



Research Paper

Changing Agricultural Cropping Pattern in North 24 Parganas

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Abstract

The number of elements in an area of production dictates the cropping pattern of a crop, which also affects the eating patterns of the people who live there. Since the Green Revolution in the 1960s, there have been several changes in the way crops are grown. The current study analyses the evolving agricultural cropping pattern in North 24 Parganas across a two-decade span from 1999–2000 to 2019–20, focusing on both temporal and geographical variability. The results show that agriculture is slowly moving away from conventional cereal-based crops and toward a wider range of crops that are more focused on the market. Spatial research shows that the district has quite varied regions.

Keywords: Cropping pattern, Temporal variation, Paddy, Vegetables, Fruits

I. INTRODUCTION

Since India's independence, the country's political elite, planners, agricultural experts, and farmers have been encouraged by the country's agricultural progress. Institutional and technological shifts in the nation's food grain production emerged from a variety of agricultural development strategies. Extensive empirical research has shown that certain agricultural areas have grown throughout time, while others have shrunk or stayed the same. Even if there have been technical advancements in agriculture, the Indian monsoon remains a gamble for the country's farmers. Due to weather and market-induced hazards, farmers generally lack knowledge regarding the results of agriculture, which creates a high level of uncertainty and risk in production, pricing, and farm earnings. Agricultural infrastructure in India is still in bad shape, despite the many successes. Consequently, India's agricultural output lags behind that of more developed nations when it comes to a number of important crops. Although agricultural growth is extremely uneven between areas and crops, the sector has grown stronger and more resilient since independence.

Now that the agricultural sector has achieved self-sufficiency and, on occasion, surpluses, it has moved past the period of shortages and reliance on imports. All around the globe, people have claimed and acknowledged the Green, White, Yellow, and Blue revolutions as significant landmarks. Currently, India ranks first in the world for wheat production, second for fruits and vegetables, and third for cashew nuts, milk, and tea. India dominates the global spice market, both in terms of production and consumption, and also ranks first in cashew exports.

Different parts of the state saw different rates of agricultural growth. Several empirical investigations carried out at the state or regional level have revealed that certain crops' area, output, and productivity have grown throughout the years, whereas the same or fewer of other crops have seen a decrease or no change at all. The expansion in land might be the result of moving some of the cultivated areas to other locations or adding more land to the existing crop rotation. Looking at the pattern of growth and harvesting for different crops in that area could help shed light on this phenomena. The loss of agricultural yields is a direct result of the misallocation of productive resources. More lucrative crops draw in resources that might otherwise go to less lucrative crops. While there are a lot of variables that might affect the amount of diversion, some of them include domestic demand, the degree of risk associated with price fluctuations, weather, and the level of technology for crop production. At the regional level, it is unclear how and to what degree the state's crops have grown, shifted, and diversified thanks to increased agricultural production techniques.

II. AGRICULTURAL CLIMATOLOGY AND ITS PARAMETERS

Climate research with an eye on the agriculture sector is known as agricultural climatology. In light of the above discussion of climate, it is useful to define agricultural climate using several criteria pertaining to agricultural climatology. These characteristics provide an overview of the opportunities and threats posed by the

weather in North 24-Parganas for the production of crops and cattle.

Solar Radiation

Life on Earth is primarily powered by solar radiation. Solar radiation has a significant impact on agricultural output. Agricultural output is unsuitable in regions with extremely high or extremely low solar radiation. The place receives enough sun radiation because it is located in a subtropical climate zone. Seasonal changes affect the quantity of incoming solar radiation, which fluctuates by around 300 Watt/m². Plants primarily respond to three main solar radiation spectra. (i) The invisible, but shorter, wavelength; (ii) Ultraviolet and other forms of solar energy; (iii) The tertiary spectrum, which includes both the UV and IR bands.

Environmental Temperature

For all forms of life on Earth, the most fundamental factor is the ambient temperature, which is the intensity component of thermal energy. Physical and chemical processes within plants are controlled by temperature. We need to make preparations to lessen the likelihood of high-temperature stress in crops that are vulnerable to it. The temperature has a role in determining whether crops are planted in the summer or winter.

