Growth and Instability Analysis of Vegetables in West Bengal, India

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Abstract

The present study is related to the growth and instability of area, production and productivity of vegetables in west Bengal. The study is based on secondary data of vegetables pertaining to various vegetables as a whole for the period of 1997-98 to 2010-11. It has been observed that the growth of area, production and productivity for all vegetables registered are positive and statistically significant and instability index for all the vegetables are also positive, which indicate that there is less risk for cultivation in the state. Compound growth rate in case of productivity for cabbage and cauliflower has been noticed negative but significant. The increase in production is due to increase in area as well as interaction of area and productivity of vegetables in the state.

1. Introduction

Vegetables are the most important factor in maintaining a healthy body. Vegetables are rich in minerals, vitamins and many other important nutrients. You can not only keep your body healthy but also escape lot of diseases by consuming vegetables. Vegetables like garlic, carrot, leeks, onions, bell peppers, asparagus, tomatoes, potatoes, sweet potatoes, squash and all other green and leafy vegetables are healthy for heart.

You can determine whether a vegetable is healthy for your heart from its color itself. Red vegetables are the store house of antioxidants that can protect your heart. Vegetables that are yellow and orange are rich in carotenoids which can save you from heart diseases. The green and leafy vegetables are rich in minerals and vitamins which are important to keep your heart healthy. Purple and blue vegetables can cure heart diseases.

India is the second producer, consumer and exporter of vegetables in the world. During 1997-98 to 2010-11, the estimated production of vegetables is 14, 72,119 tonnes from an area of 95,898 ha with productivity of 15.35 t ha^{-1}.

In West Bengal State, the area of vegetables also increased from 5.6-8.5 '000 tonnes during the period of 1997-98 to 2010-11.

2. Materials and Methods

The analysis covers the time series secondary data with respect to area, production and productivity of vegetables pertaining to various vegetables as a whole for the period of 1997-98 to 2010-11. The data set was collected from several government publications and web sites.

The compound growth rates have been computed by fitting the exponential function as below:

$Y_t = a\ b^t$, where as

Y_t=dependent variable on area, production and productivity in the year 't'

a=constant; b=regression co-efficient; t=time element which takes the value 1, 2, 3… n

After transforming the model into a linear form by taking logarithms, we get

$\log Y_t = \log a + t \log b$

By taking log Y=y, log a=A and log b=B the model becomes linear between y and t, as $y_t = A + B\ t$ fit the model by the method of ordinary least squares (OLS) technique. The compound growth rate (r) was obtained by the formula $r=(b-1)\times 100=$ (antilog B-1)×100.

The significance of growth rate was tested by applying student 't' test statistics

$t = r/S.E.(r)$

where $S.E.(r)=100\ b \times S.E.(\log b) / \log_{10} e$

Which follows 't' distribution with (n-2) degree of freedom, n is number of year considered under study. The compound growth rates have been computed for all the states as whole.

The co-efficient of variation (C.V.) was used as a measure of instability as:

C.V.=(Standard deviation/Mean)×100

Further, by taking into account of both growth rates and instability index, Vegetables production in Region was classified into four categories viz. (i) High growth rate and low instability, (ii) High growth rate and high instability, (iii) Low growth rate and low instability and (iv) Low growth rate and high instability. (v) growth rate and instability index of the region as a whole during the period was used for grouping the state (s).

In order to measure the percentage contribution of area, productivity and their interaction towards the production of Vegetables, the technique of decomposition has been adopted. The change in the production of Vegetables between any time periods can be expressed as

Change in production=Productivity effect+Area effect+ Interaction effect

$\Delta P=A_0 \Delta Y+Y_0\Delta A+\Delta A+\Delta Y$

Where, $\Delta P=P_n-P_a$, $\Delta Y=Y_n-Y_0$, $\Delta A=A_n-A_0$

A_o, P_o and Y_o are area, production and productivity in base year and A_n, P_n and Y_n, are area, production and productivity in current year ΔA and ΔY represent change in area and productivity, respectively. This procedure discussed by Devraj et al. (2003 & 2006).

