

TRENDS IN WHEAT PRODUCTIVITY IN EASTERN UTTAR PRADESH

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ABSTRACT

The major food crops of the residents of Eastern Uttar Pradesh are wheat and rice. In order to fulfill the demand for cereals in this region and to ensure food security, it is necessary to increase the production and productivity of wheat. Because of the increase in the production and productivity of wheat, necessary food will be available to all the people of this area and poverty and hunger will decrease. Eastern Uttar Pradesh is mainly an agricultural region and the main occupation of the residents is agriculture. Wheat and rice have a prominent place among food crops. In the present study, an attempt has been made to find out the current trend of wheat production and productivity in Eastern Uttar Pradesh. In this study, it was found that the production of wheat in this region is increasing continuously with some fluctuations. There is no structural break in the productivity of wheat. The productivity of wheat in different periods can be shown by a regression line. The productivity of wheat in Eastern Uttar Pradesh is less than productivity in other economic regions of Uttar Pradesh. The main causes for which is the lack of high productivity seeds, dependence on monsoon, lack of irrigation facilities, lack of information in terms of government schemes, etc. At present, new technology and high yields varieties seeds are being used in agriculture sector, due to which increase in productivity of wheat has been observed. This region has achieved quantitative self-sufficiency in terms of food grains (wheat, rice etc.) to ensure food security of its residents, but still there is a need for further improvement in the productivity of wheat qualitatively for the healthy life of the people so that people's life may be happy.

Keywords- *Wheat Productivity, Wheat Production, Trends, Eastern Uttar Pradesh.*

INTRODUCTION

The development of agricultural system in Eastern Uttar Pradesh is extremely important as it can provide food and nutrient security to the increasing population of the region through land and other limited financial resources. There has been an increasing the growth rate of agricultural production and productivity in recent years in Eastern Uttar Pradesh. In the present study, an attempt has been made to investigate the growth rate and development in farm production and productivity of major crops related to Eastern Uttar Pradesh.

Eastern Uttar Pradesh is located on the Indus-Ganga plain and consisting of the western part of Bihar, is the most densely populated region in the world. Eastern Uttar Pradesh region is bordered by Nepal in the north, Bihar and Jharkhand states in the east, Chhattisgarh, Madhya Pradesh, and Bundelkhand region of Uttar Pradesh in the south, and the central region of Uttar Pradesh in the west. Eastern Uttar Pradesh is divided into three climatic zones- North Eastern Plains, Eastern Plains, and Vindhya Region. The climate here is tropical and suitable for agriculture. The average minimum temperature in the winter season ranges from 15 Degrees Celsius to 25 Degrees Celsius in the

northern part of the plains and in the summer season the maximum temperature ranges from 32 Degrees Celsius to 46 Degrees Celsius.

Wheat is a major crop not only of the Eastern Uttar Pradesh but also of the world. It is sown in the Rabi season in November-December and harvested in April. It is called the 'King of Cereals' due to its used area, high productivity, and dominant position in international foodgrain trade. India ranks second in the world after China in both production and consumption of wheat. India's share in world wheat production is about 14.3%. Ancient records show that wheat was an important foodgrain produced in South-western Asia. This is the Centre of its origin. Wheat was also cultivated in ancient Greece and Egypt in prehistoric times. The Wheat production requires soils with low water retention, with clayey loam and loamy texture. Eastern Uttar Pradesh is a favorable natural region for wheat production.

REVIEW OF LITERATURE

Related literature review means the study of books, government and semi-government reports, encyclopedia, journals, published and unpublished thesis and records related to the research problem, which helps the researcher in selecting his research problem, preparing the outline of the study and taking the research work forward. The study of related literature is like a pillar on the basis of whose light a researcher finds his right path and obtains the right conclusion from his research work. The following literature has been reviewed by the researcher.

Singh and Supriya (2017) have undertaken investigation to evaluate the growth in area, production and productivity of Wheat crop in Uttar Pradesh. The linear growth rates and compound growth rates for the study period of 1971 to 2016 were estimated by fitting the linear function and compound function to the area, production and productivity of Wheat crop, respectively. The average area, production and productivity of Wheat in Uttar Pradesh during the study period were 9.6

million hectares, 30.01 million tons and 3.12 tons/hectare respectively and exhibited significantly increasing trend with linear and compound growth rates of 1% and 1.07 %, respectively for the area and for the production it was 1.67% and 1.70%, respectively. However, the productivity of Wheat exhibited a positive trend with the linear and compound growth rates of 2.48 % and 2.66 % respectively.