Soil Temperature

Crop vegetative development is sensitive to soil temperature. Soil temperature affects several aspects of plant life, including seed germination, root system function, disease incidence, and growth rate. Soil moisture is the physical shape that water takes when soil temperature is high. There is less water available for agricultural production in dry locations because soil moisture evaporates quickly.

Precipitation

Precipitation has a significant impact on agricultural output. This information is crucial for a number of agricultural tasks, including crop scheduling, irrigation project operation, drainage project design, soil and water conservation program planning, and climatological area classification.

Atmospheric Pressure

At high altitudes, plant life is significantly affected by the reduced air pressures that occur as one climbs higher. Oxygen and carbon dioxide are less soluble in water when you're at a high altitude and the air pressure is low. At higher elevations, when oxygen and carbon dioxide concentrations are lower, several plant species exhibit stunted development. Plants with robust root systems and sturdy stems, on the other hand, can withstand low pressure and increasing wind speeds at high altitudes.

Humidity

Temperature, wind speed and direction, and rainfall all have a role in determining humidity. Crop yield and the types of crops cultivated in any given area are heavily influenced by humidity-related metrics like relative humidity and dew point.

Evapotranspiration

The process of evaporation at the soil-air interface and transpiration by plants, occurring in soils with varying moisture levels, is called evapotranspiration. Farmers and ranchers may learn more about their crops' water needs with the use of a Pan Evaporation measurement. Improving our understanding of crops' water condition can also benefit from evapotranspiration forecasts.

Growing degree-days

Effective growth units (EGDs) are a straightforward way to relate air temperature to plant development, maturation, and growth. Growing degree-days (GDDs) are another name for this. In agronomy, degree-day units are commonly used to determine the durations of several plant developmental stages.

III. REVIEW OF LITERATURE

Mathew, Shilpa et al., (2024). Changes in the way crops are grown may teach us a lot about how farming has changed throughout time in a certain place. The objective of the current research in Kerala, India, was to ascertain the extent of crop diversity and the evolution of cropping patterns. The study indicated that the percentage of non-food crops grown rose a lot, from 43.14% to 59.29% of the total cultivated area. On the other hand, the percentage of food crops grown dropped dramatically, from 56.85% in TE 1987–88 to 40.73% in TE 2019–20. The Kozhikode district focused more on crop specialism, whereas the Idukki area had a wider range of crops. Respondents in the research locations said that high wages, bad weather, and a lack of available labour were the three biggest problems.

Verma, B. & Kumar, Dinesh (2023) Rajasthan, a state in India, was the site of the research. Out of the four main crop groups, the following were selected for investigation: pulses (moong bean, moth bean, Kharif pulses, and gram), cereals (pearl millet, maize, and wheat), oilseeds (soybean, rapeseed, and mustard), and others (cotton and cluster bean). We picked all of those crops that made up at least 5% of the arable land in a certain district. The districts were selected using a five-year average, using secondary data from the Rajasthan Agriculture Department's website (www.krishi.rajasthan.gov.in) and records and reports from the Directorate of Economics and Statistics (Jaipur, Government of Rajasthan) (2005-06 to 2009-10). The research period included 58 years, from 1956–1957 to 2014–2015. The data were studied for twelve separate periods using the Markov chain analysis technique to evaluate the change in cropping pattern.

Kaur, Apperdeep. (2022) As a consequence of the Green Revolution and globalisation, emerging nations began to use more intensive farming methods. Punjab and Haryana were two of the initial Indian states to witness an increase in agricultural production due to the Green Revolution. The decreasing agricultural output caused by a shortage of farmable land and an increasing population necessitates an aggressive food production strategy, which Punjab and Haryana must implement. The frequency with which a specific region is cultivated in a particular agricultural year is indicated by cropping intensity. Therefore, more intense cropping is a sign of intensifying agriculture in that region. Punjab (at 190.28 percent) and Haryana (at 186.93 percent) had the highest cropping intensity. Examining the spatio-temporal variability and variations in cropping intensity is the goal of this research. Greetings from everyone around! Increasing the area under cultivation or, alternatively, farming a smaller area more intensively is one approach to agricultural intensification that can help meet the food production needs of a growing population. Punjab and Haryana have shifted to an intensification strategy in agriculture since expanding lands horizontally is not feasible. This intensification of farming is made possible by scientific development.

