

Research Paper

Production Performance of Seed Spices in Rajasthan

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ABSTRACT

For analyzing the production performance of the seed spices in Rajasthan, the current study was undertaken which covered the period from 1998-99 to 2017-18. The entire period was divided into three sub-periods viz. Period I (1998-99 to 2007-08), Period II (2008-09 to 2017-18), and Overall Period (1998-99 to 2017-18). Four major seed spices mainly coriander, cumin, fennel, and fenugreek were considered for the analysis. The necessary data on the area, production, and productivity were gathered from various annual publications of Government of Rajasthan. This study aimed to analyze the growth rate and instability. For this, analytical tools such as Compound Annual Growth Rate and Instability Index (Cuddy-Della-Valle Index) were used. The study revealed that all the seed spices except the coriander showed a high growth rate during the overall period. The analysis of the instability indices revealed that the coriander was the most stable crop while fennel was highly unstable. Research-Oriented strategy, latest varieties along with an improved package of practices are necessary to develop as well as strengthen this sector.

HIGHLIGHTS

- ① Domestic prices of the crop have a significant impact on the area under the cultivation.
- ② Cultivation of seed spices increased due to the positive impact of the production technology and favourable policy measures taken by the concerned authority.

Keywords: Compound annual growth rate, Cuddy-Della-Valle index, integrated nutrient management, potential yield capacity

Around the world, India is identified as the land of spices and produces a large variety and quantity of spices. About 75 spices are grown in the country which include pepper (King of spices), cardamom (Queen of spices), chilies, ginger, turmeric, coriander, cumin, fenugreek and many others (Ashoka *et al.* 2013). During 2018-19, the spices production in India was 9,211.06 thousand tonnes from an area of about 4,032.11 thousand hectares (Annual report 2020-21, Spices Board of India, Cochin).

Spices are produced in all the states and union territories. Himachal Pradesh is known for ginger, Haryana is popular for garlic, Karnataka is renowned for pepper, ginger, cardamom (small), chili, turmeric and garlic. Orissa is known for ginger, chili, turmeric, and garlic. Kerala is famous for pepper, chili, turmeric, nutmeg, mace, and clove. Rajasthan

is popular for varied spices such as coriander, chili, cumin, garlic, fenugreek, fennel, and ajwain (Hari Babu, 2017).

Out of total spices grown in India, 20 are classified as seed spices. Seed spices are kinds of crops whose main economical part is a seed. ICAR-NRCS is working on 10 most prominent seed spices namely coriander, cumin, fenugreek, fennel, dill, ajwain, celery, nigella, caraway, and anise. Rajasthan and Gujarat which comes under arid and semi-arid parts of India are known as 'Seed Spices Bowl' as they contribute more than 80 per cent of total seed spices production (Lal, 2018). Rajasthan produced 1044.53

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thousand MT's spices in 928.90 thousand hectares' area during the year 2018-19. (Annual report 2020-21, Spices Board of India, Cochin).

Cumin

Cumin (*Cuminum cyminum*) generally known as 'Jeera' belongs to the *Apiaceae* family. Seeds have a sweet-smelling scent also a hot to some degree harsh taste. Rajasthan produced 378.65 thousand MT's of cumin from 676.24 thousand hectares' area during the year 2018-19 and emerged as the leading cumin producing state in the country (Annual report 2020-21, Spices Board of India, Cochin).

Coriander

Coriander (*Coriandrum sativum*) belongs to the family Umbelliferae which is commonly known as 'dhaniya' is another most established flavour expended in India. Rajasthan produced 89.54 thousand MT's of coriander seeds from 68.97 thousand hectares' area during the year 2018-19 (Annual report 2020-21, Spices Board of India, Cochin).

Fennel

Fennel (*Foeniculum vulgare*) ordinarily known as 'Saunf' belongs to the *Apiaceae* family. In Ayurveda, it is a custom to serve seasoned saunf to the human sorts after suppers. Rajasthan produced 35.29 thousand MT's of fennel from 30.68 thousand hectares' area during the year 2018-19 (Annual report 2020-21, Spices Board of India, Cochin).

