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Compound growth rate and instability in soybean crop of Marathwada region of Maharashtra

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Abstract
Soybean has an important and valuable place in world's oilseed cultivation scenario, due to its high productivity, profitability and vital contribution towards maintaining soil fertility. The direction and magnitude of growth and instability in area, production and productivity of Soybean was estimated with the help of functional analysis and Cuddy-Della Valle Index. Secondary time series data were used for estimating for the years from 2000-01 to 2019-20. Growth rate and instability were computed for two sub-periods and overall period. The compund growth rate of area was highest for beed (19.84) for period I and osmanabad had area, production and productivty highest for Period I, II and overall periood. Latur had highest productivity for overall period. Hingoli district was consistent in the case of area for period I, II and overall period. In case of Production for period I, II and overall period Hingoli (63.82 per cent), Parbhani (51.87 per cent) and Aurangabad (62.85 per cent), respectively showed a minimum coefficient of variation and were consistent. Parbhani district was consistent in the case of productivity for period I, II and overall period. Parbhani district showed a positive compund growth rate (16.14), (10.40) and (9.41) with minimum instability index (35.04), (41.17) and (44.84), respectively. Developed new varieties of soybean which introduced for commercial usage in India, resulted the replacement of the tradition cropping pattern and improvement in the yield resulted the increase in area and production of districts of Marathwada region of Maharashtra.

Keywords: soybean, production, compound growth rate, Maharashtra, cuddy and Della instability index (CDVI)

Introduction
Origin of soybean's introduction to India probably came from China through the Himalayan mountains many centuries ago and some believe that, it was also brought via Burma by traders from Indonesia. About 85 per cent of the world's soybeans are processed annually into soybean meal and oil. Approximately 98 per cent of the soybean meal is crushed and further processed into animal feed with the balance used to make soy flour and proteins. Brazil was first with 123.0 million metric tonnes followed by United states of America (96.61 million metric tonnes), in 2019-20. Among the states, Madhya Pradesh stood first with 55.16 lakh ha followed by Maharashtra (40.11 lakh ha). In Marathwada region soybean was cultivated on 19.85 lakh hectare with production of 22.33 lakh tonnes and productivity of 1122.5 Kg per hectare in *kharif* season.

Methodology
Districts are the lowest administrative unit at which reliable agricultural data is available in Maharashtra, hence growth and instability in area, production and yield of soybean were analysed at district level. Secondary time series data were used for estimating the above mentioned objectives for the years from 2000-01 to 2019-20. Growth rate and instability were computed for two sub-periods and overall period. Period-I consisted from the year 2000-01 to 2009-10, period-II was from the year 2011-12 to 2019-20 and overall period comprises from the year 2000-01 to 2019-20.

Linear growth rate

Over average $= \dfrac{b}{\overline{X}} \times 100$

Where,
b = Estimate of growth parameter

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x = Arithmetic mean of area /production /yield

Coefficient of variation (CV)
CV is percentage variation in mean whereas, standard deviation considered as total variation in the mean.

$$\text{Coefficient of variation} = \frac{\sigma}{\overline{x}}\ 100$$

Where,
σ = Standard deviation
x̄ = Mean

Cuddy and Della instability index (CDVi)
In recent year at international level, Cuddy-Della Valle Index is used as a measure of variability in time series data analysis.

$$CV_t = CV\sqrt{1 - r^2}$$

Where,
CV = Coefficient of variation
r^2 = Coefficient of determination of trend

Results and Discussion
The magnitude of agricultural development in Marathwada region, would be visualized through the relative changes in Area, Production and Productivity of soybean over a period of time. In this context, compound growth rates and instability had been computed.

Compound growth Performance
The compound growth performance of soybean pertaining to the two and overall period concluded that during the Period-I, the compound growth rate for area was highest for Beed district (19.84). The Osmanabad district was having the highest compound growth rate for area 14.20 and 13.99, respectively and production for period I, II and overall period with 23.78, 17.40 and 15.09, respectively. Productivity was highest osmanabad, Jalna and Latur for two and overall periods, respectively.

Table 1: District-wise compound growth rate for soybean (Percent)

Period	Particulars	Aurangabad	Jalna	Beed	Latur	Osmanabad	Nanded	Parbhani	Hingoli
I	Area	8.04	18.84	19111111 19.84	17.08	19.34	16.84	16.42	12.24
	Production	12.42	21.64	16.83	21.34	23.78	15.84	16.14	12.77
	Productivity	4.39	3.64	-6.56	2.31	4.51	-3.52	-1.36	-1.68
II	Area	6.16	9.71	13.94	6.28	14.20	9.00	8.41	6.58
	Production	6.14	16.39	0.41	0.25	17.40	12.63	10.40	8.89
	Productivity	-1.77	5.25	-5.86	-5.62	-1.98	0.77	0.36	1.51
Overall	Area	8.60	12.18	12.67	9.12	13.99	8.86	10.26	6.29
	Production	5.69	13.44	13.20	9.78	15.09	9.60	9.41	6.77
	Productivity	-2.32	1.36	-0.97	1.47	1.25	-0.89	-1.53	-0.33

Table 2: District-wise Coefficient of variation for soybean (Percent)