3. Results and Discussion

3.1. Growth rates of area, production and productivity

To understand the growth performance and relative contribution of basic components of Vegetables production in West Bengal during the period 1997-98 to 2010-11 time series data on area, production and productivity was analyzed. During the period, total vegetables of West Bengal has showed significant at 1% level of significance respectively growth rate in production (2.85) and productivity (1.38).

Critical, perusal of Table 1 indicated that among the vegetables of West Bengal, the onion registered highest significant growth rate in area (4.50) as well as significant in production (10.92) with significant growth rate in productivity (6.14) at 1% level of significance respectively. Cauliflower registered the lowest growth rate in area and production (1.99) and (0.49) as well as a significant at 1% level of significance negative growth rate (-1.48) in productivity during the period. Among the vegetables, cabbage, cauliflower showed the negative growth rate in productivity but significant. This might be due to the fact of shifting of area to other crops and or shifting cultivation. Onion indicates the highest significant growth in productivity. Rama Rao (2004) for pulses and Dhakre et al. (2009) also reported similar findings for musterd.

3.2. Instability index of area, production and productivity

Table 1: Compound growth rate of area, production and productivity of vegetables among the vegetables in west bengal during period 1997-98 to 2010-11

Vegetables	During period 1997-98 to 2010-11		
	Area	Production	Productivity
Tomato	2.47 (0.002)**	6.38 (0.003)**	3.82 (0.003)**
Cabbage	1.47 (0.002)**	0.90 (0.002)**	-0.56 (0.003)**
Cauliflower	1.99 (0.002)**	0.49 (0.001)**	-1.48 (0.001)**
Pea	1.97 (0.007)**	4.56 (0.006)**	2.54 (0.004)**
Brinjal	1.71 (0.002)**	2.50 (0.003)**	0.78 (0.002)**
Onion	4.50 (0.004)**	10.92 (0.048)**	6.14 (0.048)**
Cucurbit	1.35 (0.001)**	3.50 (0.002)**	2.12 (0.003)**
ladyfinger	2.97 (0.002)**	3.47 (0.002)**	0.49 (0.002)**
Radish	2.39 (0.002)**	4.41 (0.002)**	1.97 (0.003)**
Others	0.29 (0.003)**	5.35 (0.008)**	5.05 (0.007)**
Total	1.44 (0.001)**	2.85 (0.001)**	1.38 (0.002)**

**Significant at (p=0.01) (Figures in parentheses indicate Standard Error)

In order to assess the consistency of growth performance, it becomes imperative to study the instability index for different variables during the study period. Table 2 indicated index of instability of area, production and productivity of Vegetables for West Bengal during period 1997-98 to 2010-11.

During the period total vegetables of West Bengal as a whole recorded instability in area, production and productivity as 3.04, 1.40 and 4.88 respectively. Thus area variability has more influence on production fluctuation in the vegetables. As per Table 2 inter period analysis, instability among vegetables ranges from 3.80 (cucurbit) to 88.71 (pea) respectively.

Table 3 provides grouping of vegetables by combining different magnitudes of growth rates and instability indices in Vegetables production. Among the vegetables, Onion and Pea was recorded in high growth rate and high instability. Cauliflower and cabbage was grouped into low growth rate and high instability. Tomato and Radish were recorded in high growth rate and low instability, while Brinjal and ladyfinger recorded in low growth rate and low instability. Grouping of vegetables clearly indicated that almost half of the area under

Table 2: Index instability of area, production and productivity of vegetables among the vegetables in west bengal during period 1997-98 to 2010-11

