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Annals of Biological Research, 2018, 9 (2): 45-50

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ISSN 0976-1233

CODEN (USA): ABRNBW

ISSN:0976-1233

Existing land use, cropping pattern and resource use efficiency in Bardhaman district of West Bengal

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ABSTRACT

This paper evaluates the crop diversification nature in terms of the variations in cropping pattern with respect to land and productive resource distribution. Both the aspects of acreage and production, it is detected that with the time span of last three decades the cropping pattern in West Bengal is progressively lead by paddy both aus and boro, rapeseed and mustard jute, potato. Pulses crop as a total, have lost both in terms of area and productivity in West Bengal. The Technical efficiency (TE), allocative efficiency (AE) and economic efficiency (EE) are evaluated with the help of DEA software under the conjecture of Variable returns to scale and (Table 9.1). The EE scores for crops grown under rainfed condition range from 0.03 in the case of cowpea to 0.85 for Sugarcane. The TE scores for rainfed condition ranged from 0.46 in the case of cowpea to 0.98 in the case of Sugarcane. The EE scores for crops grown under irrigated condition range from 0.10 in the case of red gram and green gram to 0.57 for Paddy. The TE scores for irrigated condition ranged from 0.41 in the case of greengram to 0.97 in the case of paddy.

Keywords: DEA software, Allocative efficiency, Technical efficiency, Crop diversification.

INTRODUCTION

Agriculture shows a leading part in commercial and economic growth through providing food and nutrition for the country. It also creating prospects of occupation, and sharing of nationwide GDP as well as supplying raw inputs for agriculture based industries [1]. In India, around 57 % of people are engage on crop cultivation and animal husbandry [2-5]. During 1985-86 and 1992-93, the agricultural contribution to the SDP was increasing at about 4.7 per cent per annum, while the overall growth was 5.1 per cent per annum. A number of facilities for irrigation have been opened up and the consumption of chemical fertilisers has gone up from 558 thousand tonnes to 1109 thousand tonnes in between 1985-90 and 1997-02. This point is to an increase in the application of fertilisers to the extent of over 36 per cent. Aided by these improvements in the use of hyv rice almost is doubled between 1985-86 and 1992-93(Sarkar, 2018).

Both the aspects of acreage and production, it is detected that with the time span of last three decades the cropping pattern in West Bengal is progressively lead by paddy both aus and boro, rapeseed and mustard jute, potato. Pulses crop as a total, have lost both in terms of area and productivity in West Bengal. Agriculture dwell in an significant place in the frugality of West Bengal. It not only delivers food to the bulky and fast rising people but also raw supplies to numerous agro-based businesses. In the past three decades agricultural activity has moved from survival to commercial agriculture.

Nature and sources of data

Both the secondary data and primary [CCS data] were used in the study. Secondary data sources for few indicators like for subsidy rate on fertilizers and electricity the data were procured from the Department of Agriculture, DES, GoI and West Bengal State. Statistical Abstract of West Bengal (Various issues) have been used to collect data on various cropping and irrigation parameters of state's agriculture.

ANALYTICAL TOOLS AND TECHNIQUES EMPLOYED

Items	Tool/Techniques
Changes in cropping pattern Land use pattern	Diversification index
Resource use efficiency	Data Envelopment Analysis (DEA) approach
Scope of revising crop plans	Cost-return analysis using Market Prices, Economic Prices and Natural Resource Valuation Prices

Estimation of cost and returns

The costs were classified into variable and fixed costs. Variable cost includes cost of inputs, labour cost, interest on working capital and miscellaneous costs. Fixed costs were defined to include depreciation on farm implements, land revenue and taxes. While the returns included value of both main product and by-product.