Tiwari H., Singh H.P. and Tripathi U. (2017) analyzed the growth and instability in terms of area, production and productivity of wheat in Uttar Pradesh. The area under wheat registered positive growth throughout the period in all the regions of the state. While in case of production and productivity, the positive growth was observed. The productivity was highest in western region whereas lowest in Bundelkhand region.

OBJECTIVES OF THE STUDY

- To study the current trend of Wheat productivity in Eastern Uttar Pradesh.
- To study the various factors affecting Wheat productivity in Eastern Uttar Pradesh.

HYPOTHESES OF THE STUDY

- **H₀:** *There has been no significant change in the trend of Wheat productivity in Eastern Uttar Pradesh. ($\mu_1 - \mu_2 = 0$)*
H₁: *There has been a significant change in the trend of Wheat productivity in Eastern Uttar Pradesh. ($\mu_1 - \mu_2 \neq 0$)*
- **H₀:** *The effect of any one factor is not significant in affecting the productivity of Wheat in Eastern Uttar Pradesh. ($\mu_1 - \mu_2 = 0$)*
H₁: *A factor also significantly affects the productivity of Wheat in Eastern Uttar Pradesh. ($\mu_1 - \mu_2 \neq 0$)*

RESEARCH METHODOLOGY

The selection of a research methodology for a research work is very important step. Only through a proper research methodology, proper results can be obtained. In the present research, Analytical research methodology has been used. Through this methodology, an attempt has been made to analyze the current problem in detail. Secondary data has been used in this study, which has been obtained from the Economics and Statistics Division of the Government of Uttar Pradesh and the website of the Department of Agriculture and Farmers Welfare, Government of India. On the basis of the secondary data, the current trend of Wheat productivity in Eastern Uttar Pradesh has been studied. In the present study, the current trend of Wheat productivity has been tested through **Chow-test** of Stata software.

CROPPING PATTERN IN EASTERN UTTAR PRADESH

Cropping pattern means the ratio of the area used for planting different crops at a particular time. According to **T. W. Schultz** (1902-1998), "Crop pattern means the ratio of crop area at a certain point of time. Change in crop pattern means change in the proportion of agricultural area under different crops." It means the portion of agricultural land is planted under different crops and the change in this portion over time is studied. Change in cropping pattern means change in the area under different crops.

Due to the different agro-climatic conditions and variations in soil fertility in Eastern Uttar Pradesh, the region is known as a **Basket of a Variety of Crops**. Most of the parts of Eastern Uttar Pradesh are situated in the alluvial Indus-Ganga plain and in the southern part of Eastern Uttar Pradesh, plateau and rocky soil is found where there is less rainfall. Cereals and coarse grains (millet) are produced in most parts of Eastern Uttar Pradesh. At present, most of the farmers in the Indus-Ganga plain region adopt rice and wheat as agricultural rotation. The share of pulses in the total crop production area is low and a large part of the area under pulse farming is cultivated with gram, peas, and pigeon peas. Sugarcane is an important cash crop in Eastern Uttar Pradesh. This is planted on about 40% of the total sown area. Sugarcane cultivation has increased due to the expansion of irrigation facilities, the development of improved varieties of seeds and the lack of any other option for the farmer. The area under cultivation of fruits and vegetables in Eastern Uttar Pradesh is about 5%. Potato is mainly produced among vegetables. Along with Eastern Uttar Pradesh, Uttar Pradesh is also a big potato-producing state. Rapeseed, mustard, groundnut, sesame, sunflower, linseed, etc. are produced as oilseeds in Eastern Uttar Pradesh. This region is located in the fertile Indus-Ganga plain and is mainly known as a food grain-producing area. Foodgrains are cultivated on about 83% of the land area in this region.

