D-5487
[1-5]

RESEARCH ARTICLE Agricultural Science Digest, Volume Issue : ()

Growth and Instability in Significant Spices in India: An Empirical Analysis

R. Rajanbabu, Elango J. Parimalam, V. Sathishkumar

10.18805/ag.D-5487

ABSTRACT

Background: India stands first in the production of most of the spices. Still we are not able to exploit the full potential of these spices since these are often subjected to wide price unsteadiness in the domestic as well as international markets which results in fluctuations in production and yield too rendering an intense discuss on spices growth and instability. The present study carried out to examine the trend in growth and instability of major spices grown in India.

Methods: The growth and instability analysis was carried out at nationwide. The required data for the present study was collected for the period 1990-91 to 2018-19 which were further divided into three sub-periods. On the basis of highest area and production six major spices namely, pepper, cardamom, chilli, ginger, turmeric and coriander growing in the country was selected for the study. The growth rates were worked out by fitting the exponential growth function and instability analysis was used by generating Cuddy Della instability index.

Result: The analysis has revealed that most of the spices have recorded a positive and significant growth rate in all the sub-periods. Sub-period I (1990-91 to 1999-2000) emerges to be the stable period in most of the spices which also recorded a notable growth rate compared to other sub-periods. However, sub-period II (2000-01 to 2009-10) witnessed a slow pace of growth in pepper and cardamom which registered a negative growth in area, production and yield. On the other hand, the study has shown comparatively unstable behaviour in most of spices in sub-period III (2010-11 to 2018-19).

Key words: Cuddy-Della instability index, Exponential growth function, Growth rates, Productivity, Spices, Yield.

INTRODUCTION

All over the globe, the rapid growing food industry depends mostly on spices as taste and flavour makers. Health aware consumers in developed countries prefer natural colours and flavours of plant origin to cheap synthetic ones. Accordingly, spices are the fundamental building blocks of flavour in food applications. In the year 2018, the universal spices market size stood at $ 8.4 billion. As a result of increasing demand for spices on account of emergent urbanization, during the estimate period of 2019-2025, the spices market will experience growth with a benchmark compound annual growth rate of 4.80 per cent. Out of the 109 spices listed by International Organization for Standardization, 63 are grown in India. About 52 are under the Spices Board (Ministry of Commerce and Industry, Government of India), (Spices Statistics 2019), which include pepper (king of spices), cardamom (queen of spices), turmeric, chillies, ginger, coriander and many others. There is no alternative country within the world that produces as many varieties of spices as India. In almost all of the 28 States and 8 Union Territories of India, at least one spice is grown in plenty.

India stands first in the production of most of the spices. Still we are not able to exploit the full potential of these spices since these are often subjected to wide price unsteadiness in the domestic as well as international markets which results in fluctuations in production and yield too rendering an intense discuss on spices growth and instability.

Earlier studies

The earlier studies bring good background for understanding the present study. While there is an obvious need for growth in agriculture sector, the increased instability in production instills more uncertainty about sustainability of agricultural growth in India. Volatility in production affects price stability and the consumers and it increases susceptibility of low-income households to market (Chand and Raju, 2009). Rajanbabu and Ganesan (2015) have made an attempt to analyse the growth and instability in production of Indian spices and have found that the production of spices in India had increased substantially over the years due to the growing importance of the crop in both domestic and international market. The study concluded that instability index of area of cultivation, production andproductivity of spices became stable with the passage of time. Kumar and Sankaran (1998) have examined the instability in turmeric production in India and have concluded that decrease in area volatility has been compensated by the marginal increase in the yield volatility during 1980s. Rao *et al.* (1988), Larson *et al.* (2004) have

Department of Economics, Loyola College, Chennai-600 034, Tamil Nadu, India.

Corresponding Author: R. Rajanbabu, Department of Economics, Central University of Tamil Nadu, Thiruvarur-610 005, Tamil Nadu, India. Email: rajaneco@rediffmail.com

How to cite this article: Rajanbabu, R., Parimalam, E.J. and Sathishkumar, V. (2022). Growth and Instability in Significant Spices in India: An Empirical Analysis. Agricultural Science Digest. DOI: 10.18805/ag.D-5487.

Submitted: 14-09-2021 **Accepted:**12-02-2022 **Online:** 15-03-2022

found that volatility has increased in Indian agriculture for the duration of post-green revolution period owing to adoption of modern technology. The green revolution which was mainly confined to cereals especially, wheat and rice, also neglected the production of other crops like pulses, oilseeds, spices, *etc.* A number of attempts were made earlier by Hazell (1982), Ray (1983), Mahendradev (1987) and Pal and Sirohi (1989) measured the extent of instability in area, production and yield of different crops, but most of these studies are mainly related to food grains. Looking upon the importance of spices, the present study was carried out to examine the growth and instability in area, production and yield of significant spices grown in India.

