



Temporal Trends in Crop Area, Production and Productivity in Jaipur District, Rajasthan (2008–09 to 2022–23)

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ABSTRACT

Agriculture continues to play a significant role in the rural economy of Jaipur District, Rajasthan, where agricultural activity is shaped by the interaction of land resources, rainfall variability, irrigation facilities and changing cropping practices. The present study investigates temporal variations in crop area, production and productivity in Jaipur District over the period 2008–09 to 2022–23. The analysis is based on secondary data covering four broad crop groups: cereals, pulses, oilseeds and other crops. Descriptive statistical techniques, year-wise comparisons and percentage-change analysis were employed to identify changes in the agricultural structure. The results reveal an overall expansion of cultivated area and agricultural output, although the trend was characterised by considerable annual fluctuations. Total crop area increased from 939,872 hectares in 2008–09 to 1,165,100 hectares in 2022–23, representing an increase of approximately 24 per cent. During the same period, total production increased from 1,535,907 tonnes to 1,890,760 tonnes, an increase of approximately 23 per cent. The available productivity series indicates that overall productivity rose from 1,634 kg/ha in 2008–09 to 1,916 kg/ha in 2020–21. Cereals remained the principal crop group in terms of area and production, whereas pulses recorded the most pronounced expansion in cultivated area and production. Pulse area increased by approximately 120 per cent and production by about 168 per cent. Oilseeds also recorded substantial increases in area and production. Cereal and oilseed productivity showed positive long-term changes, while productivity under pulses and other crops displayed considerable instability. The findings indicate that Jaipur's agricultural system has undergone both quantitative expansion and structural diversification. Nevertheless, fluctuations in productivity highlight the continuing importance of efficient water use, improved agricultural management and climate-resilient farming practices.

INTRODUCTION

Agriculture represents an important component of the rural economy of Rajasthan. Its contribution to rural livelihoods is particularly significant in districts where cultivation remains closely connected with seasonal rainfall, irrigation resources, soil conditions and farmers' decisions regarding crop selection. Jaipur

District is an important agricultural region of eastern Rajasthan, and its cropping system includes cereals, pulses, oilseeds, vegetables and other agricultural crops.

The agricultural environment of Rajasthan is characterised by substantial variation in rainfall and water availability. Such variability can influence the extent of land cultivated, crop choice, yield levels and total agricultural output. Consequently, an examination of

agricultural change requires attention not only to the amount of land under cultivation but also to production and productivity.

Crop area, production and productivity represent three complementary indicators of agricultural development. An increase in agricultural production may occur because more land is brought under cultivation, because productivity improves, or because the cropping pattern changes towards crops with higher output. Therefore, examining these indicators together provides a more meaningful understanding of agricultural transformation than considering any single indicator independently.

Previous research has demonstrated that climatic variability and drought conditions can influence agricultural performance in Rajasthan. Dhakar, Sehgal and Pradhan (2013), for example, examined relationships between meteorological and agricultural drought indicators and demonstrated the importance of seasonal climatic conditions for agricultural performance. Similarly, research in the Banas River Basin has highlighted the relationship between climatic conditions, water availability and crop yield in the semi-arid environment of Rajasthan (Dubey & Sharma, 2018).

Official agricultural statistics provide an important basis for examining these changes. The Directorate of Economics & Statistics, Government of Rajasthan, publishes district-level agricultural information covering crop area, production, productivity, irrigation and related indicators. The *Agricultural Statistics of Rajasthan* specifically provides districts-wise information on land use, crop-wise irrigated and total area, production, cropping and irrigation intensity, and agricultural productivity.

Against this background, the present study examines temporal changes in crop area, production and productivity in Jaipur District from 2008–09 to 2022–23. The study focuses on four broad crop groups—cereals, pulses, oilseeds and other crops—with the aim of identifying the major changes in the agricultural structure and the degree of variation in agricultural performance.

STUDY AREA

Jaipur District is situated in eastern Rajasthan between 26°26'27" North and 27°51'39" North latitudes and 74°54'43" East and 76°16'55" East longitudes and has a total geographical area of 11061.44 square kilometers. It occupies an important position within the agricultural and economic geography of the state. The district is characterised by a combination of urban, peri-urban

and rural landscapes, with agriculture continuing to be an important activity in rural areas.