Technical, allocative and cost efficiencies

The term Technical efficiency or output oriented efficiency (TE) refers to the capacity of a farmhouse to yield the maximum feasible product from a given mix of resources, or the minimum feasible extents of resources to produce a given level of output. Allocative efficiency or pricing efficiency (AE) denotes to the capacity of a technically efficient farm to use resources in proportions that minimize costs of production given resources prices. Allocative efficiency is calculated based on the ratio of the minimum costs of production required by the farmhouse to yield a given level of outputs and the actual costs of the farm adjusted for TE. Economic Efficiency (EE) is the product of TE and AE. Thus, a farm is economically efficient if it is both technically and allocatively efficient. The general method of appraising the maximum conceivable output has been the Data Envelopment Analysis (DEA) supported by Charnes et.al. (1978).

Data envelopment analysis

The DEA technique is a frontier analysis method that does not necessitate functional form or a distributional form specification, and it can lodge scale problems. DEA used to apply by using both classic function or models constant returns to scale with resource positioning, in which one seeks input optimization to obtain a particular product level. Under conjecture of constant returns to scale, the linear programming (LP) models for calculating the both efficiency of farms are (Coelli et. al., 1998).

Estimation of technical efficiency

Minimization

Subject to

$$\theta X_i - X\lambda \geq 0$$

$$\lambda \geq 0 \quad (4)$$

Where,

y_i is a vector ($m \times 1$) of output of the i th Producing Farms (TPF)

x_i is a vector ($k \times 1$) of inputs of the i th TPF

Y is an output matrix ($n \times m$) for n TPFs

X is an input matrix ($n \times k$) for n TPFs

θ is the efficiency score, a scalar whose value will be the efficiency measure for the i th TPF. If $\theta=1$, TPF (Total productivity factor) will be efficient; otherwise, it will be inefficient.

The λ is a parameter ($n \times 1$) whose standards are considered to achieve the optimum solution. The λ values will be the weights used or an inefficient TPF, in the linear combination of other. The effective, TPFs which effect the forecast of the ineffective TPF on the calculated frontier.

Estimation of allocative efficiency and cost efficiency (economic efficiency)

If any researcher having price information and is ready to consider a developmental objective, such as cost optimization or income maximization, then he can quantify both technical and allocative efficiencies by DEA. One would run the following cost minimization DEA for estimation of cost efficiency (or economic efficiency) as follows

$$\text{Min } \lambda, X_i^* - W_i X_i^*,$$

$$\text{Subject to } -y_i + Y\lambda \geq 0,$$

$$X_i^* - X\lambda \geq 0,$$

$$N1 \lambda \geq 1$$

$$\lambda \geq 0, (5)$$

Where,

W_i is a vector of input prices for the i th Total Productivity Factor (TPF),

X_i is the cost minimizing vector of input quantities for the i th TPF (which is calculated by the LP),

Given the resource prices W_i and the production levels Y_i . The total cost efficiency (CE) or economic efficiency of the i th TPF can be considered as

$$CE = W_i X_i^* / W_i X_i \quad (6)$$

i.e., the fraction of lowest cost to detected cost. One can then practice equation no. 6 to calculate the allocative efficiency residually as

$$AE = CE/TE \quad (7)$$

RESULTS AND DISCUSSION

Table 1: Land use pattern in West Bengal state during the period 1980-81 to 2011-12.

	Forest area	Area under non-agricultural use	Barren & unculturable land	Permanent pasture & other grazing land	Land under misc. trees & grooves not included in net area sown	Culturable waste land	Fallow land other than current fallow	Current fallow	Net area sown	Reported area (in million hectares)
India	22.66	7.7	6.29	3.56	1.1	4.46	3.33	4.83	46.07	306.26
West Bengal	13.48	18.52	0.31	0.06	0.67	0.4	0.25	3.84	62.89	9.69

Diversification index for the West Bengal

In the present study, among the various indices of studying the extent of crop diversification at a given point of time like Herfindahl Index (HI); Transformed Herfindahl Index (THI); Ogive Index (OI); Entropy Index (EI); Modified Entropy Index (MEI); Composite Entropy Index (CEI); Gini's Coefficient (Gi); and Simpson Index (SI) of Diversification has been employed to measure degree of crop diversification and is explained as follows:

$$SI = 1 - \sum (p_i / \sum p_i)^2$$

Where, p_i is the area proportion of the i th crop in total cropped area and $i = 1, 2, 3, \dots, n$. is the number of crops. This index was first used to measure the regional concentration of industries (Theil, 1967). The value of HI is bounded by 0 (perfect diversification) and 1 (complete specialization).

