

Study on growth of major cereals in West Bengal

Debashis Sarkar[✉]

Institute of Agriculture, Visva-Bharati, Sriniketan-731236, West Bengal.

✉Corresponding author: debashis.sarkar@visva-bharati.ac.in

Paper No. 206

Received: 7 October 2014

Accepted: 6 February 2015

ABSTRACT

An effort has been made in this study to measure the sub-period growth rates of area, production and yield of two major crops i.e. rice and wheat in West Bengal. The study also tries to examine the changes in costs and profitability of these two crops during this period. It has been observed that the agriculture of the state had been able to boost its performance during the decade of eighties, at least in terms of growth rates production of rice and wheat, mainly for tremendous increment in the yield growth rates of the crops along with expansion of area under cultivation. The effective introduction of HYV technology coupled with successful implementation of land reforms programme at the very grass root level set the path of agricultural development in West Bengal. However, this scenario of impressive growth performance did not sustain for a very long period of time. The fall in the yield growth rates of crops reduces the production growth rates during the era of globalisation which have been started in the early nineties. During this period, crops such as boro rice, and total food grain experienced fall in their growth rates to a significant extent with marked deceleration in growth trend. The trend of declining cost of production with higher growth in yields got reversed in the nineties and beyond and they went up at nearly 1.5% per annum for rice and wheat. The returns over paid-out costs also for rice farmers declined at 1.15% per annum in real terms leading to distress for them. This declining profitability seems to have discouraged them in increasing spending on yield augmenting technology as shown by the relatively declining growth rate of cost of cultivation.

Keywords: rice, wheat, area, production, yield, cost of production

The performance of agriculture in West Bengal over the last three decades has witnessed a dwindling picture. Growth rates have increased and per capita incomes have gone up. Liberalization and deregulation have yielded impressive results and the economy is increasingly integrated to the world economy. Still, agriculture continues to be the backbone of the economy of West Bengal. Agriculture remains the most crucial sector of the state economy as around 72% of the total population lives in rural areas and agricultural continues to be their mainstay. However, along with the structural transformation of the economy of the state, the contribution of agriculture in State Domestic Product (SDP) is observed to follow a declining trend. It contributes a significant share to the SDP as compared to other sectors of the economy even the contributions of agriculture to total SDP (at constant prices) has declined from 41.16% in 1970-71 to 27.1% in 2000-01.

It is fact that food grain dominates the cropping pattern in West Bengal (De, 2002; Ghosh and Kuri, 2005). Food grain crops are grouped as cereals crops and pulse crops. The important cereals crops of the state include rice, wheat and maize. Food grain crops including cereals and pulses occupied 68% of gross cropped area. With the production of 16501.24 thousand tones, West Bengal occupied the top position in the food grain production in India. Though the state performed well in food grain production among the states of India, in recent years there is evidence of the stagnancy in food grain production growth rate (Ghosh and Kuri, 2007). Further, the expansion of area under cultivation is hardly possible in West Bengal. Productivity growths of most of the important crops were stagnated in the 1990s after the liberalization process began.

It has been found that the growth performance of the state has been analyzed by many scholars (Saha and

