



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(9): 352-355
© 2021 TPI
www.thepharmajournal.com

Received: 13-07-2021
Accepted: 15-08-2021

NN Jambhulkar
Scientist, Social Sciences
Division, ICAR-National Rice
Research Institute, Cuttack,
Odisha, India

US Panigrahi
Student, Department of
Agricultural Statistics, College of
Agriculture, Odisha University
of Agriculture and Technology,
Bhubaneswar, Odisha, India

J Bisen
Scientist, Social Sciences
Division, ICAR-National Rice
Research Institute, Cuttack,
Odisha, India

B Mondal
Principal Scientist, Social
Sciences Division, ICAR-
National Rice Research
Institute, Cuttack, Odisha, India

SK Mishra
Principal Scientist, Social
Sciences Division, ICAR-
National Rice Research
Institute, Cuttack, Odisha, India

GAK Kumar
Principal Scientist, Social
Sciences Division, ICAR-
National Rice Research
Institute, Cuttack, Odisha, India

Corresponding Author
NN Jambhulkar
Scientist, Social Sciences
Division, ICAR-National Rice
Research Institute, Cuttack,
Odisha, India

Growth rate and instability analysis of rice area, production and yield in Punjab

NN Jambhulkar, US Panigrahi, J Bisen, B Mondal, SK Mishra and GAK Kumar

Abstract

Rice is one of the major *kharif* crop of the Punjab state. The present study was conducted with the objective to study the growth and instability in area, production and yield of rice of different districts of Punjab state. The study was conducted with the help of secondary data of the period 1980-81 to 2017-18 collected from different state and central government sources at various time periods. The data was divided into four different periods and one overall period. The highest growth rate of the state for area and production was observed during period 1980-81 to 1989-90. The lowest growth rate for area and production was found during period 2000-01 to 2009-10 and 2010-11 to 2017-18 respectively. The growth rate of yield was highest during period 2000-01 to 2009-10 whereas lowest during period 1990-91 to 1999-2000. The lowest instability of area for the state was observed during period 2010-11 to 2017-18 and highest during overall period 1980-81 to 2017-18. The highest instability for production and yield was found during period 1980-81 to 1989-90. The lowest instability for production and yield was observed during period 2000-01 to 2009-10 and 1990-91 to 1999-2000 respectively. The instability was highest in all the districts during period 1980-81 to 1989-90 for all three variables area, production and yield of rice.

Keywords: rice, growth rate, instability, area, production, yield

Introduction

Rice is the staple food for about half of the world population and more than two thirds of the Indian population. India ranks first in rice area and second in rice production next to China. In India, rice is grown in about 44 million ha with the production of about 116 million tons of milled rice. Rice cultivation engages the most of the workforce in the economy as the source of livelihood for those people.

For higher growth of agriculture, quantitative assessment of the contribution of different factors of agricultural output growth is important for reorienting the programmes and prioritizing the agricultural development. Various factors affect the growth of agricultural output. Major ones of these factors are area and yield. (Singh, 1981; Cauvey, 1991) ^[1-2]. These major sources of output growth have significance in finalizing programmes of agricultural development and priorities of investment in it (Ranade, 1980; Deosthali and Chandrashekar, 2004) ^[3-4]. Hence, it may be vital to find why the growth rates different from one another, so as to remove the bottlenecks to achieve the fast development of agricultural sector (Sikka and Vaidya, 1985) ^[5].

Punjab is the third largest rice producing state of the country only after West Bengal and Uttar Pradesh. Punjab produces about 12 million tons of rice in about 3 million ha of area. It produces 11% rice in 7% area of the country. Agriculture is the lifeline of state's economy as it provides employment to about two third of total workers of the state. Punjab is the pioneer state for various agricultural technologies and techniques but overall state is still lagging behind in various aspects of growth in production. The instability in area and production is quite common as per various institutes and reports in Punjab. Such fluctuations severely affect the production, and indirectly employment and income distribution are affected which there by hamper the economic growth of Punjab. Several authors attempted to study trend in Punjab. Dhindsa and Sharma (1995) ^[6] studied the growth rates of area, production and yield of different crops in Punjab during the period 1965-66 to 1990-91. Kaur and Grover (2020) ^[7] analyzed trends in area, yield and production of major oilseeds in Punjab for the period 1965-66 to 2017-18. But, district wise growth and instability study of rice crop was not done.