The agricultural system of Jaipur includes the cultivation of cereals, pulses, oilseeds, vegetables and other crops. Wheat and pearl millet are important cereal crops, while gram and other pulses form an important part of the pulse category. Groundnut and other oilseeds are also cultivated in the district. Official Rajasthan agricultural information identifies Jaipur among the state's important agricultural districts for crops such as wheat, pearl millet, groundnut, tomato and pulses.

The physical environment of Jaipur is influenced by the semi-arid conditions of Rajasthan. Rainfall is concentrated mainly during the southwest monsoon, and inter-annual variation in rainfall can affect agricultural conditions. Irrigation and groundwater resources therefore have an important role in maintaining agricultural activity and reducing dependence on rainfall alone.

The agricultural significance of Jaipur and the diversity of its cropping system make it appropriate for examining long-term changes in crop area, production and productivity. The present study therefore uses a fifteen-year area and production series, together with the available productivity series, to analyse the changing agricultural pattern.(fig1.)

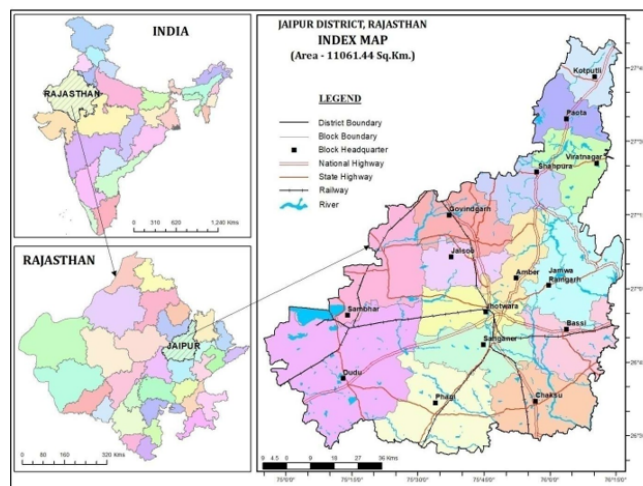


Figure 1: Source: Aquifer Mapping and Management of Ground Water Resources, Jaipur District, 2022

OBJECTIVES OF THE STUDY

The study has been undertaken with the following objectives:

1. To examine temporal changes in the area under major crop groups in Jaipur District from 2008–09 to 2022–23.
2. To analyse changes in agricultural production during the study period.
3. To examine variations in crop productivity.
4. To compare the performance of cereals, pulses, oilseeds and other crops.
5. To identify major fluctuations in agricultural area, production and productivity.
6. To examine the changing importance of different crop groups within Jaipur's agricultural system.
7. To assess the broad direction of agricultural diversification during the study period.

RESEARCH METHODOLOGY

Nature and Sources of Data

The study is based on secondary quantitative information concerning agricultural area, production and productivity. The supplied dataset covers four broad crop categories:

Cereals

Pulses

Oilseeds

Other crops

Area is expressed in hectares, production in tonnes and productivity in kilograms per hectare. The area and production observations cover fifteen agricultural years, beginning with 2008–09 and

ending with 2022–23. The productivity observations supplied for the study are available from 2008–09 to 2020–21.

The Rajasthan Directorate of Economics & Statistics maintains agricultural-statistics publications containing district-level crop information. The official portal lists agricultural-statistics publications for successive years, including 2010–11 through 2022–23, and states that these publications contain district-wise agricultural information. Rajasthan Agriculture Statistics

Analytical Procedure

The study follows a descriptive and comparative approach. The principal analytical procedures include:

Year-wise examination of crop area.

Year-wise examination of crop production.

Comparison of productivity among crop groups.

Identification of maximum and minimum observations.

Measurement of percentage change between the beginning and end of the relevant period.

Comparison of the relative performance of cereals, pulses, oilseeds and other crops.

Interpretation of major fluctuations in the context of the agricultural environment of Jaipur.

The percentage change has been calculated using:

Percentage Change = [(Final Value – Initial Value) / Initial Value] × 100

The analysis does not attempt to establish statistical causality between crop performance and individual environmental or socioeconomic variables. The supplied dataset does not contain a complete corresponding annual series for rainfall, temperature, irrigation, groundwater, fertilizer consumption, technology adoption, market prices or other explanatory variables. Consequently, climatic and water-related factors are discussed only as possible influences rather than as statistically established causes.

RESULTS AND DISCUSSION

Temporal Change in Crop

Area

The combined area under the four crop groups increased from 939,872 hectares in 2008–09 to 1,165,100 hectares in 2022–23. The resulting increase of 225,228 hectares represents approximately 24 per cent growth over the study period.