Swaminathan, 1994; Boyce, 1987; Chattopadhyay and Das, 2000). The pioneer work came from Boyce (1987) who measured the growth rates of crop output in West Bengal agriculture during 1949-80. He observed that the stagnancy of agriculture of the state comes to an end during 1980s and the growth of agricultural rose to its highest level during the decade of eighties. Saha and Swaminathan (1994) estimated growth of aggregate crop output of 6.40% during the eighties was the highest among the Indian states and this spectacular growth of the agricultural sector was widespread in the districts of the state. They argue that the land reforms measures introduced in the state during the early 1980s have significantly contributed to the impressive growth of the agriculture of the state. Chattopadhyay and Das (2000) also claimed that the agricultural growth in West Bengal during eighties is higher than the seventies. However, their estimate of the annual growth rate (3.6%) of agricultural production in West Bengal during 1977-78 to 1994-95 is much lower than that of the growth (6.4%) estimated by Saha and Swaminathan (1994) during the period from 1981-92 to 1990-91. They concluded that agricultural production in West Bengal is still dependent on rainfall and fluctuations in rainfall index significantly positively contribute to the fluctuations in agricultural production in the state. Sanyal *et. al.* (1998) and Mukherji and Mukhopadhyay (1995) also supported the view of Saha and Swaminathan (1994) that land reforms programmes is primarily responsible for the breakthrough in West Bengal agriculture. Harris (1992), however, argued that this high growth has taken place in the absence of any reform of the agrarian structure. According to his opinion, the growth was rather technological-'suitable technology' coined with favourable fertilizer-paddy price ratio. To analyze the performance of agricultural sector of the state the main emphasis has been given on the decadal growth rates of the major crops. In view of these, an effort has been made in this study to measure the sub-period growth rates of area, production and yield of two major crops i.e. rice and wheat in West Bengal. Similarly, effort has also been made to study the changes in costs and profitability of these two crops.

Data base and Methodology

The study has been conducted based on the secondary

data. The secondary data has been collected from various sources i.e. farm level data from the cost of cultivation studies, government publications, books, journals etc. Tabular analyses along with econometric analyses have been adopted to fulfil the specific objectives of the study.

Results and Discussion

An effort has been made to measure the sub-period growth rates of area, production and yield of the crops as measured by the kinked exponential growth model. For convenience, the whole period of 40 years (1970-71 to 2004-05) is divided into three sub-periods; first sub-period (1970-71 to 1980-81), second sub-period (1981-82 to 1991-92) and third sub-period (1992-93 to 2009-10). These three sub-periods have special significance to the economy of West Bengal. Clearly, the agricultural development of the state during the period 1970-71 to 1980-81 was not up to the mark, rather it was underdeveloped in nature. However, some institutional and technological changes took place in the state during the early 80s. These institutional and technological changes had some positive impact on the agricultural development of the state. The productivity and production of all important crops got increased significantly. Lastly, the third sub-period (1992-93 to 2009-10) is the period of LPG (liberalisation, privatisation and globalisation). Clearly, the final sub-period captures the impact of globalisation on the agriculture of the state.

During the first sub-period (1970-71 to 1980-81) it has been observed that the growth rates of production of almost all important crops were either low or even negative (barring boro rice). For example, total rice grew only at 0.51% per annum during the 70s. The growth rates of production of aman and Aus were 0.52 and -4.37% per annum, respectively. However, boro rice was growing at a rate of 2.53% per annum. The growth rate of production of wheat was also negative (-3.18%) during this period (Table 1). In most cases, the area and yield growth rates were either very slow or even negative, which in turn forces the output growth rate to be negative (barring growth rate of area under boro rice). Thus, it has been found that during the period 1970-71 to 1980-81, with the exception of boro rice, the growth rates of production of rice and wheat were slow. Both the

Table 1: Growth rates of area, production and yield of rice and wheat in West Bengal during 1970-71 to 2009-10
(area in '000 ha, prodn. in '000 tonnes, yield in kg/ ha)