Du, Guoming et al., (2022) In parts of China with black soil, a carefully planned planting strategy might make the land more fertile and keep agricultural production steady. The primary aim of this research was to examine the transformation of agricultural practices in Wangi County from 2002 to 2021. We utilised ArcGIS and ENVI software, which included visual interpretation, to look at three crop rotation cycles based on the categorisation data of remote-sensing inversion crops from 2002 to 2005, 2010 to 2013, and 2018 to 2021. We found that soybeans, rice, and maize took up 87.02% of the land while we were doing our investigation. 31.225% of all cropping patterns were continuous maize cultivation, 29.01% were mixed cultivation, and 24.48% were continuous maize-soybean cultivation. Specifically, continuous maize farming was more common in the south-central and west-central parts of the country. On the other hand, continuous rice cultivation was more common in the northwest to southwest parts of the country.

Mane, Umesh et al., (2022) Improvements in agricultural methods can be achieved through study on cropping patterns. Changing cropping patterns may be captured by observing changes in the proportion of different crops cultivated throughout a specific period and the difference in the areas under different crops on two distinct dates. Crop diversity is a crucial tool for comprehending the research's cropping pattern. Reconciling shifts in crop allocation in the Pune area from.

Chaurasia, Ashutosh et al., (2021). Most of our folks still get their money from farming. Studies that look at crop diversity, productivity, and trends are necessary for agriculture to move forward. The term "cropping pattern" refers to the amount of land used for different crops. "Crop diversification," on the other hand, refers to the practice of growing a variety of crops. The input-output ratio makes it feasible to conduct accurate comparisons, which is what productivity in agriculture is all about. These ideas are shaped by a number of things, such as the weather, society, and institutions. The Tara area is between the Gangetic plains and the Himalayan foothills. It is humid and has a lot of trees. This big area covers seven districts in Uttar Pradesh, from Pili hit to Maharajganj. Most of the inhabitants live in rural areas. This study will examine the cropping pattern, the spatial-temporal dynamics of crop diversification, and crop output in the Tara region of Uttar Pradesh from 2007–08 to 2017–18 at the district level.

Andrabi, Javaid. (2018). This study aims to investigate the changes in cropping pattern and intensity in agriculture in Jammu and Kashmir throughout time and space. In order to gather information, we looked to the Statistical Abstract of Jammu and Kashmir. As a percentage, we have displayed the cropping pattern and intensity. A very intense and diverse cropping plan is used by the state's agricultural industry, according to the report. The most extensively cultivated crop in the state in 2010–2011 was maize, which took up 27.4 percent of the total planted area. Wheat has been the second most farmed crop due to its increasing cropped area. The area devoted to cultivating pulses and rice decreased dramatically during that period. From 119.70% in 1965–66 to 155.79 % in 2010–11, the intensity of cropping has also been growing consistently. The state's cropping intensity was highest in the Samba district at 212.63% and lowest at 100% in the Kupwara district.

IV. RESEARCH METHODOLOGY

Study Area

The present study focuses on the agricultural cropping pattern and its spatial and temporal variations in North 24 Parganas of West Bengal.

Period of Study

The study covers a twenty-year period from 1999–2000 to 2019–20.

Sources of Data Collection

Using both primary and secondary data sources made sure that the study was reliable and thorough. Researchers visited to certain villages in different agricultural zones to collect primary data. Informal meetings and conversations with farmers, local agricultural staff, and panchayat members helped me understand crop decisions, irrigation methods, and the problems that farmers face. For this study, we examined secondary data from district statistics handbooks, reports from the agricultural department, land use records, census publications, and information on crop-wise areas that block-level agricultural offices had gathered.

Sampling Technique

A multistage sampling approach was adopted to capture spatial diversity within the district.

Methods of Data Analysis

To evaluate the changes in area and percentage share of major crops over the past decade, the collected data was systematically sorted and classified by crop type. Using simple statistical methods like percentage analysis and comparative temporal analysis, we were able to find patterns of things getting better and worse. To explore geographic variation, crop concentration across the district was compared on a zonal basis.

