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Growth and Instability in Foodgrains Production in West Bengal

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Abstract

West Bengal agriculture has started to show a sign of change since 1980's, by registering a modest growth in foodgrains production after three decades of near stagnation. Over the entire period i.e, 1950-51 to 2007-08, the state has recorded foodgrains production growth rate accounting 2.59% mainly due to moderate rise in productivity (2.23%) in spite of deceleration in area under aus (Bhadoi) rice and pulses. Study on effect of new crop production technology on growth and instability of foodgrains production reveals that growth in output of foodgrains along with constituents has become more stable compared to remaining two phases, but it is difficult to conclude a definite relationship between them. Again, yield effect has emerged as major contributor to foodgrains production increase in successive periods except wheat which clearly indicates that policy measures need to be directed towards augmentation of yields of major crops through development and popularisation of location specific HYV along with improved crop management practices to meet the growing demand of foodgrains in future.

Keywords: Adjusted instability index, compound growth rate, decomposition analysis, green revolution.

Introduction

Agricultural growth contributes to economic development is a conventional wisdom since it claims a larger share of national output and provides livelihood of majority of population in most developing countries. So, to expedite development process, agricultural sector needs to generate surpluses to facilitate the movement of both labours and capital to modern industrial sector. Even to satisfy the basic human needs agricultural growth must match population growth to avoid the Malthusian trap and stagnant development (Diao *et al.* 2007). But the fact is that, in spite of being endowed with favourable agro climatic conditions suitable for growing crops, agricultural growth in West Bengal, as in other parts of eastern and north-eastern India was slow for many years and much behind the all-India average (Saha, A. *et al.* 1994). The estimated rate of growth (1.74%) of agricultural output in West Bengal during period 1949-50 to 1980-81 was below the rates of increase of rural and total population in the state (2.31 and 2.42% respectively) (Boyce, 1987). But

the situation turns around drastically from 1980s by registering high positive growth in foodgrains production. During the period 1981-82 to 1990-91, West Bengal shows 6.4 per cent annual growth in agricultural output (Saha and Swaminathan, 1994). Once the desired level of growth is achieved, the unsettled debate centering the alleged association between high rates of growth and instability in agricultural production has become a subject in the agricultural economic literature. Instability in production affects price stability and the consumers; it increases vulnerability of low income households to market and it is also important for food management and macro economic stability (Chand and Raju, 2009). Reviews of past literatures concerning the relationship between green revolution generated modern crop production technologies induced agricultural growth and instability present quite conflicting evidence. Mehra 1981, Hazell, 1982, Ray, 1983a, Rao *et al*. 1988 have reported that instability in agricultural production has increased with the adoption of new technology whereas Mellor (1966) and Mahendradev (1987) have concluded that the introduction of modern technology has resulted in impressive growth in food production and year to year variability in cereal production has grown up. Again, the survey of literature on sources of assumed instability in crop production shows that natural factors such as rainfall, temperature, flood, droughts etc. play dominant role in such production variability through fluctuation in area and yield. Taking all this issues into consideration, this study is a modest approach to examine growth rate of major crops of West Bengal during period 1950-51 to 2007-08, and an attempt will also be made to find out the relationship between technology induced growth and associated instability by dividing entire study period into three phases, a) pre green-revolution period, 1950-51 to 1964-65, b) initial phases of adoption of improved technology, 1965-66 to 1984-85 and c) post green revolution period , 1985-86 and onwards (Chand, and Raju, 2009). Another issue that will be discussed is the contribution of area and yield rise of individual crop on over all production growth.

Material and methods

Secondary information collected from various published sources e.g. Statistical Abstract, Economic Review, Estimates of area, production and productivity of major crops of West Bengal published by Government of West Bengal forms the data base of the study. The growth rates of area, production and productivity of foodgrains for three sub-periods and entire period of study is estimated by using log-linear function Log Y= A+BT

Where, Y means area/production/yield, T indicates year (time) and the co-efficient B in the equation gives the value of growth rate. The method of Adjusted Instability Index proposed by Cuddy-Della Valle has been used to estimate variability in agricultural production.

$$\text{Adjusted Instability Index} = C.V.\sqrt{(1 - \bar{R}^2)}$$

Where, Coefficient of variation (C.V.) = $\frac{standard\ deviation}{mean}$ and $\bar{R}^2$ measures coefficient of determination. In order to measure the contribution of area and yield towards increasing production of foodgrains following model given by Bastine *et al.* (1994).has been used ,

$$P = A_0 (Y_n - Y_0) + Y_0 (A_n - A_0) + \Delta A \Delta Y$$

Where, P indicates change in production, A_0, A_n represents area in base and current year respectively, Y_0, Y_n means yield in base and current year respectively, ΔA is change in area and ΔY is change in yield. $A_0 \Delta Y/P$ measures the contribution of productivity; $Y_0 \Delta A/P$ is the share of area and $\Delta A \Delta Y/P$ estimates interaction effect of area and yield growth on production increase.

