagawanpur-I	57053000	21285	2680.43
Egra-I	104954000	29015	3617.23
Egra-II	61795000	20733	2980.51
Khejuri-I	30932000	11250	2749.51
Khejuri-II	28929000	13128	2203.61
Bhagawanpur-II	80357000	29734	2702.53
Ramnagar-I	38749000	16385	2364.91
Ramnagar-II	57486000	20261	2837.27
Contai-I	33978000	13998	2427.35
Deshapran	45477000	17678	2572.52
Contai-III	34023000	15135	2247.97
Total	1371855000	462397	2966.83

Sources: 1) Directorate of Agriculture, Govt. of W.B 2) B.A.E & S., Govt of W.B

Table – 2:Block wise distribution of agricultural productivity of Purba Medinipur district

Agricultural Productivity	Value	Blocks	No. of Blocks
Very High	Above 3567	Panskura-I, Moyna, Egra-I	3
High	3226 - 3567	Kolaghat, Mahishadal, Chandipur	3
Medium	2885 - 3226	Potashpur-I, Sahid Matangini, Tamluk, , Egra-II, Haldia Nandakumar	6
Low	2544 - 2885	Ramnagar-II, Nandigram-II, Khejuri-I, Bhagawanpur-II, Bhagawanpur-I, Nandigram-I, Deshapran.	7
Very Low	Below 2544	Sutahata, Contai-I, Potashpur-II, Ramnagar-I, Contai-III, Khejuri-II.	6

Source: Compiled by the Author

Table – 3: Proposed Implementation Gap for Improving Production and Productivity

Sr. No.	Activity / Task	Reasons for Gap	Suggested recommendation
1.	Recommended Practices	Lack of awareness; Cost involved; Fellow farmers also follow the same practice	Awareness camps / visit of trial or demonstration fields.
2	Use of High Yielding Verities	Lack of knowledge, High cost involved, Poor availability	Awareness amongst farmers; Distribution of HYV; Visit to demonstration fields.
3.	Use of Bio-pesticides and Bio-agents.	Farmers do not have any idea of these products; Lack of availability; High cost involved	Visits to experimental field for awareness creation
4.	Water Management and Irrigation	More area under irrigation needs to be planned out	The Stakeholders with the irrigation department can plan out the intervention strategies in a phased manner
5.	Harvesting Practices	Mechanization is getting popular; Cost involved	Micro Credit and loan facilities to be enhanced
6.	Farm level Processing	Farmers follow cleaning, grading and packaging practices at the farm level	Awareness and training about modern practices is required.
7.	Marketing	Individual farmer transport to the market	Capacity building for formation of cooperatives / associations for joint marketing; Creation of adequate marketing facilities; Development of processing industry

Table – 4: Research Needs under Agriculture sector

Sl. No.	Thrust Areas	Research Needs	Extension Needs	Comments/Strategies
1	Improvement of Soil Health, Use of Bio-inputs	Technology Available	Awareness, Demonstration	Training of farmers in large scale is required for dissemination of the technology.
2	Land Development, Reclamation of Water-logged areas	Technology Available	Training, Demonstration	ii) KVK is not there in the district. Atleast two KVKs should be opened in the district
3	Popularising of Integrated Pest Management	Technology Available	Training, Demonstration	iii) Being agriculturally prosperous, an Agriculture College should be established in the district.
4	Quality Seed Production	Technology Available	Training, Demonstration	The State Seed Corporation or the Agri. Deptt. need to be more equipped for popularising of the schemes of 'Seed Village', etc.
5	Improving Productivity	Continuous research required	Training, Awareness, Demonstration	Farmer Clubs should be promoted for acting as an interface between Dept and the farmers for technology dissemination.

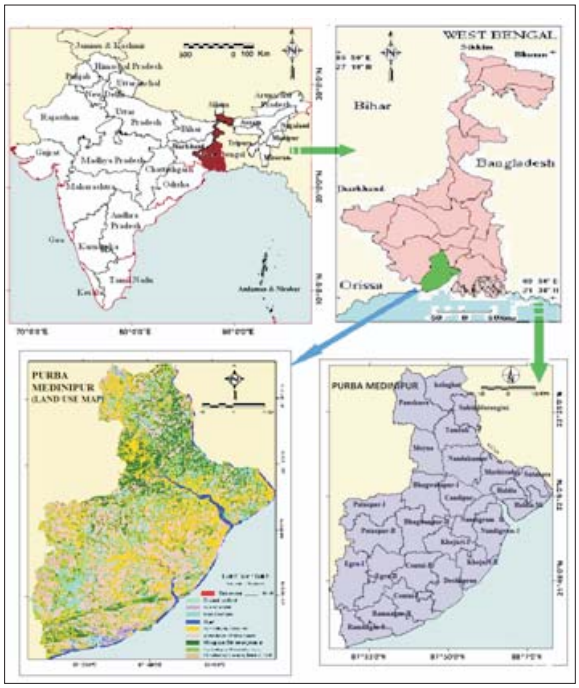

Fig. 1: Location Map ofthe Study Area

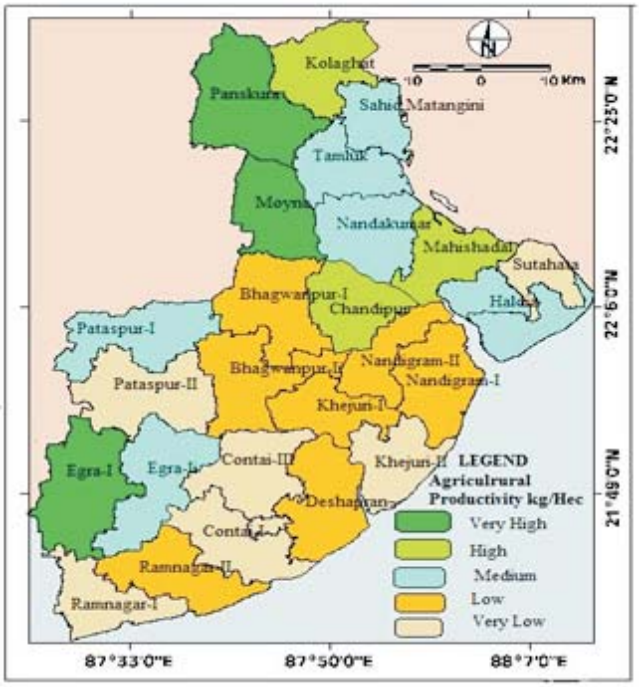

Fig. 2: Agricultural Productivity Regions of Purba Medinipur

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