Table: 1- Share of Major Crops, Fruits, and Vegetables in Gross Cropped Area in Eastern Uttar Pradesh

S No.	Crops	% Share in Gross Cropped Area in Eastern Uttar Pradesh		
		2002-03	2014-15	2020-21
1	Wheat	38.4	41.4	42.76
2	Rice	36.1	36.6	37.22
3	Other Cereals and Millets	6.7	5.2	4.03
4	Pulses	8.5	6.4	5.02
5	Oilseeds	1.6	0.9	1.20
6	Sugarcane	4.4	4.8	5.94
7	Fruits and Vegetables	2.9	2.8	2.81
8	Other Crops	1.2	1.9	1.12

Source: *Land Use Statistics at a Glance (July, 2021) Directorate of Economics and Statistics, Department of Agriculture and Farmer Welfare, GOI*

According to the agricultural production estimates of Uttar Pradesh 2020-21, 42.76% area in this region was for wheat production, 37.22% for rice production, 5.02% for pulses production, 40% for sugarcane production, 2.81% for fruit and vegetable production, and 1.2% for oilseeds. 1.12% of the land was used for other crops. Mustard is mainly produced under oilseed crops in Eastern Uttar Pradesh.

Uttar Pradesh holds the leading position in terms of wheat production in India. This state contributes 35.12% to the net sown area for wheat production in the country and also contributes 35.30% to rice production. But in terms of productivity per hectare, it is at a low level of 2.7 tonnes per hectare. Wheat production in Uttar Pradesh is distributed in three climatic zones, Eastern Uttar Pradesh 5.24 million hectares, Central

Uttar Pradesh 0.68 million hectares and Western Uttar Pradesh wheat is produced on 3.29 million hectares of land. People consume wheat in the form of bread, chapattis, porridge (Dalia), flour, etc. The nutritional profile of wheatgrass is good. Protein, starch, carbohydrates, etc. are found in it. It is also a good source of minerals and vitamins and per 100 grams of its consumption is a source of 413 kilo calories of energy.

TRENDS OF WHEAT AND OTHER MAJOR CROPS PRODUCTION IN EASTERN UTTAR PRADESH

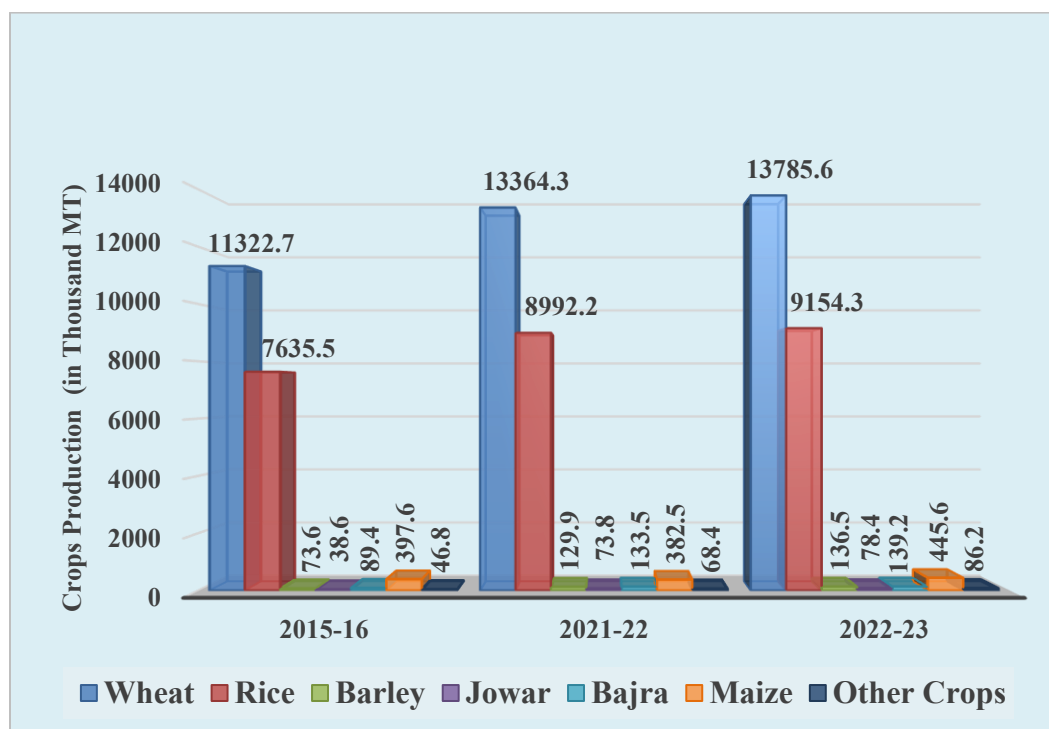
Eastern Uttar Pradesh is mainly produced Crops like wheat, rice, barley, jowar, bajra, Maize etc. A detailed description of which is shown through the following table.