Results and discussion

West Bengal agriculture has experienced an impressive growth since 1980s after a long stagnation spreading over first three decades of post independence period and again has started to show a declining trend in productivity growth rate from mid

Table 1. Estimates of compound growth rates of area, production and productivity of foodgrains along with constituents of West Bengal for period1950-51-2007-08

Crops	Area	Yield	Production
Rice	0.74*	1.69*	2.44**
Aus	-3.62	4.70*	0.91*
Aman	0.26*	1.45*	1.72*
Boro	9.99**	2.41**	12.65**
Wheat	4.38**	2.07*	6.46**
Total cereal	0.64	2.22*	2.89**
Total pulses	-0.73	0.05	-0.69
Foodgrains	0.35	2.23*	2.59**

Note: **, * indicate statistically significant at 5 and 1 per cent level respectively.

nineties. But over the entire period, the annual compound growth rate of foodgrains output is estimated to be 2.59 per cent in spite of marginal rise in area of 0.35 per cent. Productivity growth of 2.23 per cent has helped the state to achieve such a high growth in production. Among the major constituents of total foodgrains, total cereals output has registered a rise of 2.89 per cent as a result of marginal rise in rice area (0.74%) and notable growth in area under wheat (4.38%) coupled with 1.69 and 2.07 per cent increase in productivity respectively. Another important observation is the dramatic rise in boro area (9.99%) and gross deceleration in aus area (3.62%) in spite of 4.70 per cent growth in productivity. This shift in area may be due to increase in irrigated area in the state and higher productivity growth of boro rice 2.41 per cent over and above already yield level compared to aus paddy. During this period, pulses crop has witnessed a set back in area of 0.73 per cent and

marginal improvement in productivity of 0.05 per cent has failed to check the deceleration in production.

Now we will examine the growth of area, production and productivity of foodgrains crops of West Bengal in three sub-periods along with associated instability in order to find out the relationship between them. Sufficient growth in agriculture is well deserved for ensuring food and nutritional security of nation, but its positive association of variation will erode the base of economic development of the country. The study being primarily focused on assessment of modern crop production technology generated by green revolution, we will measure the in growth variation and instability in farm output more specifically, foodgrain crops in three previously mentioned sub-periods separately to compare relative performance. Table-2 reveals that foodgrains production has grown up at a faster rate with lower instability during post revolution period in stead of having minimum area growth rate compared to remaining tow phases. The highest area growth associated with maximum year to year variation is recorded in pre adoption period whereas technology adoption and dissemination stage i.e. phase II is characterized with highest production and productivity fluctuation with moderate growth rate lesser than post revolution period, but greater than phase I. During first sub-period, foodgrains production has registered a rise of 1.61 per cent though area, production and productivity of total cereals show negative growth with varying magnitudes may be due to 13.76 per cent rise in pulses production arising out of 15 per cent increase in pulses area surpassing the negative effect of productivity growth. Here, also the performance of total cereals in phase I and II shows the same behavioural pattern as in the case of foodgrains. Gross.

Table 2: Compound growth rates and Instability in area, production and productivity in three sub-periods in West Bengal

Crops	Sub-period	Area		Productivity		Production	
		CGR	Index	CGR	Index	CGR	Index
Rice	Phase-I	1.34**	4.41	0.95	10.84	2.20**	12.68
	Phase-II	0.47**	3.07	1.10*	10.62	1.58**	11.37
	Phase-III	0.32**	3.59	2.49**	4.21	2.72**	6.41
Wheat	Phase-I	-0.95	40.58	1.41	23.25	2.36	47.74
	Phase-II	8.29**	19.25	2.04*	24.70	15.37**	24.95
	Phase-III	1.19**	19.25	0.82**	8.67	2.03**	13.16
Total cereal	Phase-I	-0.53	6.08	-3.44	10.60	-2.93	13.76
	Phase-II	0.67	5.50	1.25*	16.03	1.93*	21.24
	Phase-III	0.30	3.34	2.19*	4.33	2.50*v	5.53
Total pulses	Phase-I	15.00**	10.06	-5.42	16.92	8.76**	9.48
	Phase-II	-3.08*	31.27	-0.30	9.18**	-3.34*	23.20
	Phase-III	-3.87*	10.93	1.54*	10.16	2.39*	12.79
Foodgrains	Phase-I	1.70*	5.69	-0.06	9.60	1.61*	16.37
	Phase-II	0.27	3.94	1.69*	16.03	1.98*	21.24
	Phase-III	0.25*	3.02	2.16**	4.31	2.40**	5.37

