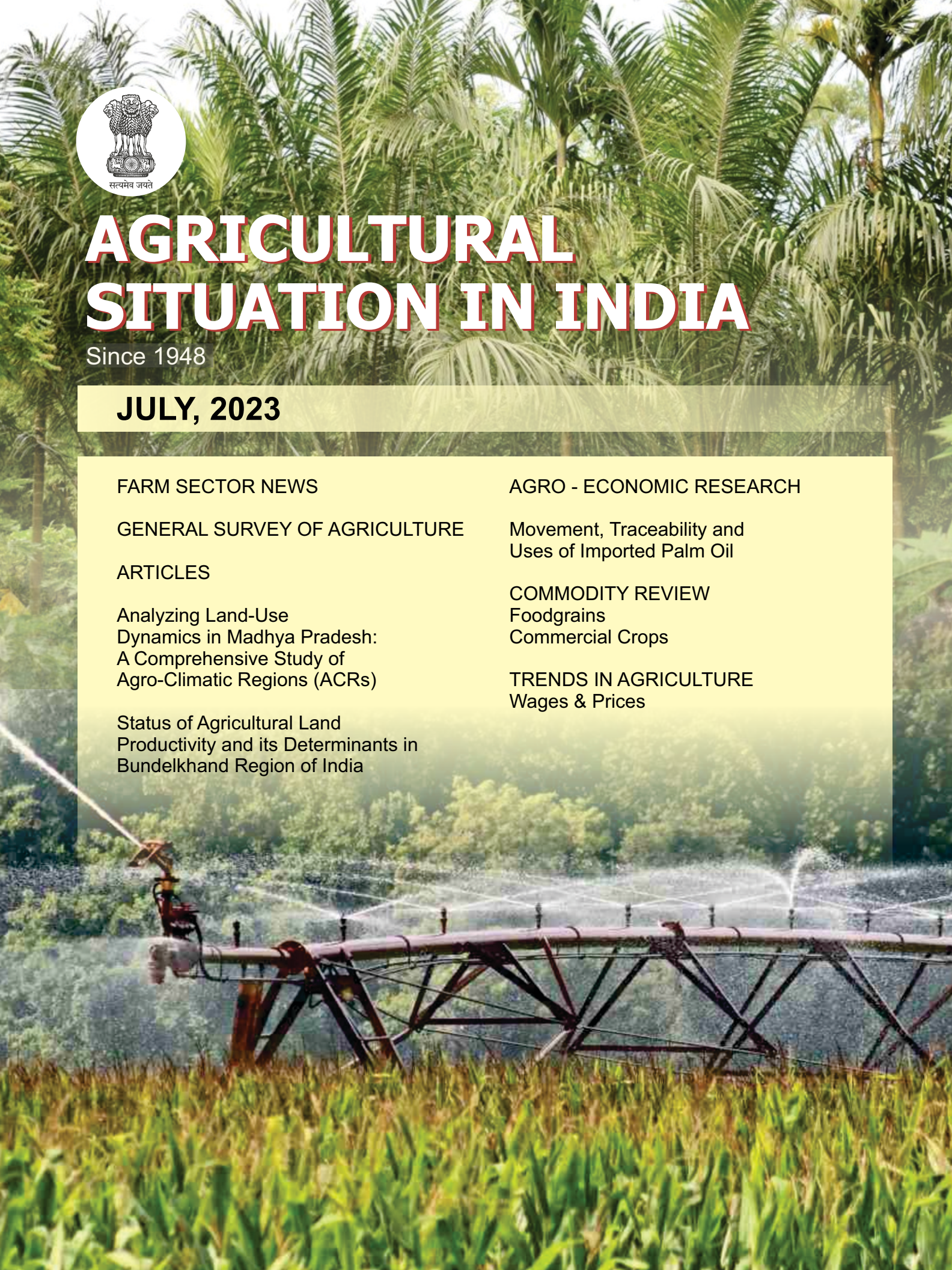

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FARM SECTOR NEWS

GENERAL SURVEY OF AGRICULTURE

ARTICLES

Analyzing Land-Use Dynamics in Madhya Pradesh: A Comprehensive Study of Agro-Climatic Regions (ACRs)

Status of Agricultural Land Productivity and its Determinants in Bundelkhand Region of India

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AGRICULTURAL SITUATION IN INDIA

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Editorial Desk

This issue of Agricultural Situation in India includes news covering the farm sector, production and procurement data of foodgrains, price indices, inflation rates, state-wise average daily wages, etc. The journal includes two research articles, one on "Analyzing Land-Use Dynamics in Madhya Pradesh: A Comprehensive Study of Agro-Climatic Regions (ACRs)" and second on "Status of Agricultural Land Productivity and its Determinants in Bundelkhand Region of India". In addition to this, an Agro-Economic Research study titled "Movement, Traceability and Uses of Imported Palm Oil" conducted by the Agricultural Economics Research Unit, Institute of Economic Growth, Delhi under the Agro-Economic Research scheme of Economics, Statistics and Evaluation Division, DA&FW is part of this edition.

The major farm sector news, inter alia, covers events such as the national workshop on the formation and promotion of Farmer Producer Organisations; the campaign for banks under the Agri Infra Fund, meeting between MoS (Agriculture) and the Deputy PM and Minister for Agriculture & Food Industries of Moldova. Other covered news includes revision in Crop Residue Management guidelines; report of the expert committee on Market Yard of National Importance platform; review progress of Phase-III of MOVCDNER.

