©*Rajasthali Journal* ISSN 2583-1720

Received: Jan '25
Revised:
Accepted: Feb '25

SPATIO-TEMPORAL ANALYSIS OF AGRICULTURAL PRODUCTIVITY IN SIKAR DISTRICT

Pankaj Kanwar[1] and Dr. Surender Choudhary[2]
[1]Research Scholar, Department of Geography, Mahararaja Ganga Singh University, Bikaner
[2]Assistant Professor, SNDB Govt. PG College, Nohar, Hanumangarh
(Affiliated to Maharaja Ganga Singh University Bikaner (Rajasthan)
E-mail: [1]priyashekhawat8947@gmail.com

ABSTRACT

Agricultural productivity plays a crucial role in ensuring food security and economic stability, particularly in semi-arid regions such as Sikar district, Rajasthan. This study examines the spatio-temporal trends in agricultural productivity of food crops, pulses, and oilseeds over the period 2013-14 to 2021-22. The analysis is based on district-level data measured in kg/hectare, revealing significant trends in crop yield improvements. Over the study period, food crop productivity increased from 1555 kg/ha in 2013-14 to 1822 kg/ha in 2021-22, demonstrating an overall growth attributed to improved irrigation infrastructure and agricultural advancements. Similarly, pulses exhibited a modest increase from 892 kg/ha to 931 kg/ha, while oilseeds demonstrated a substantial rise from 1453 kg/ha to 1886 kg/ha, likely due to enhanced cultivation practices and government initiatives promoting oilseed production.

The study employs time-series analysis to assess these changes and identify underlying patterns influencing productivity variations. The results indicate that food crops and oilseeds have experienced significant improvements, whereas pulses have demonstrated relatively slower growth. Factors such as precipitation variability, irrigation expansion, adoption of high-yielding crop varieties, and modifications in agricultural practices have contributed to these trends. Furthermore, spatial disparities within the district suggest that certain tehsils with enhanced irrigation access have exhibited higher productivity gains compared to rainfed areas.

These findings underscore the necessity for targeted interventions to enhance pulse productivity and further support oilseed cultivation to maintain sustainable agricultural growth. Policy recommendations encompass the promotion of water conservation strategies, precision farming techniques, and improved seed varieties to enhance crop resilience against climatic fluctuations. Subsequent research could incorporate GIS-based spatial mapping and remote sensing to provide a more comprehensive understanding of agricultural productivity trends across diverse regions within Sikar.

Keywords: Agriculture Productivity, irrigation, Time series analysis, GIS, Spatio-Temporal.

INTRODUCTION

Agricultural development plays a crucial role in addressing the food security needs of an increasing world population, especially in the context of climate change and environmental sustainability (Madanayake et al., 2021). As global population growth drives higher food demand, there is a growing demand of food crops. To meet the food security needs of a growing population while maintaining environmental sustainability, various innovative approaches are being explored for food crops across the world. The developing countries like India still depend on traditional intensive agriculture practices. However, the developed counties are adopting modern technology to enhance agricultural productivity. These include the use of bioinoculants to boost crop growth and resilience (Dos Reis et al., 2024), urban agriculture and vertical farming technologies (Chatterjee et al., 2020), nanotechnology-based agrochemicals (Khan et al., 2022), and digital farming technologies (Balyan et al., 2024). Additionally, supporting smallholder farmers, who constitute a significant portion of farm holdings in India and contribute to the rural economy and natural resource conservation, is crucial for agricultural development and poverty reduction efforts (Kamara et al., 2019).

Agriculture plays a crucial role in India's economy, accounting for 13.9% of the country's GDP and employing 54.6% of the workforce (Wagh & Dongre, 2016). The sector has shown significant progress over the years, with food grain production quadrupling since independence despite a tripling of the population (Ram et al., 2015). However, the agricultural sector faces numerous challenges, including climate change, soil degradation, and the need for sustainable practices. However, despite these challenges, the Indian agricultural system is shifting from traditional food crops to a modern crops system. One of the emerging trends in Indian agriculture is the adoption of organic farming. India has 1.59 million organic producers cultivating 2.7 million hectares of agricultural land (Avi & Batra, 2023). Organic farming has shown promise in improving soil fertility, increasing yields, reducing input costs, and providing better returns compared to conventional farming (Mariappan & Zhou, 2019). Another important trend is the implementation of Climate-Smart Agriculture (CSA) practices. CSA technologies and practices have been introduced in climate-smart villages to enhance crop yields, increase farm incomes, and reduce greenhouse gas emissions (Ajatasatru et al., 2024; Ghosh, 2019). In conclusion, the development of agriculture in India is characterized by a shift towards sustainable and climate-resilient practices. The adoption of organic farming, CSA technologies, and the integration of modern information technology, such as IoT-based systems (Ram et al., 2015), are shaping the future of Indian agriculture. Additionally, the government is promoting various schemes and initiatives to support farmers and improve agricultural productivity (Jaiswal et al., 2020). These trends indicate a move towards more efficient, sustainable, and technologically advanced agricultural practices in India.

