



ISSN (E): 2277-7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2022; 11(12): 3630-3634

© 2022 TPI

[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 17-09-2022

Accepted: 24-10-2022

## Agam PA

Ph.D. Student, Department of Agricultural Economics, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

## Perke DS

Head of the Department, Department of Agricultural Economics, College of Agriculture VNMKV, Parbhani, Maharashtra, India

## Chavan RV

Associate Professor, Department of Agricultural Economics, College of Agriculture VNMKV, Parbhani, Maharashtra, India

## Baviskar PP

Ph.D. Student, Department of Agricultural Economics, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

## Corresponding Author:

### Agam PA

Ph.D. Student, Department of Agricultural Economics, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

## Wheat production in India: An overtime study on growth and instability

Agam PA, Perke DS, Chavan RV and Baviskar PP

### Abstract

The area of wheat crop was more stable as compared to production and yield in India. The trends in area, production and productivity of wheat in the country revealed the area expansion growth by 1.71, 1.20 and 0.30 and 0.88 per cent per annum in period I, period II, period III and overall period. The production growth of wheat was much faster than area growth in India. The yield growth of wheat crop was positive and significant in entire study period. Increased production of wheat crop was mainly due to yield improvement and slightly due to area expansion during overall period. Export unit price recorded positive but non-significant growth in period I the export of wheat in terms of quantity and export value was declined during period II. The export unit price of wheat grew significantly the quantity as well as export value of wheat showed positive but non-significant growth in period III. The export unit price of wheat was declined period III. Wheat export recorded a growth of 6.65 per cent in terms of quantity, 9.32 per cent in terms of value and 2.51 per cent in terms of unit price in the overall period. Instability in production of wheat was increased in period III as compared to period I due to rise in yield instability of wheat. Instability indices of wheat export unit price were more stable as compared to export quantity and export value in three sub-sequent periods and overall period. Fluctuations in the export value revealed mixed trend.

**Keywords:** Wheat, export, growth rate, instability

### Introduction

Wheat (*Triticum* spp.) is the most important food grain of India and it has been describe as the “King of Cereal”. India has second rank in world wheat production. Wheat is the staple food of millions of Indians, particularly in the northern and north-western parts of the country. Wheat is a cereal grain, originally from the South West Asia, but now cultivated worldwide Wheat is a rabbi crop which is sown in the beginning of winter and is harvested in the beginning of summer. The sowing of wheat crop normally begins in September - October in Maharashtra and the harvesting is done in January-February. This grain is grown on more land area than any other commercial food. World trade in wheat is greater than for all other crops combined.

### Review of Literature

Tewari *et al.*, (2017) <sup>[1]</sup> find out the Growth and Instability in Wheat Production: A Region Wise Analysis of Uttar Pradesh the growth and instability in terms of area, production and productivity of wheat. The growth was examined by compound annual growth rate. The study relates to 1990-91 to 2013-14 which is further divided into five sub-periods area, production and productivity of wheat in all the four regions show increasing growth rate at 1 per cent level of significance during the period 1990-91 to 2013-14. During this period, the compound annual growth in production is 2.3 per cent and in productivity is 1.4 per cent of wheat in Uttar Pradesh. The positive growth in area, production, productivity of wheat can be seen in sub periods I, II and IV. During the sub-period III (2000-01 to 2004-05), the production and productivity of wheat shows negative growth rate i.e. -1.6 per cent and -2.2 per cent, respectively. While area under wheat shows positive (0.5%) growth rate in eastern Uttar Pradesh.

Singh *et al.*, (2018) estimated the growth rate of wheat crop Varanasi division of eastern Uttar Pradesh, India. The researcher viewed the coefficient of variation is 16.93 in Varanasi division. Linear and compound growth rates were 2.47 and 2.48 per-cent per annum, respectively. The production of wheat exhibited a positive trend. Productivity showed a coefficient of variation 15.69 per-cent. Linear and Compound growth rate were 1.72 and 1.63 per-cent, respectively.

Growth Rate of production of Varanasi division was 1.63 per cent and can further go up by intervention of Technology and improved Irrigation System. The study showed that Varanasi has production and productivity more suffered badly in drought year.

