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## State wise performance of jowar in India

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**Abstract**

The present study “Statewise performance of Jowar in India” was undertaken to examine the growth pattern of area, production, productivity and cost of cultivation. The data were collected on area, production, productivity and cost of cultivation of jowar grown in India pertaining to the period from 2001-02 to 2020-21 (20 years) was spilt into sub-periods i.e. period I 2001-02 to 2010-11 and period II: 2011-12 to 2020-21 and Overall: 2001-02 to 2020-21. The state wise analysis was carried out for the period I, period II and overall. The results showed that, during period I, all jowar-growing states, except Tamil Nadu and Rajasthan, experienced negative compound growth rates in area. In period II, all states showed negative growth rates, and except for Tamil Nadu, all states remained negative throughout the overall period. At overall level the compound growth rate of area of jowar was highest in Tamil Nadu. The compound growth rate of production and productivity was highest in Rajasthan. The compound growth rate of cost of cultivation was positive for all the jowar growing states. The highest coefficient of variation for area, production and productivity was observed in Maharashtra, Tamil Nadu and Rajasthan respectively. Meanwhile, Tamil Nadu recorded the highest values for Cost A<sub>1</sub>, Cost B<sub>2</sub> and cost of production. Rajasthan exhibited the highest coefficient of variation for Cost C<sub>2</sub>. The highest Cuddy Della Valle instability index for area was observed in Karnataka, production and productivity was observed in Rajasthan. Whereas, cost of cultivation of jowar includes Cost A<sub>1</sub>, Cost B<sub>2</sub> and Cost C<sub>2</sub> was highest in Rajasthan. The highest CDVI of cost of production was recorded by Tamil Nadu.

**Keywords:** Compound growth, instability, coefficient of variation, Cuddy Della Valle instability index

**Introduction**

Indian agriculture is dominated by the cultivation of food grains which occupy 76 per cent of the total cropped area and account for 80 per cent of the total agricultural production of the country. These cereals include rice, wheat, millet, gram, maize and pulses which are grown to meet the food requirements of India's vast population. Millets are generally cultivated in low-fertile land, tribal and rain-fed areas. These areas include Andhra Pradesh, Gujarat, Chhattisgarh, Haryana, Rajasthan, Maharashtra, Madhya Pradesh, Karnataka, Tamil Nadu, Uttar Pradesh and Telangana. Millets are often referred as coarse cereals and also nutria-cereals because of nutrient richness of grains. India is the leading producer of millets followed by Africa. Although millets take up relatively a lower position among food crops in Indian agriculture, they are important from food security point of view at farm and regional level. Millets are possibly the first cereals to be used for domestic purposes. They are one of the oldest foods known to human. Millets are small seeded grasses that are hardy and grow well in dry zones with limited soil fertility and moisture. Millets are unique because of their short growing period. Millets are easy to digest because of their non-glutinous and non-acid forming characters. They are better than polished rice because they release less amount of glucose over longer time period. Major millets grown in India are jowar, Bajra, Ragi, Banyard millet, Proso millet, Foxtail millet and Kodo millet. Jowar is called as great millet due to its grain size among the millets.

The Jowar (*Sorghum bicolor* L.) belongs to family Gramineae. It is the fifth most important cereal crop followed by Rice, Wheat, Maize and Barley in the world. It is often referred as 'Coarse Grain'. It is commonly known as the great millet, due to large size of grains among the millets. It is one of the main staple foods for the world's poor people in dry parts of tropical Africa, India and China because of its drought resistant nature. Though it is traditional subsistence crop but now changes its role from traditional to commercial crop.

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The demand for jowar as feed purpose is the main driving force in rising the global production and international trade.

In world, jowar is being cultivated over an area of about 44 million hectares with production of about 64 million tonnes. India ranks first in acreage, but second in production, USA being largest producer in the world. In regard to average yield Argentina rank first (4375 kg per hectare) followed by USA (4370 kg per hectare) during the year 2020-21. Jowar occupies pride place in Indian economy, as India is the biggest producer in world, but it can't be neglected that per hector yield of this crop is very low. It occupies 34 per cent of total jowar area in world and produces around 17 per cent of world's production of jowar per annum. In India, area under jowar during 2020-21 was 2735.62 (000 Ha) with annual production 28225.73(000 tonnes) and 1033 kg/ha productivity. Jowar is the fourth most important crop cultivated in both Kharif and Rabi seasons in India. The major jowar producing states are Maharashtra, Karnataka, Rajasthan, Tamil Nadu, Madhya Pradesh and Andhra Pradesh.