In such a crucial situation, the study of area, production and yield trends of the districts of Punjab is very vital for the state production of rice. The study of instability is also required for area, production and yield of rice to find out the factors responsible for them and take necessary action against it. Hence, the present study was undertaken with the objectives to study the growth of area, production and yield of rice in different districts of Punjab state and to study the district wise instability in area, production and yield of rice in Punjab state.

Material and Methods

The present study is undertaken based on secondary data on rice of Punjab state from 1980-81 to 2017-18. The district wise data on area, production and yield of rice was collected from Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India under different time periods. The study is undertaken for the period of 1980-81 to 2017-18. There are total 22 districts in Punjab state. During 1980s decade there were twelve states. Other states formed in the last forty years. Therefore, the data of 22 districts were combined into 12 districts for analysis. The data of Pathankot, Tarn Taran, Shahid Bhagat Singh Nagar, Fazilka, Barnala, Mansa district was combined to Gurdaspur, Amritsar, Jalandhar, Firozpur, Sangrur, Bhatinda district respectively. Moga and Mukatsar data was combined to Faridkot district. SAS Nagar data was merged into Patiala and Rupnagar district and Fatehgarh data was merged into Patiala district. The data was divided into five periods viz. 1980-81 to 1989-90, 1990-91 to 1999-2000, 2000-01 to 2009-10, 2010-11 to 2017-18 and the overall period 1980-81 to 2017-18. The growth rate of area, production and yield for districts of Punjab state for each period were computed to study the growth in area, production and yield of these districts. Compound growth rate was estimated using following exponential model Dandekar (1980) [8].

$$Y = ab^t$$

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

$$\text{CGR}(r) = [\text{Antilog } (\text{log } b) - 1] \times 100$$

Where,
 CGR = Compound growth rate
 t = time period in year
 Y = area/ production / productivity
 a and b = Regression parameters

The performance of agricultural output affected by climatic factors, the growth rate has been calculated based on three years average data (Dandekar, 1980; Minhas, 1966; Singh and Rai, 1997; Deosthali and Chandekar, 2004) [8, 9, 10, 4].

The instability in area, production and yield of rice was computed to measure the variability using an index of instability called Cuddy-Della Valle index (Cuddy and Della Valle, 1978) [11].

This method is used to examine the extent of risk involved in crop production. The instability in area, production and yield was estimated using the following Cuddy-Della Valle Index.

$$\text{CDVI} = \text{CV} \times \sqrt{(1 - \text{Adj. } R^2)}$$

Where,
 CDVI = Cuddy-Della Valle Instability index (per cent)
 CV = Coefficient of variation (per cent)
 Adj. R² = Coefficient of determination from a time trend regression adjusted by the number of degree of freedom

Results and Discussion

The rice area in Punjab was increase from 1.18 million hectare in 1980-81 to 3.07 million hectare in 2017-18. The area increased 2.6 times in last 38 years. The rice production was increased from 3.21 million tons in 1980-81 to 13.38 million tons in 2017-18. The rice yield was increased from 2.73 t/ha in 1980-81 to 4.37 t/ha in 2017-18. The production increased about 4.1 times, but increase in yield was only 1.6 times in last 38 years (Fig. 1). Hence, it is important to study the trend of area, production and yield of rice in Punjab.