Table: 2- Trends of Wheat and other Major Crops Production in Eastern Uttar Pradesh

(in Thousand MT)

Crops/ Year	Wheat	Rice	Barley	Jowar	Millet (Bajra)	Maize	Other Crops	Total Cereals
2015-16	11322.7	7635.5	73.6	38.6	89.4	397.6	46.8	19604.2
2016-17	10568.6	7863.8	78.4	41.7	91.4	424.3	42.3	19110.5
2017-18	11672.2	8263.4	81.9	42.5	95.6	451.2	53.4	20660.2
2018-19	11982.8	8587.5	103.3	44.6	138.9	427.3	58.1	21342.5
2019-20	12307.5	8768.9	114.2	63.2	128.2	457.0	64.9	21903.9
2020-21	12956.7	8735.7	121.9	69.4	132.7	388.7	73.2	22478.3
2021-22	13364.3	8992.2	129.9	73.8	133.5	382.5	68.4	23144.6
2022-23	13785.6	9154.3	136.5	78.4	139.2	445.6	86.2	23825.8

Source: District Statistical Magazine, all Districts of Uttar Pradesh 2023, Economic and Statistics Division, Planning Department, Uttar Pradesh



Source: Prepared by Researcher

The above table shows the trend of production of wheat and other major crops in Eastern Uttar Pradesh. The table shows the production of various crops like wheat, rice, barley, Jowar, millet, maize etc. in thousand metric tons from the year 2015-16 to the year 2022-23. It is clear from the table that the production of wheat was 11322.7 thousand metric tons in the year 2015-16, which increased to 13785.6 thousand metric tons by the year 2022-23.

TRENDS OF WHEAT AND OTHER MAJOR CROPS PRODUCTIVITY IN EASTERN UTTAR PRADESH

The productivity of agricultural crops is a relative measure. It is measured in terms of per hectare land, per unit labour, per unit capital etc. In the present study, the productivity of wheat and other major crops has been measured in terms of per hectare land. It is shown in the following table.

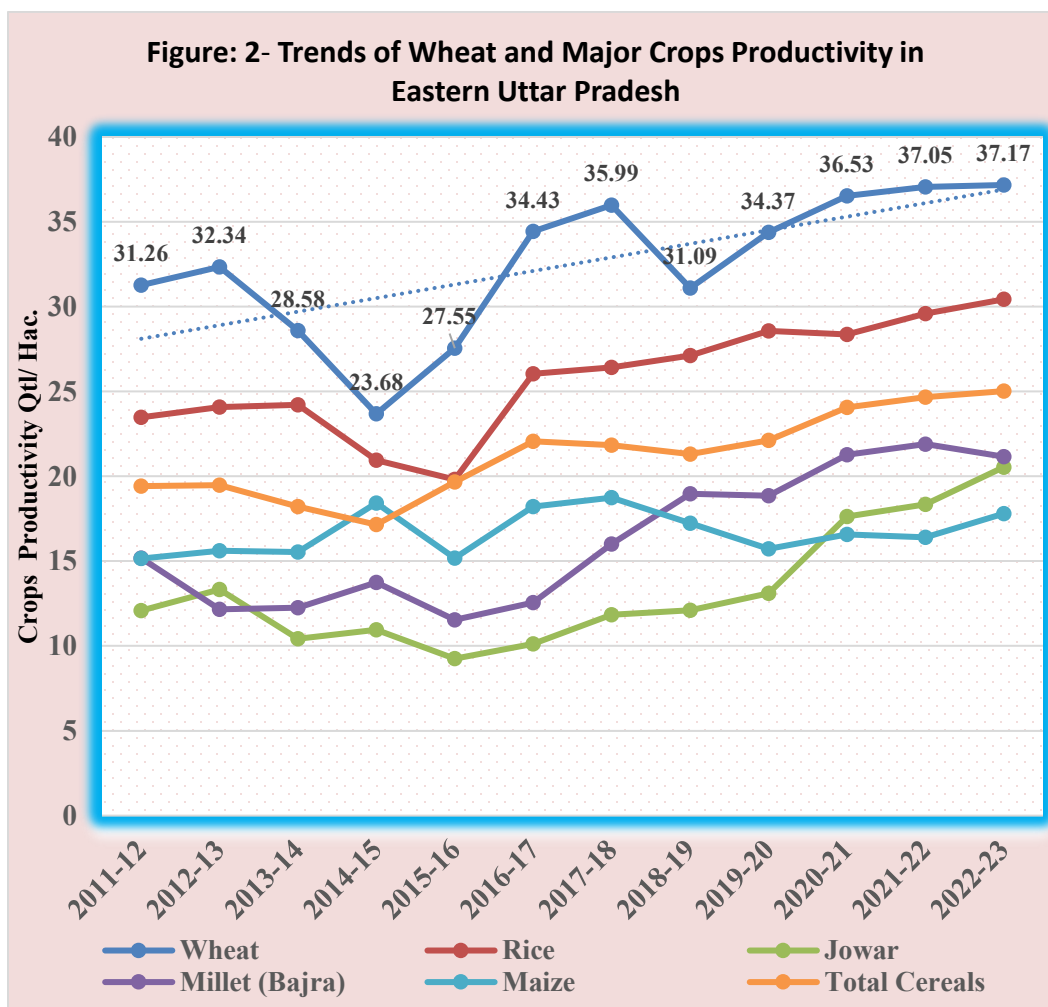
Table: 3- Trends of Wheat and Other Major Crops Productivity in Eastern Uttar Pradesh