The area trend was not uniform. The highest total area was recorded in 2010–11 at 1,163,856 hectares. A decline followed during the middle years of the series, while a renewed increase occurred after 2018–19. By 2022–23, total crop area had again exceeded 1.16 million hectares.

Cereals maintained their position as the largest crop group throughout the period. Their area changed from 528,840 hectares in 2008–09 to 529,368 hectares in 2022–23, an increase of only about 0.1 per cent. The

Table 1: Area under Major Crop Groups in Jaipur District, 2008–09 to 2022–23

TOTAL AREA UNDER CROPS (in Hectare)															
YEARS	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
CROPS															
CEREALS	528840	526529	597996	555516	545227	551906	557668	548741	556387	525532	524031	533529	543463	521633	529368
PULSES	113737	92082	200116	236297	174668	254656	214173	126469	227532	168283	223125	254816	226359	257587	250155
OILSEEDS	213692	178533	275641	206592	183384	190093	166982	135258	147304	107226	136757	161416	164283	245552	294361
OTHERS	83603	90103	110821	114621	138150	156355	146552	158455	110416	138321	123389	101763	100499	92298	91216
TOTAL	939872	907965	1163856	1113026	1041429	1153010	1085375	968923	1041639	939362	1007302	1051524	1034604	1117070	1165100

Source: Government of Rajasthan, Directorate of Economics and Statistics. (2009-2024).

near stability of cereal area is notable because total crop area increased substantially.

The most striking change occurred in the pulse category. Pulse area rose from 113,737 hectares to 250,155 hectares, representing an increase of approximately 120 per cent. This more than doubling of cultivated area indicates a substantial change in the relative importance of pulses.

Oilseeds also expanded. Their area increased from 213,692 hectares in 2008–09 to 294,361 hectares in 2022–23, equivalent to approximately 38 per cent growth.

The area under other crops increased from 83,603 hectares to 91,216 hectares, representing an increase of approximately 9 per cent.

The area data therefore reveal that the expansion of agriculture was associated primarily with the increased importance of pulses and oilseeds rather than a major increase in cereal area.

Changes in Agricultural Production

Total production increased from 1,535,907 tonnes in 2008–09 to 1,890,760 tonnes in 2022–23. This represents an overall increase of approximately 23 per cent.

Production displayed substantial annual variation. It fell to 1,050,497 tonnes in 2009–10 before rising sharply in 2010–11. The highest total production in the series was 2,023,484 tonnes in 2021–22, followed by a decline to 1,890,760 tonnes in 2022–23.

Cereals continued to account for the largest volume of agricultural production. Their output increased from 1,075,952 tonnes in 2008–09 to 1,238,830 tonnes in 2022–23, equivalent to approximately 15 per cent growth.

The relatively modest increase in cereal area, combined with the increase in cereal production, suggests

that higher productivity contributed significantly to the growth of cereal output.

The pulse category recorded the greatest proportional increase. Production rose from 82,864 tonnes to 222,165 tonnes, representing an increase of approximately 168 per cent. The increase in production broadly corresponds with the substantial expansion of pulse area.

Oilseed production increased from 268,889 tonnes in 2008–09 to 361,608 tonnes in 2022–23, representing approximately 35 per cent growth.

The other-crops category showed a contrasting pattern. Production declined from 108,202 tonnes to 68,157 tonnes, equivalent to a reduction of approximately 37 per cent. This decline is notable because the area under this category increased slightly over the same period, suggesting a reduction in the output obtained per unit of area.

Changes in Agricultural Productivity

Productivity data are available for thirteen agricultural years, from 2008–09 through 2020–21. During this period, aggregate productivity increased from 1,634 kg/ha to 1,916 kg/ha, representing approximately 17 per cent growth.

Cereals displayed the highest productivity throughout most of the series. Cereal productivity increased from 2,035 kg/ha in 2008–09 to 2,680 kg/ha in 2020–21, representing approximately 32 per cent growth. This improvement is significant because cereal area remained almost unchanged over the longer period. The evidence therefore indicates that increased cereal production was accompanied by an improvement in output per hectare.

