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GROWTH AND INSTABLITY IN PRINCIPAL CROPS OF HARYANA: AN EMPIRICAL ANALYSIS

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ABSTRACT

The dominant objectives of this research are to analyze the growth performance and instability in the area, production and productivity of principal crops of Haryana. To estimate the growth performance Compound Annual Growth Rate (CAGR) method and to measure instability the Cuddy-Della Valle Index, were employed. This study can be divided into three sub-periods:

2005-06 to 2010-2011, 2011-12 to 2016-17 and 2017-18 to 2022-23. Results of the study indicates that, several growth patterns recorded, in the CAGR of area under crop, production of the crop and productivity of the selected crops of Haryana. While considering the area under crop, highest instability at 95.41% occurred from 2011-12 to 2016-17, in case of production highest instability at 87.96% occurred during the third sub-period and productivity of the crop was highly volatile (108.43) during the third sub-period.

Highlights

Results may be in one point or more points

- Overall negative growth rate in area was registered during the first and second sub- period.

- In case of production of crop negative growth rate was recorded during the second sub-period while overall positive growth rate was found during all period in the productivity of all crops.

- While considering the area, highest instability at 95.41% occurred from 2011-12 to 2016-17, in case of production highest instability at 87.96% occurred during the third sub-period and productivity was highly volatile (108.43) during the third sub-period.

Keywords: Cuddy Della Valle index, CAGR, growth and instability, Haryana

Studies related to growth and instability in agriculture have traditionally been taken at macro level. Evidences shows that, agricultural growth in India, particularly in Haryana, has been highly volatile (Nimbrayan et al. 2023). Haryana is one of the agriculture dominant states of India. Haryana contribution in the production of wheat and rice in central pool is significant. The share of agriculture and allied sector in Gross State Value Added (GSVA) is 15.9%. Agriculture and allied sectors include crop cultivation and livestock farming such as horticulture, dairying, poultry, fisheries etc. In 2023-24, agriculture sector registered 7.2% growth. (Economic survey of Haryana, 2024-25). The importance of agriculture is not diminished, despite two reasons: Firstly, the country has achieved food security and the rural population depends on agriculture is not diminishing. Consequently, income inequality arises between the agriculture and non-agriculture sector has increased. There is the existence of regional disparities among states in terms of agricultural productivity. Agricultural productivity is highest in West Bengal as a result of its high growth while it is declining in states which were dominating in green revolution such as Haryana, Punjab and Tamil Nadu. It is also evident that the divergence of productivity among developed and underdeveloped states is continuously increasing (Chand et al. 1999). Regional disparities among the productivity appears at district level in Haryana. In case of Mustard chickpea, and cotton Bhiwani district has recorded highest productivity. In addition, the productivity of Major crops is unstable in Haryana.The yield sustainability of major crops of Haryana primarily depends on HVY seeds, improved technology and availability of irrigation facilities. (Devi et al. 2021). There is contradiction among researchers regarding the impact on new technology on growth and instability of agriculture. Some argued that variation in productivity has been reduced after the introduction of new technology while others are against this view. They argued that due to the adoption of new technology agriculture production has been more instable than earlier period (Hazell et al. 1981 and Mehra et al. 1982). Some crops such as Wheat and Paddy shown satisfactory performance over the period of time while other crop performance such as Gram, Groundnut, and Maize in terms of production is unstable. Green revolution has positive impact on sustainability but only on selected crops such as Paddy and Wheat (Sihmar R. 2014).

METHODOLOGY

For the year 2005-06 to 2022-23 data has been compiled from Statistical Abstract of Haryana for area, production and productivity. Some data has been also collected from various journals and economic survey of Haryana. The whole study period divided into the three sub-periods i.e., from 2005-06 to 2010-11, 2011-2012 to 2016-17 and 2017-18 to 2022-23.In order to study the growth performance and instability in area under crop, production and productivity of the crop, five principle crops of Haryana were chosen for the study i.e., Wheat, Rice, Bajra, Gram, and sugarcane etc.

Compound Annual Growth Rate

CAGR has been used to measure average annual growth rate of area under crop, production

$$CAGR = \left(\frac{V_t}{V_0}\right)^{\frac{1}{n}} - 1$$

and productivity of selected crops.

Here,

V_0=Initial value of the selected variable (Base Year)
V_1 = Final value of the variable (Last Year)

n = Number of Years selected

To find CAGR in percentage terms, we multiply above value by 100.

Coefficient of Variation

Coefficient of Variation is used to estimate the variability of time series. Thus, it is used as a measure of instability.

$$CV\ (\%) = \left(\frac{Standard\ deviation}{Mean}\right) \times 100$$

Cuddy-Della Valle index

Cuddy-Della Valle index used to measure the instability in variables arranged chronologically.

$$CDVI = CV \times \sqrt{1 - R^2}$$

Here,

CV = Coefficient of Variation in percentage terms

R^2 = Coefficient of Determination

RESULTS AND DISCUSSION

1.Trends in Growth and Instability in the area of selected crops of Haryana

CAGR of area of 5 major selected crops of Haryana over three sub-periods of time from 2005-06 to 2022-23 have been analysed and shown in the following table 1

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Table 1: CAGR of the area of selected crops of Haryana

Crop	2005-06 to 2010-2011	2011-12 to 2016-17	2017-18 to 2022-23
Rice	3.5	2.3	3.2
Wheat	1.7	0.26	-1.2
Bajra	0.87	-4.1	3.2
Gram	-2.9	-14	-2.29
Sugarcane	-8.14	1.44	-1.29
Mean	-0.994	-2.82	0.324

Source: Calculations of author

The CAGR of the area of the rice crop was 3.5% during 2005-06 to 2010-2011. The rate declined to 2.3% during 2011-12 to 2016-17 and it was 3.2% per annum in the third sub-period. Continuous decline has been recorded in area under Wheat during the whole period. Fluctuations was recorded the growth rate of Bajra and Sugarcane throughout the entire time period. The Area under gram recorded negative CAGR in all selected period. The average growth rate of area of all selected crops remains positive only during the third sub-period.

