January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

Growth Trends in Production and Export of Indian Spices using LOESS Approach

S. Anusha*, B. Srinivasa Kumar, D. Satish Kumar
Department of Mathematics, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Andhra Pradesh, India

Article Info
Volume 82
Page Number: 12842 - 12853
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 24 February 2020*

Abstract:
India is one of the largest exporters of spices in the world. Spices are the best source of forex currency to India. They are a good source of lively hood for the billions of formers in different states across India. It is very much essential to know the growth analysis of different spices in terms of production as well as in export which effects the Indian economy and the life style of farmers. This paper attempts to analyze trends in growth of level mazer Indian spices in terms of their production and exports during the years 1971-2017. The variables considered for production are Area, Volume, and yield. and for exports Quantity, Volume and Unit value. By using LOESS method, Men growth rate was calculated for all the years with reference to all the commodities. Growth parameter for each commodity is also analyzed. Data was analyzed with the help of open source software R.

Keywords: *Spices, Growth analysis, Area, Volume, Yield, LOESS.*

INTRODUCTION

Indian history emphasizes that India is the home of spices. Spices are sold to ancient China and Rome. It is because of the taste, quality and exquisite aroma of Indian spices. India has the largest domestic market in the world. It exports nearly 109 variety of spices which are listed by International standardization (ISO).

Primarily India exports pepper from Kerala, Karnataka, and Tamil Nadu, Chili from Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Orissa, Rajasthan, Turmeric from Andhra Pradesh, Karnataka, Tamil Nadu, Ginger from Andhra Pradesh, Karnataka, Kerala. Cardamom from Sikkim, West Bengal, Coriander from Rajasthan and Uttara Pradesh, Cumin, Fennel & Fenugreek from Rajasthan and Gujarat, Celery from Panjab and Uttara Pradesh, Nutmeg and mace garlic from Kerala and Tamil Nadu, tamarind and vanilla from Kerala & Karnataka. Processed spices such as spice oils and oleoresins, mint products, curry powder, spice powders, blends and seasonings are also exported.

The major importers of Indian spices are United States followed by China, Vietnam, the UAE, Malaysia, Saudi Arabia, the UK, Germany, Singapore and Sri Lanka. In 2018-19, India exported spices worth 231 billion rupees.

In the recent years it is identified that Indian spices' exports are facing problems in international market due to emergence of competition from countries like Malaysia, Brazil, China & Vietnam. The major hurdle is volatility both in terms of quantity and the expenditure involved in exports. Owing to this issue the area under spices cultivation has become impacted and hence exports became undependable, which has wielded a great influence on the standard of living of over a hundred million of small and marginal farmers. It has also affected the earning potential for the government and the industry. In this context, Indian government has rightly noticed that the exports of spices as a major area which is prioritized for policy modifications. By the end of 2020 spices exports is expected to generate a revenue of 25,000 billion rupees for India alone. (Spices Board, Annual Reports, 2016-17, 2017-18). In this context there is need for long term perceptive planning for spices sector to reach the stated objectives.

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

LITERATURE SURVEY

Growth Performance in Area, Production, Productivity and Export of Spices in India has been done by Ganga Devi and KS Jadav [5] by using secondary data from 2004-2014 they conclude the positive significant growth in productivity in spices in specified period. The growth analysis in production of major spices like chilli, turmeric, black pepper, cumin & coriander India is done by M. Krishnadas [1]. In his analysis the gowth rate of chilli, turmeric and coriander in productivity is positive in most of the states in india and cumin is in negative growth. In "Export and import of small cardamom in India", studied the export performance by Anbuchelvi [5]. he made comprehensive analysis of the prevailing export policies of the Government. The production of cardamom, being major export items were evaluated well, and remedial solutions were recommended to the problems of significant export items, including cardamom. In "Direction of Trade and Export Competitiveness of Chillies in India" studied by I. Bhavani Devi [3], she explained that competition of Indian chillis with Chine chillis during the period 2006-2012 in exporting and cultivation. M S, Yogesh [2] studied the Growth of Indian export and import of spices during the period 2004-2012. He analyzed the degree and direction of spices in India. S.Anusha et.al [6] are made time series analysis of 14 spices in "Time Series Analysis of Indian Spices Export and Prices". They analyze the affect of export revenues from spices and thus incomes of innumerable small and marginal cultivators of spices.

METHODOLOGY

Trend growth rates were established ordinary least square method, where the dependent variables are Area, Volume, and yield. And for exports Quantity, Volume and Unit value, Independent variable is time.

The trend growth rates are then plotted for all the individual commodities for all the years. That resulted in to growth corves using the LOESS method the mean trend growth rate was calculated for all the years to all the commodities. Growth parameter of each commodity is also analyzed similarly. By observing the growth trends with reference to specific production / export variables some general conclusions are drawn and by examine specific commodity patron the contribution of each of the commodity to the overall production / export is explain.

Growth Curve Analysis

The present analysis uses graphs of growth curves understand the growth trends and distributional aspects of the 11 Spices in terms of Area, Production, Yield, Export Quantity, Export Value, Export Unit Value over a period of 1970-71 to 2017-18. This type of analysis helps in understanding the trends and patterns in the growth of variables and the probability distributions of variables. As the sample data is Panel Data, we have repeated measurements of time series on the same variable on the same unit producing a Growth Curve. In a Growth curve we can observe an increasing, decreasing or a mix of both the patterns. Growth curves are estimated by LOESS Method which is the nonparametric alternative to parametric Ordinary Least Squares (OLS) Method. **LOESS** method gives better growth estimates as it does not assume linear trend throughout the time horizon as in the case of **OLS.**

Descriptive Analysis of trends

1.Descritptive Statistics for Total Spices

1.1Descritptive Statistics for Cardamom (Large)

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	47	26.010	1.586	22.060	25.690	26.060	26.410	30.040
Yield..Kg.Hect.	47	0.162	0.031	0.080	0.150	0.160	0.180	0.230

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

Value.lakhs.	47	1,806.904	2,509.027	9.490	66.290	1,060.000	1,922.840	8,404.000
Unit.Value.per.Kg.	47	202.099	324.722	13.350	25.215	70.250	145.290	1,263.760