Districts	Particulars	Period-I	Period-II	Overall
Aurangabad	Area	16.19	9.15	68.63
	Production	64.86	54.13	62.85
	Productivity	31.89	42.35	40.80
Jalna	Area	17.80	5.09	78.52
	Production	81.58	67.05	103.27
	Productivity	33.50	50.91	41.95
Beed	Area	18.53	18.08	82.68
	Production	83.73	87.29	124.19
	Productivity	42.66	67.93	55.83
Latur	Area	22.04	19.29	57.45
	Production	99.88	53.75	89.39
	Productivity	55.03	51.22	53.55
Osmanabad	Area	14.85	22.13	101.43
	Production	119.30	106.73	151.73
	Productivity	57.49	66.42	61.27
Nanded	Area	14.85	15.32	56.86
	Production	64.82	64.66	82.33
	Productivity	33.61	51.90	41.75
Parbhani	Area	12.17	3.77	65.22
	Production	63.97	51.87	73.72
	Productivity	29.28	41.06	34.93
Hingoli	Area	11.50	2.83	43.38
	Production	63.82	54.15	64.49
	Productivity	31.16	45.08	37.45

Among all the districts of the study area, Hingoli district had a minimum coefficient of variation i.e. 11.50, 2.83 and 43.38 per cent, respectively. This indicated that, Hingoli district was consistent in the case of area for period I, II and overall period. Latur district showed a maximum coefficient of variation i.e. 22.04 per cent for period I and Osmanabad with 22.13 and 101.43 per cent for period II and overall period, respectively were inconsistent compared to the rest of the

districts of the Marathwada region of Maharashtra state. In case of Production for period I, II and overall period Hingoli (63.82 per cent), Parbhani (51.87 per cent) and Aurangabad (62.85 per cent), respectively showed a minimum coefficient of variation and were consistent. Parbhani district had a minimum coefficient of variation i.e. 29.28,41.06 and 34.93 per cent, respectively. This indicated that, Parbhani district was consistent in the case of productivity for period I, II and overall period.

Table 3: District-wise Cuddy and Della Instability Index (CDVi) for Area, Production and Productivity of soybean in Marathwada Region.

Districts	Particulars	Cuddy and Della Instability Index (CDVi)		
		Period-I	Period-II	Overall
Aurangabad	Area	12.74	8.28	42.86
	Production	50.24	50.78	51.82
	Productivity	28.34	42.13	38.27
Jalna	Area	3.56	2.09	20.77
	Production	39.12	44.98	61.09
	Productivity	31.24	48.56	41.10
Beed	Area	3.70	1.27	26.14
	Production	62.66	76.10	92.93
	Productivity	36.69	65.86	55.55
Latur	Area	3.30	3.85	9.95
	Production	70.71	53.74	65.68
	Productivity	54.47	48.32	53.01
Osmanabad	Area	2.52	14.34	52.70
	Production	89.27	93.04	119.47
	Productivity	55.44	66.15	60.96
Nanded	Area	4.92	4.05	13.93
	Production	37.80	52.13	57.03
	Productivity	31.52	51.84	41.54
Parbhani	Area	2.43	1.46	14.58
	Production	35.04	41.17	44.84
	Productivity	28.98	41.04	33.68
Hingoli	Area	6.50	1.32	18.91
	Production	47.76	46.89	49.11
	Productivity	31.16	44.85	37.39

The table 3 revealed that, for period I Parbhani district showed a positive compound growth rate (16.42) with minimum instability index (2.43). In the period II, the Beed district showed a positive compound growth rate (13.94) with minimum instability index (1.27) and Latur district showed a positive compound growth rate (9.12) with minimum instability index (9.95). The instability Cuddy Della Vella instability index in soybean production of Marathwada region in the period I,II and overall period. Parbhani district showed a positive compound growth rate (16.14), (10.40) and (9.41) with minimum instability index (35.04), (41.17) and (44.84), respectively. The instability Cuddy Della instability index in soybean productivity of Marathwada region. Aurangabad district showed a positive compound growth rate (4.39) with minimum instability index (28.34) for period I. For period II and overall period Parbhani district showed a positive and negative compound growth rate of (0.36) and (-1.53) with minimum instability index (41.04) and (33.68), respectively.

Conclusion
The study has concluded that, area under soybean in all districts and states as whole have been increased, during period I, II and overall period. The performance of soybean in area and production was quite satisfactory mainly, due to the area expansion resulting from replacement of area under *Kharif* jower, cotton, mung bean, Tur etc. and little productivity improvement as a result of new varieties development and use throughout country.

References
1. Damodaram T, Hedge DM. Oilseeds Situation: A Statistical Compendium-2000, Directorate of Oilseeds Research, Indian Council of Agricultural Research, Hyderabad, 2000.
2. Datarkar S, Pagire BV, Pokharkar VG, Ashwini Darekar. Regional growth rates ion Area, Production and Productivity of Soybean in Maharashtra state, International journal of Tropical Agriculture. 2016;34(4):1157-1162.
3. Goswami SN, Choudhary AN, Sharma BK. Growth trend of oilseed and pulsed in India. Agricultural Situation in India. 1995;52(4):191-193.
4. Government of Maharashtra (various years), Agricultural Statistical Information of Maharashtra, Part II, Ministry of Agriculture, GOM, Various Issues.
5. Kalamkar SS. Agricultural development and sources of output growth in Maharashtra State. Artha Vijnan. 2003;45(3):297-324.
6. Khare MP. Pulses and Oilseeds Scene in Maharashtra, GIPE Monograph Series 39, Agro- Economic Research Centre, Gokhale Institute of Politics and Economics, Pune, 1994.
7. Khobarkar V, Hazari S, Wagh HJ. Growth performance of soybean on western Vidarbha. Soybean Research. 2015;15(1):57-64.
8. Shende NV, Ganvir BN, Thakare SS. Growth and instability of selected crops in Western Vidarbha. International Research Journal of Agricultural Economics and Statistics. 2011;2(1):19-27.