Fenugreek

Fenugreek (*Trigonella foenum graecum*) usually known as 'methi' has a place with the family Fabaceae. It is utilized as a foodstuff as well as for flavouring food. Rajasthan produced 59.16 thousand MT's of fenugreek from 45.31 thousand hectares' area during the year 2018-19 (Annual report 2020-21, Spices Board of India, Cochin).

The study of growth and instability would help to formulate strategies to increase the performance of the seed spices. The specific objectives of the present study are:

- (i) To study the growth of area, production, and productivity of major seed spices, and

- (ii) To analyze the instability in area, production, and productivity of major seed spices.

MATERIALS AND METHODS

The research work was based on secondary data. Four major seed spices based on the highest area were selected from the state of Rajasthan also the production of these seed spices were highest during the year 2017-18. The four seed spices viz. coriander, cumin, fennel, and fenugreek were selected. Twenty years' data i.e. 1998-99 to 2017-18 was considered for the analysis of growth rates and instability in area, production, and productivity of selected major seed spices. Twenty years' data was collected for the period from 1998-99 to 2017-18 which was further divided into three sub-periods, viz. Period I (1998-99 to 2007-08), Period II (2008-09 to 2017-18), and Overall period of twenty years (1998-99 to 2017-18). The data was collected from various authentic sources as follows:

- ♦ Agriculture Statistics (Directorate of Agriculture, Rajasthan),
- ♦ Horticultural Statistics at a Glance, (Government of India),
- ♦ Fertilizer and Agriculture Statistics Northern Region (The Fertilizer Association of India, Northern Region, New Delhi).

Compound growth rate

Compound growth rates in the area, production, and productivity of major seed spices from Rajasthan were estimated by using the exponential growth function of the form:

$$Y_t = AB^t$$

A = Intercept

B = Regression Coefficient

$$B = 1 + r$$

r = Compound Growth Rate

t = Years which can take values (1, 2,.....n)

The above equation can be expanded by taking logarithm on both sides,

$$\log Y_t = \log A + t \log B$$

Then, the per cent compound growth rate (r) per year was calculated by,

$$r = [(Antilog B) - 1] \times 100$$

The Student's t-test was used to determine the significance of the compound growth rate.

Instability index

The instability index was calculated using the Cuddy-Della-Valle Index as given below.

Estimation of instability index

The instability in area, production, and productivity of the major seed spices for 20 years were worked out with the help of the following measure:

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

Where, *CV* = Coefficient of variation of area / production / productivity of major seed spices

*R*² = Coefficient of multiple determination adjusted from trend value for original series data on area / production / productivity of major seed spices

RESULTS AND DISCUSSION

Growth rates in the area, production, and productivity of seed spices from Rajasthan

1. Coriander

During the first period (1998-99 to 2007-08), coriander showed a 0.32 per cent growth rate in terms of area which was significant. While, in terms of production and productivity, coriander showed a negative growth rate of -0.12 per cent and -0.43 per cent, respectively. The lesser domestic prices had a significant impact on the succeeding years' area under crop. The coriander being an annual crop is predominantly affected by the domestic prices as reported by Sivaraman (2001). In the second period (2008-09 to 2017-18), the coriander area showed a negative growth rate of -5.71 per cent. The production of coriander showed a negative growth rate of -5.61 per cent whereas productivity of crop showed a meagre growth of 0.11 per cent. The negative growth rate in the area was mainly due to reduction in the area of the coriander during some years. There was no specific trend in the reduction of the area. The results revealed that during the overall period (1998-99 to 2017-18), coriander

showed a positive and significant growth rate of 0.81 per cent in terms of area. In production, significant growth rate of 1.05 per cent was observed. Priya and Thyagarajan (2020) recorded negative growth rate in the area of pepper and production of turmeric during 2010-11 to 2019-20 period.