MATERIALS AND METHODS

The growth and instability analysis was carried out at nationwide. The study was based on the secondary information collected from statistical publications of Spices Board. The required data for the present study was collected for the period 1990-91 to 2018-19 which was further divided into three sub-periods, *viz.* sub-period I (1990-91 to 1999-2000) which was the period of wider dissemination of technology and was characterized by sustained growth in the agriculture sector for over a decade peaking at the year 1996 97, sub-period II (2000-01 to 2009-10) from where the deceleration of growth was started and a clear indication of slumping of the agricultural sector was visible till the year 2005 06 and sub-period III (2010-11 to 2018-19) the international trade barriers are steadily coming down. On the basis of highest area and production six major spices namely, pepper, cardamom, chilli, ginger, turmeric and coriander growing in the country was selected for the study.

Growth analysis

The compound growth rates in area, production and yield of spices in the country as an overall were analysed by using the exponential growth function of the form,

$$Y_t = a\, b^t \qquad ....(1)$$

Where,

Y_t = Dependent variable for which rate of growth is analysed.

a = intercept.

b = Regression coefficient.

t= Time variable.

The growth rate coefficient (b's) will be estimated by transforming the equation in log form:

$$\text{Log } Yt = \text{Log } a + t \text{ Log } b \qquad ....(2)$$

Thus compound growth rate (g) in percent will be estimated as:

$$g = [(\text{antilog of } b) - 1) \times 100] \qquad ....(3)$$

Significance of growth rate was judged by t-test.

Instability analysis

Instability is one of the significant decision parameter in development dynamics and more so in the context of agricultural output. An analysis of fluctuations in crop production, apart from growth, is of significance for understanding the wide fluctuations in crop production that not only affect prices and result in pointed fluctuation in them but also bring about extensive variations in disposable income of the farmers. The scale of volatility depends on the nature of crop production technology, its compassion to weather, economic environment, availability of inputs and numerous other factors. High growth in output accompanied by low level of fluctuation for any crop is desired for sustainable development of agriculture. In the present study the extent of area, production and yield instability in significant spices were analysed. The instability in area, production and yield of major spices is measured in relative terms by the Cuddy-Della Valle index which is used in recent years by some researchers as a measure of unsteadiness in time series data. The straightforward coefficient of variation overestimates the degree of volatility in time series data featured by long term trends whereas the Cuddy-Della Valle index corrects the coefficient of variation. The coefficient of variation can be computed by using the formula:

$$CV = \frac{\sigma}{\overline{X}} \times 100 \qquad ....(4)$$

Where,

σ = Standard deviation of variables considered *i.e.* area/ production/productivity of spices.

$\overline{X}$ = Mean value of the variable.

The formula suggested by Cuddy and Della (1978) will be used to estimate the index of instability.

$$\text{Instability Index} = CV \times (1 - R^2)^{0.5} \qquad ....(5)$$

Coefficient of variation will be multiplied by the square root of the difference between the unity and coefficient of multiple determinations (R^2) in the cases where R^2 is significant.

RESULTS AND DISCUSSION

Growth rates in area, production and yield of significant spices in India

The compound growth rates of area, production and yield of pepper, cardamom, chilli, ginger, turmeric and coriander for the period from 1990-91 to 2018-19 were computed. The spice wise result for the country as a whole is presented in Table 1.

Pepper

The growth analysis in pepper envisaged that overall sub-period I and III emerged out to be better period for pepper with highest and positive growth in output, on the other hand sub-period II (2000-01 to 2009-10), recorded a slow pace of growth in pepper which registered a negative growth in area, production and yield. Similar results in pepper were obtained by Soumya *et al.* (2014), Jayesh (2001), Joshi and Singh (2015) and Rajanbabu and Ganesan (2015) who concluded that this was mainly due to decrease in area and productivity of pepper in Kerala state which is the highest pepper producing state in India and due to incidence of phytophthora foot rot and pest attacks in that period.

Cardamom

The growth in output regained its pace in the sub-period I with a significant growth rate of 4.89 per cent. In sub-period II nevertheless declines in the area growth, production and yield sharply reporting a negative (-1.66 per cent and -1.28 per cent) growth rate which was significant. However, the growth rate in area, production and yield of cardamom has shown an increase over the periods recording highest in sub-period III. The growth in production was mainly contributed by high productivity which was probably attributed to introduction of high yielding varieties coupled with Integrated Nutrient Management (Soumya *et al.,* 2014).