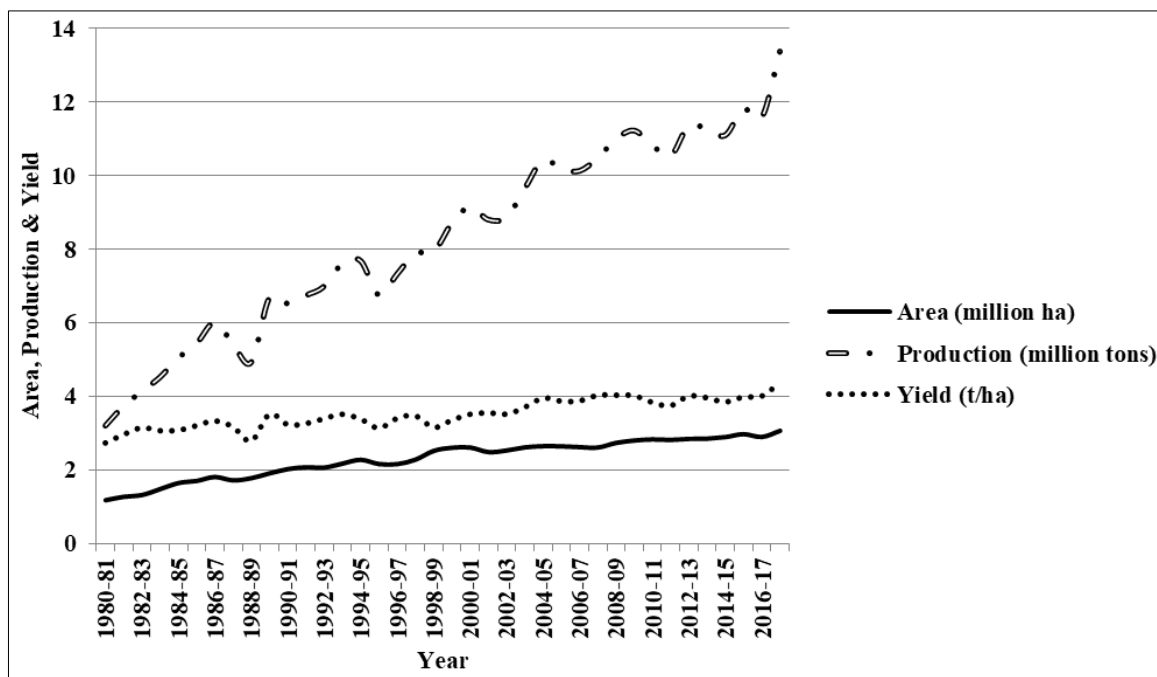


Fig 1: Area, production and productivity of rice during from 1980-81 to 2017-18

The district wise growth rate of area, production and yield of rice of Punjab district is given in Table 1. It shows that the growth in area of Punjab was highest (5.50%) during period I (1980-81 to 1989-90), while it was lowest (0.60%) during period III (2000-01 to 2009-10). The highest growth in area was 21.73% observed in Bhatinda district during period I followed by 14.04% in period II in the same district. The lowest and negative growth rate (-1.55%) was observed in same district Bhatinda during period III whereas Hoshiarpur was the penultimate district having growth rate -0.85% during period II. The growth rate for all the districts was positive for overall period V and period I only. The highest production growth rate of the state i.e. 7.11% was during period I, while lowest (1.41%) was observed in period IV. The trend of growth rate of production was same as that of area. The growth rate of production was highest for Bhatinda during period I i.e. 20.84% followed by period II (13.68%). For all the periods and all the districts, the growth rate was positive except for Gurdaspur district during period IV and Hoshiarpur in period II where it was found negative. The growth rate of yield for the state was highest during period III (2.10%) and lowest during period II (0.20%). The highest growth rate was observed in Amritsar district (4.11%) during period I followed by Bhatinda (3.09%) during period III; while the lowest and negative growth rate was found in Gurdaspur (-1.65%) during period IV followed by Rupnagar (-0.92%) in period II. The growth rate was positive for all the state during overall period V and period III; and period IV except Gurdaspur. Similar study was done for various crops in different states of the country. (Reddy, 2009; Prabakaran and Sivapragasam, 2013; Roy *et al.*, 2015; Kaur and Grover, 2020) [12, 13, 14, 7].

The growth rate explains the rate of growth over the period. Whereas, instability evaluates whether the growth performance is stable or unstable for the period for the computed variable. Hence understanding instability of the

variable is also important. To know the district wise instability in area, production and yield of rice, the fluctuation was measured with the help of Cuddy-Della Valle instability index. The results has been presented in Table 2 and discussed as under for different periods and also for overall period. The highest instability was found during period V i.e. overall period, however lowest was observed in period IV in Punjab state for area. The lowest instability was found in Ludhiana followed by Kapurthala district during period IV; however the highest instability was found in Bhatinda during period I followed by same district in period II. The instability in period IV was less as compared to other periods in all the districts. For production, lowest instability was found in period III and highest was observed during period I in the state. The lowest instability was observed during period IV i.e. 2.37 in Sangrur followed by 2.40 in Patiala district. The highest instability was 39.78 observed during period I in Bhatinda district followed by 18.81 in Kapurthala district. The trend is same as that of area i.e. the instability in period IV was less than other periods in most of the districts. For yield, the lowest instability was observed in period II and the highest was observed during period I in the Punjab state. The lowest instability was observed during period IV in Sangrur district i.e. 1.98 followed by 2.06 in Patiala district. The highest instability was found during period I i.e. 15.56 in Kapurthala followed by 11.41 in Amritsar district. The result indicates that, instability was not consistence in terms of area, production and yield during different periods (Shaheen and Shiyani, 2004; Shende *et al.*, 2011 and Suresh *et al.*, 2013) [15, 16, 17].

In nutshell, the instability was highest in all the districts during period I for all three variables area, production and yield of rice. Bhatinda, Amritsar, Kapurthala are the districts with highest instability, whereas Sangrur, Patiala, Ludhiana are the districts of least instability during different periods.