The annual rate of inflation based on all-India WPI has decreased from 14.07 percent in July, 2022 to (-) 1.36 percent (provisional) in the month of July, 2023. The annual food inflation rate increased by 7.75 percent in the month July, 2023 (provisional) over July, 2022, whereas on month-on-month basis, the food inflation rate increased by 7.13 percent in July, 2023 over June, 2023, provisionally. The cumulative monsoon season rainfall in the country during the period 1st June, 2023 to 26th July, 2023 has been 5 percent higher than the long period average (LPA). Current live storage in 146 major water reservoirs in the country is 85.94 BCM, as against the average storage of last 10 years, 77.55 BCM.

The article "Analyzing Land-Use Dynamics in Madhya Pradesh: A Comprehensive Study of Agro-Climatic Regions (ACRs)" examines the growth and instability in area under different parameters of land-use pattern across 11 agro-climatic zones of Madhya Pradesh. The findings indicate an increase in NCA, GCA, forest area, non-agricultural land use area, and area under tree crops and groves, while barren and uncultivable land, permanent pastures, cultivable wasteland, and old and current fallow land exhibited noticeable deceleration. A varied pattern of instability in different land-use parameters was noted among the ACRs of the state throughout the study period. Policies aimed at enhancing the groundwater table may facilitate the conversion of fallow land into cultivable areas for farmers. Promotion of stabilization measures like robust crop insurance initiatives may help address the challenges posed by persistent volatility in the ACRs. Ensuring adequate government input support and facilitating the access of inputs and technology to farmers could help mitigate the fluctuations observed in the land use pattern.

The article on "Status of Agricultural Land Productivity and its Determinants in Bundelkhand Region of India" aims to explore the current status and trends of land productivity in the Bundelkhand region of Uttar Pradesh and Madhya Pradesh. It also seeks to analyze convergence/divergence trends in land productivity over time. Additionally, the study investigates potential avenues for regional development, particularly in land and groundwater utilization. The study finds that the contribution of the Bundelkhand region of both states to their respective state incomes is significantly low due to the under-development of the Bundelkhand region, lack of modern technology techniques for irrigation and farming purposes, and dependence on monsoons for irrigation. Crop productivity in the Bundelkhand region of both states is less than that in the non-Bundelkhand region due to deficiency of soil nutrients and poor soil fertility because of extreme climatic variability, high temperatures, and undulating topography. The study suggests the usage of groundwater resources in the Bundelkhand region to bring more area under irrigation and hence improve productivity, as there has been an underutilization of available resources due to inadequate knowledge regarding water resources and management.

The Agro - Economic Research on "Movement, Traceability and Uses of Imported Palm Oil" analyzes palm oil trade trends in India and globally, examines port-wise landings of palm oil, and highlights the diverse roles of palm oil in our daily lives. The study finds that over the years, the increase in production of palm oil in India has been relatively low compared to other edible oils, which necessitate the import of palm oil, thus making India the world's leading importer of palm oil, along with countries like China, the EU, Pakistan, and the US. The majority of India's imports of palm oil come in the form of crude oil, primarily from Malaysia and Indonesia. Ports of entry, such as the Kandla Sea, are essential for the importation of palm oil. The oil finds its utilization across diverse sectors, particularly in food, primarily as cooking oil, and in confectionery and industrial applications. However, heavy dependence on imports has made India susceptible to global price fluctuations, discouraging oil palm cultivation. The study suggests stable pricing mechanisms, incentives for farmers, improved post-harvest practices, technological advancements in mills and refineries, alternatives like mustard and coconut oil in cooking, and educating manufacturers and consumers about substitution possibilities as some of the ways in which India's reliance on palm oil can be reduced.

Promodita Sathish

Farm Sector News

Meetings and Events

National workshop on Formation and Promotion of Farmer Producer Organisations

The Ministry of Agriculture & Farmers Welfare (MoA&FW), Government of India, in association with Small Farmers Agribusiness Consortium (SFAC) organized a one-day national workshop on Formation and Promotion of Farmer Producer Organisations (FPOs) on 12th July, 2023. The workshop was presided over by Secretary (Agriculture), GoI, Sh. Manoj Ahuja. The Additional Secretary, MoA&FW, Sh. Faiz Ahmed Kidwai and Additional Secretary and Managing Director, SFAC, Dr Maninder Kaur Dwivedi addressed the participants. Over 100 participants, including Secretaries, Commissioners and Directors (Agriculture) from 17 states and UTs, and 15 Project Implementing Agencies (agencies of the Central and State Governments) of the scheme were present in the workshop.

In his presiding address, Secretary, Sh. Manoj Ahuja spoke of the important role played by the leadership and clear vision in establishing and achieving the aspiration of supporting marginal farmers, and that the development of the entire value chain should be the goal of FPO rather than just production.

In his address, Sh. Kidwai stressed on the need for monitoring by IAs of CBBOs, sensitisation of government functionaries; facilitation by Government agencies in getting licenses and bank finance for FPOs.