1.2.Descritptive Statistics for Cardamom (Small)

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	526	205.875	244.221	5.700	49.000	99.600	234.725	977.500
Production..Tonnes.	526	234.464	349.237	1.600	25.750	93.155	263.225	2,149.000
Yield..Kg.Hect.	526	1.510	1.573	0.020	0.300	1.000	2.100	7.000
Value.lakhs.	526	16,658.803	48,592.009	7.000	392.530	1,919.270	9,695.907	507,075.630
Unit.Value.per.Kg.	526	99.541	399.238	0.670	9.648	27.875	74.005	8,278.000
Area.Hects..	48	82.321	11.423	68.330	71.927	81.700	91.480	105.000
Yield..Kg.Hect.	48	0.132	0.204	0.020	0.040	0.080	0.160	1.400
Value.lakhs.	48	8,253.128	13,620.971	314.110	1,238.905	2,500.135	5,918.470	60,908.150
Unit.Value.per.Kg.	48	386.235	305.240	37.400	154.898	291.515	534.913	1,124.790

1.3. Descriptive Statistics for Chilly

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	48	812.752	70.336	654.000	771.525	807.250	842.025	977.500
Yield..Kg.Hect.	48	1.150	0.548	0.500	0.700	0.950	1.600	2.900
Value.lakhs.	48	69,356.155	125,267.120	31.630	718.663	8,081.025	57,620.925	507,075.630
Unit.Value.per.Kg.	48	35.954	31.650	4.260	9.075	29.555	45.805	126.690

1.4. Descriptive Statistics for Corriander

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	48	417.917	110.497	242.000	357.750	399.500	491.000	674.000
Yield..Kg.Hect.	48	0.598	0.256	0.300	0.400	0.500	0.700	1.300
Value.lakhs.	48	7,708.391	12,081.472	9.740	195.107	2,103.045	7,648.775	49,812.500
Unit.Value.per.Kg.	48	27.305	28.266	2.190	6.640	16.200	34.472	108.290

1.5. Descriptive Statistics for Cumin

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	48	329.281	255.439	73.600	130.875	264.600	518.150	966.000
Yield..Kg.Hect.	48	0.444	0.129	0.200	0.375	0.400	0.500	0.800
Value.lakhs.	48	29,467.825	59,087.343	82.620	315.942	1,930.005	18,413.960	241,798.780
Unit.Value.per.Kg.	48	57.970	49.114	3.060	14.965	47.450	90.720	168.300

1.6.Descriptive Statistics for Fenugreek

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	48	56.625	43.063	23.900	32.850	38.800	56.975	219.000
Yield..Kg.Hect.	48	1.235	0.216	0.900	1.075	1.200	1.400	2.000
Value.lakhs.	48	3,226.531	5,258.372	14.580	168.352	854.275	2,885.775	23,380.000
Unit.Value.per.Kg.	48	17.719	16.428	1.400	4.130	12.940	25.860	70.150

1.7. Descriptive Statistics for Funnel

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	48	34.100	29.154	5.700	14.575	18.450	41.425	99.600
Yield..Kg.Hect.	48	1.255	0.193	0.900	1.100	1.200	1.400	1.700
Value.lakhs.	48	3,555.478	6,662.327	25.450	107.007	673.625	2,799.225	30,875.930
Unit.Value.per.Kg.	48	34.095	30.803	2.170	8.665	23.900	48.657	113.010

1.8. Descriptive Statistics for Garlic

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	47	119.781	79.118	28.000	60.500	94.300	147.050	321.000
Yield..Kg.Hect.	47	4.262	0.781	3.000	3.600	4.100	4.900	6.000
Value.lakhs.	47	3,012.237	6,736.052	7.000	165.665	400.000	1,368.415	30,936.380
Unit.Value.per.Kg.	47	21.016	21.795	0.670	5.365	12.470	31.870	95.380

1.9. Descriptive Statistics for Ginger

Variable	N	Mean	Std. dev.	Min.	25 %	Median	75 %	Max.
Area.Hects..	48	81.640	41.872	21.600	56.975	71.950	104.600	168.000
Yield..Kg.Hect.	48	3.673	1.151	1.400	3.275	3.550	3.800	7.000
Value.lakhs.	48	5,535.775	8,366.882	209.940	692.342	2,249.785	4,390.375	33,133.000
Unit.Value.per.Kg.	48	35.680	31.953	3.470	13.355	20.490	46.758	109.930