India's major food crops include wheat, rice, and maize, which are crucial for the country's food security (Madhukar et al., 2019). These crops have shown varying trends in yield improvement across different states over the past decades. For instance, wheat yields in 13 states, rice yields in 11 states, and maize yields in 6 states are no longer improving (Madhukar et al., 2019). This stagnation in crop yields is a significant concern, affecting large areas of cultivated land. Interestingly, while some regions face yield stagnation, others have seen increases. In Punjab, for example, post-monsoon rice crop production increased by 25% between 2002 and 2016 (Jethva et al., 2019). However, this increase has been associated with a rise in post-harvest agricultural fire activity, leading to increased aerosol loading and air pollution in northern India (Jethva et al., 2019). Climate change is having a significant impact on India's food crops. Studies indicate that land productivity for most crops decreases with an increase in annual mean temperature (Praveen & Sharma, 2019; Praveen & Sharma, 2019). This poses a threat to food security, particularly for small and marginal farming households (Praveen & Sharma, 2019). To address these challenges, India needs to focus on sustainable agricultural practices, including efficient crop residue management, soil health improvement, water use efficiency, and adaptation strategies to mitigate the effects of climate change (Patel et al., 2020; Singh et al., 2024). Traditional farming methods, such as double cropping, mixed cropping, and crop rotation, could play a crucial role in achieving sustainability in agriculture while improving nutrition quality (Patel et al., 2020).

Rajasthan's agriculture is the backbone of its economy, shaped by its arid and semi-arid climate. Despite water scarcity and extreme weather, the state cultivates major crops like bajra, wheat, mustard, and pulses, supported by irrigation projects like the Indira Gandhi Canal. Traditional farming methods coexist with modern techniques, ensuring agricultural sustainability in challenging conditions. Rajasthan's agricultural productivity is influenced by various factors, including climate, soil conditions, and farming practices. Tree-based farming systems are prevalent across Rajasthan's agroclimatic zones, with P. cineraria dominating in arid western regions and A. nilotica in semi-arid to dry sub-humid areas (Singh et al., 2024). These systems provide economic, social, and environmental benefits, helping farmers cope with climatic adversities. Interestingly, crop yields in tree-based systems vary significantly across agroclimatic zones and agroforestry systems. This variability highlights the complex interactions between trees, crops, and environmental factors in agroforestry systems. To improve agricultural productivity in Rajasthan, various approaches are being explored. Climate-smart agriculture (CSA) technologies and practices have shown promise in enhancing crop yields, farm incomes, and reducing greenhouse gas emissions (Ghosh, 2019).

STUDY AREA

The district is situated in the northeastern section of the state, with an average elevation of 422 meters above sea level. It shares borders with Jhunjhunu District to the north, Churu District to the northwest, Nagaur District to the southwest, and Jaipur District to the southeast. Additionally, it has a small boundary with Mahendragarh District of Haryana at its northeastern corner. Encompassing 7742.43 square kilometers, the district accounts for approximately 2.26 percent of the state's total area. In terms of size, Sikar district ranks 19th among the 32 districts in the state. The district's topography can be divided into two main regions. The western part is characterized by sand dunes, while the eastern half features hill ranges. The far northern area around Ramgarh is semi-desert, and the southern portion of the district boasts fertile loamy soil. The district's climate is marked by hot summers, limited rainfall, chilly winters, and generally dry air except during the brief monsoon season. Rainfall in the area is not only scarce but also varies significantly from year to year, frequently resulting in drought conditions.

Sikar was established as a separate district following the integration of Jaipur state into the United State of Greater Rajasthan in 1949, a status it maintains to this day. For administrative purposes, the district is divided into nine subdivisions, which correspond to nine Tehsils: Sikar, Fatehpur, Lachhmangarh, Neem-ka-Thana, Sri Madhopur, and DantaRamgarh, among others. It also comprises nine Panchayat samities: Dhod, Khandela, DantaRamgarh, Piprali, Fatehpur, Lachhmangarh, Neen-ka-Thana, Sri Madhopur, and Patan. The district contains 329 gram panchayats.

OBJECTIVE

1. To analyze the pattern of cropped area under major crops in Sikar district over a 10-year period.
2. To examine the patterns of crop production and agricultural productivity over the past 10 years in Sikar district.

DATABASE AND RESEARCH METHODOLOGY

This study relies primarily on secondary data and uses line graphs, bar charts, and tables for data analysis, each with their own strengths and weaknesses depending on the task at hand.

The secondary data of the area under different crops has been obtained from the agricultural statistics report of three time periods, along with the district annual statistical handbook of 2010-11, 2015-16 and 2021-22. For the data analysis, various tools such as line graphs are particularly effective for displaying temporal data and identifying trends, especially when dealing with multiple time series (Javed et al., 2010). Bar charts, on the other hand, are more suitable for comparing values and identifying main effects (Shah & Freedman, 2011). They are generally more efficient for comparisons across time series with a large visual span, while standard line graphs are typically more efficient for comparisons over smaller visual spans where overlap and clutter are reduced (Javed et al., 2010). Interestingly, bar graphs have been found to be problematic for presenting continuous data in small sample size studies, as they may obscure important aspects of data distribution (Weissgerber et al., 2017; Weissgerber et al., 2019). The use of chart type should be based on the specific task, data complexity, and user familiarity (Meyer et al., 1997). Line and bar graphs are generally more effective than pie charts or tiered bar graphs for change and proportion judgments (Hollands & Spence, 1992). However, there is a growing trend towards using more informative visualizations that show data distribution, such as dot plots, box plots, and violin plots, especially for small sample size studies (Weissgerber et al., 2017; Weissgerber et al., 2019). These alternative visualizations can provide more transparency and facilitate critical evaluation of data, promoting reproducibility and open science in research (Weissgerber et al., 2017).