Crop	Kinked exponential growth rate			Trends break++		R2	DW
	1970-71 to 1980-81	1981-82 to 1991-92	1992-93 to 2009-10	First break 1980-81	Second break 1991-92		
Area							
Aus rice	-2.63 (-4.181)*	-1.57 (-2.938)**	-4.75 (-6.876)*	1.09 (1.07)	-2.85 (-2.91)**	0.88	1.46
Aman rice	0.07 (0.324)	0.51 (2.809)**	-0.61 (-2.81)**	0.47 (0.92)	-1.45 (-2.456)**	0.22	2.38
Boro rice	3.18 (3.09)*	9.65 (10.99)**	3.78 (-3.691)*	6.89 (3.89)*	6.23 (-1.23)	0.93	2.04
Total	-0.20 (-0.783)	1.23 (5.564)*	-0.20 (0.81)	1.56 (3.34)*	-1.41 (-2.561)**	0.74	2.17
Wheat	-2.07 (-1.059)	-1.42 (-0.794)	3.79 (1.891)***	0.89 (0.231)	5.45 (1.651)	0.55	1.51
Production							
Aus rice	-4.37 (-5.394)*	4.47 (6.561)*	-2.51 (-2.82)**	7.19 (5.43)*	-6.89 (-5.16)*	0.61	2.18
Aman rice	0.52 (0.649)	4.45 (6.48)*	1.41 (1.43)	4.12 (2.91)**	-3.43 (-2.16)*	0.85	2.19
Boro rice	2.53 (2.24)**	11.07 (11.49)*	3.69 (3.12)*	8.71 (4.63)*	-31.08	0.96	2.12
Total	0.51 (0.612)	5.31 (7.409)*	1.82 (2.11)**	4.89 (3.53)*	-3.65 (-2.22)**	0.89	2.09
Wheat	-3.18 (-1.642)	-0.43 (0.072)	4.13 (1.85)***	2.71 (0.89)	4.92 (1.32)	0.62	1.29
Yield							
Aus rice	1.74 (-2.779)**	6.05 (11.13)*	1.91 (3.19)*	7.81 (8.05)*	-4.56 (-4.421)*	0.92	1.61
Aman rice	0.45 (2.504)**	3.94 (-5.01)*	0.56 (0.561)	3.53 (1.215)	-3.654 (-2.75)**	0.83	1.73
Boro rice	-0.65 (-1.44)	1.42 (3.671)*	0.12 (0.21)	2.34 (3.561)*	1.54 (-1.34)	0.40	1.46
Total	0.72 (0.855)	4.07 (5.665)*	173 (1.235)***	3.45 (2.41)**	-2.54 (-1.81)***	0.82	1.91
Wheat	-1.11 (-1.001)	0.98 (0.987)	0.81 (0.715)	2.12 (1.21)	-0.43 (-0.21)	0.33	1.69

Source: Bureau of Applied Economics and Statistics, Government of West Bengal

Note: *p = 0.01, **p = 0.05, ***p = 0.1

++First trend break (1981-82) and second trend break (1992-93) measure the differential value of estimated slopes and their significance at the break points respectively, with t values in parentheses. Thus the trend breaks provide us with the estimated values of the change in the decadal growth rates of production, area and yield rate respectively of the crops concerned. Figures in parentheses present the t values corresponding to each of the estimated growth rates. The corresponding *'s signify the level of significance of the estimates of decadal growth rates and that of the differential growth rates at the trend breaks.

area expansion under crops and the yield of these crops were responsible for this slow growth of output.

This situation of slow growth, however, changed during the 80's when the growth rates of area, production and yield of rice improved significantly, while those for wheat have either deteriorated or remained stagnant. From Table 1, it has been found that during the second sub-period (1981-82 to 1991-92), the growth rate of area of total rice improved significantly from a negative growth rate observed during the previous decades of 70s to 1.23% per annum during the second sub-period and this incremental growth rate was significant

(as tested by the significance of trend breaks). The yield growth rate of total rice jumped from 0.72% per annum during seventies to 4.07% per annum during the period 1981-82 to 1991-92 (Table- 1). During the second sub-period, more than 70% of the output growth came from yield growth. The similar fashion of growth trend has been observed for aman rice. For Aus rice the growth rate of area was negative (-1.57%) per annum during the second sub-period (Table- 1). However, a massive increase in the yield growth rate (6.05%) during the 80s resulted in the impressive growth of output at a rate of 4.47% per annum. In case of boro paddy quite an opposite scenario has been observed where the area growth rate plays the

major role behind its impressive output growth of over 11% per annum during the second sub-period. Boro was introduced on massive scale as HYV crop in the state during the early 80s. As it was a HYV crop, its yield level was already high and its high yield was the main factor for its rapid expansion in the state. As far as wheat is concerned, it has been found that the state has been able to achieve a marginal positive growth rate in yield rate as against the negative growth of the 70s. However, area and production of wheat have registered marginal improvement, though the rates still remain negative. Due to the

impressive growth, performance of paddy crops has turned the growth of food grain production to an optimum level of 4.52% per annum during the second sub-period. This was one of the best food grain production performances among the Indian states.