Bhatnagar and Saxena (2000)<sup>[2]</sup> estimated area, production of wheat in Haryana. Growth performance of production of wheat is better than its growth in area and yield. Area and production have decreased in third decade but it has not affected the average yield of wheat. An estimate of area, production and yield of wheat in Haryana has been obtained for next years with 95 percent confidence limit.

### Objective

1. To study the growth in area, production, productivity and export of wheat in India
2. To measure instability in area, production, productivity and export of wheat in India

### Methodology

#### Estimation of Growth Rates

The growth rates in area, production, yield and export of wheat in India was studied by using compound growth rates.

The growth rate was estimated using following model

$$Y_t = a \cdot b^t$$

Where

$Y_t$  = Depended variable for which growth rate is to be estimated

$a$  = Intercept

$b$  = Regression coefficient

Log transformation of the above equation log

$$Y_t = \log a + t \log (b)$$

$$\text{Compound Growth rate (\%)} = \{ \text{antilog } (b) - 1 \} \times 100$$

Where,

$$b = \log (b).$$

The significance of the regression coefficient tested using the student's 't' test.

#### Degree of instability in production and export cereal crops

In order to study the instability in the export wheat crops, Coefficient of variation and Cuddy Della Valle's instability was used.

Coefficient of variation (CV)

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

Where,

$\sigma$  = Standard deviation

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

Where,

$\bar{X}$  = Arithmetic mean

$X$  = Variable

$n$  = Number of observations

The simple Coefficient of Variation (C.V) often contains the trend component and thus over estimates the level of instability in time series data characterized by long term trends. To overcome this problem, this study was use the instability index (I.I) given by Cuddy della Valle (1978)<sup>[3]</sup> which corrects the coefficient of variation, Cuddy Della Valle's instability is estimated as follows.

#### Cuddy Della Valle's Instability Indices (C.D.I)

C.D.I. was used to measure instability of wheat crops which is close to approximation of the average year to year per cent variation adjusted for trend. The algebraic form of it is;

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

Where,

CV = Simple Estimates of coefficient of variation in per cent and

$R^2$  = Coefficient of determination from a time trend regression

(Linear) adjusted by the number of degree of freedom.

### Results and Discussion

#### Growth in area, production and productivity of Wheat

An attempt in this session has been made to examine the changes in compound growth rates (CGR) of area, production, yield and export of wheat were estimated at region national level for three sub-periods and overall period i.e. 1990-91 to 2019-20. The Period-I starts from the year 1990-91 to 1999-00, period II starts from the year 2000-01 to 2009-10 and third period III starts from 2010-11 to 2019-20. The compound growth rates (CGR) of wheat and are reported in Table 1.

#### Compound growth rates of area, production and productivity of wheat in India

The trends in area, production and productivity of wheat in the country are presented in Table 1 and Fig. 1 that, wheat crop revealed the area expansion growth by 1.71, 1.20 and 0.30 and 0.88 per cent per annum in period I, period II, period III and overall period. In period third, the area under wheat crop increased at a non-significant rate. The production growth of wheat was much faster than area growth in India. The production of wheat was significantly increased at the rate of 3.57, 1.90 and 1.84 per cent per annum in periods I, II, III and overall period. As the yield is concerned, it was highly significant in period first (1.82 per cent). The yield growth of wheat crop was positive and significant in entire study period but it was improved at slower rate in subsequent periods. The production of wheat was significantly increased by 3.57, 1.90 and 1.84 per cent per annum from first to third period. The positive and significant growth in production (1.84 per cent) was mainly due to yield improvement (1.54 per cent) as area was non-significantly changed during third period. Thus, increased production of wheat crop was mainly due to yield improvement and slightly due to area expansion during overall period.

With limited scope for expansion of area, the increase in the growth of production of wheat in future would depend on further improvements in yield per hectare, particularly in the areas where the yields continue to be far below the potential.

In this context, recent release of new dwarf wheat varieties with high yield potential, particularly for cultivation in central parts of India, is welcome development. Apart from multiplication and supply of certified seeds of these and other better varieties to the farmers, it would also be important to increase the investment for better utilization of water resources and motivate.