RESULT AND DISCUSSION

AREA UNDER FOOD CROPS

Table 1: Area Under Major Food Crops

Sikar District: Area Under Major Food Crops											**(Area in hectare)**	
S.N.	**Year**	**Total Cropped Area**	**Food Crops**									
			Cereals				**Pulses**					
			Bajra	**Wheat**	**Barley**	**Total**	**Moong**	**Chaula**	**Moth**	**Gram**	**Total**	
I	2010-11	846573	328946	100483	35743	465172	17277	51911	10310	84841	164339	
2	2015-16	722330	272758	92333	29425	394516	24806	26082	2492	31285	84665	
3	2021-22	771947	254238	79723	19416	353377	78530	22540	268	67688	169026	
Source: Agriculture Statistics of Rajasthan (2010-11,2015-16, 2021-22), Directorate of Economics & Statistics, Rajasthan, Jaipur.												

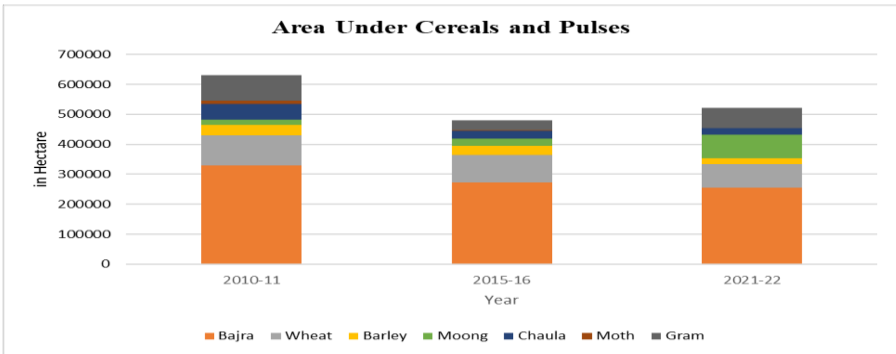

Figure 1: Area Under Cereals and Pulses

As illustrated in Table 1 and Figure 1, the total area under cultivation in Sikar district has experienced variations across the years. Initially, it saw a reduction from 8,46,573 hectares in 2010-11 to 7,22,330 hectares in 2015-16, representing a 14.67% decrease. Subsequently, the cultivated area increased to 7,71,947 hectares by 2021-22, indicating a 6.87% rebound.

CEREALS

The area under cereal cultivation has exhibited a consistent decline. Bajra, the predominant cereal crop, experienced a 17.08% reduction from 3,28,946 hectares in 2010-11 to 2,72,758 hectares in 2015-16, and further decreased by 6.80% to 2,54,238 hectares in 2021-22. Wheat cultivation diminished by 8.13% from 2010-11 to 2015-16 and by an additional 13.63% from 2015-16 to 2021-22, resulting in an overall 20.66% decrease. Barley underwent the most significant reduction, declining by 17.96% from 2010-11 to 2015-16 and a further 34.01% by 2021-22, culminating in a 45.67% decrease. The total area under cereal cultivation contracted by 15.16% between 2010-11 and 2015-16 and by 10.42% by 2021-22, leading to an overall 24.03% reduction over the period.

PULSES

In contrast to cereals, pulses have undergone significant alterations. Moong exhibited the most substantial growth, increasing by 43.67% from 17,277 hectares in 2010-11 to 24,806 hectares in 2015-16 and subsequently escalating 216.73% to 78,530 hectares in 2021-22, resulting in an overall 354.68% increase. Gram, conversely, experienced a 63.13% decline between 2010-11 and 2015-16 but subsequently recovered by 116.41%, culminating in a net decrease of 20.19%. Moth cultivation diminished substantially, reducing from 10,310 hectares in 2010-11 to a mere 268 hectares in 2021-22. Chaula similarly demonstrated a downward trend, with a 56.54% reduction over the entire period.

The data indicates a shift from cereal-based agriculture toward pulse cultivation, particularly Moong, which has experienced a substantial increase. This shift may be attributed to changing market preferences, improved price incentives for pulses, government support, and evolving climatic conditions favouring pulse production over traditional cereals. This is because wheat and barley require intensive irrigation, and during this time period, the groundwater level has declined significantly in this region. This decline in water level has substantially altered the agricultural cropping pattern in the district.

AREA UNDER OILSEEDS AND PULSES

Table 2: Area Under Oilseeds and Cash Crops

Sikar District: Area Under Oilseeds and Cash Crops								(Area in hectare)			
S.N.	Year	Total Cropped Area	Oil Seeds				Cash Crops				
			Mustard	Groundnuts	Taramira	Total	Guar	Methi	Onion	Total	
I	2010-11	846573	74622	23763	18706	117091	63743	12900	9373	86016	
2	2015-16	722330	48937	21438	1478	71853	129418	12116	15188	156722	
3	2021-22	771947	71019	34782	24185	129986	78897	4863	20176	103936	

Source: Agriculture Statistics of Rajasthan (2010-11,2015-16, 2021-22), Directorate of Economics & Statistics, Rajasthan, Jaipur.