Chilli

In case of chilli, the area growth showed a decline of -0.99 per cent in sub period II from previous period. But it is interesting to note that despite decline in area growth in sub-period II, there was an increase in output and yield growth, this can be attributed to the acceptance of new package of practices and with economic liberalization in the period, farmers cultivating chilli gained initially which leads to increase in production in spite of slight or no change in area of cultivation. The area further witnessed a negative growth rate of -0.62 per cent in sub-period III. This change in area growth is the effect of change in cropping pattern of the farmers growing chilli, severe influence of pest and diseases and fluctuations in the prices of chilli during the period. The findings of the study were at par with the results obtained by Rajur *et al.,* 2008. The output and yield growth rate noticed a decline in sub-period III. Overall the growth rate in output and yield was much better in sub-period II than other periods.

Ginger

The growth rate in ginger witnessed an increase in area, production and yield over the periods but it was experienced that growth in production is higher and remarkable than the growth in yield. Ginger recorded highest output growth (14.68 per cent) in sub-period II, almost more than double the growth in sub-period I. The increase in production can be attributed to higher productivity of ginger in Kerala which is the major ginger growing state in India. Yield growth rate also jumped from 2.09 per cent in sub-period I to 11.76 per cent in sub-period III.

Turmeric

In case of turmeric (Table 1) reveals that in sub-periods I and II, the growth rate of production was higher than that of productivity and area. The lower growth in area in sub-period III might be due to stability in area under turmeric, *i.e.* there is no scope to allocate additional area under new planting. Turmeric noticed a negative in output and yield growth rate in sub-period III. Report of Karvy Comtrade (2008) suggested that this decline is mainly the result of fluctuation in prices of turmeric in the period that reached to its lower level and partly due to the drought condition in Andhra Pradesh which is the major turmeric producing state. It is important to note that growth witnessed in all periods was significant at one per cent level.

Coriander

The growth rate in coriander registered an increase in area, production and yield over the periods but it was observed that growth in production is higher and significant than the growth in yield. Coriander recorded highest output growth (7.27 per cent) in sub-period II. The increase in output can be credited to higher productivity of coriander in Rajasthan in that era which is one of the most important coriander growing states in India (Kumawat and Meena, 2005). Productivity growth rate also skipped from 0.95 per cent in sub-period I to 5.61 per cent in sub-period III.

Overall analysis of growth in spices reveals that sub-period I (1990-91 to 1999-2000) recorded a positive and noteworthy growth rates for all spices except cardamom (-1.34 per cent) in area. Sub-period II (2000-01 to 2009-2010) however, recorded a slow pace of growth in some spices especially pepper which registered a negative growth in area, production and yield. Sub-period III (2010-11 to 2018-19) witnessed a positive and significant growth rates with higher production growth for all spices excluding turmeric which shows a negative growth in production and yield. It was observed from the analysis that output growth was primarily on account of growth acceleration in yields that offset the deceleration in area growth.

Table 1: Growth rates in area (A), production (P) and yield (Y) of spices in India (1990-91 to 2018-19) (Percentage).

Spices	Sub-periods									Overall		
	I			II			III					
	1990-91 to 1999-2000			2000-01 to 2009-10			2010-11 to 2018-19			1990-91 to 2018-19		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Pepper	1.46*	2.56*	1.08*	-0.62*	-3.15*	-2.55*	-3.24*	2.04*	5.46**	-1.35*	-0.25*	1.11*
Cardamom	-1.34*	4.89*	6.32*	-0.39*	-1.66*	-1.28*	0.79*	6.55*	5.71*	-0.36*	3.64*	4.01*
Chilli	0.94*	4.40*	3.40*	-0.99*	4.70*	5.74*	-0.62*	5.39*	6.04*	-0.69*	3.48*	4.20*
Ginger	4.47*	6.65*	2.09*	7.24*	14.68*	6.93*	1.77*	13.74**	11.76*	4.56*	8.86*	4.11*
Turmeric	5.18*	6.08*	0.85*	1.80*	6.17*	4.30*	1.17*	-3.93*	-5.05*	2.08*	3.50*	1.39*
Coriander	4.29*	5.28*	0.95*	4.15*	7.27**	3.00*	0.91*	6.57**	5.61*	1.37*	0.84*	3.59*

*Significant at P<0.001; **Significant at P<0.05.