The production of wheat, which had been on an upswing during 1990-96 mainly on account of a decline in the average yield due to unfavorable weather conditions at the time of maturity of. (Commission for agricultural costs and prices price policy for rabi crops of 1995-96) during the nineties area of wheat increased. The rate of yield growth has recorded a sharp deceleration. Wheat production increase was due to timely/early sowing of wheat, no attack of pests and diseases, more area under hybrid varieties and exceptionally favorable weather conditions i.e as against an expansion of area, the increase in output of wheat was rather sluggish. During TE 1990-91, it increased by 17.4 million tonnes to 70.5 million tonnes during TE 1999-2000(CACP report 2000-2001).

Oladele and Kenamara (2015) [6] find same result that in spite of a remarkable growth rate in wheat production in India during her research study period, Limbore and Khilare (2015) [5] in his research reported that production of wheat steadily increased with maximum productivity. Anjum and Madulika (2018) [11] reprobated that the growth rate of area under wheat has shown continuous decline throughout the entire period. Day (2020) observed that the wheat area was increased significant growth in area production also increased. India has shown a tremendous growth in wheat production especially after the Green revolution in the 1960.

**Table 1:** Compound growth rates of area, production and productivity of wheat in India

Sr. No.	Period	Area		Production		Productivity	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	1.71***	7.72	3.57***	9.51	1.82***	4.99
2	Period II	1.20***	5.40	1.90***	3.66	0.69*	1.92
3	Period III	0.30 <sup>NS</sup>	1.01	1.84***	3.65	1.54**	2.33
4	Overall	0.88***	12.94	2.11***	17.74	1.22***	12.69

**Note: Period I:** 1990-91 to 1999-00;

**Period II:** 2000-01 to 2009-10

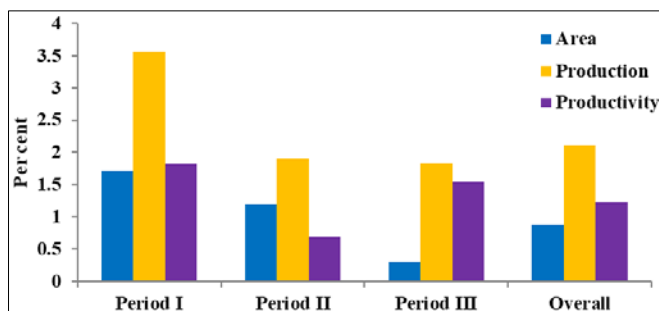
**Period III:** 2010-11 to 2019-20;

**Overall:** 1990-91 to 2019-20

\*, \*\* and \*\*\* are significant at 10, 5 and 1 per cent level of significance

CAGR= Compound Annual Growth Rate (per cent per annum)

Area (000 ha), Production (000 tonnes), Productivity (kg/ha)



**Fig 1:** Compound growth rate of area, Production and productivity of wheat

### Compound growth rates of wheat exported from India

The quantity of wheat export and export value it could be

seen from the (Table 2 and Fig. 2) declined at a non-significant rate whereas, the export unit price recorded positive but non-significant growth in period I The export of wheat in terms of quantity and export value was declined by 71.10 and 67.47 per cent during period II respectively. The export unit price of wheat grew significantly at the rate of 12.54 per cent per annum in the same period. The quantity as well as export value of wheat showed positive but non-significant growth in period III. However, the export unit price of wheat was declined at 2.25 per cent in period III. Thus, wheat export recorded a growth of 6.65 per cent in terms of quantity, 9.32 per cent in terms of value and 2.51 per cent in terms of unit price in the overall period. Rajkumar and Dadhaicha (2013) [8] evaluate the growth performance of Indian's agricultural export. Wheat export from 2000 to 2004 showed the increasing trend 27.50 per cent and decreasing trend from 2005 to 2006 but start increasing from 2009 till 2010 but again decline.