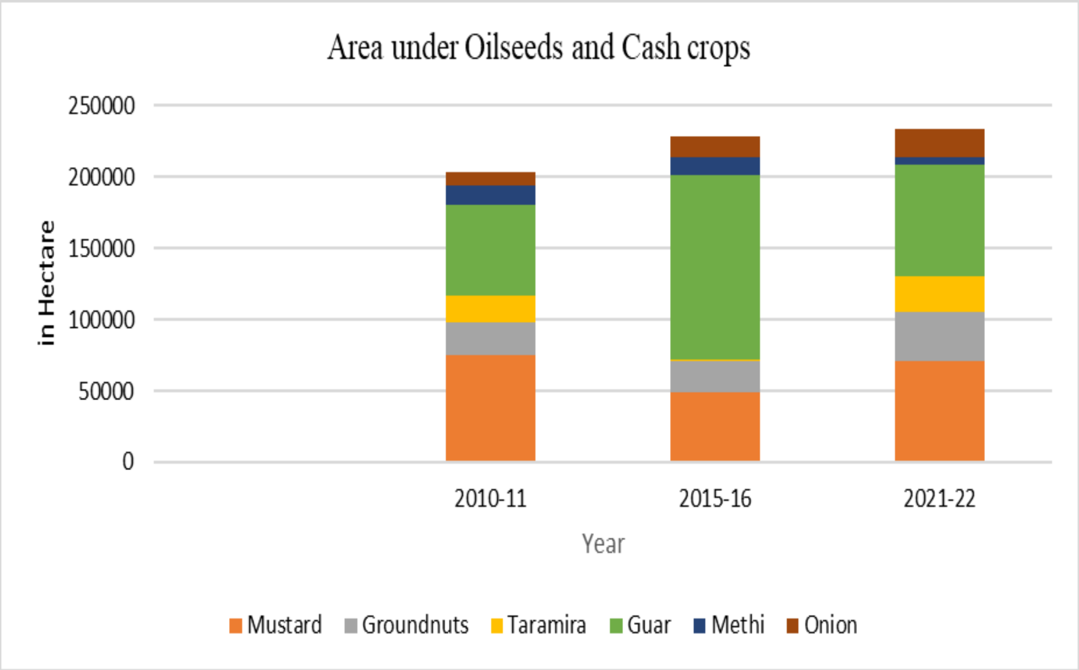

Figure 2: Area Under Oilseeds and Cash Crops

Table 2 and Figure 2 illustrate that the cultivation of oilseeds exhibited diverse trends. The area under Mustard, the predominant oilseed, decreased substantially by 34.42% from 74,622 hectares in 2010-11 to 48,937 hectares in 2015-16 but subsequently increased by 45.11% to 71,019 hectares in 2021-22, indicating a near recovery. Groundnut experienced a 9.79% reduction from 23,763 hectares in 2010-11 to 21,438 hectares in 2015-16, but later increased by 62.23% to 34,782 hectares in 2021-22. Taramira, however, demonstrated extreme variability, declining 92.10% from 18,706 hectares in 2010-11 to 1,478 hectares in 2015-16, before recovering to 24,185 hectares in 2021-22, representing a 1,537.13% increase in six years. The total area under oilseeds decreased by 38.65% between 2010-11 and 2015-16 but subsequently increased by 80.94% by 2021-22, resulting in an overall 11.04% increase over the period. This expansion in area under oilseeds is attributed to government MSP as well as changing climatic conditions in the region, as these crops are less water-intensive compared to traditional crops.

CASH CROPS

Table 2 and Figure 2 demonstrate that cash crop cultivation exhibited substantial variation. Guar experienced remarkable growth, increasing by 103.02% from 63,743 hectares in 2010-11 to 129,418 hectares in 2015-16, but subsequently declined by 39.04% to 78,897 hectares in 2021-22. This fluctuation can be attributed to the sudden increase in guar prices during the 2013 to 2015 period, resulting from the discovery of shale oil and gas in the USA. Methi cultivation remained relatively stable, decreasing slightly from 12,900 hectares in 2010-11 to 12,116 hectares in 2015-16, before experiencing a sharp decline of 59.84% to 4,863 hectares in 2021-22. Onion cultivation, conversely, displayed steady growth, increasing by 62.06% from 9,373 hectares in 2010-11 to 15,188 hectares in 2015-16 and further by 32.86% to 20,176 hectares in 2021-22. The total area under cash crops expanded by 82.25% between 2010-11 and 2015-16 but subsequently decreased by 33.69% by 2021-22, resulting in an overall 20.89% increase over the period.

The data indicate significant alterations in cropping patterns, with oilseeds, particularly Mustard and Groundnut, gaining prominence in recent years. Taramira, which had nearly disappeared in 2015-16, exhibited a substantial resurgence by 2021-22. Among cash crops, Guar cultivation experienced a dramatic increase followed by a precipitous decline, while Onion cultivation steadily expanded. These variations likely reflect fluctuating market conditions, climate adaptability, and governmental incentives influencing agricultural decision-making in Sikar district.

PRODUCTION OF MAJOR CROPS

Table 3: Production of Major Crops in Sikar District.

Sikar District: Production of Major Crops													Production in M.T.	
S. N.	**Tehsil/ District**	**Food Crops**							**Oil Seeds**			**Cash Crops**		
		Cereals			**Pulses**									
		Bajra	**Wheat**	**Barley**	**Moong**	**Chaula**	**Moth**	**Gram**	**Mustard**	**Groundnuts**	**Taramira**	**Guar**	**Methi**	**Onion**
I	2010-11	431344	343783	94401	8194	30962	2893	94121	96870	50344	7653	50001	13674	165507
2	2015-16	247451	323185	101505	7679	11770	438	39222	56641	42912	791	91295	14167	439504
3	2021-22	320867	287585	74239	32730	10172	32	88879	97991	81578	15057	66840	7152	496813

Source: Agriculture Statistics of Rajasthan (2010-11,2015-16, 2021-22), Directorate of Economics & Statistics, Rajasthan, Jaipur.