Cropping pattern on sample farms

It could be observed from the Table 2 that rice was the major crop on the sample farms accounting for about 23 per cent followed by potato, sugarcane and mustard which together accounted for 2/3rd of the GCA and jute was the leading crop among oilseeds under rainfed situation.

As expected under canal irrigated situation paddy being the more water intensive crop accounted for about 60 per cent of the GCA, rice and potato are the other two distantly competing crops for area with a share of about ten and seven per cent of the GCA on the sample farms.

Table 2: Cropping pattern from sample data under Rainfed situation TE-2014-15. Source: Govt. of WB, Dept. of Applied Economics and Statistics.

SN	Particulars	n (No. of observations)	TE 2014-15 (ha)	% of Sample GCA
1	Bajra	18	62.6	1.53
2	Mustard	183	742.9	18.17
3	Maize	18	62.6	1.53
4	Paddy	228	939.21	22.97
5	Potato	183	742.9	18.17
6	Wheat	48	193.89	4.74
7	Cowpea	10	36.09	0.88
8	Gram	18	55.38	1.35
9	Green gram	52	183.87	4.5
11	Sugarcane	61	200.03	4.89
12	Jute	95	373.44	9.13
13	Safflower	12	49.42	1.21
14	Cotton	7	23.25	0.57
	Gross cropped area	1045	4089.27	100

Table 3: Growth Rate of production of different Crop in West Bengal during 1990-91 to 2014-15. Source: Govt. of WB, Dept. of Applied Economics and Statistics.

Crops	Growth Rate of Output
Rice	92.16
I. Aus	1.84
II. Aman	51.17
III. Boro	399.38
Potato	402.12
Sugarcane	1643.46
Jute	84.93
Total food Grains	91.52
Rapeseed & Mustard	326.65
Total pulses	-23.46

Table 3 shows a distinction between the growth rates of different main crops and crops group during the period of 1990-91 to 2014-15. From the above table it can be detected that there has been a significant develop in output over a period in case of single crops like rice, rapeseed and mustard, sugarcane, jute and potato.

Diversification index for the West Bengal

Table 4: Crop Diversification Index for West Bengal state.

Particulars	TE 1994-95	TE 2004-05	TE 2014-15
Simpson Diversity Index (SDI) during triennium ending	0.7698	0.7883	0.8002

Thus it could be inferred from the Table 4 that the West Bengal state had a highly diversified cropping pattern as the value of SDI approached unity during the study period.

Crop wise farm technical, efficiency, allocative and economic efficiency

In simple terms, Technical Efficiency (TE) reflects the ability of the firm to obtain a given output with minimal input. The Allocative Efficiency (AE) reflects the ability of a firm to use the inputs in optimal proportions. The Economic Efficiency (EE) is the product of the two efficiencies. The following diagram explains the concepts.

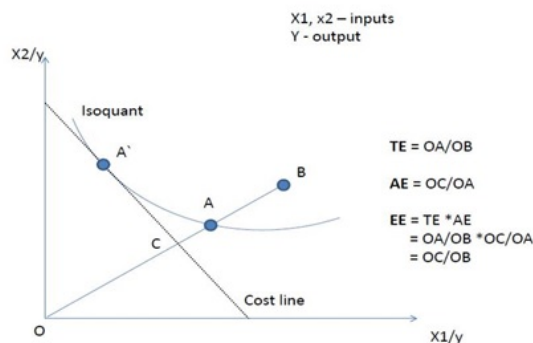


Table 5: Technical, allocative and economic efficiency of crops by considering variable returns to scale in West Bengal TE 2014-15.