However, West Bengal failed to sustain the high growth path as achieved during the eighties. The growth rate of production of rice and wheat declined in the subsequent periods. The area growth rate of aman rice becomes negative during the decade of nineties and the yield growth rate also reduced

Table 2. Different costs in the production of rice and wheat at all-India level

Year	Rice			Wheat			paddy cost as a percentage of wheat cost		
	CoP*	CoC**	A ₂ CoC**	CoP*	CoC**	A ₂ CoC**	CoP	CoC	A ₂ CoC
1981-82	99	2892	1705	122	3260	1946	81	89	88
1982-83	116	2824	1680	125	3475	2065	93	81	81
1983-84	108	3351	1959	135	3462	2039	80	97	96
1984-85	113	3582	2107	133	3752	2121	85	95	99
1985-86	118	3718	1966	123	3959	2335	96	94	84
1986-87	124	3717	2240	132	4058	2391	94	92	94
1987-88	144	4653	2828	146	4826	2777	99	96	102
1988-89	147	5704	3636	168	5636	3292	87	101	110
1989-90	172	6340	3539	172	5769	3361	100	110	105
1990-91	185	6526	3734	197	6872	3800	94	95	98
1991-92	218	7884	4161	204	7693	4303	106	102	97
1992-93	238	7684	3957	238	8808	4823	100	87	82
1994-95	279	11212	6369	294	10990	5446	95	102	117
1995-96	306	11207	6324	318	11681	6100	96	96	104
1996-97	338	12651	6703	361	13760	6927	94	92	97
1997-98	370	13581	7246	381	13236	6853	97	103	106
1998-99	398	15495	8710	383	14316	7268	104	108	120
1999-00	442	16978	9275	415	16459	8038	106	103	115
2000-01	448	17365	9798	450	17132	8751	99	101	112
2001-02	469	18655	10619	466	17279	9058	101	108	117
2002-03	530	19193	10949	499	18837	10027	106	102	109
2003-04	483	19583	10988	498	18925	10195	97	103	108
2004-05	529	20670	11776	537	19810	10975	98	104	107
2005-06	529	21182	11845	592	21847	11584	89	97	102
2006-07	546	22059	12543	586	23847	12681	93	93	99
2007-08	NA	NA	NA	617	25575	13166	-	-	-

Source: CACP, Government of India

* Measured in ₹ per quintal. ** Measured in ₹ per hectare

Table 3. All India trend growth rates of different costs and yields in rice and wheat

Period	Rice	Wheat
Cost of production (Constant prices)		
1981-82 to 1992-93	-0.2(-0.44)	-2.1(-3.21)**
1994-95 to 2006-07	1.2(2.04)*	1.4(3.22)**
Cost of cultivation (Constant prices)		
1981-82 to 1992-93	2.2(3.37)**	1.2(2.06)*
1994-95 to 2006-07	1.7(2.66)*	1.7(3.44)**
A2 Cost of cultivation (Constant prices)		
1981-82 to 1992-93	1.3(1.65)	0.5(0.92)
1994-95 to 2006-07	1.9(2.64)*	2.4(5.35)**
Yield (kg/ha)		
1981-82 to 1992-93	2.4(6.79)**	-0.3(-0.63)
1994-95 to 2006-07	0.8(9.20)**	-0.1(-0.27)

Note: The deflator used is WPI for Non-food articles with 1981-82 = 100 and * = 95% confidence level; ** = 99% confidence level. 't' values are given in parentheses.