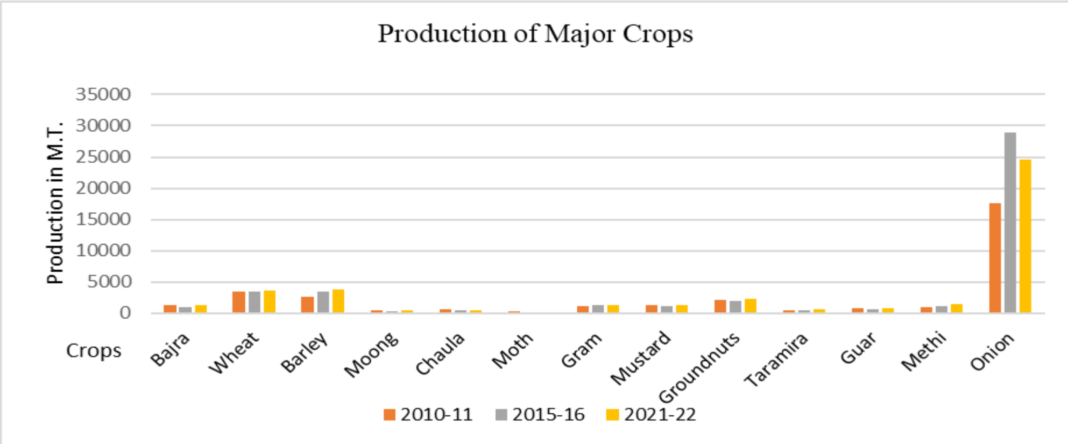

Figure 3: Production of Major Crops

Table 3 and Figure 3 demonstrate that agricultural production in Sikar district has exhibited substantial fluctuations across various crop categories between 2010-11, 2015-16, and 2021-22. While certain crops have experienced growth, others have shown marked declines attributable to changing climatic conditions, market demand, and agricultural practices.

FOOD CROPS (CEREALS AND PULSES)

The production of cereals has exhibited fluctuations over the years. Bajra, a major staple crop, experienced a significant decrease from 4,31,344 metric tons (MT) in 2010-11 to 2,47,451 MT in 2015-16 (a 42.63% decline) but subsequently recovered to 3,20,867 MT in 2021-22, representing a 29.67% increase from 2015-16 levels. Wheat production also declined by 6.02% from 2010-11 to 2015-16 and further by 11.02% in 2021-22, indicating a consistent reduction over the period. Barley demonstrated some variations, increasing from 94,401 MT in 2010-11 to 1,01,505 MT in 2015-16, but subsequently decreasing to 74,239 MT in 2021-22, resulting in an overall 21.37% reduction since 2010-11. This decline is primarily attributed to the decrease in cropped area under these crops.

Among pulses, Moong exhibited significant growth, increasing 299.34% from 8,194 MT in 2010-11 to 32,730 MT in 2021-22, indicating a shift toward pulse cultivation. However, Gram production decreased by 58.33% in 2015-16 before recovering in 2021-22, demonstrating fluctuating trends. Moth, which had a production of 2,893 MT in 2010-11, experienced a substantial decline to 32 MT in 2021-22, suggesting its near disappearance from cultivation.

OIL SEEDS

Mustard, the primary oilseed crop, experienced a significant decrease of 41.52% from 96,870 MT in 2010-11 to 56,641 MT in 2015-16 but subsequently increased by 72.99% to 97,991 MT in 2021-22, exceeding previous levels. Groundnut also exhibited a decline of 14.77% in 2015-16 but later demonstrated an increase of 90.15% by 2021-22, indicating improved production. Taramira, a minor oilseed, displayed extreme fluctuations, decreasing by 89.66% in 2015-16 before increasing by 1,803.80% by 2021-22, demonstrating substantial recovery. This recovery was attributed to an expansion of the area under Taramira cultivation.

CASH CROPS

Cash crops demonstrated diverse trends. Guar production exhibited a significant increase from 50,001 MT in 2010-11 to 91,295 MT in 2015-16 (an 82.58% increase) but subsequently decreased by 26.79% to 66,840 MT in 2021-22. Methi (fenugreek) production remained relatively constant from 2010-11 to 2015-16 but subsequently declined by 49.55% in 2021-22. Onion, a high-value crop, displayed substantial growth, increasing from 1,65,507 MT in 2010-11 to 4,39,504 MT in 2015-16 (165.56% increase) and further to 4,96,813 MT in 2021-22 (13.05% growth), establishing itself as a predominant cash crop. The data indicate a significant transformation in agricultural production patterns in Sikar district. While traditional cereals such as Bajra and Wheat are experiencing declines, pulses, particularly Moong, are gaining prominence. Oilseed production, notably Mustard and Groundnut, has exhibited substantial recovery in recent years. Among cash crops, Onion has emerged as a major contributor, while Guar and Methi have demonstrated fluctuating trends. These alterations may be attributed to evolving climatic conditions, market demand, and governmental incentives promoting crop diversification.

PRODUCTIVITY OF MAJOR CROPS

FOOD CROPS

Table 4: Productivity of Food Crops

Sikar District: Productivity of Food Crops (in Kg/hectare)								
S.N.	Year	Food Crops						
		Cereals			Pulses			
		Bajra	Wheat	Barley	Moong	Chaula	Moth	Gram
I	2010-11	1311	3421	2641	474	596	281	1109
2	2015-16	907	3500	3450	310	451	176	1254
3	2021-22	1262	3607	3824	417	451	119	1313
Source: Agriculture Statistics of Rajasthan (2010-11,2015-16, 2021-22), Directorate of Economics & Statistics, Rajasthan, Jaipur.								