**Table 2:** Compound growth rates of wheat exported from India

Sr. No.	Period	Export Quantity		Export Value		Export Unit Price	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	-46.62 <sup>NS</sup>	-1.52	-39.27 <sup>NS</sup>	-1.11	13.76 <sup>NS</sup>	1.47
2	Period II	-71.10***	-4.83	-67.47***	-4.47	12.54***	8.13
3	Period III	14.87 <sup>NS</sup>	0.44	12.29 <sup>NS</sup>	0.38	-2.25*	-1.87
4	Overall	6.65***	-4.83	9.32***	-4.47	2.51***	8.13

**Note: Period I:** 1990-91 to 1999-00;

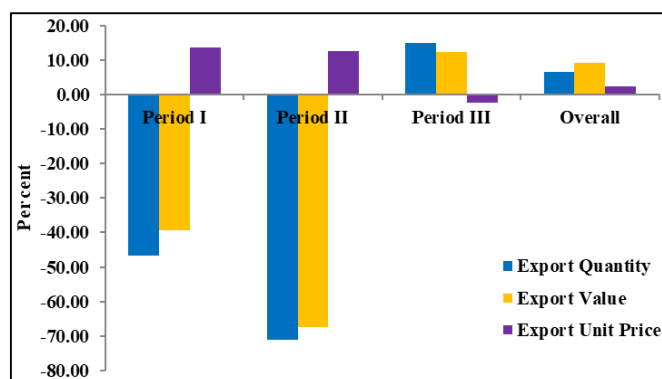
**Period II:** 2000-01 to 2009-10

**Period III:** 2010-11 to 2019-20;

**Overall:** 1990-91 to 2019-20

\*, \*\* and \*\*\* are significant at 10, 5 and 1 per cent level of significance

CAGR= Compound Annual Growth Rate (per cent per annum)



**Fig 2:** Compound growth rate of wheat export from India

Parihar (2019) [7] found similar result on export value, quantity of wheat export showed positive compound growth rate of the during (2009 to 2019) period of the study. Limbore and Khilare (2015) [5] revealed that compared to export quantity, value earned was relatively low that bring to conclusion that India must strengthen its export strategies and increased the export of wheat to effectively utilize its export potential. Suresh (2016) [10] reported India's export of wheat has not registered significant growth rate.

### Instability in area, production, productivity and Export of wheat

In this section, we have focused to examine and explain the fluctuations in area, production, productivity and export changes from one period to the other period for selected

cereal crops. Table 3: Instability indices of area, production and productivity of wheat in India. The estimates of area, production and yield instability in wheat crop at national level were presented in (Table 3 and Fig. 3). In India, area under wheat crop was found relatively stable as CDVI was 1.85, 1.87 and 2.52 per cent in consecutive periods. Fluctuations in area of wheat were slightly increased over the period of time.

**Table 3:** Instability indices of area, production and productivity of wheat in India

Period	Area			
	Mean	SD	CV	CDVI
Period I	25.55	1.40	5.48	1.85
Period II	26.90	1.09	4.07	1.87
Period III	30.24	0.81	2.68	2.52
Overall	27.56	2.28	8.28	3.14
Period	Production			
	Mean	SD	CV	CDVI
Period I	63.91	7.13	11.16	3.35
Period II	73.42	5.31	7.23	4.34
Period III	95.95	6.73	7.01	4.22
Overall	77.76	15.01	19.30	5.86
Period	Productivity			
	Mean	SD	CV	CDVI
Period I	2.50	0.16	6.34	3.17
Period II	2.73	0.10	3.75	3.09
Period III	3.17	0.23	7.21	5.44
Overall	2.80	0.33	11.82	4.76