Pulse productivity was considerably more variable. It declined from 729 kg/ha in 2008–09 to 124 kg/ha in 2009–10, followed by a sharp recovery to 1,274 kg/ha in

Table 2: Production of Major Crop Groups in Jaipur District, 2008–09 to 2022–23

TOTAL PRODUCTION UNDER CROPS (in Tonnes)															
YEARS	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
CROPS															
CEREALS	1075952	841770	1310464	1143599	1136097	1143050	1201986	1035526	1278941	1155082	1206562	1346954	1456533	1309193	1238830
PULSES	82864	11459	254989	152098	178007	269040	146773	78178	205994	97760	182262	253376	184013	249578	222165
OILSEEDS	268889	172536	303557	238862	217638	233984	191662	153465	205487	168117	199280	256107	270533	394209	361608
OTHERS	108202	24732	57619	53146	59361	85439	76805	73314	74473	63711	59988	75576	71229	70504	68157
TOTAL	1535907	1050497	1926629	1587705	1591103	1731513	1617226	1340483	1764895	1484670	1648092	1932013	1982308	2023484	1890760

Source: Government of Rajasthan, Directorate of Economics and Statistics. (2009-2024).

Table 3: Productivity of Major Crop Groups in Jaipur District, 2008–09 to 2020–21

TOTAL PRODUCTIVITY UNDER CROPS (in Kg/Hect)														
YEARS	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	
CROPS														
CEREALS	2035	1599	2191	2059	2084	2071	2155	1887	2299	2198	2302	2525	2680	
PULSES	729	124	1274	644	1019	1056	685	618	905	581	817	994	813	
OILSEEDS	1258	966	1101	1156	1187	1231	1148	1135	1395	1568	1457	1587	1647	
OTHERS	1294	223	639	464	430	546	524	463	674	461	486	743	709	
TOTAL	1634	1157	1655	1426	1528	1502	1490	1383	1694	1581	1636	1837	1916	

Source: Government of Rajasthan, Directorate of Economics and Statistics. (2009-2024).

2010–11. Productivity subsequently fluctuated, reaching 994 kg/ha in 2019–20 before declining to 813 kg/ha in 2020–21.

The pronounced variability in pulse productivity indicates that pulse production was comparatively unstable during the study period. Such instability may reflect variations in moisture conditions, rainfall, crop management and other agricultural factors, although the available data do not allow the individual effects of these variables to be quantified.

Oilseeds showed a comparatively favourable productivity trend. Productivity increased from 1,258 kg/ha in 2008–09 to 1,647 kg/ha in 2020–21, representing approximately 31 per cent growth. The simultaneous expansion of oilseed area and improvement in productivity indicates a strengthening of the position of oilseeds within the agricultural system.

The other-crops category performed less favourable. Productivity declined from 1,294 kg/ha to 709 kg/ha, a reduction of approximately 45 per cent. Because this category combines several different crops, its aggregate trend should be interpreted cautiously. Crop-specific analysis would be necessary to determine which crops were responsible for the decline.

Comparative Performance of Crop Groups

The three indicators together reveal different patterns among the major crop groups.

Cereals remained the foundation of agricultural production. Their area remained relatively stable, but their productivity increased substantially. This suggests that the growth of cereal production was associated more strongly with productivity improvements than with area expansion.

Pulses underwent the most substantial structural expansion. Their cultivated area more than doubled and their production increased by more than one and a half times. Nevertheless, their productivity was highly variable. Thus, the expansion of pulses was primarily associated with greater cultivated area, while yield performance remained comparatively unstable.

Oilseeds demonstrated both area expansion and productivity improvement. Their area increased by approximately 38 per cent and their productivity rose by approximately 31 per cent during the available productivity period. This combination indicates relatively positive long-term development.

The other-crops category presented a different pattern. Although its area changed comparatively little, production declined and productivity fell considerably.

This indicates that the category requires more detailed examination at the individual-crop level.

Overall Agricultural Transformation

The aggregate results point towards an expanding and increasingly diversified agricultural system in Jaipur.

Between 2008–09 and 2022–23, total crop area increased by approximately 24 per cent, while total production increased by approximately 23 per cent. The available productivity data indicate an approximately 17 per cent increase between 2008–09 and 2020–21.

The changes were not evenly distributed among crop groups. Cereals retained their dominant position, while pulses and oilseeds gained importance. The substantial increase in pulse cultivation represents the most pronounced change in the cropping structure.

Annual fluctuations are another major characteristic of the data. Total production fell sharply in 2009–10, increased substantially in 2010–11, declined again in later years and subsequently reached a peak in 2021–22. Such variation indicates that agricultural growth in Jaipur has not followed a smooth linear trajectory.