**Materials and Methods**

This study was conducted on secondary data (Indiaagristat.com) from 2001-02 to 2020-21 (20 years) comprises of three periods that is Period-I: 2001-02 to 2010-11, Period II: 2011-12 to 2020-21 and Overall: 2001-02 to 2020-21. The growth rate was examined using compound growth rate functions, and the instability was assessed using the coefficient of variation and the Cuddy Della Valle index.

**Growth rate analysis**

The state wise compound growth rates of area, production, productivity and cost of cultivation were estimated by using following exponential model.

$$Y = a.b^t$$

$$\text{Log } Y = \text{log } a + t \text{ log } b$$

Where,  
 Y = Area / Production / Productivity / Cost of cultivation  
 t = Time Variable  
 b = Regression coefficient  
 a= Intercept

Then the per cent compound growth rates ‘r’ will be computed by using the following formula  
 CGR (r) = [Antilog (log b) - 1] × 100

Where,  
 r = Compound growth rate.

**Instability analysis**

The degree of instability in area, production, productivity and cost of cultivation of jowar was measured by using coefficient of variation (CV %) and Cuddy Della Valle’s instability index (CDVI).

**Coefficient of variation (CV)**

Degree of instability in area, production, productivity and cost of cultivation of jowar were estimated by using coefficient of variation.

$$\text{Coefficient of variation (CV)} = \frac{\sigma}{\bar{X}} \times 100$$

Where,

$\sigma$  = S = Standard deviation

$$S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$\bar{X}$ = Arithmetic means.  
 X = Variable  
 n = Number of observations

**Cuddy Della Valle’s Instability Index (CDVI)**

It was used to measure instability of jowar which is close to approximation of the average year to year percent variation adjusted for trend. The algebraic form of it was

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

Where,  
 CV = Simple estimates of coefficient of variation in per cent and  
 R<sup>2</sup> = Coefficient of determination from a time trend regression adjusted by the number of degree of freedom.

**Results and Discussion**

**Growth rate in area of Jowar**

The compound growth of area under Jowar cultivation in Period-I, Period-II, and overall period has been estimated and presented in Table 1. The growth rates of different states during period I, Maharashtra and Karnataka experienced negative growth rates of -2.37 per cent and -4.01 per cent respectively. On the other hand, Tamil Nadu displayed the highest positive growth rate of 8.17 per cent, followed by Rajasthan with 1.63 per cent. During period II, all states experienced a decline in area growth rate. Maharashtra and Karnataka showed significant negative growth rates of -6.18 per cent and -4.54 per cent respectively. Similarly, Tamil Nadu displayed a negative growth rate of -4.37 per cent and Rajasthan had a slight decline of -0.65 per cent.

**Table 1:** State-wise growth rates of area of Jowar in India (Per cent)

Sr. No.	Name of States	Period I	Period II	Overall
1	Maharashtra	-2.37	-6.18	-4.93
2	Karnataka	-4.01	-4.54	-4.03
3	Rajasthan	1.63	-0.65	-0.35
4	Tamil Nadu	8.17	-4.37	0.89***
	India	-2.07	-4.13**	-3.46

**Note:** \*\*\*Significant at 1% level, \*\* Significant at 5% level

The overall 20-year analysis reveals that the compound growth rate of the area was negative in all states, except Tamil Nadu, which showed a positive growth rate of 0.89 per cent and significant at 1 per cent level. Notably, Maharashtra, Karnataka, and Rajasthan recorded the highest negative growth rate of -4.93 per cent, -4.03 per cent and -0.35 per cent respectively. In case of whole country, the growth rates in India exhibited a negative trend in terms of area. In both periods I and II, as well as overall, the growth rates showed a decline of -2.07 per cent, -4.13 per cent, and -3.46 per annum, respectively. Period II had significantly negative compound growth rates at 5 per cent. This indicates a decrease in the agricultural land area over time.