(in Quintals per Hectare)

Crops / Year	Wheat	Rice	Jowar	Millet (Bajra)	Maize	Total Cereals
2011-12	31.26	23.48	12.08	15.18	15.15	19.43
2012-13	32.34	24.08	13.33	12.15	15.62	19.47
2013-14	28.58	24.21	10.42	12.26	15.54	18.21
2014-15	23.68	20.94	10.96	13.75	18.43	17.15
2015-16	27.55	19.81	9.25	11.54	15.17	19.66
2016-17	34.43	26.05	10.12	12.55	18.22	22.06
2017-18	35.99	26.42	11.84	16.01	18.74	21.83
2018-19	31.09	27.12	12.10	18.97	17.24	21.31
2019-20	34.37	28.57	13.10	18.85	15.72	22.12
2020-21	36.53	28.36	17.62	21.26	16.58	24.06
2021-22	37.05	29.59	18.35	21.90	16.41	24.66
2022-23	37.17	30.43	20.54	21.15	17.80	25.02

Source: District Statistical Magazine, all District of Eastern Uttar Pradesh, Economic and Statistical Division, Planning Department, Uttar Pradesh 2023

In the above table, the productivity of wheat, rice, barley, jowar, millet, maize and other crops in Eastern Uttar Pradesh for the years 2011-12 to 2022-23 has been shown in Quintals per Hectare.



Source: Prepared by Researcher

Figure-2 shows the current trend of productivity of various food grain crops like Wheat, Rice, Jowar, Bajra, Maize etc. in Eastern Uttar Pradesh through a line graph. The dark blue line shows the productivity of Wheat and the dotted blue line shows the path of continuous increase in the productivity of Wheat without a fluctuation. It is clear from the line graph that the productivity of Wheat is increasing from the year 2011-12 to 2022-23, But it lacks a consistent growth path and is shows many fluctuations. This fluctuation in the growth of wheat productivity shows that the productivity of wheat is increasing but the rate of increase in wheat productivity is not stable. Sometimes it is negative and sometimes positive.

The productivity of cereals in Eastern Uttar Pradesh is very low compared to other economic regions of Uttar Pradesh and other states of India like Punjab, Haryana etc.

CAUSES OF LOW AGRICULTURAL PRODUCTIVITY IN EASTERN UTTAR PRADESH

The level of agricultural productivity in Eastern Uttar Pradesh is lower than that in Western and central economic regions Uttar Pradesh. The productivity per hectare and productivity per unit of labour are low in these regions. In Eastern Uttar Pradesh, there

are many reasons for low agricultural productivity which are as follows:

- Lack of Capital.
- Small Land Holding.
- Lack of Hybrid Seeds.
- Use of Traditional Production Technology.
- Lack of Irrigation Facilities and Dependency on Monsoon.
- Lack of Mechanization in Agriculture.
- Less and Unscientific Use of Fertilizers.
- Lack of Information about the Government Schemes for Agricultural Development.