The technical sessions were on the following themes:

- Mrs B Sivarani of Salem Veerapandi Vattara Kalanjiam and Ashish Naphade of Krushi Vikas va Gramin Prashikshan Sanstha shared the experiences of successfully mobilising farmers, which could be replicated by other CBBOs.
- To enable market linkages, presentation on ONDC was also made and successful integration of more than 900 FPOs were presented. Signcatch presented the B2B linkages for FPOs which could be replicated by other FPOs. Aland Bhootai Millets Farmers Producer Company, ORMAS and Koriya Agro Producer Company also described successful market linkages of FPOs.
- Satmile Satish Club O Pathagar and DVARA E-Registry shared some innovative instances of local value addition by FPOs;
- Tribal Cooperative Marketing Development Federation (TRIFED) presented their schemes and experience of promoting tribal FPOs and carrying out market linkage;
- NABSanrakshan, a subsidiary of NABARD, presented details of credit guarantee scheme and some successful examples of FPOs availing guarantee under the scheme.

The workshop ended with an open session, where key operational aspects of the scheme were discussed. As a part of the discussion, the participants appreciated the initiative of sharing information and examples to ensure cross learning across all the entities.

Campaign for banks under Agri Infra Fund

Shri Manoj Ahuja, Secretary, Ministry of Agriculture & Farmers Welfare on 12th July, 2023 launched a new campaign for banks under Agri Infra Fund titled BHARAT (Banks Heralding Accelerated Rural & Agriculture Transformation). This one month-long campaign (from 15th July 2023 to 15th August 2023) with a target of Rs. 7200 crore was launched through video conference and was attended by more than 100 banking executives that included MDs/Chairman, EDs of commercial banks in public and private sector, Regional Rural Banks, Small finance banks, NBFCs and select cooperative banks. While addressing the gathering of bank executives and Ministry officials, Shri Samuel Praveen Kumar, Joint Secretary (AIF) highlighted the progress made since the inception of this ambitious flagship scheme. In his welcome address, he complimented the banks for their active involvement and support to promote this scheme which has resulted in creation of more than 31, 850 agri infra projects in the country with Rs. 24750 crore as loan amount under AIF with an outlay of Rs. 42,000 crore.

Expressing satisfaction at the support from the MoA&FW and Project Monitoring Unit of AIF, participating executives from banks came up with many suggestions to take AIF scheme to newer heights. Secretary, MoA&FW congratulated the top performing banks in different categories, namely State Bank of India, Canara Bank, Punjab National Bank, HDFC, Kotak Mahindra Bank, Madhya Pradesh Gramin Bank, Madhyanchal Gramin Bank and Punjab Gramin Bank for their laudable effort in contributing to take this scheme forward and appealed to all the banks to achieve targets considering the vast potential for agri infra projects in our country. The banks were also advised to carry out an assessment of impact of the projects created under the scheme at ground level.

Technological advancements in crop insurance

The Ministry of Agriculture and Farmers Welfare on 21st July, 2023 launched several new technological initiatives under the Pradhan Mantri Fasal Bima Yojana to empower farmers and streamline the operations. The launch event was held in New Delhi wherein Union Agriculture Minister, Shri Narendra Singh Tomar and Union Minister for Earth Sciences, Shri Kiren Rijiju launched several new initiatives under PMFBY and RWBCIS, such as YES-Tech Manual, WINDS portal and door to door enrollment app AIDE/Sahayak, marking a turning point in India's crop insurance landscape. The event also shed light on the remarkable achievements and transformative steps taken by the Ministry of Agriculture and Farmers Welfare to empower farmers and mitigate risks effectively.

Unveiling the WINDS , Union Minister of Earth Sciences, Shri Kiren Rijiju, called for adapting agriculture to climate change with a "responsive and appropriate scientific mechanism."

YES-TECH Manual is a comprehensive guide developed after extensive testing and piloting in 100 districts of India. It facilitates the implementation of YES-TECH, a technology-driven yield estimation system, offering methodologies, best practices, and integration insights for accurate yield assessments at the gram panchayat level. On the other hand, the WINDS portal is a centralized platform that hosts, manages and processes hyper-local weather data collected by automatic weather stations and rain gauges at taluk/block and gram panchayat levels. The portal enhances risk assessment and decision-making in crop insurance, agriculture advisories, and disaster mitigation, supporting the agricultural sector and rural economy. The AIDE app's introduction on android platform aims to revolutionize the enrolment process, bringing it directly to the doorstep of farmers. This door-to-door enrolment ensures a seamless and transparent process, making crop insurance more accessible and convenient for farmers.

Meeting held between MoS (Agriculture) and Deputy PM and Minister for Agriculture & Food Industries of Moldova

A meeting between Minister of State for Agriculture & Farmers Welfare, Sushri Shobha Karandlaje and Deputy Prime Minister and Minister for Agriculture & Food Industries of Moldova, Mr Vladimir Bolea was held on 31st July, 2023 at Krishi Bhawan, New Delhi.

Welcoming the Moldovan Deputy PM and his delegation, Sushri Shobha Karandlaje mentioned about the 31 years of close and friendly diplomatic relations between India and Moldova. She expressed her happiness on opening of Moldovan Resident Mission in New Delhi. Both Ministers emphasized on the potential for increasing bilateral trade in agricultural commodities and for strengthening of bilateral agricultural cooperation through exchange of knowledge and technology.

Mr Vladimir Bolea proposed signing of a Memorandum of Understanding for cooperation between the two countries in the field of agriculture which would provide an institutional mechanism for cooperation between the two countries. Mr Bolea also expressed Moldova's interest in exporting vegetable oils to India and importing fertilizers and pesticides from India. He expressed Moldova's support to India for its membership of UN Security Council in 2027 and informed that Moldova is a candidate to become an EU member and follows the EU standards and therefore their products are safe to consume. He highlighted the Moldovan culture of producing wine and apples as a way of life and expressed their interest in exporting

these products to India.