The agricultural environment of Rajasthan provides an important context for understanding this variability. Previous research has established relationships between drought conditions, rainfall variability and agricultural responses in Rajasthan (Dhakar et al., 2013). Similarly, studies of the Banas River Basin have identified climatic and water-related factors as important considerations in understanding crop performance (Dubey & Sharma, 2018).

However, agricultural production is influenced by multiple interacting factors. Rainfall and irrigation may affect crop outcomes, but changes in crop choice, seed varieties, fertilizer application, agricultural technology, soil management, groundwater conditions and market incentives can also influence farmers' decisions and productivity. Consequently, the present study identifies these factors as potential influences rather than claiming direct causal relationships.

MAJOR FINDINGS

The principal findings of the study are as follows:

- Total crop area increased from 939,872 hectares in 2008–09 to 1,165,100 hectares in 2022–23, representing approximately 24 per cent growth.
- Total agricultural production increased from 1,535,907 tonnes to 1,890,760 tonnes, representing approximately 23 per cent growth.

- Cereals remained the dominant crop group throughout the study period.

- Cereal area remained almost stable, increasing only marginally from 528,840 hectares to 529,368 hectares.

- Pulse area increased from 113,737 hectares to 250,155 hectares, representing approximately 120 per cent growth.

- Pulse production increased from 82,864 tonnes to 222,165 tonnes, representing approximately 168 per cent growth.

- Oilseed area increased from 213,692 hectares to 294,361 hectares, representing approximately 38 per cent growth.

- Oilseed production increased from 268,889 tonnes to 361,608 tonnes, representing approximately 35 per cent growth.

- Cereal productivity increased from 2,035 kg/ha in 2008–09 to 2,680 kg/ha in 2020–21, representing approximately 32 per cent growth.

- Oilseed productivity increased from 1,258 kg/ha to 1,647 kg/ha, representing approximately 31 per cent growth.

- Aggregate productivity increased from 1,634 kg/ha to 1,916 kg/ha during the available productivity period, representing approximately 17 per cent growth.

- Pulse productivity showed considerable annual fluctuations.

- Productivity under other crops declined by approximately 45 per cent between 2008–09 and 2020–21.

- The overall agricultural structure indicates increasing diversification, particularly through the expansion of pulses and oilseeds.

- Despite overall growth, agricultural production remained subject to substantial annual variation.

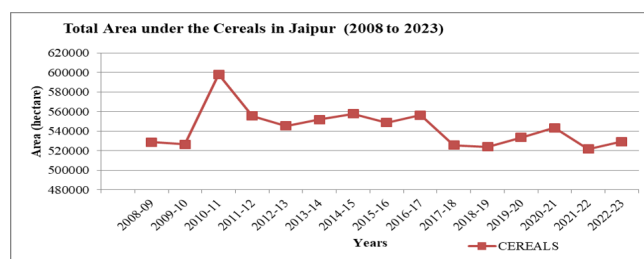


Figure 2: Total Area under the Cereals in Jaipur District, Rajasthan (2008- 2023) based on Table 1.

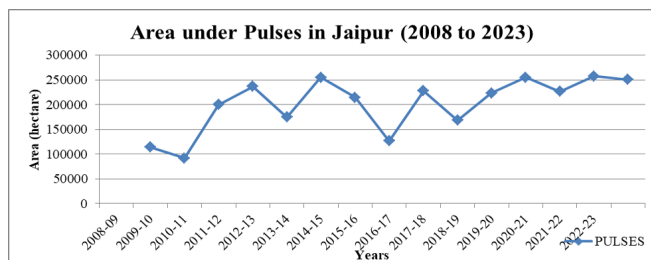


Figure 3: Area under Pulses in Jaipur District, Rajasthan (2008 to 2023) based on Table 1.

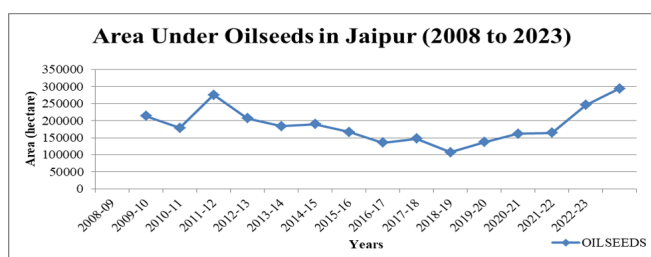


Figure 4: Area under oilseeds in Jaipur District, Rajasthan (2008 to 2023) based on Table 1.