Source: CACP, Government of India

significantly. As a result of which the output of aman rice declined only to 2.51% per annum. During the nineties, the output growth rate of boro rice declined to 3.69% per annum and this fall in growth rate is significant (Table- 1).

The trends in C2 cost of cultivation per hectare and C2 cost of production per quintal and A2 cost of cultivation for the period 1981-82 to 2007-08 for rice and wheat crops are examined in this section. There have been debates that rice should be given similar minimum support prices (MSP) as compared to wheat as the costs of both the crops are similar. Similarly, an effort has been made to examine this issue here by looking at the trends in ratio of rice costs to wheat costs. The total cost of production per unit of rice and wheat, which includes imputed values of land, labour and capital, shown in Table-2, reveals that the unit costs of the former are somewhat lower than those of the latter. However, the situation seems to have changed after 1994-95 and there are several years in which paddy cost of production per unit exceeded that of wheat. This was particularly noticeable after 1999-2000.

The ratio of paddy cost of production to that of wheat is lower than the ratio of their cost of cultivation because of higher yields in paddy. The ratio of A2 cost of cultivation (CoC) of rice to wheat was higher

than the corresponding ratio of C2 CoC as shown in Table-2. This may be because of lower imputed values of land, labour and capital in case of paddy compared to wheat. The conclusion is that the costs of rice have been similar to those of wheat since the mid-1990s. The ratio came down to 0.90 and 0.91 in the case of cost of production (CoP) in the years 2005-06 and 2006-07. On the whole the demand that the MSP of rice should be closer or slightly below wheat based on cost data may need sympathetic hearing. However, it may be noted that although cost is a major one, it is only one factor among many factors in determining MSP.

The growth rates in the real costs of production declined in the background of a robust gain in per hectare yields in the first period, while these costs went up in real terms in the second period (Table-3). As can be seen from the table, the growth rate in yields came down from 2.4 to 0.8 in rice and from -0.3 to -0.1 in wheat in the first and second periods respectively. The growth in yield outstripped growth in cost of cultivation during the eighties enabling the cost per quintal to go down. Another important point to be noted is that the cost of cultivation has grown at a more or less same rate in the recent period indicating that the lower profitability might have discouraged farmers to invest in higher use of inputs and technology.

Table 4, CoP of different states in relation to all-India average in rice and wheat (Per quintal for different triennium)

State	Rice (per cent)			Wheat (per cent)		
	TE 1984-85	TE 1996-97	TE 2006-07	TE 1984-85	TE 1996-97	TE 2006-07
Andhra Pradesh (AP)	93	92	73	-	-	-
Assam	88	114	126	-	-	-
Chhattisgarh	-	-	94	-	-	149
Himachal Pradesh (HP)	102	-	50	121	130	109
Haryana	111	124	106	103	78	84
Jharkhand	-	-	-	-	-	187
MP	102	109	138	95	122	116
Punjab	105	96	77	98	92	84
Rajasthan	-	-	-	104	85	77
Tamil Nadu	-	-	128	-	-	-
West Bengal	119	117	121	-	-	157
All-India	100					

Source: CACP, Government of India

Now the question is which states are relatively efficient in costs of production relative to all-India average. The states of HP, AP and Punjab are the efficient producers of rice in the triennium ending 2007 (Table- 4). The farmers of AP and Punjab could produce a quintal of rice at 27% and 23% lower cost than that of the all-India average and they have improved efficiency of production by reducing the cost of production relative to all-India average during the study period. The obverse is true in case of Assam and M.P. Madhya Pradesh, produces rice at 30% higher costs. Also, farmers from Assam and Tamil Nadu are expensive in rice production, which may be impinging on their profitability seriously. Rajasthan, Punjab and Haryana are the efficient producers compared to all-India average for wheat. Here, Jharkhand, West Bengal and Chattisgarh produce wheat at whopping 87%, 57% and 49% higher cost than all-India.