V. RESULTS AND DISCUSSION

Temporal Variations in Agricultural Cropping Pattern

Variations in rainfall, input types, and climatic instability make it impossible for any one region's cropping pattern to be steady. Varieties of high-yielding crops, improvements in irrigation infrastructure, and advances in agricultural technology all contribute to shifts in the passage of time. The causes of these shifts in cropping patterns are local and geographically specific. Investigating discrete factors that contribute to changes across location and time is, thus, a worthy endeavour. Results for nine different crops grown in the study area between 1999 and 2000 and 2019 and 2020 are shown in Table 1 and Figure 1.

Table 1: Temporal Variations in Agricultural Cropping Pattern

Sr. No.	Name of the Crops	1999–2000		2009–10		2019–20	
		Area (Ha)	Percent to NSA	Area (Ha)	Percent to NSA	Area (Ha)	Percent to NSA
1	Paddy	165200	55.40	158450	50.25	149320	46.80
2	Wheat	18240	6.12	21460	6.81	23890	7.49
3	Jute	46280	15.52	48960	15.53	50110	15.71
4	Potato	12860	4.31	15490	4.91	18120	5.68
5	Vegetables	21450	7.19	26580	8.42	31840	9.98
6	Oilseeds	7240	2.43	6580	2.08	5930	1.86
7	Pulses	9540	3.20	8210	2.60	7350	2.30
8	Fruits	8620	2.89	10840	3.44	13460	4.22
9	Flowers & Others	4720	1.58	6910	2.19	9870	3.09