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

Growth Pattern in Area Under Cultivation for Spices

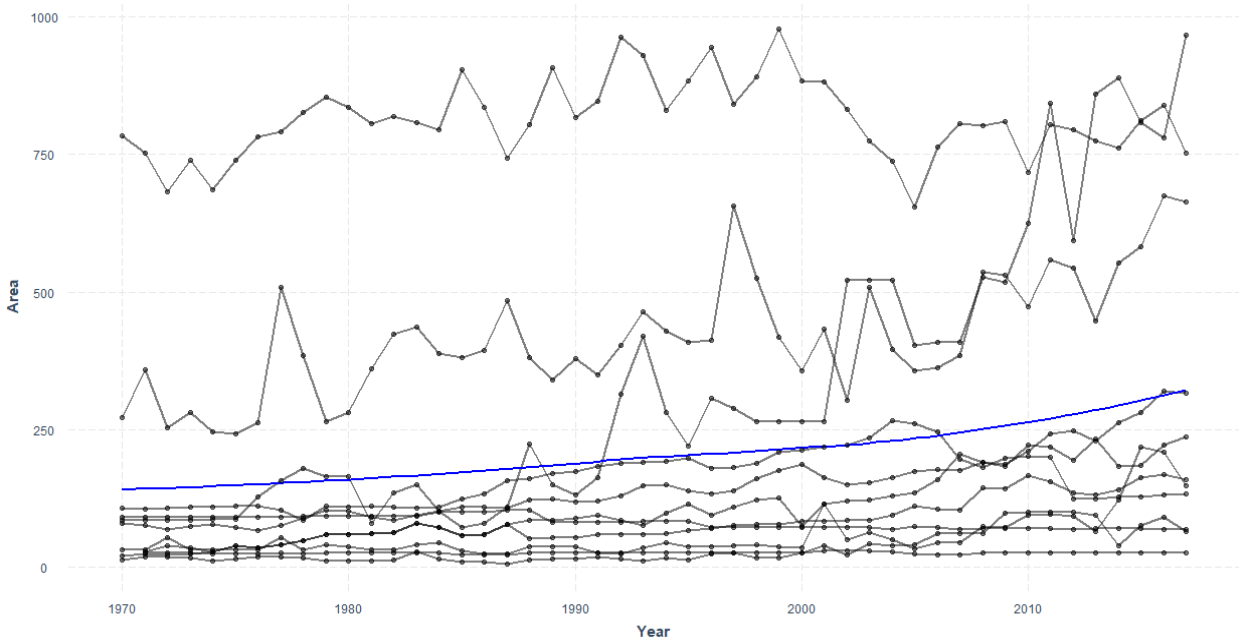

Fig:1 Growth of all spices in Area from 1971-2017

Fig.1 Shows the growth trends of all the eleven Spices in terms of the Area under cultivation over a period of 1970-71 to 2017-18.. The blue line is the mean trend . We can see that Growth trend in Area of nearly every spice during the period 1970 – 1980 is flat. But during the period 1980- 1990 there is gradual uptrend in the average Growth in Area of these spices . However, the period 1990-2000 there are wild fluctuations in the Area of Spices and a general upward mean trend is observed in Area Growth of the Spices. Since, the year 2000 Till 2017 we observe cumulative growth in Area under cultivation of Spices and relative stability in growth.

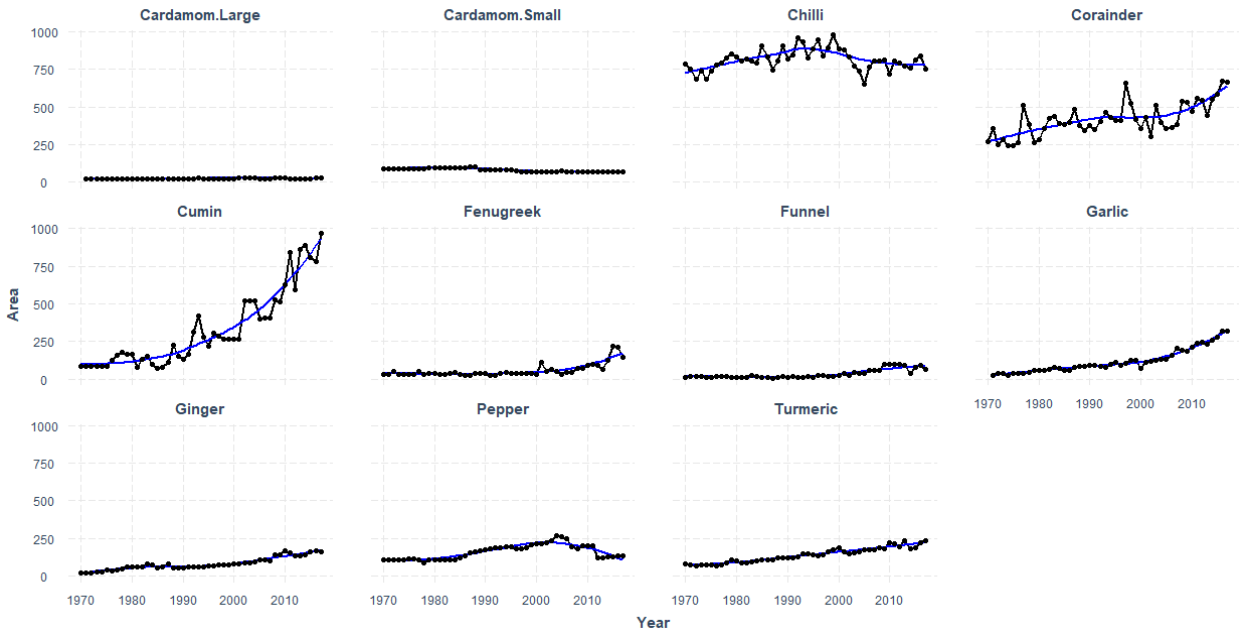

Fig:2 Individual growth of spices in Area from 1971-2017

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

Fig.2 Provides individual growth trends of each of the eleven Spices during the study period of 1970-2017. Area under cultivation for Spices like Coriander, Ginger, Garlic and Pepper has increased rapidly. In case of chilies there are wild fluctuation in growth trend. The remaining spice crops witnessed flat growth trend in area under cultivation.