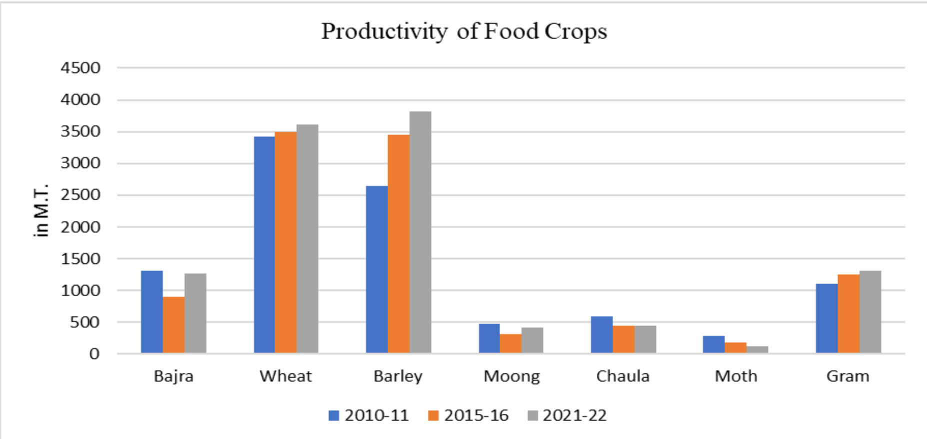

Figure 4: Productivity of Food Crops

Table 4 and Figure 4 demonstrate that the productivity of major crops in Sikar district has exhibited fluctuations over the years, influenced by climatic variations, technological advancements, and modifications in agricultural practices. The data elucidate significant trends in the productivity of cereals and pulses from 2010-11 to 2021-22.

CEREAL PRODUCTIVITY TRENDS

Among cereals, Bajra productivity exhibited a decline from 1,311 kg/ha in 2010-11 to 907 kg/ha in 2015-16 (30.80% decrease); however, it subsequently increased to 1,262 kg/ha in 2021-22, demonstrating a 39.16% recovery. Wheat productivity has remained relatively stable, increasing marginally from 3,421 kg/ha in 2010-11 to 3,500 kg/ha in 2015-16 (2.31% rise) and further to 3,607 kg/ha in 2021-22 (3.06% increase from 2015-16). Barley demonstrated the most substantial growth in productivity, increasing from 2,641 kg/ha in 2010-11 to 3,450 kg/ha in 2015-16 (30.63% increase) and further to 3,824 kg/ha in 2021-22 (10.82% increase).

PULSES PRODUCTIVITY TRENDS

Among pulse crops, Moong (mung bean) productivity exhibited fluctuations, initially decreasing from 474 kg/ha in 2010-11 to 310 kg/ha in 2015-16 (a 34.39% reduction) before increasing to 417 kg/ha in 2021-22 (a 34.52% increase). Chaula productivity declined from 596 kg/ha in 2010-11 to 451 kg/ha in 2015-16 (a 24.32% reduction) and subsequently remained constant at 451 kg/ha in 2021-22. Moth bean demonstrated a continuous decline, from 281 kg/ha in 2010-11 to 176 kg/ha in 2015-16 (a 37.36% reduction) and further to 119 kg/ha in 2021-22 (a 32.39% decrease). Gram (chickpea) productivity has shown improvement, increasing from 1,109 kg/ha in 2010-11 to 1,254 kg/ha in 2015-16 (a 13.08% increase) and further to 1,313 kg/ha in 2021-22 (a 4.70% increase).

The observed trends indicate that cereal crops, particularly Barley and Wheat, have demonstrated consistent increases in productivity, while Bajra and Moong have exhibited recovery following initial declines. However, Moth and Chaula are displaying persistent decreases in productivity, which may be attributed to alterations in agricultural preferences, soil degradation, or water availability issues. The overall increase in Gram productivity suggests enhanced adaptation to contemporary farming techniques. These findings underscore the necessity for region-specific agricultural strategies to improve pulse production while maintaining advancements in cereal productivity through enhanced irrigation systems, superior seed varieties, and climate-resilient farming practices.

OILSEEDS AND CASH CROPS PRODUCTIVITY

Table 5: Productivity of Oilseeds and Cash Crops

Sikar District: Productivity of Oilseeds and Cash Crops (in Kg/hectare)							
S.N.	Year	Oil Seeds			Cash Crops		
		Mustard	Groundnuts	Taramira	Guar	Methi	Onion
I	2010-11	1297	2119	409	784	1060	17658
2	2015-16	1157	2002	535	705	1169	28938
3	2021-22	1380	2345	623	847	1471	24624
Source: Agriculture Statistics of Rajasthan (2010-11,2015-16, 2021-22), Directorate of Economics & Statistics, Rajasthan, Jaipur.							