Instability in area, production and yield of some significant spices in India

Table 2 presents the estimates of instability in area, production and yield for major spices in India which are discussed below:

Pepper

Area under pepper showed a low instability during sub-period I (7.95 per cent) which increases to 10.63 per cent in the 2Ks (sub-period II) which was the period of negative growth in area, output and yield of pepper. It further rose to 17.06 per cent in sub-period III. Instability in the yield of pepper was less than the instability in area in sub-period I. Sub-period II recorded a raise in pepper yield instability which almost increases to double from 5.79 per cent to 12.15 per cent which may be the result of negative growth rate in yield in the same sub-period. The instability again increases with high in sub-period III to 27.54 per cent. The ups and downs in yield instability of pepper were subjected to favourable and unfavourable climatic conditions (Soumya *et al.,* 2014). Instability in pepper output decline from 6.75 per cent to 5.58 per cent in the 1990s. However, the variability in pepper production after 2010-11 was considerably higher (20.09 per cent). On the whole analysis propose that sub-period I was most steady period for pepper which was considered a period of wider distribution of technology and economic liberalisation which had opened its gates for international markets.

Cardamom

Degree of instability was very low in sub-period I which also witnessed high and significant growth rates in production and yield. Instability in the area under cardamom declined from 3.04 per cent in sub-period I to 2.23 per cent in sub-period II and reached 4.82 per cent in the sub-period III. It however, needs to be noted that the production instability in cardamom increases progressively in sub-period III. It is the yield instability that largely contributes to variations in output of cardamom. Overall analysis reveals that there was continuous fluctuation in output and yield instability over the periods.

Chilli

In case of chilli, the instability in area reported slightly decreases from sub-period I to sub-period II showing instability of 5.71 and 5.23 per cent respectively. The instability increase in sub-period III (6.98 per cent), which may be the result of negative growth rate in area in that sub-period. The instability in chilli yield continuously increased from sub-period I (1990-91 to 1999-2000) to sub-period III (2010-11 to 2018-19). Due to this increase in yield instability the output also constantly increased. Overall the instability analysis in chilli reveals stability in area over periods whereas production and yield showed some variations.

Ginger

Extent of instability was very low in sub-period I which also witnessed high and significant growth rates in area, production and yield. Instability in the area under ginger increased from 3.01 per cent in sub-period I to 5.58 per cent in sub-period II and the increase continued in the sub-period III also. It is important to note that the production instability in ginger increases progressively and in sub-period III it was five times higher than that recorded during the sub-period I. It is the productivity instability that mainly contributes to hicks in output of ginger. Overall analysis reveals that there was continuous increase in area, output and yield instability over the periods.

Turmeric

For turmeric, the area instability first declined to 7.67 per cent in the second sub-period but further increases to 11.74 per cent in the third sub-period. It, however, needs to be notice that the yield instability in turmeric reduces almost to 75 per cent in second sub-period from the previous sub-period. The variations in yield of turmeric were mostly influenced by the rainfall and other weather factors. Positive climate conditions prevailing in the major turmeric growing areas in the country (Tamil Nadu, Andhra Pradesh, Karnataka, Orissa and West Bengal) and the vital steps taken by the Spices Board. Conversely, the production instability continuously decreased from sub-period I (15.07 percent) to sub-period III (8.56 percent). These results implied that there was a high instability in sub-period I.

Coriander

The volatility analysis of coriander noticed that output and yield in sub-period I and III were almost of the same extent,

Table 2: Instability in area (A), production (P) and yield (Y) of spices in India (1990-91 to 2018-19) (Percentage).

Spices	Sub-Periods									Overall 1990-91 to 2018-19		
	I 1990-91 to 1999-2000			II 2000-01 to 2009-10			III 2010-11 to 2018-19					
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Pepper	7.95	6.75	5.79	10.63	5.58	12.15	17.06	20.09	27.54	16.67	13.88	25.45
Cardamom	3.04	9.50	9.30	2.23	8.03	6.21	4.82	13.21	16.94	4.16	14.75	15.30
Chilli	5.71	8.17	5.81	5.23	10.63	10.34	6.98	15.22	10.81	6.41	11.94	10.20
Ginger	3.01	4.72	3.95	5.58	19.02	16.65	7.86	26.24	19.46	8.33	22.95	21.28
Turmeric	20.58	15.07	20.26	7.67	11.87	7.93	11.74	8.56	8.19	13.67	16.51	16.59
Coriander	16.98	16.95	10.41	16.91	25.54	11.36	12.14	16.66	10.19	18.21	22.09	11.79

though the output and yield volatility declines in the sub-period III but the decline was not much, whereas, sub-period II witnessed a different situation. Overall analysis reveals that there was fluctuation in output and yield instability over the periods.