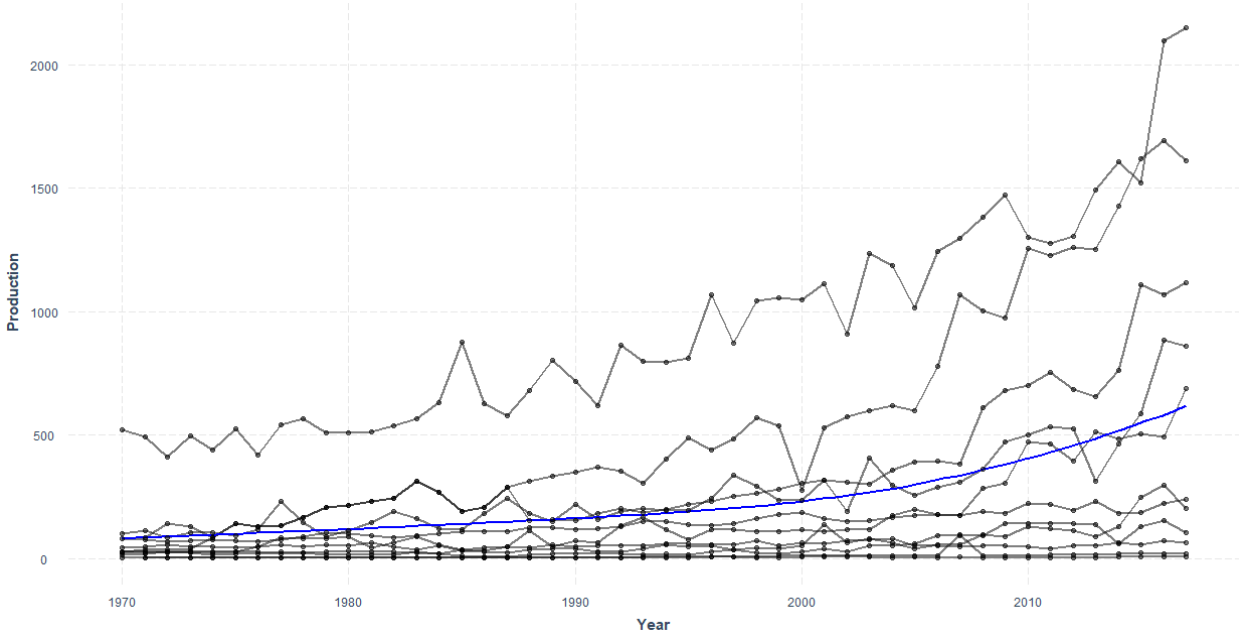

Fig:3 Growth of all spices in Production from 1971-2017

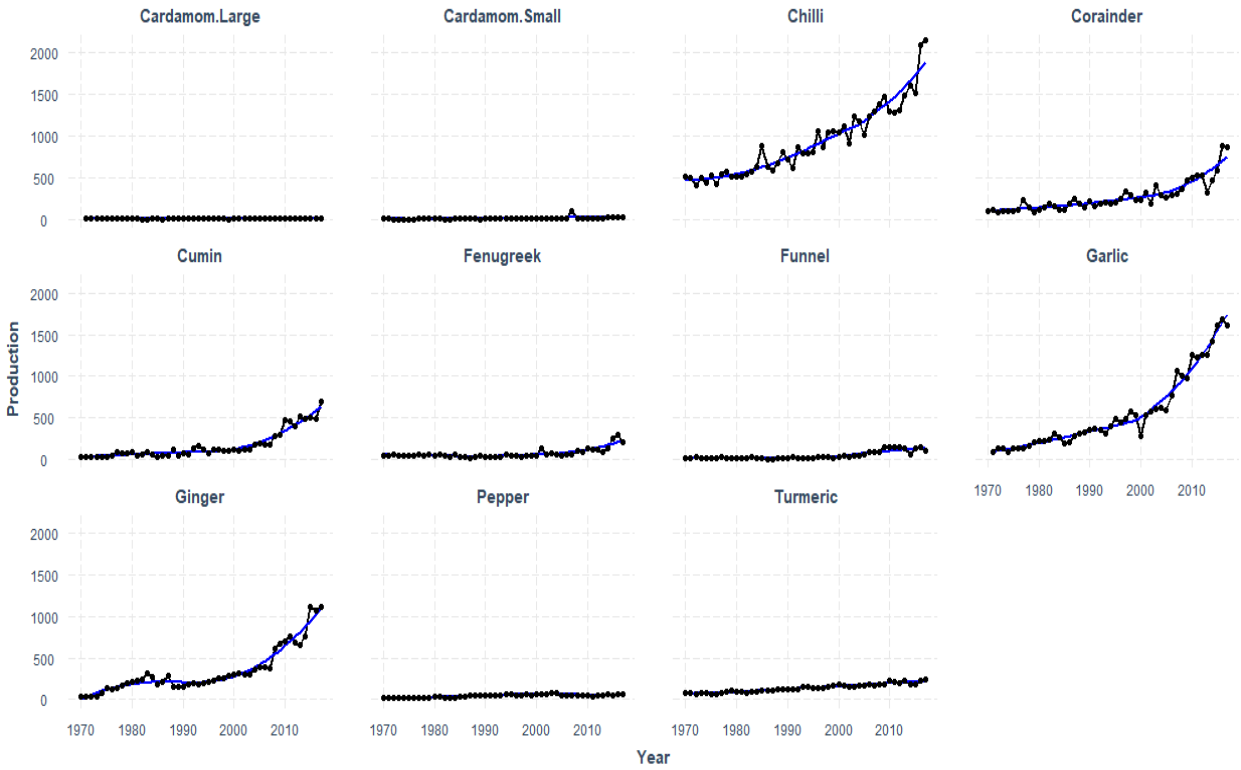

Fig: 4 Individual growth of spices in production from 1971-2017

Fig.3 Shows the growth trends of all the eleven Spices in terms of the Area under cultivation over a period of 1970-71 to 2017-18. The blue line is the mean trend. We can see that Growth trend in

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

production of chilis is raising rapidly from 2071 onwards, were as coriander, Ginger, Garlic, cumin are slowly raised up 1990 and then they are also increased more. The remaining commodities are very slow increasing growth i.e. almost flat in showing graph.

Fig-4 showed the individual commodity growth trends of each of the eleven Spices during the study period of 1971-2017. Production under cultivation for Spices like Chili, Garlic and Ginger has increased rapidly. In case of Coriander and cumin there are wild fluctuation in growth trend. The remaining spice crops witnessed flat growth trend in area under cultivation.

