Dynamics of Major Spices in India: An Overview

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Abstract
Spices have substantial medicinal value owing to their rich content. There is no better linctus than the ones that come from shrubberies. It's time we shift to an improved and better lifestyle with our domestic herbs and spices. The top six spices; red chillies, garlic, turmeric, coriander, cumin and black pepper are taken for analysis in this study on the basis of area. This study has studied the growth and instability in area, production and yield of major spices in India from 2011-12 to 2020-21. There was a significant increase in the area of pepper, with a compound annual growth rate of 12.68 percent, followed by cumin at 3.00 percent. There was also a significant increase in the production of Pepper and Garlic at 13.85 percent and 13.66 percent, respectively, and a significant increase in the yield of Coriander and Cumin at 7.69 percent and 7.14 percent, respectively, according to the projected trends in the area, production, and yield of millets using the semi-log function. The Cuddy-Della Valle index provided the best estimations, and instability was found more in the area of pepper (30.71%), followed by coriander (12.61%); production of pepper (24.20%), followed by coriander (21.03%); and yield of pepper (19.72%), followed by coriander (13.34%). This study reveals that the instability was high in the area, production and yield Pepper 52.77 percent, 56.41 percent and 49.64 percent respectively by using Coppock's instability index. There is more possibility for growing all varieties of spices to promote throughout India, which is desired to blow in years to come.

Keywords: Area, Production and Yield, Cultivators, Time Series Analysis, Instability Index

Introduction

India is the principal manufacturer and customer of spices worldwide. The demand for spices and their foodstuffs is always collective both in the internal and external market. The terrestrial and climatic individualities of South India in general and Kerala in particular are the foremost gifts of nature in the world of spices. Spices have been used by people since ancient times. Currently, no food is available in the food court without spices. The cultivation of spices plays a vital role in increasing the income of the farmers in rural and urban areas in India. There are 109 spices grownup in the world and remarkably, 63 spices are grown in India. The largest producer and largest exporter of spices in the world is India. This article highlighted the growth rate and instability rate of the top six spices produced in India.

Objectives of the Study

The objectives of the study are as follows:

- To assess the growth rate of area under cultivation, production and yield of major spices in India from 2011-12 to 2020-21.
- To explore the level of instability in area, production and yield of major spices in India.

Research Methodology

The data collected for this study were secondary data. The data were collected from Horticultural Statistics at a Glance 2022. To analyse the area, production, and yield of spices in India during the study period, the following appropriate statistical tools were used. Simple percentage and regression analyses were used to determine the compound growth rate of the spices. The Cuddy-Della Valle index and Coppock's Instability index are adopted for calculating instability in area, production and yield of major spices. A new initiative, the Rainfed Area Development Programme (RADP) has launched on a pilot basis as a sub-scheme of Rashtriya Krishi Vikas Yojana (RKVY) during 2011-12. The RADP targets refining the excellence of life of farmers, especially small and marginal farmers, by offering an ample platform of undertakings to maximise farm earnings for pretty food and livelihood safety. Based on RADP, the study period covers a period of ten years, from 2011–12 to 2020-21.

Estimation of Compound Growth Rate

The Compound Growth Rate of the trend in area, production and yield of spices in India has been calculated for the period from 2011–12to 2020-21 in India.

A semi-log model

Log y = a + bt

Where

't' is time period in years.

'y' is the value of the variable considered

a and b are parameters, which have been fitted to the data on the important chosen variables. The model promotes the compound growth rates for the chosen variables. Compound growth rate has been calculated as

Compound Growth Rate (CGR) = [(Antilog b-1)] x 100

't' values of the estimates are worked out to test the significance. The coefficient of determination namely R2 is calculated to know the explaining power of the model.

Estimation of Cuddy Della Valle Instability Index

The Cuddy Dell Valle Index (CDI) (1978) is used to overcome the limitation of CV and it is a statistical tool that, quantifies instability in time-series data in agriculture. As against that Cuddy Della Valle index attempts to adjust the CV by using the coefficient of determination (R2). Hence CV adjusts with R2 to determine the agricultural production. To test the instability for the long-term, the following (CDV Index) formula has been used.

CDV Index = CV√1-R2

where, CV is the Coefficient of Variation in per cent and R2 is the coefficient of determination from time trend regression adjusted by the number of degrees of freedom.

Different Ranges of Instability are:

- Low instability = between 0 and 15
- Median instability = greater than 15 and lower than 30
- High instability = greater than 30

Estimation of Coppock's Instability Index

Instability was also analyzed by using Coppock's index, which is calculated as the antilog of the square root of the logarithmic variance using the following formula (Coppock, 1962).

Coppock Index = (Antilog) $\sqrt{(V\log-1)*100}$

$\mathrm{V\ log} = 1\ (N-1)\ \sum(\log pt+1-\log pt-M)2$

$\mathrm{M} = 1\ (N-1)\ \sum(logpt+1-\log pt)$

The Coppock instability index is a more accurate measure of instability than CV because it adjusts for the general trend and how much a series fluctuates around its growth path. Greater instability is indicated by a higher index numerical value.