MoS agreed to the proposal of signing of an MoU and proposed that India will soon share a draft MoU with them. She also requested the Moldovan side to send proposal for cooperation in exchange of technology.

General Agricultural Sector News

Revision in Crop Residue Management guidelines

The Government has revised the Crop Residue Management guidelines enabling efficient ex-situ management of paddy straw generated in the States of Punjab, Haryana, Uttar Pradesh and Delhi. As per the revised guidelines, techno-commercial pilot projects for Paddy Straw Supply Chain will be established under the bilateral agreement between the Beneficiary/ Aggregator (farmers, rural entrepreneurs, cooperative societies of farmers, Farmers Producer Organizations (FPOs) and panchayats) and industries utilizing the paddy straw.

The Government shall provide financial assistance on the capital cost of machinery and equipment. The required working capital may be financed either by the industry and beneficiary jointly or utilizing the Agriculture Infrastructure Fund (AIF), NABARD financial or financing from the financial institutions by the beneficiary. The land for storage of the collected paddy straw will be arranged and prepared by the beneficiary as may be guided by the end-use industry. Project proposal based financial assistance will be extended for machines and equipments such as higher HP tractor, cutters, tedder, medium to large balers, rakers, loaders, grabbers and telehandlers which are essentially required for establishment of paddy straw supply chain.

State Governments shall approve these projects through project sanctioning committee. Government (jointly by Central and State Governments) will provide financial support of @ 65% of the project cost while Industry as primary promoter of the project will contribute 25% and will act as the primary consumer of the feedstock collected. Farmer or group of farmers or rural entrepreneurs or cooperative societies of farmers or FPOs or panchayats will be the direct beneficiary of the project and will contribute the balance 10%.

The outcomes of the above interventions are:

- The initiative will supplement the efforts of paddy straw management through in-situ options;
- During the three-year tenure of the interventions, 1.5 million metric tonne of surplus paddy straw is expected to be collected which would otherwise have been burnt in fields.
- About 333 biomass collection depots of capacity 4500 MT will be built in the states of Punjab, Haryana, Uttar Pradesh and Madhya Pradesh.
- Air pollution caused by stubble burning will be considerably reduced.
- It would generate employment opportunities of about 9,00,000 man days.
- The interventions will encourage a robust supply chain management of paddy straw which shall further help in making paddy straw available for various end uses i.e., power generation, heat generation, bio- CNG, etc. by power/bio-CNG/bio-ethanol producers.
- Establishment of supply chain would result in new investments in biomass to biofuel and energy sectors.

Report of the expert committee on Market Yard of National Importance platform

Government of India has always been supporting the idea of strengthening Agricultural Produce Market Committees (APMCs) and making them more transparent and competitive with the advent of new edge digital technologies through improving infrastructure and services offering to the farmers.

Achievement of e-NAM has been path breaking in agri-marketing sector. Though 1361 regulated markets have become a part of the e-NAM platform, a need has been felt that for obtaining a competitive price especially for surplus farmer produce inter-mandi and more importantly, inter-state trade is crucial and it is essential that a more concerted intervention is needed for creating a larger reach for the farmer's surplus produce through an efficient and seamless marketing system across India by promoting quality based trading with a transparent price discovery mechanism for inter-mandi & inter-state trade.

Taking a stride of policy reforms to the next level and with a vision to enhance the share of the producers in the end consumer price, Government of India had constituted a high-level expert committee on 21st April, 2023, to promote inter-mandi & inter-State trade through conceptualization and implementation of Market Yard of National Importance (MNI). The said expert committee was chaired by Dr. Manoj Rajan, Special Secretary (Agriculture), Government of Karnataka with the members from State Agri Marketing Boards of Uttar Pradesh, Karnataka, Rajasthan, Telangana, Odisha and Bihar. Apart from State representative, Director (Agriculture Marketing), DA&FW, GoI, Deputy AMA, DMI, representative from SFAC and Strategic Partner for e-NAM were also the members of the said committee. The Committee has been assigned the task of recommending the framework for implementation of MNI.

On 4th July, 2023, the Chairperson submitted the report of the expert committee on MNI platform. Aforesaid committee has recommended the implementation framework of MNI-P platform, legal framework & inter-state reciprocity of license and movement, dispute resolution mechanism, rollout strategy, etc. This platform will provide an opportunity to farmers of the participating states to sell their surplus produce beyond its state boundaries. This platform would enable to create digital ecosystems that leverage the expertise of various segments of agriculture value chain.

Review progress of Phase-III of MOVCDNER

A two-day Stakeholder Workshop meeting was organized on 13th July to review the progress of Phase-III of the Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), a Centrally Sponsored Scheme which aims to develop end to end organic value chains in North Eastern States.

The scheme was reviewed with focus on how to liquidate the committed liability of Phase III and roadmap for implementation of Phase IV of the scheme staring 2023-24. States were requested to suggest the activities and plans which could be taken up associated with availability of funds under MOVCDNER scheme.

Shri Rakesh Ranjan, Additional Secretary (INM), Ministry of Agriculture and Farmers Welfare chaired the meeting on 14th July 2023, in the presence of Dr. Yogita Rana, JS (INM) and Shri Angshuman Dey, JS (MDONER). The representatives of the 8 NE States (Mizoram, Manipur, Meghalaya, Assam, Sikkim, Arunachal Pradesh, Nagaland and Tripura), NEDFi and officers from MoA&FW and MoRD participated in the workshop. The session started with presentation on the recommendations given by the states on day 1 to scale up the scheme and have a robust implementation system.