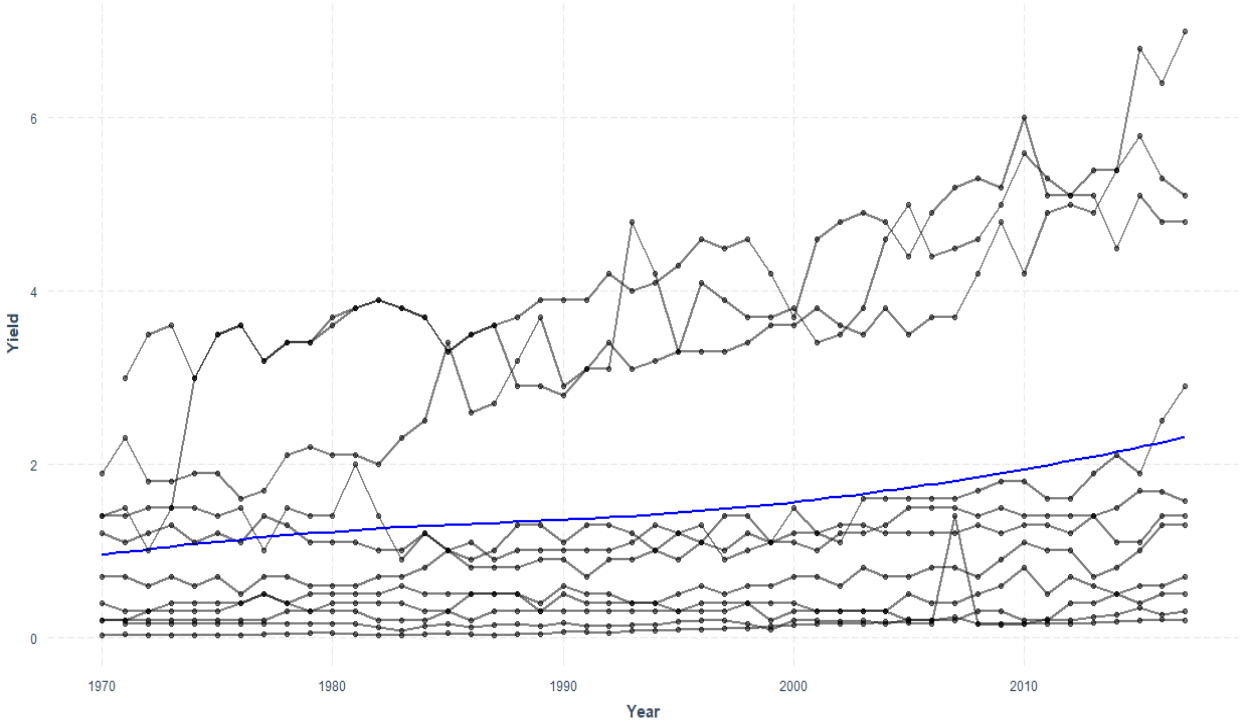

Fig:5 Growth of all spices in yield from 1971-2017

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

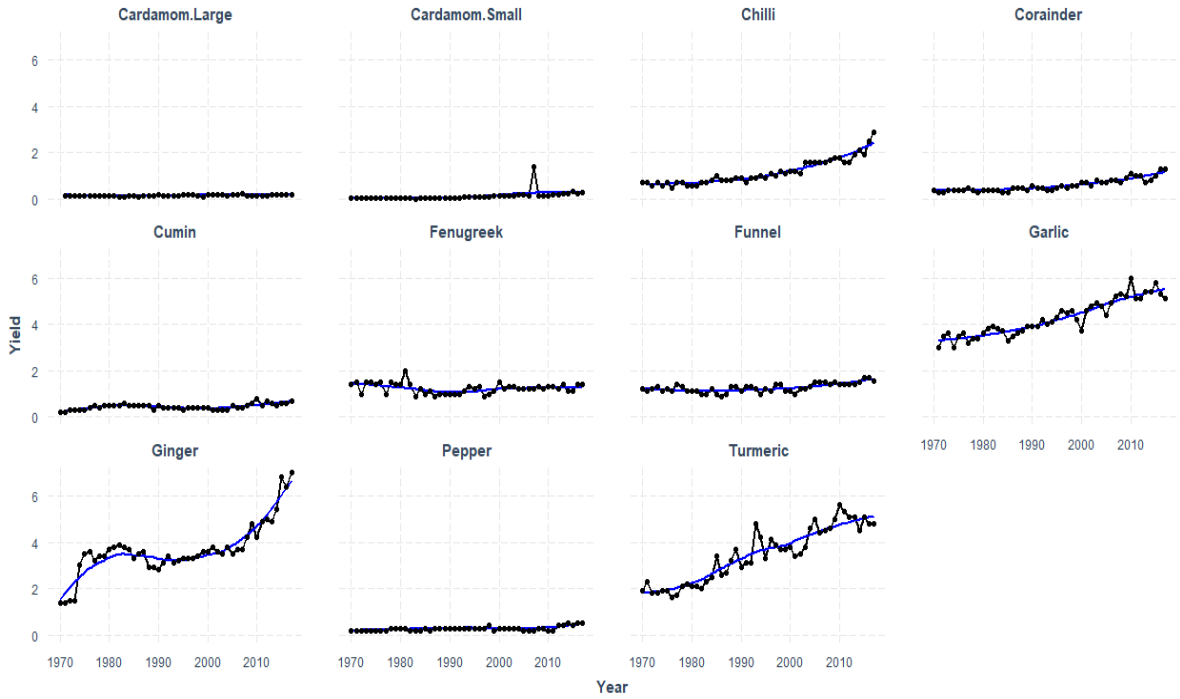

Fig:6 Individual growth of spices in yield from 1971-2017

Fig.5 indicates the yield of all mentioned commodities in India during period 1971 to 2017. The growth is continuous in all the commodities. The growth of chilli, Ginger, Garlic and Turmeric is above the average of all commodities. The remaining also have the growth but it is below the average growth.

From fig.6 shows the individual growth of all commodities. The growth of yield is in the order Ginger , Garlic, turmeric, Chili and Coriander are having rapid growth. Fenugreek, Funnel and cumin having general growth and remaining have a small growth. Ginger has more growth from 1971 to 1990. From 1990 to 2000 the growth is very slow and then the growth is rapid until last. The growth of turmeric is continuous. It has highest peak at 2010.chillis has a slow continues growth from stating but it is raised 2010. Pepper has good growth up to 1980 than is growth almost constant and very slow.