Note: **, * indicate statistically significant at 5 and 1 per cent level respectively.

deceleration in pulses area with high year to year fluctuation has prominently been reflected in production front in both beginning and post revolution period. In fact, fossil-fuel based high yielding crop production technology has by passed pulse crops. Among total cereals, rice production grows at the rate more than 2per cent in both pre and post adoption stage but with higher stability at the later. Higher area and marginal productivity growth associated with10.84 per cent instability has helped total rice production to register a rise of 2.20 per cent with 12.68 per cent variability in the period prior to green revolution and the period designated as adoption stage is marked with highly unstable low growth in production. The state has achieved outstanding all round success in case of rice in all counts during phase III. It has witnessed 2.72 per cent acceleration with 6.41 per cent instability in rice production which is attributable to productivity rise of 2.49 per cent with minimum deviation of 4.21 per cent and the contribution of area growth is as less as 0.32 per cent during last period. Wheat, another important cereal has gained maximum benefit from modern technology registering 15.37 per cent increase in production with associated year to year fluctuation of 24.95 per cent in revolution period. High area (8.29%) and moderate productivity (2.04%) growth though with high variability in both cases (more than 19%) are phenomenal in achieving such high rate of production rise are far ahead of remaining two periods. Actually, green revolution has become instrumental to popularize wheat in the state though failed to increase stability in all aspects. Among rice, aus (bhadoi) paddy has experienced severe setback in area in all periods which is clearly reflected in production growth, even in spite of rise in productivity. Area growth of 1.28 per cent has uplifted production to 1.65 per cent with high instability during pre-revolution period and the situation has remained more or less unchanged in adoption stage except reduction in variability in all measures. The performance of aman in post revolution period is remarkable in terms of production and productivity growth coupled with more stability. Boro rice has harvested maximum benefit indirectly through area shift from other crops, mostly from aus rice and directly through productivity rise from modern technology during revolution period by registering an area growth of 14.02 per cent and productivity and production rise of 4.57 and 19.22 per cent with high instability (between 11 to 18%).

Higher rate of growth of food grains products in successive periods may be attributed to better response of total cereals, more specifically rice and wheat towards modern crop management practices embedded with application of chemical fertilizers, plant protection chemicals along with the HYV's and expansion of irrigated areas during revolution and post revolution period. Instability in area growth has become stable in later two sub-periods more particularly, in the last phase compared to the period prior to adoption of technology where as in case of productivity and production of foodgrains vis-à-vis total cereals, the observation is completely reverse i.e. less stable in phase II. The production of individual crops and total foodgrains had become more stable during 1990s compared to 1980s (Larsen et al., 2004). It may be due to lack of knowledge regarding recommended package of practices of the adopters

during this phase. But year to year fluctuation for the same crops has come down more than 60 per cent in phase III. The states which show below 4per cent year to year deviation from growth trend are Bihar, Kerala, Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal (Chand, 2010). The departure from estimated value i.e. 5.37 per cent may result from differences in selection of sub-periods period along with techniques in measuring growth rate and instability index. Adoption of standardized practices and widespread dissemination may be the reason behind drastic reduction in instability. Factors which might have attributed to the decline in variability in foodgrains yield and production seems to be 1) expansion of irrigation, 2) improvement in availability of other inputs and institutional credits and 3) policy of minimum support prices that provided stable economic environment to induce investment in production along with technology adoption in a larger area and improvements in various aspects of technology (Chand, 2010).

Again wheat has got largest benefit from new crop production technology in terms of augmentation of area, production and productivity growth rate with maximum deviation. In fact, evolution of green revolution technology took place centering wheat in Northern parts of India which might have tempted farmers to allocate more area to the crop with the objective of getting highest benefit. Since wheat benefitted to the greatest extent from green revolution technology the observed increase in variability in foodgrains and all crops output cannot attributed to green revolution technology as such (Rao, *et al*., 1988).