Table 1: Compound Growth Rates in Area, Production, Productivity of Coriander in Rajasthan

Period	Area	Production	Productivity
Period I	0.32**	-0.12	-0.43
Period II	-5.71	-5.61	0.11
Overall Period	0.81**	1.05**	0.23

**-Significant at 1 per cent.

2. Cumin

During the first period (1998-99 to 2007-08), cumin showed a negative growth rate of -0.59 per cent in terms of area, -2.94 per cent in terms of production and -2.35 per cent in terms of productivity which might be due to the incidence of diseases and pest attack (cumin wilt, blight, and powdery mildew) as reported by Farooqi *et al.* (2005). Also, cultivation of cumin on the marginal lands with low fertility might be another reason. During the second period (2008-09 to 2017-18), cumin showed a positive growth rate of 12.43 per cent in terms of area, 20.66 per cent in terms of production, and 7.30 per cent in terms of productivity (all were significant). The results revealed that during the overall period (1998-99 to 2017-18), cumin showed a positive and significant growth rate of 6.84 per cent, 9.10 per cent and 2.12 per cent in terms of area, production, and productivity, respectively. Bairwa *et al.* (2020) also recorded significant growth rate in the area, production and productivity of cumin in the Jodhpur district of Rajasthan during 2005-06 to 2018-19 period.

Table 2: Compound Growth Rates in Area, Production, Productivity of Cumin in Rajasthan

Period	Area	Production	Productivity
Period I	-0.59	-2.94	-2.35
Period II	12.43**	20.66**	7.30**
Overall Period	6.84**	9.10**	2.12**

**-Significant at 1 per cent.

3. Fennel

The area-wise growth of fennel for the first period (1998-99 to 2007-08) was 10.84 per cent which was positive and significant also a positive and significant growth (17.56 per cent) was observed in production of fennel. The growth rate in productivity of fennel was 6.06 per cent which was significant. The tremendous growth rate in the production might be due to expansion in the area as well as increased productivity. As per the results, fennel showed positive and significant growth in all aspects, during the second period (2008-09 to 2017-18). It showed a growth rate of 10.87 per cent in the area, 14.29 per cent in the production, and a growth of 3.09 per cent in terms of productivity. During the overall period (1998-99 to 2017-18), fennel followed a trend of positive and significant growth. The area of fennel showed a growth rate of 12.50 per cent while production showed a growth rate of 17.19 per cent. The growth in productivity of fennel was 4.16 per cent during this period. The high growth in the production was mainly due to positive growth in the area and yield. Soumya *et al.* (2014) also recorded significant growth rate in the area, production and productivity of pepper in Karnataka state during 2001-2010 period.

Table 3: Compound Growth Rates in Area, Production, Productivity of Fennel in Rajasthan

Period	Area	Production	Productivity
Period I	10.84**	17.56**	6.06**
Period II	10.87**	14.29**	3.09**
Overall Period	12.50**	17.19**	4.16**

**-Significant at 1 per cent.

4. Fenugreek

During the first period (1998-99 to 2007-08), the fenugreek showed a positive and significant growth rate of 1.52 per cent in terms of area while production showed a growth rate of 0.56 per cent which was positive and significant at 1 per cent level of significance. Fenugreek showed a negative growth of -0.95 per cent in the productivity. The prime reason might be lack of proper production technology. While, the lower growth in the production was attributed by reduction in the area of fenugreek due to higher price of competing crop i.e. Linseed. During the second period (2008-09

to 2017-18), area-wise growth was 5.82 per cent which was positive and significant. The production showed positive and significant growth of 7.40 per cent. The growth in terms of productivity was 1.48 per cent which was also positive and significant. The expansion in the area and increased productivity was the main reason behind high growth in the production. The results revealed that during the overall period (1998-99 to 2017-18), the area showed a positive and significant growth rate of 5.70 per cent while the growth in production was 5.99 per cent. Productivity showed a growth of 0.27 per cent during the overall period. Kumawat (2014) also recorded a significant growth rate in the area and production of fenugreek in the Sikar district of Rajasthan during the 1985-86 to 2012-13 period.