**Growth rate in production of Jowar**

The production analysis of the Jowar is given in Table 2. During period I, the growth rate of production was highest in

Maharashtra at 9.70 per cent, followed by Karnataka at 7.12 per cent and Rajasthan at 5.50 per cent. On the other hand, Tamil Nadu exhibited a negative growth rate of -0.68 per cent in production. Furthermore, the states of Maharashtra and Karnataka demonstrated statistically significant positive growth rates at 5 per cent.

During period II, Tamil Nadu exhibited the highest growth rate in production at 7.09 per cent and statistically significant positive growth rates at 5 per cent, followed by Rajasthan at 2.25 per cent. Conversely, Maharashtra and Karnataka experienced negative growth rates with -1.18 per cent and -3.64 per cent, respectively.

In terms of overall period analysis, Rajasthan had the highest compound growth rate of production at 4.73 per cent, followed by Tamil Nadu with a positive growth rate of 3.66 per cent and statistically significant at 1 per cent. However, Karnataka and Maharashtra experienced negative growth rates of -0.82 per cent and -2.78 per cent respectively.

**Table 2:** State-wise growth rates of production of Jowar in India (Per cent)

Sr. No.	Name of States	Period I	Period II	Overall
1	Maharashtra	9.70**	-1.18	-2.78
2	Karnataka	7.12**	-3.64	-0.82
3	Rajasthan	5.50**	2.25	4.73
4	Tamil Nadu	-0.68	7.09**	3.66***
	India	4.64	-0.94**	-1.23

**Note:** \*\*\*Significant at 1% level, \*\*Significant at 5% level

When considering the growth rate of jowar production across the entire country, period I showed a positive growth rate of 4.64 per cent. However, in period II and overall, the growth rates were negative at -0.94 per cent and -1.23 per cent per annum, respectively. Period II had a statistically significant at 5 per cent level.

**Growth rate in productivity of Jowar**

The productivity analysis of the Jowar is given in Table 3. During period I, Karnataka had the highest growth rate of productivity for jowar, which were 9.89 per cent and statistically significant at 1 per cent. Maharashtra followed with a growth rate of 7.35 per cent, and Tamil Nadu had a growth rate of 3.67 per cent which was significant at 5 per cent level. Rajasthan exhibited a non-significant growth rate of 3.77 per cent per annum. During period II, all major four jowar growing states shows the non-significant growth rate of productivity in which Karnataka experienced a negative growth rate of -0.38 per cent, while Tamil Nadu had the lowest growth rate at -1.00 per cent.

At overall period, Rajasthan exhibited the highest compound growth rate of productivity at 5.09 per cent. Following closely behind were Karnataka with a growth rate of 2.76 per cent. These two states displayed statistically significant positive growth at a 5 per cent confidence level. In case of whole country the growth rates were positive in both the periods as well as in overall. In period I, the growth rate was 6.93 per cent. In period II (3.29%) and overall period (2.31%) these two periods were significant at 1 per cent level.

**Growth rates of cost of cultivation of Jowar**

It is revealed from the Table 4 that, during period I, the growth rate of cost of cultivation was positive in all the states except for Tamil Nadu i.e. Cost B<sub>2</sub> (-0.22%). The highest growth rate of Cost A<sub>1</sub> and Cost C<sub>2</sub> was found in Maharashtra i.e. 7.76 per cent and 9.01 per cent respectively and they were positively significant at 1 per cent level. The compound growth rate of

Cost B<sub>2</sub> was highest in Karnataka i.e. 8.89 per cent and cost of production was highest in Rajasthan i.e. 9.83 per cent, they were positively significant at 1 per cent level.

**Table 3:** State-wise growth rates of productivity of Jowar in India (Per cent)

Sr. No.	Name of States	Period I	Period II	Overall
1	Maharashtra	7.35**	3.99	1.15
2	Karnataka	9.89***	-0.38	2.76**
3	Rajasthan	3.77	3.04	5.09**
4	Tamil Nadu	3.67**	-1.00**	2.60
	India	6.93	3.29***	2.31***

**Note:** \*\*\*Significant at 1% level, \*\* Significant at 5% level.

During period II, the compound growth rate of cost of cultivation was positive in all the states. The highest growth rate of Cost A<sub>1</sub>, B<sub>2</sub>, C<sub>2</sub> and cost of production was highest in Rajasthan i.e. 20.23 per cent, 17.98 per cent, 19.71 per cent and 15.06 per cent respectively and they were positively significant at 1 per cent level except Cost C<sub>2</sub>.