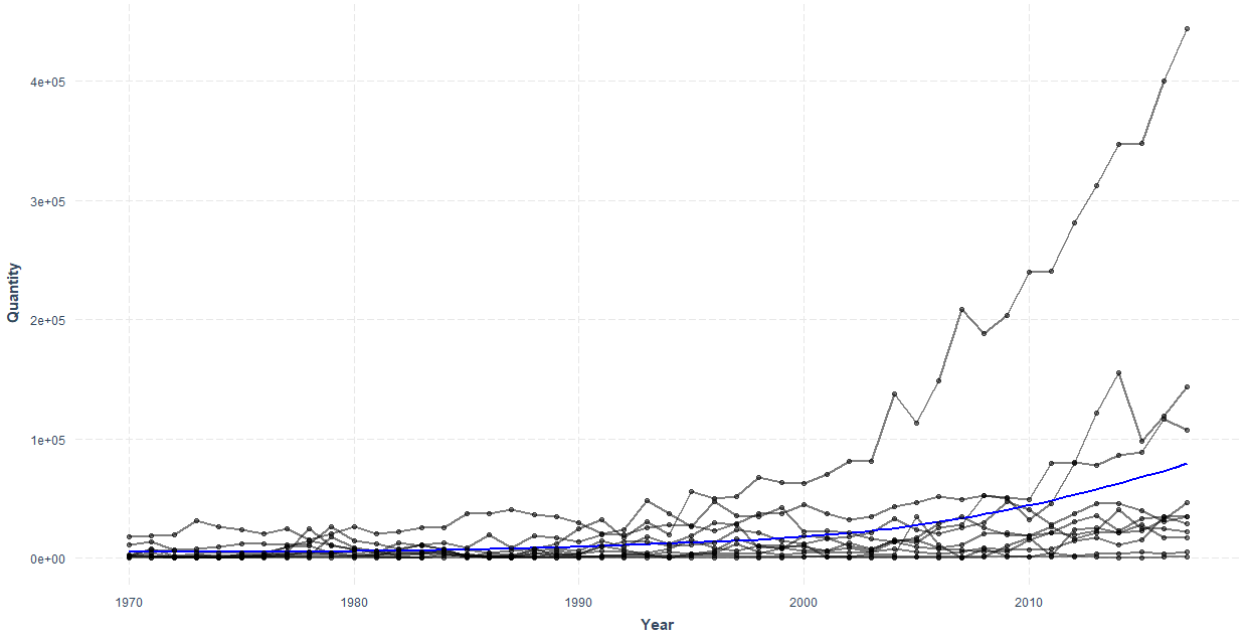

Fig:7 Growth of all spices in Quantity from 1971-2017

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

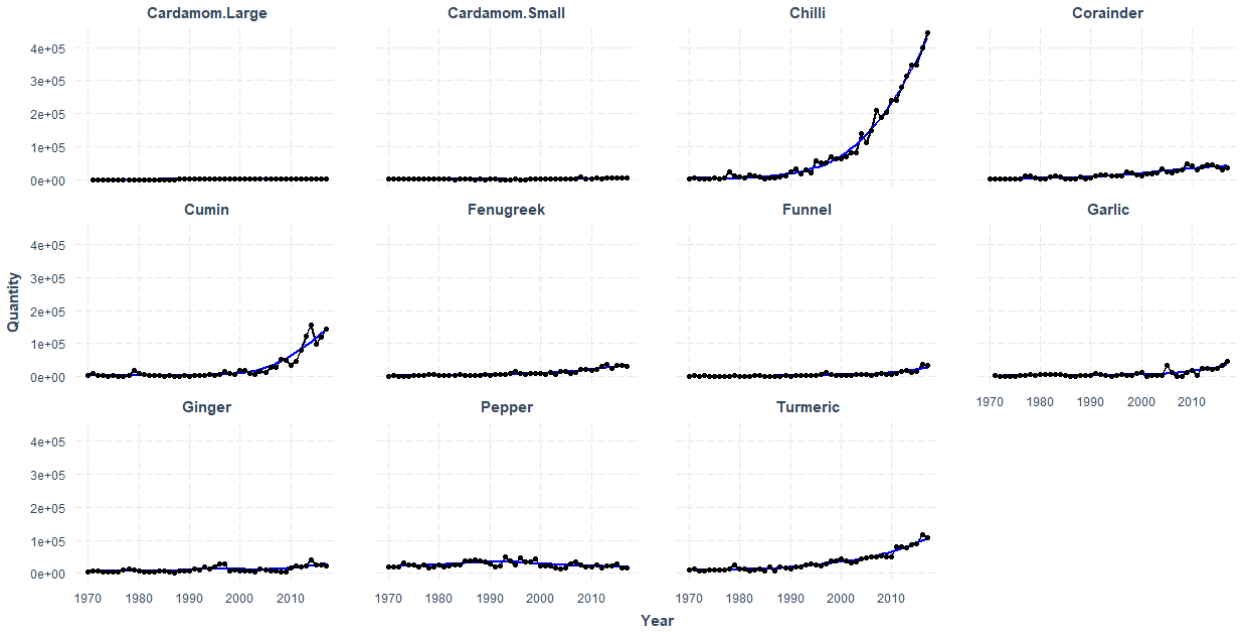

Fig:8 Individual growth of spices in Quantity from 1971-2017

Fig.7 provides the relation of time period and growth of specified spices in quantity in the period 1971-2017. Chili, cumin and turmeric growth in quantity is above the average growth of all spices. Chilis have rapid and high growth. The remaining have below average slow growth.

Fig.8 showed the individual analysis of growth in quantity with respect to the time period. From 1990 chillis have more rapid growth, at the end it reaches high peak. Cumin has very slow growth upto 2000 then only it raises rapidly. Turmeric has slow increase in starting but continuous. From 1990 its growth is more than the average of its own. The remaing spices very slow growth it seems to be constant.