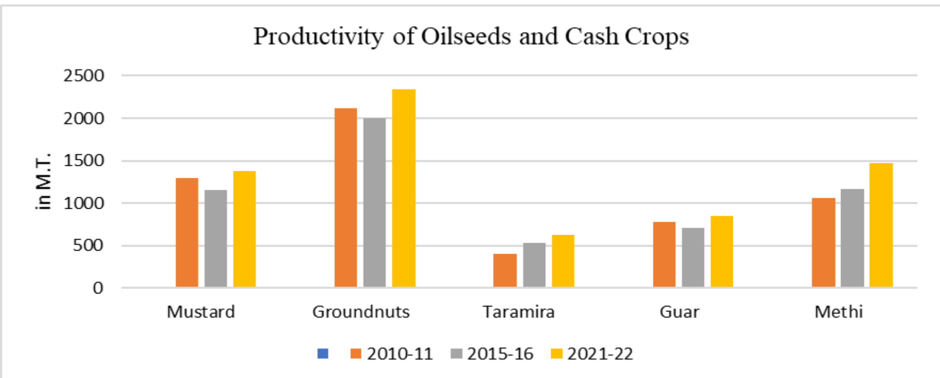

Figure 5: Productivity of Oilseeds and Cash Crops

Table 5 and Figure 5 illustrate that the productivity of oilseeds and cash crops in Sikar district has exhibited fluctuations over the period from 2010-11 to 2021-22, reflecting variations in climatic conditions, agricultural practices, and market demands.

OILSEEDS PRODUCTIVITY TRENDS

Mustard productivity exhibited a decline from 1,297 kg/ha in 2010-11 to 1,157 kg/ha in 2015-16 (10.78% decrease), subsequently demonstrating a recovery to 1,380 kg/ha in 2021-22 (19.27% increase). Groundnut productivity displayed a comparable trend, decreasing from 2,119 kg/ha in 2010-11 to 2,002 kg/ha in 2015-16 (5.52% reduction), followed by an increase to 2,345 kg/ha in 2021-22 (17.13% growth). Taramira, a drought-resistant oilseed, demonstrated consistent improvement in productivity, increasing from 409 kg/ha in 2010-11 to 535 kg/ha in 2015-16 (30.81% increase) and further to 623 kg/ha in 2021-22 (16.45% increase).

CASH CROPS PRODUCTIVITY TRENDS

Guar productivity exhibited a decline from 784 kg/ha in 2010-11 to 705 kg/ha in 2015-16 (10.07% decrease), subsequently demonstrating an improvement to 847 kg/ha in 2021-22 (20.14% increase). Methi (Fenugreek) displayed consistent growth, increasing from 1,060 kg/ha in 2010-11 to 1,169 kg/ha in 2015-16 (10.28% rise) and further to 1,471 kg/ha in 2021-22 (25.84% increase). Onion productivity experienced a substantial increase, rising from 17,658 kg/ha in 2010-11 to 28,938 kg/ha in 2015-16 (63.96% rise), followed by a modest decline to 24,624 kg/ha in 2021-22 (14.92% decrease).

The productivity trends indicate that Mustard, Groundnuts, and Taramira have demonstrated improvement in recent years, suggesting enhanced adaptation of oilseed crops to evolving agricultural practices. Among cash crops, Guar and Methi have exhibited consistent growth, while Onion productivity reached its peak in 2015-16 but subsequently declined, potentially due to climatic factors or market fluctuations. These trends underscore the necessity for climate-resilient agricultural techniques, efficient irrigation systems, and market-oriented crop selection to maintain and augment agricultural productivity in Sikar district.

CONCLUSION

The agricultural trends in Sikar district from 2010 to 2021 demonstrate significant shifts in cropping patterns, production, and productivity, primarily influenced by groundwater depletion, changing climatic conditions, and evolving government policies. The decline in the total cropped area between 2010-11 and 2015-16 reflects increasing water scarcity, as the region heavily depends on groundwater for irrigation, which has been depleting due to excessive extraction and insufficient recharge. Traditional water-intensive crops such as wheat and barley have experienced a reduction in sown area, while drought-resistant crops like moong and gram have gained prominence, indicating an adaptive response to declining water availability.

The role of government interventions, including the promotion of micro-irrigation techniques, crop diversification schemes, and support for oilseed cultivation under national programs, has also shaped these trends. The substantial increase in mustard and groundnut production aligns with policy-driven incentives and improved agronomic practices, while cash crops such as onion have benefited from market demand and enhanced storage facilities. However, the decline in the productivity of certain pulses and cereals suggests the necessity for further investment in soil health management, water conservation, and sustainable farming practices to mitigate the adverse effects of resource depletion and climate variability.

REFERENCES

1. Avi, A., & Batra, V. (2023). Organic Farming in India: Evolution, Current Status and Policy Perspectives. *Space and Culture, India*, *11*(2), 18–34. https://doi.org/10.20896/saci.v11i2.1328
2. Balyan, S., Jhang, T., Tripathi, S. N., Pandey, P., Tripathi, A., & Jangir, H. (2024). Seeding a Sustainable Future: Navigating the Digital Horizon of Smart Agriculture. *Sustainability*, *16*(2), 475. https://doi.org/10.3390/su16020475
3. Chatterjee, A., Debnath, S., & Pal, H. (2020). *Implication of Urban Agriculture and Vertical Farming for Future Sustainability*. intechopen. https://doi.org/10.5772/intechopen.91133
4. Dos Reis, G. A. D., De Queiroz Fonseca Mota, P., Pastrana Puche, Y., Rodrigues, C., Scapini, T., Karp, S. G., Pozzan, R., Lima Serra, J., Martínez-Burgos, W. J., Ocán-Torres, D., & Soccol, C. R. (2024). Comprehensive Review of Microbial Inoculants: Agricultural Applications, Technology Trends in Patents,

and Regulatory Frameworks. *Sustainability*, *16*(19), 8720. https://doi.org/10.3390/su16198720