Whereas, at the overall period, the compound growth rate of cost of cultivation was positive for all the states. The highest growth rate of Cost A<sub>1</sub> was showed by Rajasthan i.e. 11.05 per cent and significant at 1 per cent level. The highest compound growth rate of Cost B<sub>2</sub>, Cost C<sub>2</sub> and cost of production was observed in Tamil Nadu i.e. 10.79 per cent, 11.40 per cent and 11.60 per cent respectively and they were positively significant at 1 per cent level. The estimated compound growth rates were found to be positive for remaining states found to be satisfactory.

**Table 4:** State-wise growth rates of cost of cultivation of Jowar in India

Sr. No.	Particulars	Period I	Period II	Overall
1	<b>Maharashtra</b>			
	Cost A <sub>1</sub>	7.76***	4.93***	8.78***
	Cost B <sub>2</sub>	8.76***	3.58***	7.52***
	Cost C <sub>2</sub>	9.01***	4.96***	8.73***
	Cost of production	9.36***	5.77***	10.58**
2	<b>Karnataka</b>			
	Cost A <sub>1</sub>	7.75***	6.29***	9.88***
	Cost B <sub>2</sub>	8.89***	6.15***	10.72***
	Cost C <sub>2</sub>	8.49***	7.53***	11.05***
	Cost of production	5.48	4.46	7.06***
3	<b>Rajasthan</b>			
	Cost A <sub>1</sub>	5.31***	20.23***	11.05***
	Cost B <sub>2</sub>	3.19	17.98***	9.55***
	Cost C <sub>2</sub>	4.90	19.71	10.83***
	Cost of production	9.83***	15.06***	11.29***
4	<b>Tamil Nadu</b>			
	Cost A <sub>1</sub>	7.75***	11.89***	9.97***
	Cost B <sub>2</sub>	-0.22	13.27***	10.79***
	Cost C <sub>2</sub>	0.70**	13.76	11.40***
	Cost of production	5.92	14.06***	11.60***

**Note:** \*\*\*Significant at 1% level, \*\* Significant at 5% level.

Hence it is concluded that, the decline in area under cultivation and production may lead to a decrease in the supply of jowar, which could lead to higher prices. The increase in productivity may help to offset the decline in area under cultivation and production. However, the increase in the cost of cultivation may make it more difficult for farmers to produce jowar profitably. The results obtained are in close agreement with the findings of Charulya *et al.* (2011) he revealed that, highest negative growth rate in area was observed in Gujarat and productivity growth rates were positive among the states.



**Instability of area of Jowar**

It is seen from Table 5 that, during period I, the coefficient of variation as well as Cuddy Della Valle instability index of area was highest in Tamil Nadu i.e.17.58 and 10.75% respectively, followed by Rajasthan i.e. 12.81 per cent and 10.28 per cent respectively. The lowest Cuddy Della Valle instability index was observed in Karnataka (3.15%). Maharashtra showed CV and CDVI was 8.29 and 3.81 per cent respectively. India, as a whole, recorded low instability in the area under cultivation, with a coefficient of variation (CV) of 7.00 per cent and a Cuddy Della Valle instability index (CDVI) of 3.42 per cent.

**Table 5:** State-wise area instability indices of Jowar in India (Per cent)

Sr. No.	States	Particular	Period I	Period II	Overall
1	Maharashtra	CV	8.29	22.10	28.79
		CDVI	3.81	13.64	11.02
2	Karnataka	CV	11.42	15.31	24.24
		CDVI	3.15	6.98	24.46
3	Rajasthan	CV	12.81	8.97	10.58
		CDVI	10.28	8.76	10.37
4	Tamil Nadu	CV	17.58	25.94	22.35
		CDVI	10.75	15.14	21.80
	India	CV	7.00	16.11	20.95
		CDVI	3.42	10.85	8.27

During period II, the CV of area and CDVI highest in Tamil Nadu i.e. 25.94 and 15.14 per cent respectively followed by Maharashtra i.e. 22.10 per cent and 13.64 per cent respectively, whereas the lowest Cuddy Della Valle instability index was observed in Karnataka (6.98%). Rajasthan had a CV (8.97%) and CDVI (8.76%). Considering India as a whole, the low instability was observed in area i.e. 16.11 per cent (CV) and 10.85 per cent (CDVI).