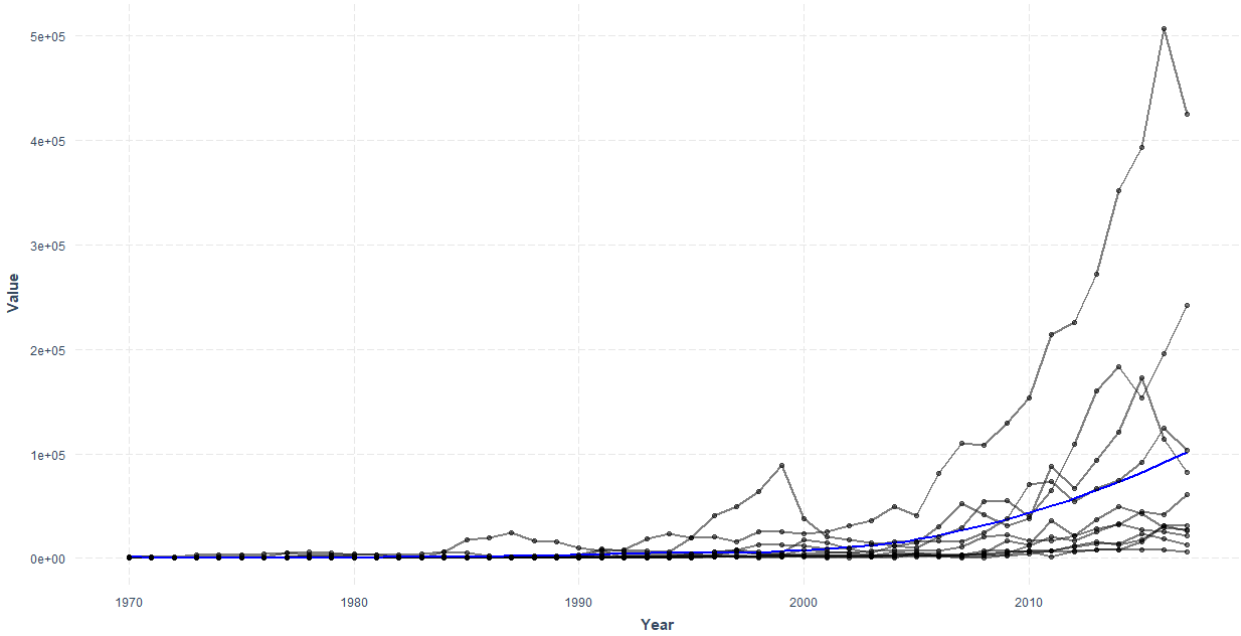

Fig: 9 Growth of all spices in Value from 1971-2017

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

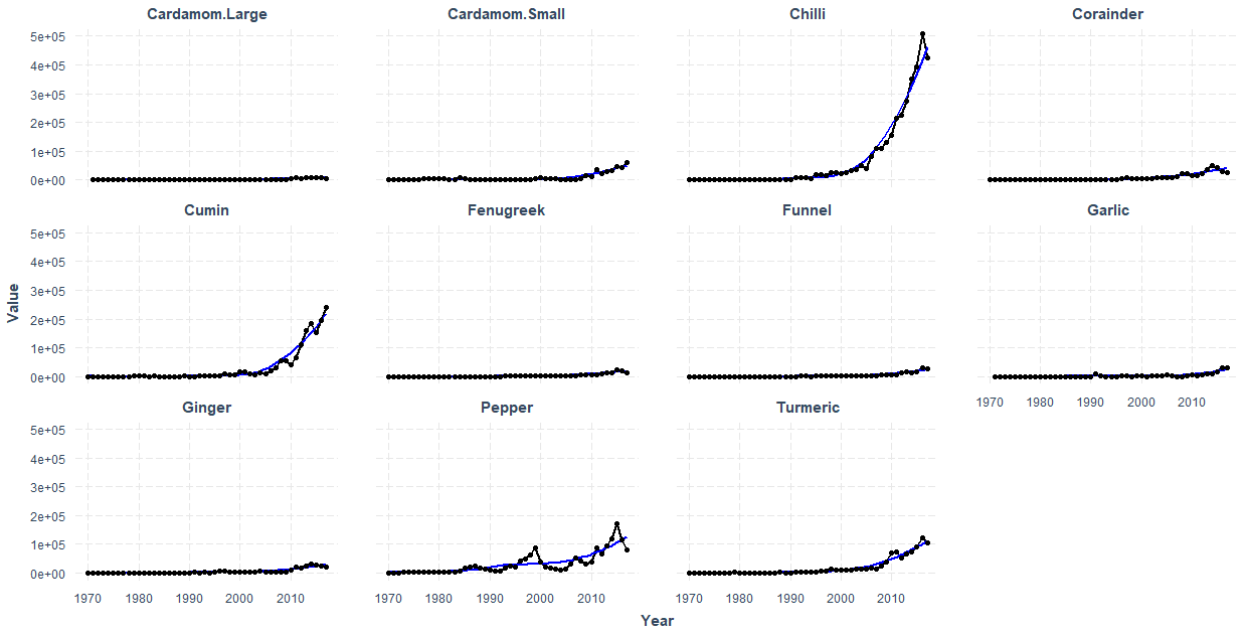

Fig:10 Individual growth of spices in value from 1971-2017

Fig.9 showed the growth trend in the value of all spices with reference to the time period 1971-2017. The average growth shown in blue line. Chili, cumin, pepper and turmeric are in above the overall average growth in value of the spices. the remaining growth is almost constant up to 2010 thean only their growth stats visually.

Fig. 10 showed individual value growth of all spices. the value of chilis is raising sharply from 1990.The visual growth of cumin from 2010. From 1990 the growth of pepper started. Turmeric also raised from 2010. The remaining all spices almost flat in curve their growth is almost negligible.