Research Gap

The various reviews make it clear that studies are all based on area, production, yield, marketing and export of any one spice or all spices in India. The previous research has not been undertaken on the instability of major spices, particularly with special reference to area, production and yield. Therefore, this study was conducted to identify instability using the Cuddy-Della Valle and Coppock's instability indices. Hence, this study is a comprehensive effort to examine instability in major spices in India.

Table 1 Annual Compound Growth Rate of Area, Production and Yield of Spices in India from 2011-12 to 2020-21

Variable	Regression co-efficient		R2	CGR
	a	b		
Area	7.91938	0.04859 (45.544)*	0.99	4.97
Production	8.42805	0.08899 (18.687)*	0.98	9.30
Yield	0.50985	0.04016 (9.509)*	0.92	4.09

Source: Computed from collected data
Note: 1. * Significant at one per cent level
2. Figures in parentheses indicates 't' value

Table 1 presents the growth performance of area, production and yield of spices in India for the period 2011-12 to 2020-21. From the above table it is observed that the growth rates of area, production and yield were highly positive and significant at the 1 per cent level during the study period. This is due to a suitable monsoon and reduced cost of cultivation.

Table 2 Annual Compound Growth Rate of Area, Production and Yield of Red Chillies in India from 2011-12 to 2020-21

Variable	Regression co-efficient		R2	CGR
	a	b		
Area	6.74613	-0.01932 (-2.008)**	0.36	-1.91
Production	7.16313	0.048983 (3.238)**	0.59	5.02
Yield	0.40528	0.06938 (4.661)**	0.75	7.18

Source: Computed from collected data
Note: 1. ** Significant at five per cent level
2. Figures in parentheses indicates 't' value

Table 2 presents the growth performance of area, production and yield of red chillies in India for the period 2011-12 to 2020-21. From the above table, it is observed that the growth rate of production and yield were highly positive and significant at the 5 percent level during the study period, except for the area which showed a negative growth rate during the study period. This is mainly due to the increased cost of cultivation in the latter.

Table 3 Annual Compound Growth Rate of Area, Production and Yield of Garlic in India from 2011-12 to 2020-21

Variable	Regression co-efficient		R2	CGR
	a	b		
Area	5.35516	0.05337 (3.902)*	0.68	5.48
Production	6.76079	0.12810 (7.011)*	0.87	13.66
Yield	1.43518	0.06370 (3.655)*	0.65	6.57

Source: Computed from collected data
Note: 1. * Significant at one per cent level
2. Figures in parentheses indicates 't' value

Table 3 presents the growth performance of garlic area, production, and yield in India for the period 2011-12 to 2020-21. From the above table it is observed that the growth rate of the area, production and yield were highly positive and significant at the 1 per cent level during the study period.

Table 4 Annual Compound Growth Rate of Area, Production and Yield of Turmeric in India from 2011-12 to 2020-21

Variable	Regression co-efficient		R2	CGR
	a	b		
Area	5.11291	0.05358 (3.818)*	0.67	5.50
Production	6.84144	0.01154 (0.679)	0.061	1.16
Yield	1.73170	-0.04269 (-4.084)*	0.70	-4.17

Source: Computed from collected data
Note: 1. * Significant at one per cent level
2. Figures in parentheses indicates 't' value

Table 4 presents the growth performance of area, production and yield of turmeric in India for the period 2011-12 to 2020-21. From the above table it is observed that the growth rate of area was highly positive and significant at the 1 per cent and yield was negatively significant at the 1 per cent level during the study period except for production which showed an insignificant growth rate during the study period. This is mainly due to the failure of the monsoon and the increased cost of cultivation.

Table 5 Annual Compound Growth Rate of Area, Production and Yield of Coriander in India from 2011-12 to 2020-21

Variable	Regression co-efficient		R2	CGR
	a	b		
Area	6.22376	0.01392 (0.774)	0.07	1.40
Production	5.87634	0.08717 (2.786)**	0.52	9.10
Yield	-0.35407	0.07393 (3.726)*	0.66	7.67

Source: Computed from collected data
Note: 1. * Significant at one per cent level
2. ** Significant at five per cent level
3. Figures in parentheses indicates 't' value

Table 5 presents the growth performance of the area, production and yield of coriander in India for the period 2011-12 to 2020-21. From the above table, it is observed that the growth rate of production was highly positive and significant at the 5 percent level, the growth rate of area was insignificant, and the growth rate of yield was significant at the 1 percent significance level during the study period.

Table 6 Annual Compound Growth Rate of Area, Production and Yield of Cumin in India from 2011-12 to 2020-21

Variable	Regression co-efficient		R2	CGR
	a	b		
Area	6.38337	0.06900 (4.240)*	0.71	7.14
Production	5.83716	0.09096 (5.924)*	0.83	9.52
Yield	-0.56069	0.01635 (1.109)	0.14	1.64

Source: Computed from collected data
Note: 1. * Significant at one per cent level
2. Figures in parentheses indicates 't' value

Table 6 presents the growth performance of area, production and yield of cumin in India for the period 2011-12 to 2020-21. From the above table it is observed that the growth rates of area and production were highly positive and significant at the 1 per cent level and the growth rate of yield was insignificant during the study period.