**Note: Period I:** 1990-91 to 1999-00;

**Period II:** 2000-01 to 2009-10

**Period III:** 2010-11 to 2019-20;

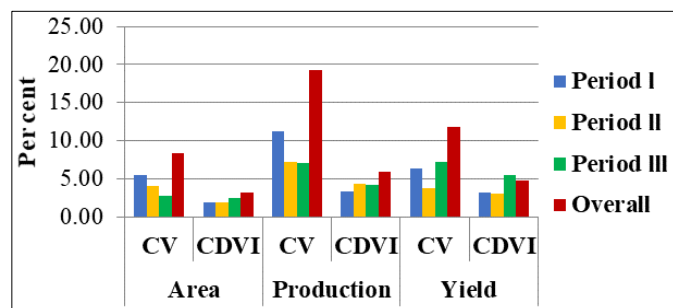
**Overall:** 1990-91 to 2019-20

**SD** = Standard Deviation,

**CV** = Coefficient of Variation (per cent per annum),

**CDVI** = Cuddy Della Valle's Instability Index (per cent per annum)

**Area** (000 ha), **Production** (000 tonnes), **Productivity** (kg/ha)



**Fig 3:** Instability indices of Wheat in Area, Production and Yield in India

Instability in production of wheat was increased in period III (4.22 per cent) as compared to period I (3.35 per cent) due to rise in yield instability of wheat from 3.17 per cent to 5.44 per cent in this period. Similar result found in Anjum and

Madhulika (2018) <sup>[1]</sup> reported that the instability in the area for, wheat increased in second period (2000-01 to 2009-10) of study but declined in third period, but production of wheat has declined in the second period but again increased in the third period (2009-10 to 2016-17) The area of wheat crop was more stable as compared to production and yield in India. The area of wheat crop was more stable as compared to production and yield in India. The instability indices for wheat area, production and productivity were 3.14 per cent, 5.86 per cent and 4.76 per cent in overall period

**Instability indices of wheat exported from India**

The instability indices of wheat export presented in (Table 4 Fig. 4) revealed that, the exported quantity of wheat registered instability (CDVI) of 126.49, 84.87, 128.17 and 151.49 per cent per annum, for period I, II, III and overall period respectively.

**Table 4:** Instability indices of wheat exported from India (Per cent)

Period	Export Quantity (Metric Tones)		
	Mean	CV	CDVI
Period I	239615.45	127.01	126.49
Period II	1403076.15	113.50	84.87
Period III	1744104.11	138.85	128.17
Overall	1128931.90	155.07	151.49
Period	Export Value (Thousand US\$)		
	Mean	CV	CDVI
Period I	61355.12	134.20	131.56
Period II	172781.19	110.10	86.77
Period III	499363.08	141.32	130.34
Overall	244499.79	184.56	176.48
Period	Export Unit Price (US\$/Tonnes)		
	Mean	CV	CDVI
Period I	326.69	158.75	150.71
Period II	172.77	38.29	14.26
Period III	289.04	13.58	11.27
Overall	262.83	113.98	113.97

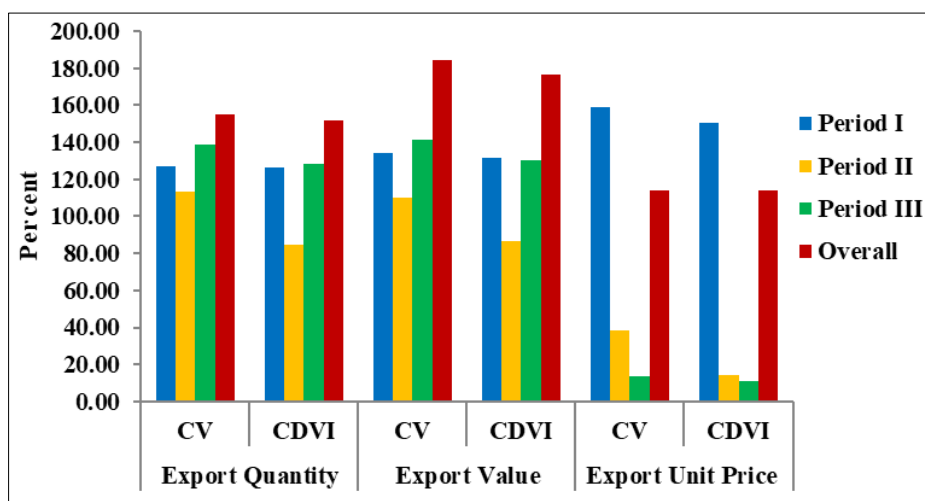
**Note:** Period I: 1990-91 to 1999-00;

Period II: 2000-01 to 2009-10

Period III: 2010-11 to 2019-20; Overall: 1990-91 to 2019-20

CV =Coefficient of Variation (per cent per annum), CDVI = Cuddy Della Valle's Instability Index (per cent per annum), Export Quantity = (tonnes), Export Value= (1000 US\$), Export Unit Price= (US\$/tonnes)

The estimated values of CV also showed instability of 127.01 per cent, 113.50 per cent, 138.85 per cent and 155.07 per cent during three sub-periods and overall period. It suggested the fact that, the variations in exported quantity of wheat were high in period III. However, the fluctuations in the export value revealed mixed trend i.e. variations in export value were higher (134.20 and 131.56 per cent) in period I, but declined in period II (110.10 and 86.77 per cent) and again it increased in period III (141.32 and 130.34 per cent).