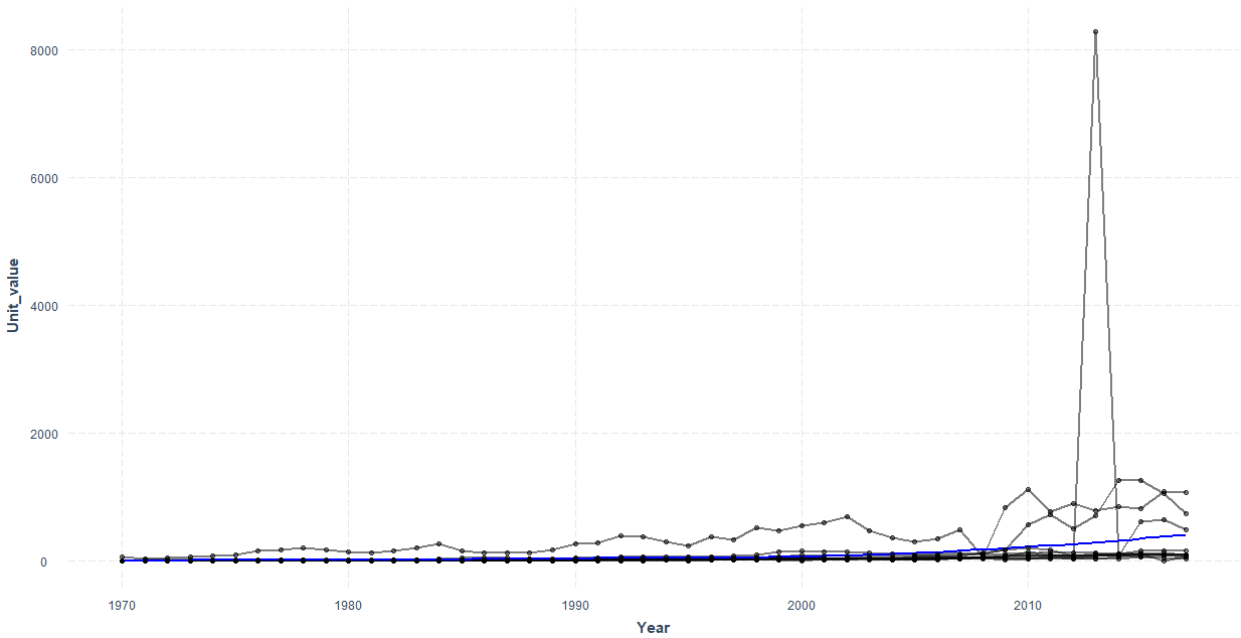

Fig: 11 Growth of all spices in unit_value from 1971-2017

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

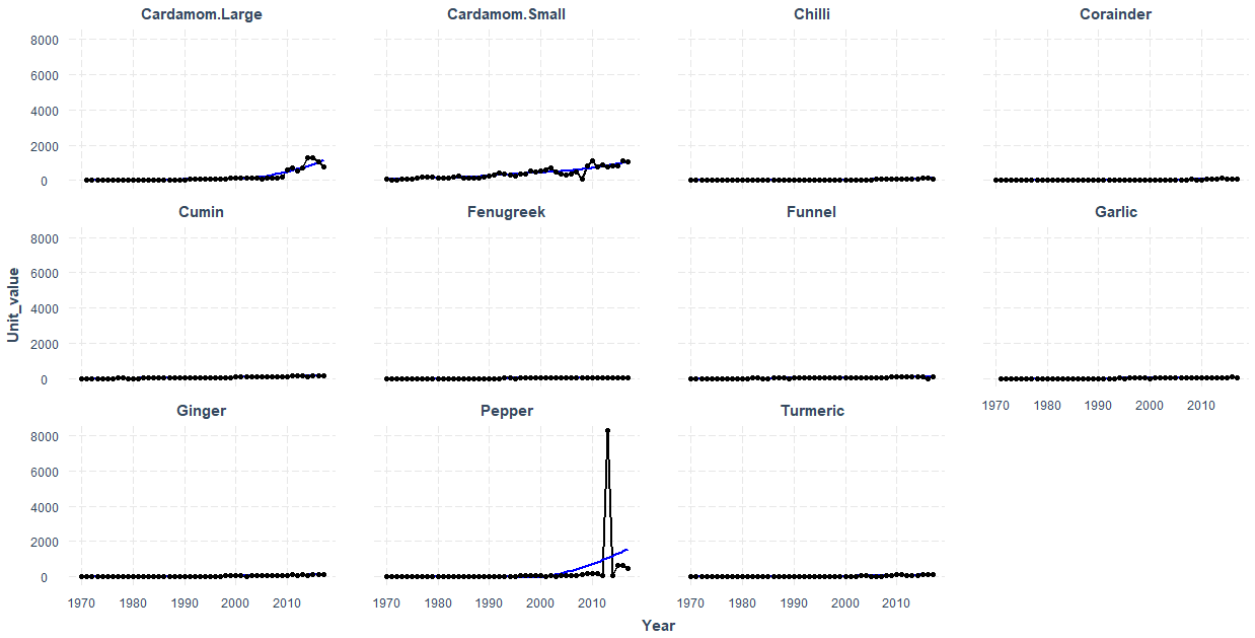

Fig: 12 Individual growth of spices in unit-value from 1971-2017

Fig.11 showed unit value of each commodity with respect to the duration period 1971 to 2017.

The unit value of three commodities cardamom large, small and pepper only above the overall average value, the remaining are below the overall average and they almost flat in curve.

Fig.12 showed individual growth of spices with respect to unit_value. From 2010 the unit_value of cardamom is raised and is above their average unit value. Pepper has max unit value growth in 2010 to 2015. The remaining spices have constant unit values.

CONCLUSION

1. The two type spices i.e. production (Area, Volume and yield) and export(Quantity, Volume and Unit value) are mutually related.
2. The Area under cultivation over a period of 1970-71 to 2017-18, the cultivated area of chilli (654-977.5 thousand hectors), coriander (242-674 thousand hectors) and cumin (73.6 to 966) is increased rapidly. The increased rate in cultivated area is more cumin.
3. The production if five spices (chillis (411.7-2149), coriander (83-883), Ginger (29.3-1118), Garlic (84-1693), cumin(28-689)) in India during 1971-2017 is raised rapidly.
4. The growth rate of yield of chilli, Ginger, Garlic and Turmeric is above the average of all commodities in India.
5. The growth rate of quantity in chilli, Ginger and Turmeric raised in India from 1971. Mainly the growth is rapid from 1995 onwards.
6. The value of the chili cumin and pepper has appreciable growth in India from 2000
7. The unit_value of the cardamom(13.35-1263.76) and pepper(3.11-827.8) is raised rapidly in India.

REFERENCES

1. Krishnadas, M. & AYYOOB, S.M.. (2011). Growth in Area, Production and Productivity of Major Spices in India- An Economic Analysis.
2. M S, Yogesh & Mokshapathy, S. (2014). GROWTH OF INDIAN EXPORT AND IMPORT OF SPICES. BEST: International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS). 2. 41-46.
3. I. Bhavani Devi(2016), “Direction of Trade and Export Competitiveness of Chillies in India” Agricultural Economics Research Review Vol.

January-February 2020
ISSN: 0193-4120 Page No. 12842 - 12853

29 (No.2) July-December 2016 pp 267-272

4. Ganga Devi and KS Jadav. “Growth Performance in Area, Production, Productivity and Export of Spices in India”. Acta Scientific Agriculture 2.11 (2018): 87-90.
5. M., Anbuchelvi. (2019). Import and Export of Small Cardamom in India. Shanlax International Journal of Arts, Science and Humanities. 7. 97-111. 10.34293/sijash.v7i1.561.
6. S.Anusha et.al “Time Series Analysis of Indian Spices Export and Prices” Indian J. Agric. Res.,A-5283