Table 7 Annual Compound Growth Rate of Area, Production and Yield of Black Pepper in India from 2011-12 to 2020-21

Variable	Regression co-efficient		R2	CGR
	a	b		
Area	4.38571	0.11941 (4.623)*	0.75	12.68
Production	3.56061	0.11941 (4.623)*	0.78	13.85
Yield	-0.92010	0.02467 (1.352)	0.20	2.49

Source: Computed from collected data
Note: 1. * Significant at one per cent level
2. Figures in parentheses indicates 't' value

Table 7 presents the growth performance of area, production and yield of black pepper in India for the period 2011-12 to 2020-21. From the above table it is observed that the growth rates of area and production were highly positive and significant at the 1 per cent level and the growth rate of yield was insignificant during the study period.

Table 8 Cuddy Della Valle Instability index for Area, Production and Yield of Major Spices in India

Particulars		Red Chillies	Garlic	Turmeric	Coriander	Cumin	Black Pepper
Area	Mean	764.59	290.42	231.07	553.59	874	178.37
	S.D	58.34632	53.22	37.83631	67.6739	217.2436	69.58311
	CV	7.63106	18.32362	16.37439	12.22455	24.85625	39.01054
	AdR2	0.616997	0.339715	0.470142	1.06329	0.229539	0.619837
	CDVI	5.994133	10.67994	11.22741	12.60546	11.90868	30.71288

Production	Mean	1707.11	1911.05	1025.81	619.51	581.8	78.4
	S.D	303.4407	777.86	123.4274	171.8133	176.7358	36.21166
	CV	17.77511	40.70318	12.03219	27.73375	30.37742	46.18834
	AdR2	0.385223	0.790083	1.124948	0.574778	0.159396	0.274582
	CDVI	11.03235	6.014955	12.76177	21.0261	12.128	24.20295
Yield	Mean	2.25	6.17	4.5	1.11	0.63	0.44
	S.D	0.494469	1.39	0.60663	0.23	0.64031	0.107497
	CV	21.97642	22.60086	13.48067	20.72072	10.16369	24.43108
	AdR2	0.232515	0.61176	0.731126	0.414504	0.937916	0.651661
	CDVI	10.59699	4.204436	11.52677	13.34041	9.843132	19.72212

Source: Computed from collected data

It is evident from the above table that during the study period, the highest instability in area was found in pepper (30.71 percent), followed by coriander (12.61 percent). Low instability for the area (5.99 per cent) was recorded in red chillies. Medium instability in the area has been found in cumin and turmeric (11.91 and 11.22 per cent). The instability varies from 5.99 per cent to 30.71 per cent for the area which is low to high unstable in the study period.

The highest instability in production was recorded for Black Pepper (24.20 per cent), followed by coriander (21.03 per cent). Low instability for production was registered in Garlic (6.01 per cent) followed by Red chillies (11.03 per cent). The instability varies from 6.01 per cent to 24.20 percent for the production which is in the low to highly unstable range.

The high instability index for the yield registered in black pepper (19.72) was followed by coriander (13.34 per cent), turmeric (11.52 per cent), and red chillies (10.59 percent).

Table 9 Coppock's Instability index for Area, Production and Yield of major spices in India

Particulars	Red Chillies	Garlic	Turmeric	Coriander	Cumin	Black Pepper
Area	40.04	43.88	43.56	41.81	48.56	52.76
Production	44.47	53.64	41.85	50.29	51.03	56.40
Yield	46.49	45.46	42.51	46.57	41.08	49.63

Source: Computed from collected data

The result of Coppock's instability analysis of the area, production, and yield of various spices in India was given in the above table. The instability analysis revealed that in the study period higher instability for the area was observed in Black pepper (52.77%) whereas production and yield were highly unstable in Black pepper (56.41% and 49.64% respectively). The lowest instability was shown in red chillies for the area (40.04%), whereas for production, low instability was found in turmeric (41.86%) followed by red chillies (44.48%) and for yield, the spice observed was cumin (41.08%).

Conclusion

The study explores the trends and growth rate in the area of cultivation, production, and yield of major spices in India and reveals that there was a highly positive and significant growth in the area, production, and yield of spices during the entire period. All six spices have significant growth rates in area, production and yield except for the growth rate in area of red chillies and the yield of turmeric. The analysis revealed that during the study period, higher instability was observed in the area, production, and yield of black pepper. It is suggested that the negative growth in red chillies and turmeric and higher instability in black pepper require benefits of the Rainfed Area Development Programme for the

small farmers who are engaged in spice production, the use of improved varieties, the adoption of advanced agricultural techniques and value-added processing with greater efficiency. There is scope to improve all varieties of spices in India by diverting more production of spices through appropriate policy support at central and state levels.

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