SN	Crops	Rainfed		
		TE	AE	EE
	Paddy	0.97	0.72	0.7
	Maize	0.74	0.42	0.31
	Wheat	0.9	0.9	0.81
	Cowpea	0.46	0.06	0.03
	Gram	0.61	0.17	0.1
	Greengram	0.98	0.68	0.67
	Redgram	0.51	0.31	0.16
	Soyabean	0.82	0.58	0.48
	Groundnut	0.55	0.37	0.2
	Sugarcane	0.98	0.87	0.85
	Mustard	0.85	0.68	0.58
13	Potato	0.71	0.7	0.5

Table 6: Technical, allocative and economic efficiency of crops by considering variable returns to scale in West Bengal TE 2014-15.

SN	Crops	Irrigated		
		TE	AE	EE
	Paddy	0.97	0.59	0.57
	Maize	0.6	0.6	0.36

	Wheat	0.82	0.58	0.48
	Cowpea	0.6	0.39	0.23
	Gram	0.5	0.41	0.21
	Redgram	0.63	0.16	0.1
	Potato	0.79	0.77	0.61
	Sugarcane	0.91	0.5	0.46
	Groundnut	0.5	0.4	0.2
	Mustard & Rapeseed	0.64	0.58	0.37
	Soyabean	0.53	0.38	0.2
13	Greengram	0.41	0.25	0.1

The TE, AE and EE are calculated using the DEA software under the assumption of Variable returns to scale and (Table 4). The EE scores for crops grown under rainfed condition range from 0.03 in the case of cowpea to 0.85 for Sugarcane; The TE scores for rainfed condition ranged from 0.46 in the case of cowpea to 0.98 in the case of Sugarcane; The EE scores for crops grown under irrigated condition range from 0.10 in the case of red gram and green gram to 0.57 for Paddy; The TE scores for irrigated condition ranged from 0.41 in the case of greengram to 0.97 in the case of paddy; Table 5).

CONCLUSION

The present chapter has analysed the nature of crop diversification in terms of the changes in cropping pattern with respect to acreage and production distribution. In the case of crops grown under borewell irrigation condition during the period TE 2014-15, the highest fertilizer subsidy and irrigation subsidy was received by the Sugarcane growers followed by Paddy growers, as both were the water and fertilizer intensive crops. Generally for pulse crops, fertilizer and irrigation subsidies were low and the highest fertilizer subsidies recorded in Gram. Besides being remunerative, oilseed crop also require less irrigation which makes them ideal for cultivation in the areas with less rain or irrigation. Pulses, as a whole, have lost both in terms of acreage and production in West Bengal. The indices of diversification mostly indicate an increasing degree of crop diversification over time. The annual growth rates in term of acreage and production of mail food grain crops like paddy, mustard, jute and potatoes show decreasing movements during the second period. As a conclusion, we can say that the cropping pattern alteration in West Bengal has undeniably been an emerging veracity which is replicated through adoption of a diversification cropping pattern by the farmers.

REFERENCES

- [1] Johnston BF and Mellor JW. *A Further Note, Economic and Political Weekly*. **1961**. 37(30): p. 566-93.
- [2] Paul A 2015. *Naya Udyog Publication*.
- [3] Suresh A and Reddy KTR. *Agric Econ Res Rev*. **2006**. 19: p.159-171.
- [4] Chand R, Raju SS, Pandey LM. *Ind J Agri Econo*. **2008**. 63(3): p. 299-309.
- [5] Majumdar K, Basu P. *Ind J. Agric. Econ*. **2005**. 60: p. 220-234.
- [6] http://cgwb.gov.in/District_Profile/westbengal/BROCHURE.pdf