Conclusions

It reveals from the study that the agriculture in West Bengal had been able to boost its performance during the decade of eighties, at least in terms of growth rates production of rice and wheat, mainly for tremendous increment in the yield growth rates of the crops along with expansion of area under cultivation. The effective introduction of HYV technology coupled with successful implementation of land reforms programme at the very grass root level set the path

of agricultural development in the state of West Bengal. However, this scenario of impressive growth performance did not sustain for a very long period of time. The fall in the yield growth rates of crops reduces the production growth rates during the era of globalisation which have been started in the early nineties. During this period, crops such as boro rice, and total food grain experienced fall in their growth rates to a significant extent with marked deceleration in growth trend.

The cultivation of the same crop on the same piece of land over a long period and non-optimum doses of chemical fertilizer might cause the soil fertility to decline in the state. This is also very much prominent from the stagnation of yield level of rice and wheat in West Bengal in the recent years. And this stagnation or slowing down of yield growth rates of rice and wheat cause the total agricultural output to grow at a slower rate in the recent times. This is the main cause of concern of today, especially with respect to the food security issue of the state. The trend of declining cost of production with higher growth in yields got reversed in the nineties and beyond and they went up at nearly 1.5% per annum for rice and wheat. The returns over paid-out costs also for rice farmers declined at 1.15% per annum in real terms leading to distress for them. This declining profitability seems to have discouraged them in increasing spending on yield augmenting technology as shown by the relatively declining growth rate of cost of cultivation.

The price intervention in enhancing MSPs for wheat in 1997-98, 2006-07 and 2007-08, keeping in view of the fact that the market prices are higher, has distorted the intercrop price parity between rice and wheat. Though the costs of production are similar for these two crops since the mid-nineties, the wheat MSP has been 14% higher than that of paddy since then and up to 2007-08. In the recent period, the rice farmers have also suffered from lower price realization than the respective MSPs since 2000-01, lower (7%) returns over total costs compared to 27% in wheat and higher growth in costs of production compared to the whole sale price indices between 2002-03 and 2006-07. On the whole, the analysis presented in the paper shows that there is some merit in the argument that the MSP of rice should be closer or slightly below that of wheat. Therefore, hikes in support prices for rice are justified in this background.

References

- Boyce, JK. Agrarian Impasse in Bengal: Institutional Constraints to Technological Change. New York : Oxford University Press; 1987
- Chattopadhyay, AK and Das,PS. Estimation of growth rate: A critical analysis with reference to West Bengal agriculture. *Ind J Agric Econ.* 2000; 55: p116-135.
- De, UK. Economics of Crop Diversification. New Delhi: Akansha Publishing House; 2002
- Ghosh, BK. And Kuri, PK. Changes in cropping pattern in West Bengal during 1970-71 to 2000-01. *IASSI .* 2005; 24: 39-56.
- Ghosh, BK. and Kuri, PK. Agricultural growth in West Bengal from 1970-71 to 2003-04: A decomposition analysis. *ICFAI J. Agric. Econ.* 2007; 4: p30-46.
- Harris, J. What is happening in rural West Bengal: Agrarian reforms, growth and distribution. *Econ Polit Week.* 1992; 28: p1237-1247.
- Mukherji, B. and Mukhopadhyay, S. Impact of institutional change on productivity in a small-farm economy: Case of Rural West Bengal. *Econ Polit Week.* 1995; 30: p2134-2137.
- Saha, A. and Swaminathan, M. Agricultural growth in West Bengal in the 1980s: A disaggregation by districts and crops. *Econ Polit Week.* 1994; 29: pA-8-A-8.
- Sanyal, M.K., Biswas, PK. and Bardhan, S. Institutional change and output growth in West Bengal agriculture: End of impasse. *Econ Polit Week.* 1998; 33: p2979-2986.