The estimates of decomposition analysis of production growth of individual crops and crop combinations in three sub periods into area, yield and interaction effects presented in table 3 reveal that area effect is the main source of output growth of foodgrains in pre-revolution period, 73.32 per cent is attributed to area, 21.81 per cent to yield and only 4.87 per cent to interaction effect. Among the components of foodgrains, area accounts for 54.24 per cent of rise in total rice production whereas yield is single contributor to wheat output and effect of area is negative. In the second phase, yield effect is 81.84 per cent for foodgrains and 73.36 per cent for rice is turn out to be major factor of production growth, but in case of wheat, combined effect of yield and area contributes 57.47 per cent to production. Yield component further strengthen position by claiming 82.98 and 107.80 per cent rise in output of respective crops during post technology adoption period, but in case of wheat, expansion in area is the major source of production augmentation. In short, pre revolution phase is characterized by lower growth with moderate variability of almost all crops or combinations and high instability is associated with lower rise is the feature during mid-phase whereas post-technology adoption period is marked with higher rate of increase with more stability.

Summarily, increase in foodgrains production is becoming more and more dependent on yield factor of rice in West Bengal but area effect can also play an important role in future subject to expansion of irrigated area.

Table 3: Sources of Agricultural growth in period 1950-51 to 2007-08

Crops	1950-64			1965-84			1985-2007		
	Yield effect	Area effect	Interacti-on effect	Yield effect	Area effect	Interacti-on effect	Yield effect	Area effect	Interacti-on effect
Rice	38.42	54.24	7.35	73.36	18.00	8.64	107.80	-21.41	13.61
Wheat	100.75	-0.46	-0.28	8.03	34.50	57.47	30.81	64.39	4.80
Total Cereal	33.69	59.15	7.16	65.57	22.66	11.77	74.80	15.81	9.39
Total Pulses	-19.35	220.49	-101.14	-356.56	274.67	181.89	-62.84	129.99	32.85
Food-grains	21.80	73.32	4.87	81.84	11.55	6.61	82.98	10.44	6.58

Conclusion and policy implication

The state West Bengal registers an overall growth rate of 2.59per cent in foodgrains production mainly due to rise in productivity of 2.23 per cent with the main support of better performance of total cereals, specifically rice and wheat. Negative growth of pulses production on account of deceleration in area has impeded more foodgrains output growth than realised. Increase in area growth is mainly responsible for foodgrains production rise in pre-revolution period whereas in subsequent two phases, productivity growth is the main source. Green revolution phase is characterized by higher growth in production and productivity associated with more instability in case of foodgrains, mainly rice compared to pre technology adoption stage. Productivity and production growth of foodgrains along with its constituents except pulses has shown upward trend and also year to year fluctuation in area, productivity and production of all crops has also come down. Decomposition analysis of output growth reveals that area is the main contributor in first phase whereas productivity is the most powerful factor for augmenting production of foodgrains in West Bengal in revolution and post revolution phase. The present analysis clearly indicates limited scope for the horizontal expansion because of declining land potential, acceleration in yield rate is becoming more and more important. To meet the growing demand for foodgrains, future policy will have to be centered on the development HYVs and popularization of location specific crop management techniques to boost productivity of major foodgrains crops in the state.

Reference

Boyce, K.J. 1987. Agrarian Impasse in Bengal: Institutional Constraints to Technological Change. Oxford University Press, Oxford.

Chand, R. 2010. Price and Non-price Factors in Agriculture Growth. Economic and Political Weekly , **25:**34.

Chand, R. and Raju, S.S. 2009. Instability in Indian Agriculture during different phases of technology and policy. *Indian Journal of Agricultural Economics*, **64**(2):187-207.

Dev, Mahendra, S. 1987. "Growth and Instability in Foodgrains Production : An Interstate Analysis", *Economic and Political Weekly*, **22**(39)26: A82-A92.

Diao *et al*. 2007. The role of agriculture in development: implications for sub-saharan Africa. Research Report 153 Washington D.C.: International Food Policy Research Institute.

Hazell, Peter, B.R. 1982, Instability in Indian Foodgrains Production, Research Report No. 30, International Food Policy Research Institute, Washington D.C., U.S.A.

Mehra, Shakuntala. 1981. Instability in Indian Agriculture in the Context of the New Technology, Research Report No. 25, International Food Policy Research Institute, Washington D.C., U.S.A.

Mellor, J.W. 1966. The Economics of Agricultural Development. Ithaca: Cornell Univ. Press.

Rao, C.H.H., Ray, S.K. and Subbarao, K. 1988. Unstable Agriculture and Droughts-Implications for Policy. New Delhi: Vikas Publishing House Pvt. Ltd.

Ray, S.K. 1983. Growth and Instability in Indian Agriculture. Institute of Economic Growth, Delhi.

Saha, A. and Swaminathan, M. 1994. Agricultural Growth in West Bengal in the 1980s. *Economic and Political Weekly,* **29**(13):A2-A11.