CONCLUSION AND POLICY INFERENCES

The analysis of growth and instability of spices has exposed that most of the spices have registered a positive and considerable growth rate in all the sub-periods. Sub-period I materializes to be the steady period in most of the spices which also witnessed a notable growth rate in area, production and yield compared to other two sub-periods. This can be attributed to the liberalization policy of government during that period which leads to increase in output and yield of these export oriented commodities. However, sub-period II witnessed a slow pace of growth in pepper and cardamom which registered a negative growth in area, production and yield. Coriander witnessed high growth and a low diminishing volatility in sub-period III, conversely spice like ginger viewing fast growth in production is offset by high or increasing instability. The study has shown comparatively unstable behaviour in most of spices in sub-period III.

There are various sources of instability and growth affecting factors in agriculture sector, in case of spices it was observed from the past studies that variation in weather and price fluctuations play a pivotal role. Policy research and analysis support is essential for raising productivity in the rain-fed areas and also for insulating the crop sector from year-to-year variations in rainfall. Agricultural practices would have to involve the use of varieties and species that have the ability to cope with drier conditions, higher temperatures and emerging pests and diseases. This would enhance the capacity of the farmers to allocate their resources effectively and reduce risks. Moreover, the problem of price volatility in spices is also a significant factor for near to the ground growth. For farmers to feel keen to spice production they principal need a guaranteed and competitive price for their produce, enabling them to sustain their families. The Government's responsibility as a provider of agricultural extension services must be complementary to the creation of efficient markets.

Conflict of interest: None.

REFERENCES

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

Cuddy, J.D.A. and Della Valle, P.A. (1978). Measuring the instability of Time Series Data. Oxford Bulletin of Economics and Statistics. 40: 79-85.

Hazell, P.B.R. (1982). Instability in Indian Food Grain Production. Research Report No. 30, International Food Policy Research Institute, Washington, D.C. pp. 1-5.

Jayesh, T. (2001). Production and export performance of pepper and cardamom in south India: an economic analysis. University of Agricultural Science, Dharwad, India. pp. 7-12.

Joshi, D. and Singh, H.P. (2015). An empirical analysis of growth and instability in major spices in India. International Journal of Agriculture Sciences. 7: 440-444.

Karvy Comtrade. (2008). Turmeric Seasonal Report. Karvy Comtrade Ltd, Hyderabad.

Kumar, N.A. and Sankaran, P.G. (1998). Instability of turmeric production in India. Journal of Spices and Aromatic Crops. 7: 19-22.

Kumawat, R.C. and Meena, P.C. (2005). Growth and instability in area, production and yield of major spice crops in Rajasthan vis-à-vis India. Journal of Spices and Aromatic Crops. 14: 102-111.

Larson, D.W., Jones, E., Pannu, R.S. and Sheokand, R.S. (2004). Instability in Indian agriculture - a challenge to the green revaluation technology. Food Policy. 29: 257-273.

Mahendradev, S. (1987). Growth and instability in food grains production: An inter-state analysis. Economic and Political Weekly. 22: A82-A92.

Pal, S. and Sirohi, A.S. (1989). Sources of growth and instability in Indian crop production-A Decomposition Analysis. Agricultural Situation in India. 44: 933-936.

Rajanbabu, R. and Ganesan, S. (2015). Growth and instability in production of Indian spices. International Journal of Management and Social Development. 2: 42-50.

Rajur, B.C., Patil, B.L. and Basavaraj, H. (2008). Growth performance of chilli in Karnataka. Karnataka Journal of Agricultural Science. 21: 312-313.

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

Ray, S.K. (1983). An Empirical investigation of the nature and causes for growth and instability in Indian agriculture. Indian Journal of Agricultural Economics. 38: 459-474.

Soumya, C., Burark, S.S., Sharma, L. and Jain, H.K. (2014). Growth and instability in production and export of selected spices of India. International Journal of Seed Spices. 4: 1-10.

Spices Statistics. (2019). Spice Board, Ministry of Commerce and Industry, Government of India.

Subramanian, K.K. and Mohanan Pillai, P. (1986). Kerala's industrial backwardness: Exploration of alternative hypotheses. Economic and Political Weekly. 21: 577-592.

Thumar, V.M., Khunt, K.A., Thanki, P.M. and Kumar, K. (2012). Growth and export performance of major seed spices of India. Indian Journal of Agricultural Marketing. 26: 21-35.

World Bank. (1992). World Development Report. Oxford University Press, New York.