Table 4: Compound Growth Rates in Area, Production, Productivity of Fenugreek in Rajasthan

Period	Area	Production	Productivity
Period I	1.52**	0.56**	-0.95
Period II	5.82**	7.40**	1.48**
Overall Period	5.70**	5.99**	0.27

**-Significant at 1 per cent.

Instability in the area, production, productivity of seed spices from Rajasthan

The seed spices were classified based on the percentage of variation they exhibited as follows:

Instability	Low	Moderately High	High
Percentage	<15%	15-30 %	≥ 30%

1. Coriander

The coriander showed moderate to high variation. During the overall period (1999-2018), the Cuddy-Della- Valle index in terms of the area was 26.72 per cent. The results showed that instability in the area of coriander was more and less similar during all the periods. The highest instability in terms of production of the coriander was during the first period (1998-99 to 2007-08) i.e. 30.31 per cent. The instability in productivity was highest in second period (2008-09 to 2017-18) i.e. 22.85 per cent. Soumya *et al.* (2014) also recorded similar instability in the area, production, and productivity of coriander in India during the 2001-2010 period.

Table 5: Measure of Instability in Area, Production, Productivity of Coriander in Rajasthan (In Per cent)

Crops	Period I	Period II	Overall Period
Area	26.89	20.07	26.72
Production	30.31	22.35	30.31
Productivity	12.93	22.85	18.39

2. Cumin

The instability in the cumin in terms of the area was higher during the first period (1998-99 to 2007-08) compared to other two periods. The Cuddy-Della-Valle index during the first period was 40.11 per cent. During the overall period (1998-99 to 2017-18), instability in terms of production was 49.32 per cent. But, highest instability in production of cumin was observed in first period which was 50.65 per cent. The cumin showed higher instability in the productivity as compared to other seed spices. During 1997-98 to 2007-08, the instability in productivity was 31.63 per cent which was highest compared to other periods. Bairwa *et al.* (2020) recorded instability in the area, production and productivity of cumin in the Jodhpur district of Rajasthan during 1991-92 to 2004-05 period.

Table 6: Measure of Instability in Area, Production, Productivity of Cumin in Rajasthan (In Per cent)

Crops	Period I	Period II	Overall Period
Area	40.11	15.96	30.83
Production	50.65	26.58	49.32
Productivity	31.63	22.92	30.07

3. Fennel

Fennel showed highest variation during the overall period (1998-99 to 2017-18), the instability in area during this period was 73.14 per cent.

Table 7: Measure of Instability in Area, Production, Productivity of Fennel in Rajasthan (In Per cent)

Crops	Period I	Period II	Overall Period
Area	44.02	65.45	73.14
Production	40.55	89.67	107.84
Productivity	17.45	20.68	19.67

The production instability in this period was 107.84 per cent while the variation in productivity was low during the same period which was 19.67 per cent. The highest instability in productivity was

observed during second period which was 20.68 per cent. Priya and Thyagarajan (2020) recorded similar instability in the area of ginger during 2010-11 to 2019-20 period.

4. Fenugreek

Fenugreek showed highest variation during the first period (1998-99 to 2007-08). The highest variation in area of fenugreek was observed during this period which was 50.54 per cent. The instability in the area might be due to aberrant weather conditions and greater competition from crops like linseed. The instability in the production was also highest during this period. The CDVI had shown variation of 51.90 per cent. The variation in productivity of fenugreek was lowest in the second period (2008-09 to 2017-18). The Cuddy-Della-Valle index was 9.33 per cent. The lower instability in the productivity was mainly due to consistent higher productivity because of good quality seeds and improved package of practices. Kumawat (2014) also recorded similar instability in the area, production, and productivity of fenugreek in the Chittorgarh district of Rajasthan during the 1985-86 to 2012-13 period.