At the overall period, the coefficient of variation for area under jowar cultivation was observed highest in Maharashtra (28.79%) whereas, the lowest coefficient of variation and Cuddy Della Valle instability index was observed in Rajasthan i.e. 10.58 and 10.37 per cent respectively. The highest Cuddy Della Valle instability index was observed in Karnataka i.e. 24.46 per cent. Considering India as a whole, the low instability was observed in area i.e. 20.95 per cent (CV) and 8.27 per cent (CDVI).

**Instability of production of Jowar**

It could be seen from Table 6 that, during period I, The highest coefficient of variation as well as Cuddy Della Valle instability index was observed in Rajasthan i.e. 52.47 per cent and 51.85 per cent respectively. The lowest coefficient of variation as well as Cuddy Della Valle instability index of production was observed in Tamil Nadu i.e. 10.76 and 10.56 per cent respectively. As a whole country, India recorded moderate instability in production i.e. 19.77 per cent (CV) and 16.02 per cent (CDVI).

During period II, the coefficient of variation as well as Cuddy Della Valle instability index of production was observed highest in Tamil Nadu i.e. 36.29 per cent and 35.75 per cent respectively and lowest in Karnataka i.e. 16.85 per cent and 12.48 per cent respectively. Considering India as a whole, the moderate instability was observed in production i.e. 21.68 per cent (CV) and 20.58 per cent (CDVI). At the overall period, the coefficient of variation as well as Cuddy Della Valle instability index of jowar production was observed lowest in Karnataka i.e. 21.11 per cent and 20.60 per cent respectively. The highest coefficient of variation was observed in Tamil Nadu (38.63%). The highest Cuddy Della Valle instability index was observed

in Rajasthan (33.30%). Considering India as a whole, the moderate instability was observed in production i.e. 21.68 per cent (CV) and 20.58 per cent (CDVI).

**Table 6:** State-wise production instability indices of Jowar in India (Per cent)

Sr. No.	States	Particular	Period I	Period II	Overall
1	Maharashtra	CV	26.08	30.69	35.02
		CDVI	18.39	30.60	32.61
2	Karnataka	CV	22.40	16.85	21.11
		CDVI	16.32	12.48	20.60
3	Rajasthan	CV	52.47	20.80	38.46
		CDVI	51.85	19.64	33.30
4	Tamil Nadu	CV	10.76	36.29	38.63
		CDVI	10.56	35.75	32.07
	India	CV	19.77	16.07	21.68
		CDVI	16.02	15.86	20.58

**Instability of productivity of Jowar**

It could be seen from Table 7 that, during period I, the coefficient of variation as well as Cuddy Della Valle instability index of productivity was highest in Rajasthan i.e. 46.48 and 45.74 per cent respectively. The lowest coefficient of as well as Cuddy Della Valle instability index was observed in Tamil Nadu i.e. 16.27 per cent and 12.37 per cent respectively. As a whole country, India recorded moderate instability in productivity i.e. 23.69 per cent (CV) and 15.64 per cent (CDVI).

**Table 7:** State-wise productivity instability indices of Jowar in India (Per cent)

Sr. No.	States	Particular	Period I	Period II	Overall
1	Maharashtra	CV	25.67	25.84	25.79
		CDVI	18.78	23.59	25.10
2	Karnataka	CV	31.62	13.55	23.92
		CDVI	20.27	13.51	19.92
3	Rajasthan	CV	46.48	21.58	37.73
		CDVI	45.74	21.44	37.32
4	Tamil Nadu	CV	16.27	23.24	26.28
		CDVI	12.37	23.10	26.13
	India	CV	23.69	17.38	20.85
		CDVI	15.64	14.21	16.95

During period II, the coefficient of variation as well as Cuddy Della Valle instability index of productivity was observed highest in Maharashtra i.e. 25.84 per cent and 23.59 per cent respectively and lowest in Karnataka i.e. 13.55 per cent and 13.51 per cent respectively. Considering India as a whole, the moderate instability was observed in production i.e. 17.38 per cent (CV) and 14.21 per cent (CDVI). At the overall period, the highest coefficient of variation as well as Cuddy Della Valle instability index was observed in Rajasthan i.e. 37.73 per cent and 37.32 per cent respectively and lowest observed in Karnataka i.e. 23.92 per cent and 19.92 per cent respectively. India as a whole, the moderate instability was observed in productivity i.e. 20.85 per cent (CV) and 16.95 per cent (CDVI).