Shri Ranjan emphasized the importance of service providers to facilitate market linkages and creating brand value of organic products. He also highlighted the focus of the Government in NE and exhorted the 8 states to ensure the complete utilization of funds earmarked for NE states, focus on export of organic products to ensure maximum benefit to the farmers of the NE region.

The MOVCDNER scheme launched during 2015-16 has helped in bringing 1.73 lakh ha area under organic farming, benefiting 1.89 lakh farmers. During this period, 379 FPOs/FPCs were formed involving creation of 205 collection, aggregation and grading units, 190 Custom Hiring Centres and 123 processing unit and pack houses. 7 brands have also been developed.

General Survey of Agriculture

Trend in Food Prices

The rate of inflation, based on all-India WPI, stood at -1.36% (Provisional) for the month of July, 2023 as compared to 14.07% during the corresponding period of last year.

WPI Food Index (Weight 24.38%): The Food Index consisting of 'Food Articles' from Primary Articles group and 'Food Product' from Manufactured Products group has increased from 175.2 in June, 2023 to 187.7 in July, 2023. The annual rate of inflation (Y-o-Y) based on WPI Food Index changed from (-)1.24 %in June, 2023 to 7.75% in July, 2023.

Based on Wholesale Price Index (WPI) (2011-12=100), the WPI of pulses, cereals and vegetables increased by 9.59 percent, 8.31 percent and 62.12 percent, respectively, and for fruits, it decreased by 8.91 percent in July, 2023 over corresponding period of last year. On month-on-month basis, the WPI for cereals, vegetables and pulses increased by 1.03 percent, 81.15 percent and 1.80 percent, respectively, and for fruits, it decreased by 6.99 percent in July, 2023 over June, 2023.

Among cereals, the WPI based rate of inflation for wheat and paddy increased by 8.01 percent and 9.03 percent, respectively, in July, 2023 over July, 2022 while on month-on-month basis, the WPI for paddy and wheat increased by 1.68 percent and 0.11 percent, respectively, in July, 2023 over June, 2023.

Rainfall and Reservoir Situation, Water Storage in Major Reservoirs

Cumulative Monsoon Season (June-September), 2023 rainfall for the country as a whole during the period 1st June, 2023 to 26th July, 2023 has been 5% higher than the Long Period Average (LPA). Rainfall in the four broad geographical divisions of the country during the above period has been higher than LPA by 34% in North-West India, by 14% in Central India and by 2% in South Peninsula but lower than LPA by 25% in East & North East India. Out of 36 meteorological sub-divisions, 13 meteorological sub-divisions received large excess/ excess rainfall, 17 meteorological sub-divisions received normal rainfall and 6 meteorological sub-divisions received deficient/large deficient rainfall.

Out of 715 districts for which rainfall data is available, 98 (14%) districts received large excess rainfall, 144 (20%) districts received excess rainfall, 245 (34%) districts received normal rainfall, 199 (28%) districts received deficient rainfall and 29(4%) districts received large deficient rainfall.

Current live storage in 146 reservoirs (as on 27th July, 2023) monitored by Central Water Commission having Total Live Capacity of 178.19 BCM was 85.94 BCM as against 101.58 BCM on 27.07.2022 (last year) and 77.55 BCM of normal storage (average storage of last 10 years). Current year's storage is 85% of last year's storage and 111% of the normal storage.

All-India Crop Situation- Kharif 2023-24

As per progress of area coverage report, area sown in the current year 2023 is 830.31 lakh ha (76% of normal area) as compared to 831.65 lakh ha during the corresponding period of last year. Higher area has been covered under rice (4.33 lakh ha), coarse cereals (2.28 lakh ha), oilseeds (3.42 lakh ha) and sugarcane (2.66 lakh ha) compared to corresponding period of last year.

A statement indicating comparative position of area coverage under major crops as on 28.07.2023 during current Kharif season *vis-a-vis* the coverage during the corresponding period of last year is given in Annexure-I.

Annexure-I

All India Crop Situation - Kharif (2023-24) as on 28-07-2023					
					(in lakh ha.)
Crop Name	Normal area of whole kharif season (DES)	Area sown reported			Absolute change
		This year 2023	% of normal for whole season	Last year 2022	
Rice	399.45	237.58	59.5	233.25	4.33
Jowar	17.36	10.58	61.0	10.56	0.02
Bajra	73.24	60.60	82.7	58.08	2.52
Maize	75.71	69.36	91.6	68.94	0.43
Total coarse cereals	**181.91**	**145.76**	**80.1**	**143.48**	**2.28**
Total cereals	**581.36**	**383.34**	**65.9**	**376.48**	**6.61**
Tur	46.29	31.51	68.1	37.50	-5.99
Urad	39.23	25.83	65.8	30.06	-4.23
Moong	36.56	27.64	75.6	29.78	-2.14
Others	17.62	11.85	67.3	11.81	0.04
Total pulses	**139.70**	**96.84**	**69.3**	**109.15**	**-12.32**
Total foodgrains	**721.05**	**480.17**	**66.6**	**485.88**	**-5.70**
Groundnut	45.04	37.58	83.4	38.59	-1.01
Soybean	117.44	119.91	102.1	115.63	4.28
Sunflower	1.23	0.52	41.9	1.64	-1.12
Sesamum	15.94	10.07	63.2	10.04	0.04
Niger seed	1.48	0.09	6.4	0.20	-0.10
Castor seed	8.68	2.77	32.0	1.39	1.39
Total oilseeds	**189.81**	**171.02**	**90.1**	**167.61**	**3.42**
Cotton	128.67	116.75	90.7	117.91	-1.16
Sugarcane	48.85	56.00	114.6	53.34	2.66
Jute & Mesta	6.90	6.37	92.3	6.92	-0.56
All crops	**1095.29**	**830.31**	**75.8**	**831.65**	**-1.34**