Table 8: Measure of Instability in Area, Production, Productivity of Fenugreek in Rajasthan (In Per cent)

Crops	Period I	Period II	Overall Period
Area	50.54	34.15	41.14
Production	51.90	36.65	44.58
Productivity	13.38	9.33	11.86

CONCLUSION

The coriander showed a lower growth rate during the overall period, this might be due to the fact that the coriander has reached its potential yield capacity in the state of Rajasthan. Most of the seed spices showed high instability in area, production, and productivity during the study period. The reason might be that mostly seed spices cultivation is dependent upon the domestic prices of crop which was lower in the initial investigation period. Also, aberrant weather conditions, cultivation of crops on the marginal lands, and high occurrence of the diseases in the first period (1999 to 2008) whereas tremendous growth due to better quality seeds and production technology in the second period (2009 to 2018) could be the cause of variation.

The farmers must be acquainted with the latest varieties and improved package of practices of seed spices from Agricultural Research Stations of the State Agricultural Universities and NRCSS, Ajmer to improve the productivity of seed spices.

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Area, Production and Productivity of Coriander, Cumin, Fennel, and Fenugreek in Rajasthan from 1998-99 to 2017-18

Year	Coriander			Cumin			Fennel			Fenugreek		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1998-99	198.20	179.60	906.00	147.70	56.15	380.00	2.23	1.14	513.00	35.20	35.50	1008.00
1999-00	124.20	127.80	1029.00	138.70	35.40	255.00	5.16	2.63	511.00	29.80	32.20	1082.00
2000-01	145.10	166.30	1145.00	199.80	76.76	384.00	6.24	3.19	510.00	29.70	45.70	1541.00
2001-02	204.70	234.00	1143.00	381.50	45.11	380.00	9.54	7.07	741.00	107.90	127.80	1185.00
2002-03	112.30	122.70	1092.00	321.20	70.48	219.00	4.14	2.05	496.00	43.90	56.20	1281.00
2003-04	241.40	300.10	1243.00	227.10	120.60	531.00	6.36	4.59	721.00	56.80	64.10	1128.00
2004-05	148.40	169.80	1144.00	159.54	69.09	433.00	4.89	4.22	865.00	43.78	52.90	1209.00
2005-06	136.80	142.40	1041.00	135.11	52.24	387.00	3.90	3.66	939.00	27.80	29.90	1075.00
2006-07	131.10	155.10	1183.00	149.82	23.67	158.00	9.10	7.63	839.00	40.50	47.20	1166.00
2007-08	212.80	166.12	780.00	215.47	66.36	308.00	14.63	9.73	666.00	49.80	48.91	982.00
2008-09	245.09	273.69	1116.00	169.14	42.72	253.00	7.50	6.25	833.00	62.90	77.30	1229.00
2009-10	232.14	281.23	1211.00	203.85	80.53	395.00	8.75	5.60	640.00	58.90	70.30	1193.00
2010-11	197.89	218.90	1106.00	330.63	114.90	348.00	27.01	26.16	970.00	80.40	94.20	1172.00
2011-12	268.02	329.64	1230.00	468.00	177.80	380.00	59.12	85.19	1441.00	82.35	87.38	1061.00
2012-13	158.68	231.92	1462.00	495.69	176.35	356.00	14.80	14.98	1012.00	65.51	71.52	1092.00
2013-14	182.88	117.18	641.00	488.32	233.80	479.00	15.16	14.28	942.00	55.40	64.10	1157.00
2014-15	249.30	198.80	797.00	434.80	120.80	278.00	15.56	13.85	890.00	81.70	84.20	1030.00
2015-16	212.73	227.20	1068.00	511.08	200.85	393.00	27.59	30.72	1113.00	157.00	190.36	1212.00
2016-17	181.71	220.16	1211.00	500.14	337.01	674.00	45.19	56.23	1244.00	129.71	178.66	1377.00
2017-18	97.80	143.78	1470.00	581.36	354.67	610.00	21.32	20.27	951.00	67.66	95.96	1418.00

Note: A = Area ('000 ha), P=Production ('000 tonnes) and Y = Yield (kg/ha)