**Instability indices of cost of cultivation of Jowar**

It could be seen from Table 8 that, state wise coefficient of variation and Cuddy Della Valle instability index of Cost A<sub>1</sub> of jowar in India was estimated and presented. During period I, the coefficient of variation was highest in Tamil Nadu (28.45%) and lowest in Rajasthan (23.85%). The highest Cuddy Della Valle instability index was observed in Rajasthan (15.81%) and lowest in Maharashtra (13.36%). In period II,

Rajasthan had the highest coefficient of variation (CV) of Cost A<sub>1</sub> (49.46%) and Cuddy Della Valle instability index (CDVI) (21.50%), while Maharashtra had the lowest CV (18.86%) and CDVI (12.45%) of Cost A<sub>1</sub>. At the overall period, the coefficient of variation as well as Cuddy Della Valle instability index of Cost A<sub>1</sub> was observed highest in Rajasthan i.e. 73.98 per cent and 31.11 per cent respectively. The lowest coefficient of variation as well as Cuddy Della Valle instability index was observed in Maharashtra i.e. 48.19 per cent and 14.23 per cent respectively.

State wise coefficient of variation and Cuddy Della Valle Instability Index of Cost B<sub>2</sub> of jowar in India was estimated and presented. During period I, the coefficient of variation was highest in Karnataka (31.21%) and lowest in Rajasthan (17.59%). The highest Cuddy Della Valle instability index was observed in Tamil Nadu (18.25%) and lowest in Maharashtra

(13.21%). In period II, Rajasthan had the highest coefficient of variation (44.40%) and Cuddy Della Valle instability index (CDVI) of Cost B<sub>2</sub> highest in Maharashtra (27.66%), while Karnataka had the lowest CV of Cost B<sub>1</sub> (23.52%) and CDVI in Tamil Nadu (12.13%). At overall period, the coefficient of variation was highest in Tamil Nadu (68.90%) and lowest in Maharashtra (48.48%). The highest Cuddy Della Valle instability index was observed in Rajasthan (31.58%) and lowest in Karnataka (15.51%).

State wise coefficient of variation and Cuddy Della Valle Instability Index of Cost C<sub>2</sub> of jowar in India was estimated and presented Table 8. During period I, the coefficient of variation was highest in Maharashtra (30.73%) and lowest in Tamil Nadu (18.46%). The highest Cuddy Della Valle instability index was observed in Tamil Nadu (18.33%) and lowest in Maharashtra (14.18%).

**Table 8:** State-wise cost of cultivation instability indices of Jowar in India (Per cent)

Sr. No.	Particulars	Period I	Period II	Overall	
<b>1</b>	<b>Maharashtra</b>				
	Cost A	CV	26.51	18.86	48.19
		CDVI	13.36	12.45	14.23
	Cost B	CV	29.41	29.42	48.48
		CDVI	13.21	27.66	23.29
	Cost C	CV	30.73	24.44	49.99
		CDVI	14.18	19.09	16.60
	Cost of production	CV	34.05	21.95	56.45
		CDVI	14.36	21.69	15.38
	<b>2</b>	<b>Karnataka</b>			
Cost A		CV	28.45	23.24	54.51
		CDVI	15.51	13.92	15.35
Cost B		CV	31.21	23.52	57.64
		CDVI	14.80	14.07	15.51
Cost C		CV	30.19	25.90	59.88
		CDVI	14.22	12.91	14.75
Cost of production		CV	30.07	19.40	45.03
		CDVI	24.20	14.64	19.04
<b>3</b>		<b>Rajasthan</b>			
	Cost A	CV	23.85	49.46	73.98
		CDVI	15.81	21.50	31.11
	Cost B	CV	17.59	44.40	65.66
		CDVI	14.45	22.03	31.58
	Cost C	CV	21.83	47.46	71.90
		CDVI	15.47	20.53	30.68
	Cost of production	CV	31.42	42.92	67.97
		CDVI	12.12	6.60	12.99
	<b>4</b>	<b>Tamil Nadu</b>			
Cost A		CV	28.45	35.79	62.71
		CDVI	15.51	13.16	21.08
Cost B		CV	18.27	37.91	68.90
		CDVI	18.25	12.13	28.76
Cost C		CV	18.46	39.01	71.32
		CDVI	18.33	12.31	27.69
Cost of production		CV	30.44	41.92	71.17
		CDVI	24.60	18.69	25.36