Table 1: District wise growth rate of area, production and yield of rice in Punjab state for different periods

S. N.	District	Area					Production					Yield				
		P-I	P-II	P-III	P-IV	P-V	P-I	P-II	P-III	P-IV	P-V	P-I	P-II	P-III	P-IV	P-V
1	Amritsar	3.19	1.08	1.49	0.21	1.76	7.43	2.24	1.60	1.94	2.71	4.11	1.15	0.11	1.73	0.93
2	Bhatinda	21.73	14.04	-1.55	4.92	7.97	20.84	13.68	1.50	5.64	8.73	-0.73	-0.31	3.09	0.69	0.71
3	Faridkot	7.25	6.52	1.39	3.08	4.78	8.41	5.61	4.31	3.45	5.69	1.08	-0.86	2.87	0.36	0.87
4	Ferozepur	4.00	1.38	-0.36	2.11	1.16	5.39	2.87	1.38	2.33	2.13	1.33	1.46	1.75	0.22	0.96
5	Gurdaspur	2.14	1.08	0.35	0.01	1.09	3.99	1.72	1.98	-1.64	2.01	1.82	0.63	1.62	-1.65	0.91
6	Hoshiarpur	3.76	-0.85	-0.27	0.63	1.38	3.56	-0.20	1.06	1.13	2.50	-0.19	0.65	1.34	0.50	1.11
7	Jalandhar	5.85	1.46	1.82	0.78	2.48	6.89	1.64	3.05	1.76	3.08	0.98	0.18	1.21	0.97	0.59
8	Kapurthala	4.63	0.00	1.29	0.19	1.40	3.75	0.74	2.94	1.07	2.40	-0.84	0.74	1.63	0.88	0.98
9	Ludhiana	8.93	1.11	0.84	0.08	1.95	8.79	0.31	3.26	0.66	2.58	-0.13	-0.79	2.41	0.58	0.62
10	Patiala	3.05	2.08	0.18	-0.34	1.39	4.43	1.62	2.81	0.22	2.27	1.34	-0.45	2.63	0.56	0.87
11	Rupnagar	3.37	3.84	0.52	-0.51	2.78	5.43	2.88	2.20	1.47	3.21	1.99	-0.92	1.67	1.99	0.42
12	Sangrur	12.57	2.70	0.43	0.50	3.06	12.54	2.47	3.39	1.67	4.05	-0.03	-0.22	2.95	1.17	0.96
	Punjab	5.50	2.37	0.60	0.88	2.30	7.11	2.58	2.71	1.41	3.26	1.52	0.20	2.10	0.53	0.94

P-I: Period I (1980-81 to 1989-90); P-II: Period II (1990-91 to 1999-2000); P-III: Period III (2000-01 to 2009-10);

P-IV: Period IV (2010-11 to 2017-18); P-V: Period V (1980-81 to 2017-18)

A: Area, P: Production; Y: Yield

Table 2: District wise instability of area, production and yield Rice in Punjab state for different periods

S. N.	District	Area					Production					Yield				
		P-I	P-II	P-III	P-IV	P-V	P-I	P-II	P-III	P-IV	P-V	P-I	P-II	P-III	P-IV	P-V
1	Amritsar	4.02	2.33	1.80	0.84	4.77	13.50	4.59	5.67	10.14	10.62	11.41	3.37	4.76	9.82	9.48
2	Bhatinda	40.02	20.38	10.09	6.41	19.60	39.78	16.43	9.55	8.58	17.43	7.14	6.94	4.59	2.99	7.10
3	Faridkot	15.24	17.40	5.79	2.76	12.01	11.48	11.88	6.67	3.12	12.20	6.48	5.93	3.43	2.40	6.05
4	Ferozepur	4.67	6.40	3.82	1.63	6.68	11.06	6.06	4.36	5.50	8.10	10.05	5.28	5.00	5.76	7.36
5	Gurdaspur	3.44	2.52	2.49	0.59	4.90	10.95	5.69	3.82	11.42	9.10	10.98	4.76	2.48	11.04	7.93