MEASURES TO INCREASE AGRICULTURAL PRODUCTIVITY IN EASTERN UTTAR PRADESH

To increase the agricultural productivity in Eastern Uttar Pradesh, it is very important to develop infrastructure because without developing the infrastructure, it will not be possible to increase agricultural production and productivity. Hence, to increase agricultural production and productivity, infrastructure such as agricultural seed production centers, expansion of irrigation facilities, agricultural crop production centers, arrangement of warehouses for storage of crops, arrangement of transport, arrangement of proper information system in rural areas, ensuring information about the current prevailing prices to all the farmers are necessary.

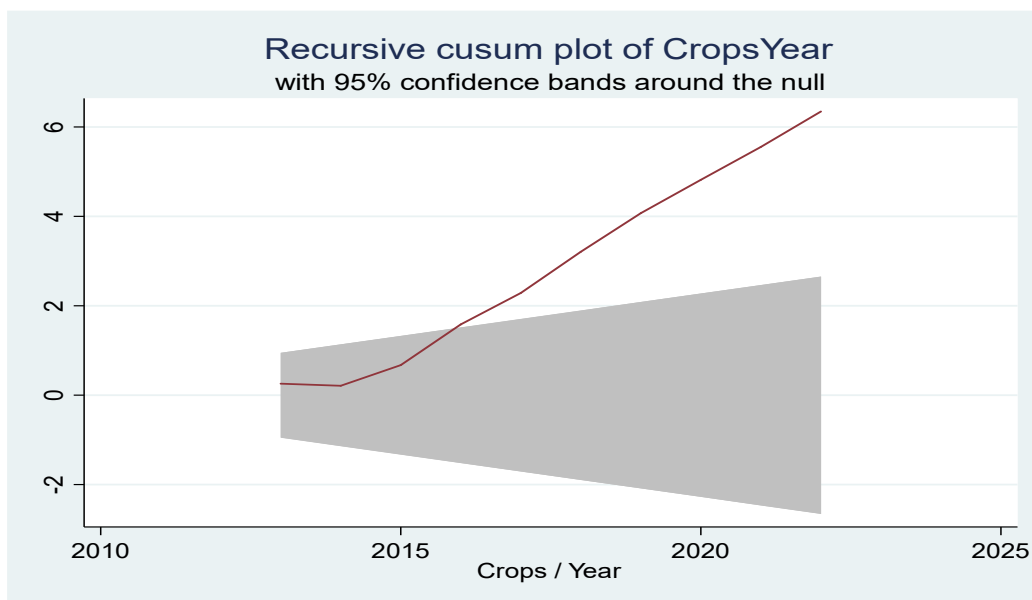
- ❖ Provision of Capital for Investment in Agriculture.
- ❖ Consolidating Agricultural Holdings.
- ❖ Use of Modern Technology in Agriculture.
- ❖ Adequate Provision of High-Productivity (Hybrid) Seeds.

- ❖ Development of Irrigation Facilities.
- ❖ Mechanization of Agriculture.
- ❖ Ensure availability of Fertilizers.
- ❖ Announcement of Remunerative Minimum Support Price for All Crops.
- ❖ Training of farmers, Agricultural Research and Development.
- ❖ Establishment of Regular Markets (Mandies).

As a result of the Green Revolution in Uttar Pradesh, there has been several times increase in agricultural productivity in some important crops like wheat and rice, due to use of new production system, use of high-productivity seeds, increase in the use of fertilizers, expansion in irrigation facilities etc. However, considering the growth of the population of Eastern Uttar Pradesh, the rate of increase in productivity in the production of crops is low. India is a developing country and developing countries depend on grains to fulfill their nutritional needs. After independence, the Government of India and the Government of Uttar Pradesh have strived to become self-reliant in the agricultural sector and have implemented many schemes to increase agricultural production and productivity, in which they have achieved some success. But there is still a need to make more efforts in this area.