In period II, Rajasthan had the highest coefficient of variation (CV) of Cost C<sub>2</sub> (47.46%) and Cuddy Della Valle instability index (20.53%), while Maharashtra had the lowest CV of Cost C<sub>2</sub> (24.44%) and CDVI in Tamil Nadu (12.31%). At overall period, the coefficient of variation was highest in Tamil Nadu (71.32%) and lowest in Maharashtra (49.99%). The highest Cuddy Della Valle instability index was observed in Rajasthan (30.68%) and lowest in Karnataka (14.75%).

State wise coefficient of variation and Cuddy Della Valle instability index of cost of production of jowar in India was estimated and presented Table 4.9. During period I, the

coefficient of variation was highest in Maharashtra (34.05%) and lowest in Karnataka (30.07%). The highest Cuddy Della Valle instability index was observed in Tamil Nadu (24.60%) and lowest in Rajasthan (12.12%). In period II, Rajasthan had the highest coefficient of variation (CV) of cost of cultivation (42.92%) and lowest in Karnataka (19.40%). The highest Cuddy Della Valle instability index was observed in Maharashtra (21.69%) and lowest in Rajasthan (6.60%). At overall period, the coefficient of variation was highest in Tamil Nadu (71.32%) and lowest in Maharashtra (49.99%). At overall period, Tamil Nadu had the highest coefficient of

variation (CV) of cost of production (71.17%) and Cuddy Della Valle instability index (25.36%).

Based on the outcomes of this study, it can be concluded that, the data shows that the cost of cultivation of jowar has increased significantly in recent years. The cost of cultivation has increased in all states over the three periods. The increase in the cost of cultivation is likely due to a multitude of factors, including heightened prices of inputs, decreasing farm sizes, and inclement weather conditions.

### Conclusion and Policy Implications

The result of the study leads to conclude that, at overall level the compound growth rate of area of jowar was highest in Tamil Nadu (0.89%) and production and productivity were highest in Rajasthan (5.09% & 4.73% respectively). The compound growth rate of Cost  $A_1$  was highest in Rajasthan i.e. 11.05 per cent. Tamil Nadu recorded the highest growth rate of Cost  $B_2$  (10.79%), Cost  $C_2$  (11.40%) and cost of production (11.60%). The highest coefficient of variation for area, production, and productivity were observed in Maharashtra (28.79%), Tamil Nadu (38.63%), and Rajasthan (37.73%), respectively. Meanwhile, Tamil Nadu recorded the highest values for Cost  $A_1$  (62.71%), Cost  $B_2$  (68.90%) and cost of production (71.17%). Rajasthan exhibited the highest coefficient of variation for Cost  $C_2$  (71.90%). The highest Cuddy Della Valle instability index for area was observed in Karnataka (24.46%), while for production and productivity was observed in Rajasthan (33.30% and 37.73% respectively). Meanwhile, Tamil Nadu had a highest CDVI of Cost  $B_2$  (10.87%). Moreover, Rajasthan recorded the highest CDVI values for Cost  $A_1$  and Cost  $C_2$ , (73.98% and 71.90% respectively). Additionally, Tamil Nadu recorded the highest CDVI of cost of production (25.36%).

The area and production under the crop is declining, and leads to the higher productivity of the crop. This pattern suggests a potential shift towards more efficient and concentrated cultivation practices. Therefore, there is need to concentrate to jowar crop for policy makers and researchers.

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