Source: Crops Division, DA&FW

Articles

Analyzing Land-Use Dynamics in Madhya Pradesh: A Comprehensive Study of Agro-Climatic Regions (ACRs)

SHIVCHARAN MEENA[1] AND D.P. RAI[2]

Abstract

Efforts have been made to assess the scenario of growth and volatility in various parameters of land-use across the Agro-Climatic Regions (ACRs) of Madhya Pradesh. The study is based on the secondary data, which was collected for past 20 years (2000-01 to 2019-20) for the 11 ACRs of Madhya Pradesh. Compound Annual Growth Rate (CAGR) and instability index was used for analysis of the data. The study revealed an elevation in the net cultivated area, gross cropped area, forest area, area under non-agricultural utilize and area under tree crops & groves with a highly significant CAGR of 0.25, 2.07, 0.01, 0.94 and 0.27 percent, respectively, during the reference period. The barren & un-cultivable land, permanent pastures, cultivable wasteland, old and current fallow land showed perceptible deceleration by 0.24, 0.57, 1.56, 1.92 and 3.35 percent, respectively, during the period under study at the state level. More or less similar trend was observed in all the ACRs for the same period. All the parameters of land-use except area under current fallow land showed low instability at the state level. Area under current fallow was found to have medium instability. A mixed pattern of instability in different parameters of land-use was recorded among the ACRs of the state during the period.

Keywords: *Agro-climatic regions, land use pattern, growth, instability, Madhya Pradesh*

1. Introduction

Land is a crucial natural resource and a pertinent determinant of country's socio-economic and ecological health. Sustainable utilization of land resources is the need of the hour for continuous supply of land and the well-being of people of the country. A country's' socio-economic priorities at any given time shape the drivers of the land use change. India, as a developing country, is pushing its industrial and service sector to create favourable conditions for production and consumption of goods and services (Rathee, 2014). With one-sixth of the global population, India is the most populated nation on earth. India's population was estimated to be around 1.42 billion in 2022, as per official data. India is characterized by an immense diversity in climate, topography, flora, fauna, land use, and socio-economic conditions (FAO, 2017b). During the past 140 years, India has experienced remarkable land use and land-cover changes including deforestation, cropland changes, and urban expansion (Roy *et al*., 2015; Tian *et al*., 2014). Over half of the territory is used as cropland, making India one of the largest producing countries of agricultural commodities worldwide (FAO, 2017a; Teluguntla *et al*., 2015). As per the Second Advance Estimates of National Income, 2022-23 released by Ministry of Statistics & Programme Implementation (MoSPI), the share of Gross Value Added (GVA) of agriculture and allied sectors in total economy in 2022-23 is 18.30%.The share of workers engaged in agriculture rose marginally from 45.6 percent in 2019-20 to 46.5 percent in 2020-21 (Economic Survey, 2023). At national scenario, a little more than half of total land area of 328.73 million hectare is used for agriculture, which includes 140.02 million hectare net sown area under cultivation, 200.2 million hectares gross cropped area with a cropping intensity of 143.6% and 26.17 million ha for non-agricultural uses (GoI, Annual report 2020-21). Over the years, there has been a gradual increase in the area under non-agricultural uses.

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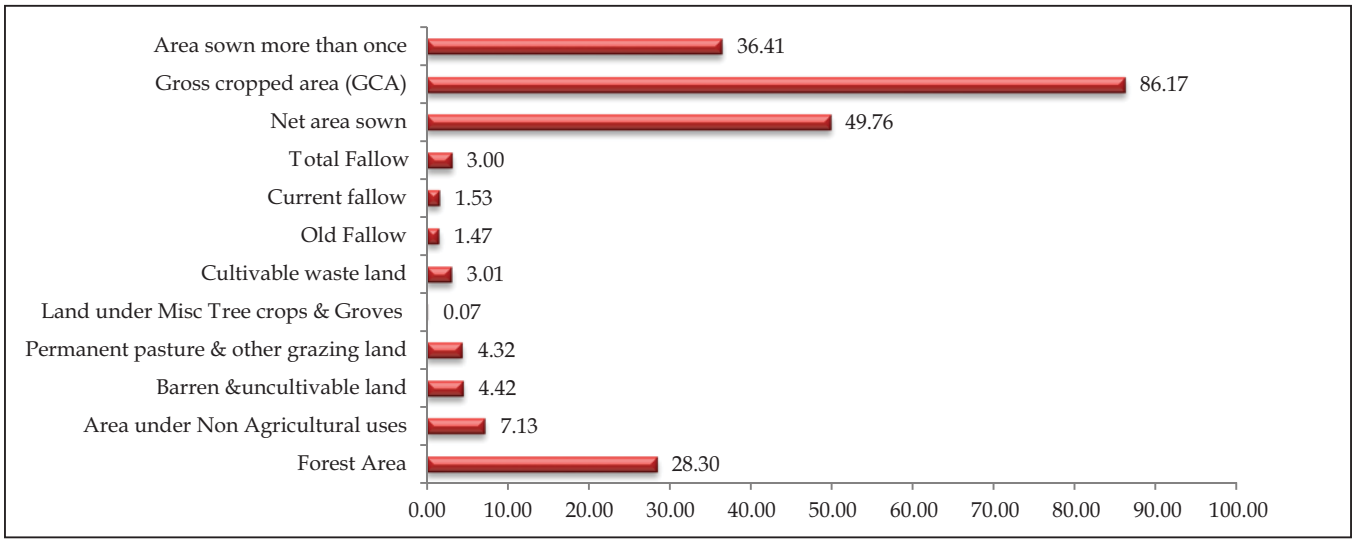
Madhya Pradesh is an agrarian economy with 35% share of GVA coming from primary sector, especially agriculture and allied sector. Around 49.76% (153.02 lakh ha) of total land in the state (307.56 lakh ha) is under cultivation. The fallow land constitutes 3.00% of the total geographical area of the state (TE 2019-20) while 28.30% of total geographical area is under forest. Current fallow occupies a share of 1.53% of total, while 7.13%, 1.47% and 3.01% of total area are under land put to non-agriculture uses, old fallow and cultivable waste land, respectively.