5. Ghosh, M. (2019). Climate-smart Agriculture, Productivity and Food Security in India. *Journal of Development Policy and Practice*, *4*(2), 166–187. https://doi.org/10.1177/2455133319862404
6. Hollands, J. G., & Spence, I. (1992). Judgments of change and proportion in graphical perception. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *34*(3), 313–334. https://doi.org/10.1177/001872089203400306
7. Jaiswal, S., Kotambe, N., Kharade, T., Shinde, S., Patil, M. D., & Vyawahare, V. A. (2020). Collaborative Recommendation System For Agriculture Sector. *ITM Web of Conferences*, *32*, 03034. https://doi.org/10.1051/itmconf/20203203034
8. Javed, W., Mcdonnel, B., & Elmqvist, N. (2010). Graphical Perception of Multiple Time Series. *IEEE Transactions on Visualization and Computer Graphics*, *16*(6), 927–934. https://doi.org/10.1109/tvcg.2010.162
9. Jethva, H., Torres, O., Field, R. D., Lyapustin, A., Gautam, R., & Kayetha, V. (2019). Connecting Crop Productivity, Residue Fires, and Air Quality over Northern India. *Scientific Reports*, *9*(1). https://doi.org/10.1038/s41598-019-52799-x
10. Kamara, A., Cooke, R. A., Rhodes, E. R., & Conteh, A. (2019). The Relevance of Smallholder Farming to African Agricultural Growth and Development. *African Journal of Food, Agriculture, Nutrition and Development*, *19*(01), 14043–14065. https://doi.org/10.18697/ajfand.84.blfb1010
11. Khan, F., Upadhyay, T. K., & Pandey, P. (2022). Applications of Nanotechnology-Based Agrochemicals in Food Security and Sustainable Agriculture: An Overview. *Agriculture*, *12*(10), 1672. https://doi.org/10.3390/agriculture12101672
12. Madanayake, N. H., Hossain, A., & Adassooriya, N. M. (2021). Nanobiotechnology for agricultural sustainability, and food and environmental safety. *Quality Assurance and Safety of Crops & Foods*, *13*(1), 20–36. https://doi.org/10.15586/qas.v13i1.838
13. Madhukar, A., Kumar, V., & Dashora, K. (2019). Spatial and Temporal Trends in the Yields of Three Major Crops: Wheat, Rice and Maize in India. *International Journal of Plant Production*, *14*(2), 187–207. https://doi.org/10.1007/s42106-019-00078-0
14. Mariappan, K., & Zhou, D. (2019). A Threat of Farmers' Suicide and the Opportunity in Organic Farming for Sustainable Agricultural Development in India. *Sustainability*, *11*(8), 2400. https://doi.org/10.3390/su11082400
15. Melody Carswell, C., Frankenberger, S., & Bernhard, D. (1991). Graphing in depth: perspectives on the use of three-dimensional graphs to represent lower-dimensional data. *Behaviour & Information Technology*, *10*(6), 459–474. https://doi.org/10.1080/01449299108924304
16. Meyer, J., Leiser, D., & Shinar, D. (1997). Multiple Factors that Determine Performance with Tables and Graphs. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *39*(2), 268–286. https://doi.org/10.1518/001872097778543921
17. Patel, S. K., Sharma, A., & Singh, G. S. (2020). Traditional agricultural practices in India: an approach for environmental sustainability and food security. *Energy, Ecology and Environment*, *5*(4), 253–271. https://doi.org/10.1007/s40974-020-00158-2
18. Praveen, B., & Sharma, P. (2019). Climate Change and its impacts on Indian agriculture: An Econometric analysis. *Journal of Public Affairs*, *20*(1). https://doi.org/10.1002/pa.1972
19. Ram, V. V. H., Dhanalakshmi, S., Vidya, P. M., & Vishal, H. (2015). *Regulation of water in agriculture field using the Internet Of Things*. *49*, 112–115. https://doi.org/10.1109/tiar.2015.7358541
20. Reddy, D. A., Dadore, B., & Watekar, A. (2019). Crop Recommendation System to Maximize Crop Yield in Ramtek region using Machine Learning. *International Journal of Scientific Research in Science and Technology*, *6*(1), 485–489. https://doi.org/10.32628/ijsrst196172
21. Shah, P., & Freedman, E. G. (2011). Bar and line graph comprehension: an interaction of top-down and bottom-up processes. *Topics in Cognitive Science*, *3*(3), 560–578. https://doi.org/10.1111/j.1756-8765.2009.01066.x
22. Singh, B., Singh, G., Bisnoi, M., Parihar, K., & Chouhan, A. S. (2024). Climatic Variations

Influenced Distribution and Productivity of Different Agroforestry Systems in Rajasthan, India. *Annals of Arid Zone*, *63*(3), 13–30. https://doi.org/10.56093/aaz.v63i3.142983

23. Wagh, R., & Dongre, A. P. (2016). Agricultural Sector: Status, Challenges and it's Role in Indian Economy. *Journal of Commerce and Management Thought*, *7*(2), 209. https://doi.org/10.5958/0976-478x.2016.00014.8
24. Weissgerber, T. L., Savic, M., Winham, S. J., Stanisavljevic, D., Garovic, V. D., & Milic, N. M. (2017). Data visualization, bar naked: A free tool for creating interactive graphics. *Journal of Biological Chemistry*, *292*(50), 20592–20598. https://doi.org/10.1074/jbc.ra117.000147