ANALYSIS OF DATA

In the present research paper, the structural break in the productivity of wheat given in Table-3 has been tested through Chow-test. It is clear from Table-3 that there has been a continuous increase in the productivity of wheat from the year 2011-12 to the year 2022-23. In the present study, the null hypothesis has been tested as follows.

Figure: 2- Graphical Representation of Wheat Productivity in Eastern Uttar Pradesh from 2011-12 to 2022-23

Source- Drawn by Researcher through STATA software

The present figure mainly shows the productivity of Wheat from the year 2011-12 to the year 2022-23 in Eastern Uttar Pradesh. As a thumb rule, this graph shows the volatility in the productivity of Wheat over the last 12 years because the productivity line

crosses the shaded area. In the given graph, a significant change can be seen in the productivity of Wheat around the year 2016. There has been a significant increase in the average productivity of Wheat in Eastern Uttar Pradesh in the last 12 years.

Table: 4 Regression Result Description of Productivity of Wheat in Eastern Uttar Pradesh Relative to Time Series

. regress CropsYear Wheat						
Source	SS	df	MS	Number of obs	=	12
Model	65.5758348	1	65.5758348	F(1, 10)	=	8.47
Residual	77.4241652	10	7.74241652	Prob > F	=	0.0156
Total	143	11	13	R-squared	=	0.4586
				Adj R-squared	=	0.4044
				Root MSE	=	2.7825
CropsYear	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Wheat	.5735161	.1970661	2.91	0.016	.1344254	1.012607
_cons	1997.859	6.455474	309.48	0.000	1983.475	2012.243

Source: Calculated by Researcher through STATA Software

In the present table, the regression relationship of Wheat with respect to the time series is given in the above regression table. The details are as follows:

F- Value	= 0.0156
R-square	= 0.4586
Adjusted R-Square	= 0.4044
Root Mean Square Error	= 2.7825

P-Value: - = 0.016

The significance of the regression model in the above table is 0.0156. The value of R-Square is 0.4586 and the P value is 0.016. This makes it clear that the present regression model shows a significant chronological growth of Productivity of Wheat.

Table: 5 Statistical Testing for the Increase in Productivity of Wheat in Eastern Uttar Pradesh through Structural Breaks

. estat sbcusum				
Cumulative sum test for parameter stability				
Sample: 2011 - 2022			Number of obs = 12	
Ho: No structural break				
Statistic	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
recursive	2.1155	1.1430	0.9479	0.850

Source: Calculated by Researcher through STATA Software

In the above table, the productivity of Wheat in Eastern Uttar Pradesh has been statistically tested chronologically from the year 2011-12 to the year 2022-23. This test is known as Structural Break in statistics. This test has been done with STATA software. This test is known as **Chow-test** in STATA software. STATA software has the **estat sbcusum** command for the Chow-test. It gives statistical explanation of stability, growth, decline etc. of time series. The present table includes discussion of a total of 12 years.

RESULTS AND DISCUSSION

The value of test statistic is **2.1155**. Correspondingly, the table value at 1% significance level is 1.1430, the table value at 5% significance level is 0.9479 and the table value at 10% significance level is 0.850.

As a thumb rule, when the calculated value is greater than the value in the test statistics table (at the 1% significance level) then the null hypothesis is rejected. On the contrary, if the calculated value is less than the value of 1% significance level of the table then the null hypothesis is not rejected.

The calculated Test Statistics value in this table is **2.1155**. The table value of **Chow-test** is 1.1430 at the 1% level of significance. Hence, it is clear that the calculated value of **Chow-test** is greater than the table value so the null hypothesis is rejected. This is why the alternative hypothesis defines the result. The average productivity of Wheat of Eastern Uttar Pradesh from the year 2011-12 to the year 2022-23 shows a significant increase on the statistical scale in chronological order.

CONCLUSION

On the basis of the study, it can be said that the productivity of wheat in Eastern Uttar Pradesh is increasing continuously from the year 2011-12 to the year 2022-23. In the present study, the growth rate of wheat productivity has been tested at 1% percent significance rate through the Chow-test. On the basis of the Chow-test, it is clear that there is a continuous increase in the productivity of wheat in Eastern Uttar Pradesh, there is no structural break in it and data related to different time periods can be displayed by the same regression line.

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