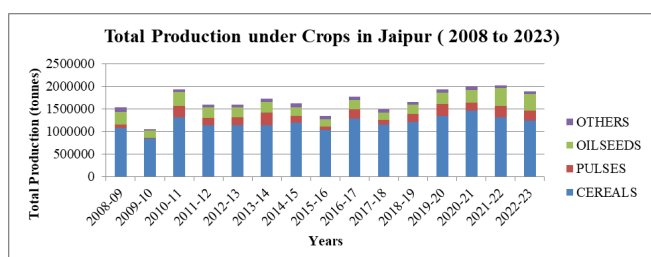


Figure 5: Total Production under different crops in Jaipur District, Rajasthan (2008 to 2023) based on Table 2.

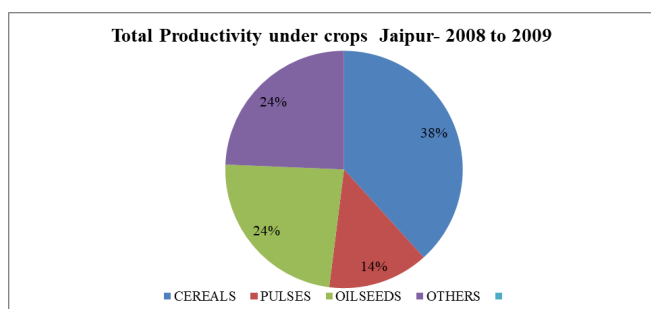


Figure 6: Total Productivity under crops in Jaipur - 2008 to 2009 based on Table 3.

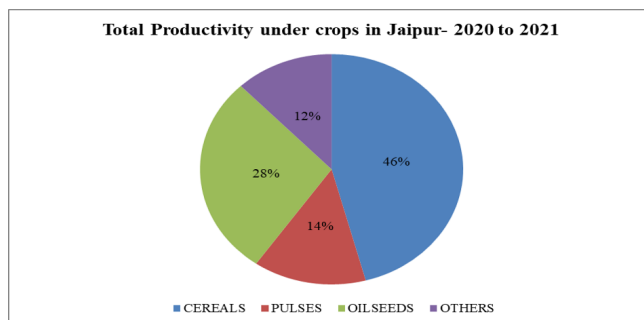


Figure 7: Total Productivity under crops in Jaipur, Rajasthan - 2020 to 2021 based on Table 3.

CONCLUSION

The analysis of agricultural trends in Jaipur District over the period 2008–09 to 2022–23 reveals an overall expansion in cultivated area and agricultural production accompanied by changes in the relative importance of different crop groups.

Total crop area increased by approximately 24 per cent, while production increased by approximately 23 per cent between the beginning and end of the study period. The available productivity series also indicates an improvement in aggregate productivity of approximately 17 per cent between 2008–09 and 2020–21.

Cereals continued to occupy the leading position in the agricultural system. Their cultivated area remained almost unchanged, yet cereal productivity increased substantially. This indicates that improvements in output per hectare played an important role in maintaining and increasing cereal production.

The most significant structural transformation occurred in pulses. Their cultivated area increased by approximately 120 per cent and production by approximately 168 per cent. Oilseeds also recorded substantial growth in both area and production, accompanied by an improvement in productivity. These changes suggest a gradual strengthening of crop diversification within Jaipur's agricultural system.

At the same time, the data reveal considerable instability. Pulse productivity fluctuated markedly between years, while the productivity of other crops declined considerably over the available period. Total production also experienced substantial increases and decreases from one agricultural year to another.

The findings therefore suggest that future agricultural development should not focus exclusively on increasing the amount of cultivated land or total output. Greater attention should be given to improving the stability of productivity, efficient utilisation of water re-

sources, soil conservation, suitable crop diversification, improved seed material and climate-resilient agricultural practices.

The study has certain limitations. Most importantly, the available dataset does not provide annual observations for all factors that potentially influence agricultural productivity. Rainfall, irrigation intensity, groundwater availability, fertilizer use, technology adoption, market prices and farm-level management variables were not incorporated into the statistical analysis. The observed relationships should therefore be regarded as descriptive rather than causal.

Future research can address these limitations by combining agricultural statistics with climatic, hydrological and socioeconomic information. Correlation and regression analysis, coefficient of variation, compound annual growth rate and other quantitative techniques could be employed to determine the factors associated with agricultural change more precisely. Such an approach would provide a stronger basis for agricultural planning and sustainable resource management in Jaipur District.

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