6	Hoshiarpur	6.76	6.70	7.35	2.72	8.21	15.54	5.52	12.55	6.09	12.75	8.73	2.12	6.41	3.91	6.63
7	Jalandhar	3.53	3.39	2.61	0.56	4.92	10.89	5.51	5.07	4.54	6.72	9.02	4.86	3.92	4.08	6.01
8	Kapurthala	6.73	2.40	1.36	0.47	5.72	18.81	8.71	3.85	4.03	8.53	15.56	7.02	4.24	3.75	8.98
9	Ludhiana	8.23	2.66	1.02	0.23	9.84	13.18	6.12	4.09	3.02	8.74	8.56	6.40	3.79	2.86	8.04
10	Patiala	4.98	2.57	1.96	0.83	7.43	7.52	5.93	3.56	2.40	7.26	6.59	4.65	2.69	2.06	5.98
11	Rupnagar	11.47	5.10	5.60	4.41	9.85	14.36	6.24	5.61	9.88	8.32	10.17	5.42	3.06	7.28	8.76
12	Sangrur	10.40	3.75	1.50	0.98	12.00	12.43	5.59	4.10	2.37	8.23	8.94	4.68	3.38	1.98	6.67
	Punjab	4.92	4.34	2.22	1.63	5.66	10.37	5.40	3.22	4.69	5.90	6.84	4.06	2.27	3.38	4.76

P-I: Period I (1980-81 to 1989-90); P-II: Period II (1990-91 to 1999-2000); P-III: Period III (2000-01 to 2009-10);

P-IV: Period IV (2010-11 to 2017-18); P-V: Period V (1980-81 to 2017-18)

A: Area; P: Production; Y: Yield

Conclusion

In this study, the growth rates and instability of area, production and yield rice in Punjab state has been analyzed. This will helpful for researchers, policy makers for deciding their agricultural policy and effective implementation of agricultural policy in different districts of Punjab state. The policies can be modified and reoriented as per the requirement and need of the rice stakeholders in different districts of Punjab.

Acknowledgements

The financial support received from the Indian Council of Agricultural Research, New Delhi, India, is thankfully acknowledged. The authors are thankful to the Director, ICAR- National Rice Research Institute, Cuttack, India for providing necessary facilities.

References

- Singh DV. A component analysis and value productivity growth of important crops in Himachal Pradesh. *Agricultural Situation in India* 1981;36(6):479-484.
- Cauvey R. Groundnut production in Tamil Nadu: A decomposition analysis. *Agricultural Situation in India* 1991;46(5):321-324.
- Ranade CG. Impact of cropping pattern on agricultural production. *Indian Journal of Agricultural Economics* 1980;35(2):85-92.
- Deosthali V, Chandrehekhar MN. Rice: Region wise growth trends in Maharashtra. *Economics and Political Weekly* 2004;39(3):240-242.
- Sikka BK, Vaidya CS. Growth rates and cropping pattern changes in agriculture in Himachal Pradesh. *Agricultural Situation in India* 1985;39(11):843-846.
- Dhindsa KS, Sharma A. Analysis of cropping pattern changes in Punjab during 1965-66 to 1990-91. *Indian Economic Review* 1995;30(1):69-87.
- Kaur A, Grover DK. Trends in area, yield and production of major oilseeds in Punjab: District-wise analysis. *Agricultural Situation in India* 2020;75(10):26-36.
- Dandekar VM. Introduction seminar on data and methodology for the study of growth rates in agriculture. *Indian Journal of Agricultural Economics* 1980;35(2):1-12.
- Minhas BS. Rapporteur's report on measurement of agricultural growth. *Indian Journal of Agricultural Economics* 1966;21(4):165-182.
- Singh IJ, Rai KN. Regional variations in agricultural performance in India. *Indian Journal of Agricultural Economics* 1997;52(3):374-377.
- Cuddy JDA, Della Valle PA. Measuring the instability of time series data. *Oxford Bulletins of Economics and Statistics* 1978;40(10):79-84.
- Reddy A. Growth and instability in chickpea production in India: A state level analysis. *Agricultural Situation in India* 2009;32(9):621.
- Prabhakaran K, Sivapragasam C. Analysis of growth rates of rice and sorghum in Andhra Pradesh. *International Journal of Farm Sciences* 2013;3(1):1-9.
- Roy A, Singh NU, Dhar DS, Mohanty AK, Singh SB, Tripathi AK. Food security in north-east region of India - A state-wise analysis. *Agricultural Economics Research Review* 2015;28:259-266.
- Shaheen FA, Shiyani RL. Growth and instability in area, production and yield of fruit crops in Jammu and Kashmir: A Disaggregate Analysis. *Agricultural Situation in India* 2004;60(10):657-663.
- Shende NN, 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.
- Suresh A, Ramsundaram PS, Wankhade JS. Impact of technology and policy on growth and instability of agricultural production: The case of cotton in India. *Indian Journal of Agricultural Sciences* 2013;83(9):939-948.