Table 2: Instability in the area of selected crops of Haryana

Crops	2005-06 to 2010-2011	2011-12 to 2016-17	2017-18 to 2022-23
Rice	2.97	2.07	2.57
Wheat	1.19	4.82	2.45
Bajra	3.99	15.15	9.47
Gram	12.51	24.77	16.33
Sugarcane	14.1	3.79	6.03
C.V	85.04	95.41	78.46

Source: Calculations of author

The instability of the area under the crops such as Wheat, Bajra and Gram have been positively grown during 2011-12 to 2016-17 and it decreased during 2017-18 to 2022-23 . For rice and sugarcane, the instability has been decreased in the 2nd sub-period but again increased in the 3rd period. Considering the area of all the crops over time, it can be seen that the instability has declined over the whole period of time.

2.Trends in Growth and Instability in the production under Principal crops of Haryana

Table 3: CAGR of the production under the selected crops of Haryana

Crops	2005-06 to 2010-2011	2011-12 to 2016-17	2017-18 to 2022-23
Rice	1.64	3.46	3.94
Wheat	5.51	-1.15	-2.04
Bajra	10.88	-3.88	12.93
Gram	8.85	-8.66	-1.53
Sugarcane	-5.09	3.41	-1.54
Mean	4.358	-1.364	2.352

Source: Calculations of author

The growth of agriculture production over the period of time shows the development of agriculture sector.

Bajra has registered the highest growth rate, from 2005-06 to 2010-2011 among the 5 principal crops and it was followed by Gram. Rice and Bajra accounted highest annual growth in production during the second sub-period and third sub-period respectively. The average growth rate, was negative for all crops from 2011-12 to 2016-17 and it was highest during the 1st sub-period.

Table 4: Instability of the production of selected crops of Haryana

Crops	2005-06 to 2010-2011	2011-12 to 2016-17	2017-18 to 2022-23
Rice	4.13	2.07	4.49
Wheat	4.63	36.7	3.29
Bajra	13.72	20.83	12.84
Gram	31.87	23.71	21.46
Sugarcane	23.41	5.95	3.32
C.V	77.5	78.68	87.96

Source: Calculations of author

The instability in the production of all selected crops of Haryana has increased over the selected period of time. Fluctuating trends recorded in instability in the production of Rice, wheat and Bajra. For Gram and sugar, the instability in production has declined over the period of time.

2.Trends in Growth and Instability in the productivity of selected crops of Haryana

It can be shown through Table 5 that CAGR of productivity of the Bajra and Wheat declined during the second period and continued as negative in case of wheat from 2017-18 to 2022-23. In case of Gram and Sugarcane it remains positive in all periods and for Rice it is negative only in the 1st period.

Table 5: CAGR of the productivity of selected crops of Haryana

Crops	2005-06 to 2010-2011	2011-12 to 2016-17	2017-18 to 2022-23
Rice	-1.79	1.09	0.82
Wheat	3.76	-1.41	-0.81
Bajra	9.92	-0.23	9.34
Gram	12.13	4.99	0.91
Sugarcane	1.99	1.95	0.35
Mean	5.202	1.278	2.122

Source: Calculations of author

For all crops highest productivity was registered during the first period and during the whole period it remains positive for all crops.

Table 6: Instability of the productivity of selected crops of Haryana

Crops	2005-06 to 2010-2011	2011-12 to 2016-17	2017-18 to 2022-23
Rice	6.69	3.09	4.61
Wheat	4.44	42.83	2.18
Bajra	12.81	6.78	6.2
Gram	23.14	26.09	11.48
Sugarcane	7.94	2.71	3.32
CV	67.64	108.43	65.37

Source: Calculations of author

Above table indicates the rising instability in the productivity of Wheat and Gram crop from 2011-12 to 2016-17 and then downwards trends in the period of 2017-18 to 2022-23 . In addition to this, the fluctuating trends registered in productivity of Rice and Sugarcane crop. In case of Bajra crop, the instability continued to decline throughout the period. The instability in the productivity of all crops on an average has increased from 2011-12 to 2016-17 as compared to the period of 2005-06 to 2010-2011 and then again declined in the last phase i.e. 2017-18 to 2022-23.

CONCLUSION

The area under principal crops in Haryana state had changed significantly during the studied period. The area under the Wheat, Gram and Sugarcane has decreased while it is increased for Rice during the whole studied period. For Bajra crop it is declined only in the second sub-period. Similar results have been found in case of production of crops. Maximum productivity growth was recoded for Gram and Bajra during the first and third sub-period respectively. This study reveals that Rice crop shows less instability than all other selected crops in terms of area under crop, production and productivity of the crop. The average growth rate of area under all crops remains positive only during the last phase of the study. The instability in the production of all the crops on an average has increased over the whole period of time. In case of Gram and sugar crop, this instability has declined. For all crops highest productivity was registered during the first period and during the whole period it remains positive for all crops. It can be seen that productivity of all the crops over time, highest instability registered in the second sub-period as compared to the other two periods of the study.

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