Figure 1: Land Use Pattern in Madhya Pradesh -TE 2019-20 (%)



Source: DACNET

Barren and uncultivable land occupies around 4.42%, whereas permanent pasture and other grazing land covers 4.32% of total geographical area (Figure 1).The state is blessed with 11 agro-climatic regions (ACRs) providing ecological support system for production of unique crops and varieties. Over a period of time, there has been a gradual shift in land use pattern in Madhya Pradesh, as reported by Meena *et al*., 2022.

Land use is a major issue of global environment change. There is a subsequent need for development of a system of optimum land utilisation. The analysis of land use is an important aspect of economic studies. At present, land-use is continuously changing as a result of changes in pattern and magnitude of human activities. So, how lateral the land use pattern has been is a matter of concern for agricultural economists.

1.1 Objectives of the study

The objectives of the paper were to analyse the growth and instability in area under different parameters of land-use pattern across various agro-climatic zones of Madhya Pradesh and to suggest the possibilities for better use of land resources under different agro-climatic regions.

2. Data source and methodology

The study pertains to various agro-climatic regions (ACRs) of Madhya Pradesh. The state is blessed with 11 agro–climatic regions, which exist in 5 crop zones (Table 1).

TABLE 1: DIFFERENT AGRO-CLIMATIC REGIONS AND CROP ZONES IN MP

S. No.	Agro-climatic Regions	Crop/Zones	Districts covered
1	Northern Hill Region of Chhattisgarh	Rice zone	Shahdol, Mandla, Dindori, Anuppur, Sidhi(Partly), Umaria
2	Chhattisgarh Plains		Balaghat
3	Kymore Plateau & Satpura Hills	Wheat-Rice zone	Rewa, Satna, Panna, Jabalpur, Seoni, Katni, Sidhi (except Singroli tehsil)
4	Central Narmada Valley	Wheat zone	Narsinghpur, Hoshangabad Sehore (Partly), Raisen (Partly)
5	Vindhya Plateau		Bhopal, Sagar, Damoh, Vidisha, Raisen (except Bareli Teh.), Sehore (except Budni Teh.), Guna (Partly).
6	Gird Region	Wheat-Jowar zone	Gwalior, Bhind, Morena, Sheopur-Kala, Shivpuri, (except Pichore, Karera, Narwar, Khania-dana Teh.), Guna (except Aron, Radhogarh, Chachoda Tehsil) Ashoknagar
7	Bundelkhand Region		Chhattarpur, Datia, Tikamgarh, & Shivpuri (Partly)
8	Satpura Plateau		Betul & Chhindwara
9	Malwa Plateau	Cotton-Jowar zone	Mandsaur, Neemuch, Ratlam, Ujjain, Dewas, Indore, Shajapur, Rajgarh & Dhar (Partly), Jhabua (Partly)
10	Nimar Valley		Khandwa, Burhanpur, Khargone, Barwani, Harda, Dhar (Partly) District.
11	Jhabua Hills		Jhabua & Alirajpur District (except Petlawad Tehsil) & Dhar (Partly)

Source: AERC, JNKVV, Jabalpur

The study is based on secondary time series data for the period of 2000-01 to 2019-20 collected from various sources such as Basic Statistics (Government of Madhya Pradesh), Statistical Abstracts, Agricultural Statistics at a Glance, indiastat.com. Compound Annual Growth Rate (CAGR) and instability index are used for analysis of the data.

2.1 Compound Annual Growth Rate analysis: The Compound Annual Growth Rate (CAGR) of area, production and exports of organic produce from India has been calculated using an exponential function. A time-series data is fitted in an exponential trend equation, post which, the equation is further solved to deduce the CAGR.

The exponential trend equation used in this case is of the following form:

$$Y_t = ab^t \qquad \text{(eq. 1)}$$

where,

Y_t = Parameters of land-utilization and cropping pattern

a = constant

b = coefficient that shows the rate of change

t = time variable with an annual frequency (Year = 1, 2…, n)

Converting eq. 1 into a semi log exponential form:

$$\log(Y_t) = a+tb \qquad \text{(eq. 2)}$$

Eq. 1 can also be written as:

$$Y_t=Y_0 (1+r)t \qquad \text{(eq. 3)}$$

Taking log on both sides:

$$\log (Y_t) = \log (Y_o) + t \log (1+r) \qquad \text{(eq. 4)}$$

Comparing eq. 2 and eq. 4, we get:

$$a = \log (Y_o)$$

$$b = \log (1+r)$$

The CAGR can be calculated by using the following method:

$$b = \log (1+r)$$

$$\text{Antilog } (b) = 1+r$$

$$\text{Antilog } (b) - 1 = r$$

i.e. $r = \text{Antilog } (b) - 1$

When this value of r is multiplied by 100, it gives the percentage compound annual growth rate as per the formula.