**Fig 4:** Instability indices of Wheat in Export Quantity, Value and Unit price from India

The unit price of wheat registered higher fluctuations (158.75 and 150.71 per cent) in period I but it became more stable during period III as compared to period I and period II. Instability indices of wheat revealed that, the export unit price was more stable as compared to export quantity and export value in three sub-sequent periods and overall period. Oladele and Kenamara (2015)<sup>[6]</sup> observed that instability index in the export of wheat was very high, which signified that India could not meet up in the world wheat market despite volume of production of wheat. Parihar (2019)<sup>[7]</sup> stated that the instability of wheat export in terms of quantity, value showed highest instability in wheat export entire research study period.

### Conclusion

The trends in area, production and productivity of wheat in the country are revealed the area expansion growth by 1.71, 1.20 and 0.30 and 0.88 per cent per annum in three sub-periods and overall period. In period III, the area under wheat crop increased at a non-significant rate. The production growth of wheat was much faster than area growth in India. As the yield is concerned, it was highly significant in period I. The yield growth of wheat crop was positive and significant in entire study period but it was improved at slower rate in subsequent periods. The production of wheat was significantly increased I to III period. The positive and significant growth in production was mainly due to yield improvement as area was non-significantly changed during period III. Thus, increased production of wheat crop was mainly due to yield improvement and slightly due to area expansion during overall period. The quantity of wheat exported from India and export value declined at a non-significant rate whereas, the export unit price recorded positive but non-significant growth in period I. The export of wheat in terms of quantity and export value was declined during period II. In contrary, the export unit price of wheat grew significantly. The quantity as well as export value of wheat showed positive but non-significant growth in III period. However, the export unit price of wheat was declined

### References

1. Anjum S, Madhulika. Growth and instability analysis in Indian agriculture. *International Journal of Multidisciplinary Research and Development*.

2018;5(11):119-125.

- Bhatnagar S, Saxena KK. An estimate of area and production of wheat in Haryana. *Agricultural situation in India*. 2000;69(3):131-132.
- Cuddy JDA, Della VPA. Measuring the Instability of Time Series Data. *Oxford Bulletin of Economics and Statistics*. 1978;40(1):79-85.
- Dey A, Dinesh, Rashmi. Rice and wheat production in India: An overtime study on growth and instability. *Journal of Pharmacognosy and Phytochemistry*. 2020;9(2):158-161.
- Limboire, Nilesh V, Khillare, Shrirang K. An analytical study of Indian agriculture crop production and Export with reference to wheat. *Review of Research*. 2015;4(6):01-08.
- Oladele Aderonke Toyin, Kenamara Denis Magnus. Trends in production and export of wheat in India. *International Research Journal of Agricultural Economics and Statistics*. 2015;6(1):189-192.
- Parihar S. Investigating growth instability and concentration of Indian agricultural export. *Tenth conference on excellence in research and education*. 2019;(2):28-3.
- Rajkumar, Dadhich V. Growth and performance of India's agricultural export, *International Journal of 360 Management review*. 2013;1(1):1-13.
- Singh L, Bansal S. Growth and Instability in Area, Production and Yield of Pulses in Punjab. *Agricultural Situation in India*. 2020;77(7):36-42.
- Suresh A, Mathur VC. Export of agricultural commodities from India: Performance and prospects. *Indian Journal of Agricultural Sciences*. 2016;86(7):876-83.
- Tewari H, Singh HP, Tripathi U. Growth and Instability in Wheat Production: A Region Wise Analysis of Uttar Pradesh, India *International Journal of Current Microbiology and Applied Science*. 2017;6(9):2537-2544.