Vegetables	During period 1997-98 to 2010-11		
	Area	Production	Productivity
Tomato	3.99	21.31	13.50
Cabbage	4.56	5.87	15.87
Cauliflower	8.45	3.60	19.31
Pea	88.71	52.39	27.38
Brinjal	10.87	18.19	6.29
Onion	29.34	1261.59	810.05
Cucurbit	3.80	11.08	16.18
ladyfinger	4.51	10.90	11.52
Radish	6.59	10.31	12.65
Others	11.64	124.05	100.99
Total	3.04	1.40	4.88

Vegetables of the West Bengal suffers from low growth. Hence, there is a tremendous potential for increasing the vegetables production of the West Bengal region. This clearly indicated that there is a need of developing states with specific strategy rather then old blanket strategy of state as a whole.

The results of the instability indices depicted that the instability indices for area, production and productivity for vegetables in the West Bengal were positive and thereby indicating less riskiness for growing of vegetables in the region.

3.3. Cntribution of area, productivity and their interaction

With the help of additive decomposition model the percentage contribution of area, productivity and their interaction on Vegetables production in the West Bengal for different vegetables have been estimated and presented in Table 4. As indicated that at the West Bengal level, percentage contribution of area (172.32) is more as compared to productivity (146.66) and their interaction (-4.04).

As Table 4 reveals during the period, at the vegetables level, cucurbit and other vegetables found to be highest contribution of productivity component respectively (34.84) and (48.02), while pea witnessed the lowest contribution of productivity component (2.87) towards production differential. Brinjal found to be highest change in production (70.59), while pea witnessed the lowest change in production (4.69) It can notice that for major vegetables especially for cauliflower and cabbage the contribution of productivity towards production is either low or negative.

The interaction effect of area and productivity in cabbage, cauliflower, pea, brinjal onion, cucurbit, ladyfinger and radish were decreasing as indicated by the negative values. Although the interaction effect of area and productivity in tomato and others vegetables were found increasing as indicated by the positive values.

Table 3: Vegetables of West Bengal with combination of different magnitudes of Growth rates and Instability Indices in Vegetables production

Sl.	Different Magnitudes	Vegetables
1.	High growth rate and high instability	Onion, Pea
2.	Low growth rate and high instability	Cauliflower, Cabbage
3.	High growth rate and low instability	Tomato, Radish
4.	Low growth rate and low instability	Binjal, ladyfinger

Table 4: Contribution of Area, Productivity (Yield) and their Interaction in the production of Vegetables at West Bengal during period 1997-98 to 2010-11

Vegetables	During period 1997-98 to 2010-11			
	Yield effect	Area effect	Interaction	Change in production
Tomato	23.87	17.24	0.60	41.71
Cabbage	-4.68	27.97	-2.72	20.57
Cauliflower	-14.54	32.90	-5.93	12.43
Pea	2.87	2.37	-0.55	4.69
Brinjal	20.77	50.34	-0.52	70.59
Onion	6.59	10.02	-3.63	12.98
Cucurbit	34.84	21.52	-0.69	55.67
Ladyfinger	4.62	19.19	-0.29	23.52
Radish	8.31	8.20	-0.52	15.99
Others	48.02	6.99	1.81	56.82
Total	146.66	172.32	-4.04	314.94

During the period, in eleven vegetables, area effect was found higher than the productivity and interaction effect. Hence for vegetables of the West Bengal and the contribution of area component dominated over productivity component towards production of Vegetables.

4. Conclusion

The above discussion highlighted the fact that the growth of area, production and productivity for vegetables in the West Bengal registered positive and statistically significant. The instability index for all the vegetables was positive, thereby indicating the less riskiness for cultivation in the state. Compound growth rate in case of productivity for cabbage and cauliflower witnessed negative but significant. The study of Instability index indicated that area variability has more influence of production fluctuation of the West Bengal vegetables. The study revealed that half of the area under the crop in the West Bengal suffered from low growth rate in production. Hence, there is need for developing state specific strategy rather than old blanket strategy of West Bengal as a whole.

5. References

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