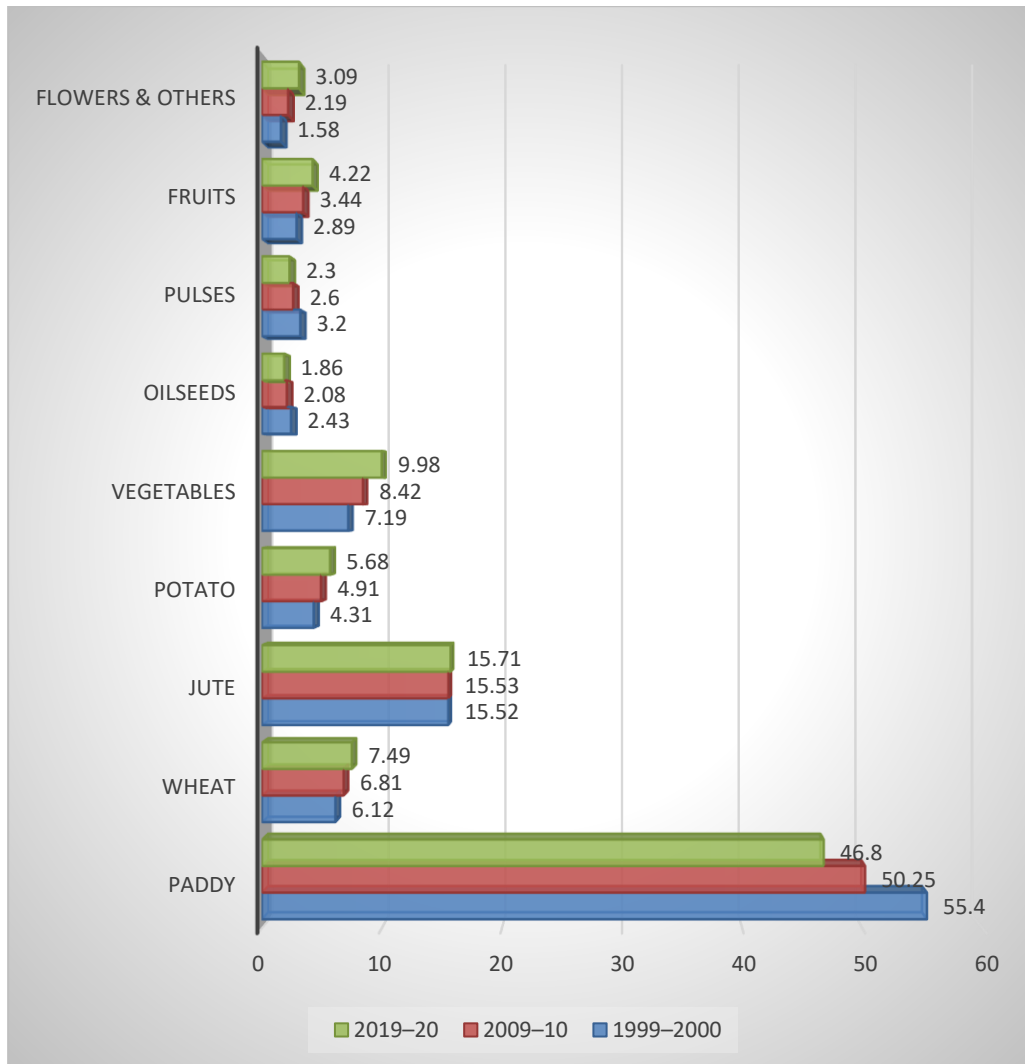


Figure 1: Temporal Variations of the North 24 Parganas (1999-2000 to 2019-20)

Table 1 shows that the cropping pattern in North 24 Parganas, West Bengal, has been shifting progressively toward more diversified and profitable agriculture from 1999-2000 to 2019-20. Paddy is still the most significant crop, but the amount of land it covers has gone down from 165,200 hectares (55.40% of the total) to 149,320 hectares (46.70% of the total). This suggests that farmers are slowly migrating away from traditional grain cultivation. Better irrigation and more crops grown in the winter led to a little increase in wheat farming, from 18,240 hectares (6.12%) to 23890 hectares (7.49%). A little rise from 46280 hectares (15.52%) to 50110 hectares (15.71%) showed that jute was still an important crop and could still grow well in the area.

At the same time, crops that can be sold for more money also showed big growth. The amount of land used to grow vegetables went by a lot, from 21,450 hectares (7.19%) to 31,840 hectares (9.98%). The amount of land used to grow potatoes also went up, from 12,860 hectares (4.31%) to 18,120 hectares (5.68%). The number of flowers and fruit grown also went up steadily. The amount of fruit grown went from 8620 hectares (2.89%) to 13460 hectares (4.22%), while the number of flowers grown went from 4720 hectares (1.58%) to 9870 hectares (3.09%).

Table 2: Spatial Variation of Major Crops in North 24 Parganas (2019-20)

Crop	Northern Agrarian Zone (%)	Eastern Deltaic & Wetland Zone (%)	Central & Southern Peri-Urban Zone (%)
Paddy	52.4	58.6	34.8
Wheat	6.8	5.2	8.4
Jute	17.5	14.8	6.2
Potato	5.4	4.1	7.6
Vegetables	8.9	9.6	24.2
Pulses	3.6	3.1	2.0
Oilseeds	2.8	2.4	1.5

Fruits	1.9	1.8	6.5
Flowers	0.7	0.4	8.8

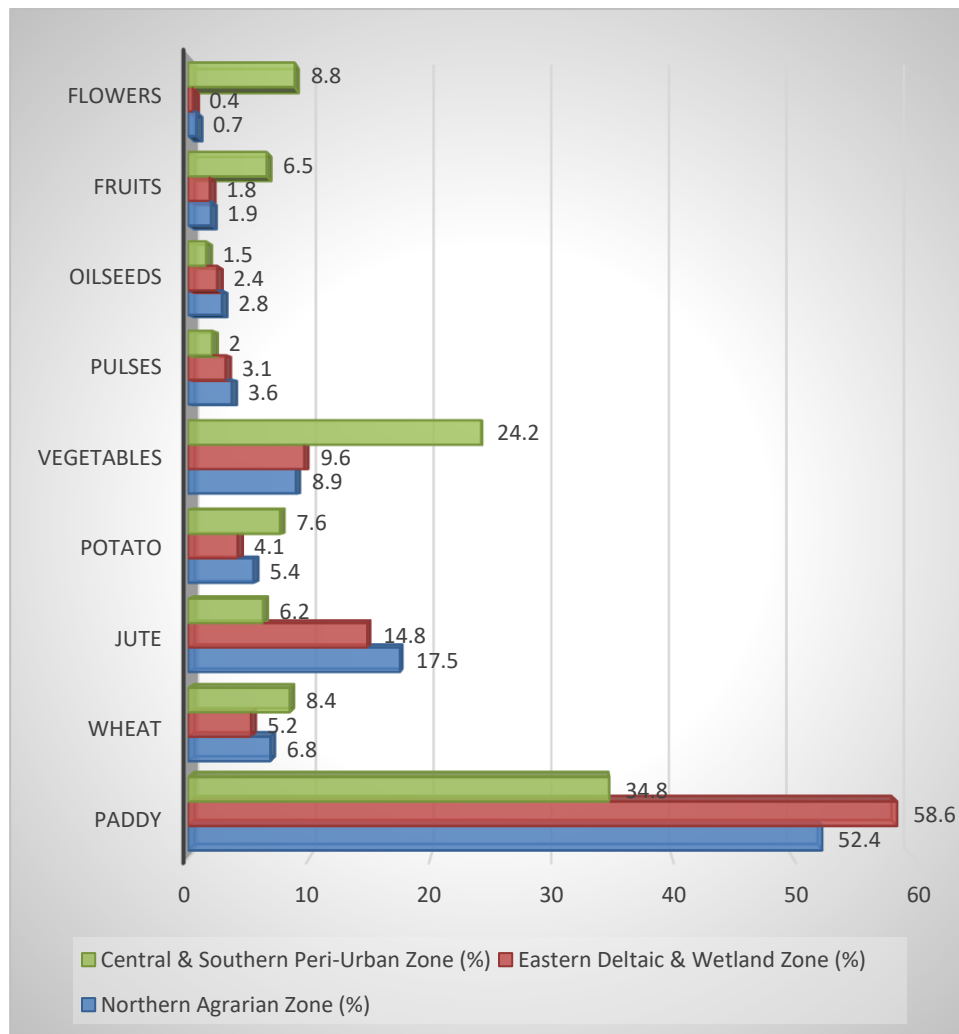


Figure 2: Spatial Variation of Major Crops in North 24 Parganas (2019–20)

In the 2019–20 cropping season, cropping in North 24 Parganas, West Bengal, shows clear regional specialisation. The peri-urban belt's proportion of paddy is falling to 34.8% because to diversification. In contrast, the eastern deltaic zone and northern agrarian zones have the highest shares of paddy, at 58.6% and 52.4%, respectively. The northern zone has an unusually high concentration of jute (17.5%), the peri-urban areas have an unusually high concentration of wheat (8.4%), and the southern areas have an unusually high concentration of potatoes (7.6%). The peri-urban zone has a lot more veggies grouped together than other places (24.2% vs. about 9%). Pulses and oilseeds are still low throughout all zones, usually below 4%. There are too many fruits (6.5%) and flowers (8.8%) in the peri-urban areas.

VI. CONCLUSION

The study of changes in cropping patterns in North 24 Parganas shows without a doubt that agriculture in the district is going through a steady but big change. Paddy is essential to the agricultural economy, but its decreasing share shows how farmers are changing their techniques in response to changing market conditions, limited resources, and new economic opportunities. The little increase in wheat and the steady price of jute show that conventional crops are still important. However, the most important change is the rapid growth of high-value crops including vegetables, potatoes, fruits, and flowers. Temporal research shows that improvements in irrigation systems, the spread of high-yielding varieties, and more technical understanding have all had a big role in making agriculture more diverse. At the same time, regional disparities show how physical features and being close to cities may affect things. The northern and deltaic regions focus on growing jute and grains since the land and water conditions are good for these crops. Peri-urban areas, on the other hand, are becoming more commercialised and diverse because of better infrastructure and access to markets.

Despite these positive changes, the shrinking amount of land used for pulses and oilseeds raises concerns about food security and soil health. Additionally, increasing urbanisation, the breaking up of arable land, and environmental stressors might make it harder for agriculture to grow in a sustainable way in the future. As a result, fair policies that focus on irrigation efficiency, helping farmers grow different types of crops, building market infrastructure, and promoting sustainable farming practices are needed. The change in farming practices in the district shows how farmers can be flexible and adapt to changes in the economy and the environment. To ensure long-term agricultural sustainability, economic stability, and regional food security, it will be important to improve institutional support, promote resource-efficient farming, and encourage a variety of farming methods.

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