CAGR = (Antilog of (b)-1*100)

2.2 Cuddy Della Valle Instability (CDVI) index: Cuddy and Valle (1978) created the Cuddy- Della Valle index to measure the instability in time series data that is characterized by trend. The Cuddy Della Valle index de-trends the given series first, indicating the direction of instability. The use of the coefficient of variation as a measure of instability in time series data has significant drawbacks. If the time series data show any trend, the variation assessed by coefficient of variation can be overstated, *i.e.* if coefficient of variation is used to quantify instability, the region with expanding output at a constant rate will score high in instability. In contrast, the Cuddy-Della Valle index uses coefficient of determination to de-trend the coefficient of variation.

The Coefficient of Variation (CV) is a statistical measure of data points' dispersion around the mean in a data series. The coefficient of variation is a useful statistic for assessing the degree of variation between two data series, even if the means are radically different. It indicates the ratio of the standard deviation to the mean.

$$\text{Coefficient of variation} = \frac{\text{Sandard Deviation (SD)}}{\text{Mean}} \times 100$$

Further, the instability index is calculated to look at the fluctuations or volatility in time series data of area under different parameters of land-use using the following formula:

$$\text{Instability Index (I)} = CV \times \sqrt{1 - \text{Adjusted } R^2}$$

CV = Coefficient of Variation

Adj R^2 = Coefficient of determination

The ranges of CDVI (Sihmar, 2014) are given as follows:

Low instability = between 0 and 15;

Medium instability = greater than 15 & lower than 30

High instability = greater than 30

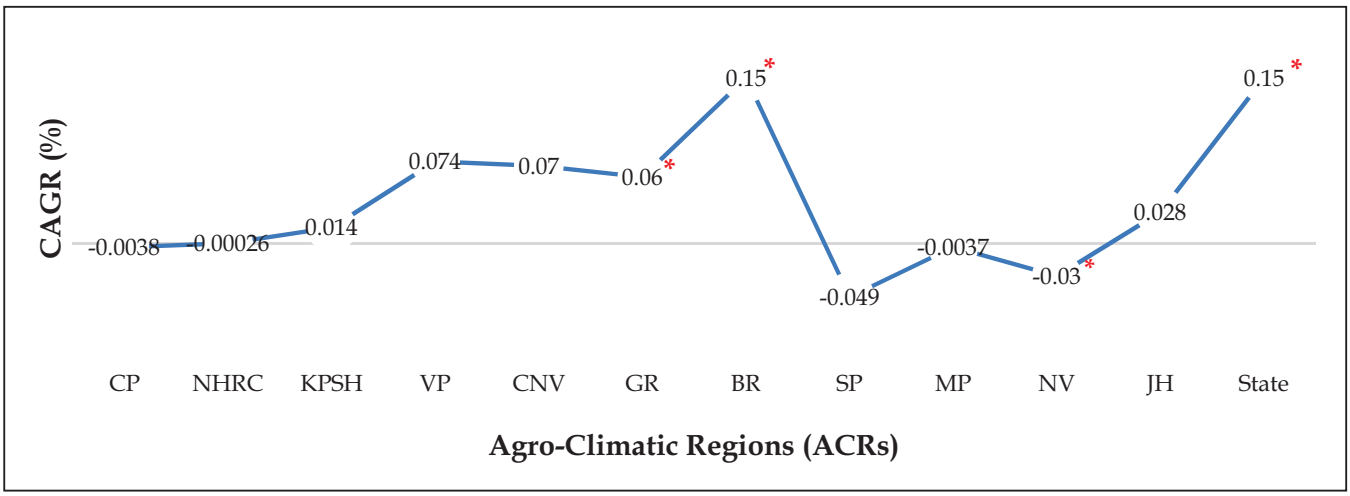
3. Results and discussion

Compound growth rate and instability index have been worked out for different categories of land use for different agro-climatic regions and for State as a whole for the period of 2000-01 to 2019-20 to examine the spatial and temporal dimension of the dynamics of land use pattern. Growth and instability of various parameters of land-use is as follows:

(i) Forest Area: From the decadal growth rate and trend analysis of forest area in Madhya Pradesh, it was observed that the forest area has slightly increased with a highly significant compound growth of 0.01 percent per annum during the period in Madhya Pradesh. The result is in conformity of Kumari *et al.*, 2019.

The growth of area of the forest in all the ACRs was found to have increased marginally, with positive but insignificant growth in seven of 11 regions of Madhya Pradesh. Although in Gird region and Bundelkhand region, the growth rate was positive and highly significant for the period. Satpura plateau and Nimar valley showed marginally decreased growth rate of 0.05 (insignificant) and 0.03 (highly significant) percent per annum respectively. Kolar and Rathi (2020) is in support of these findings. The accelerated growth has been mainly due to the efforts made by the Government to save and harness our invaluable resource by community participation and plantation drives on various occasions. However, in some certain ACRs, a marginal downfall in growth rate was recorded in past twenty years (Figure 2).

Figure 2: Growth of Forest Area in different ACRs

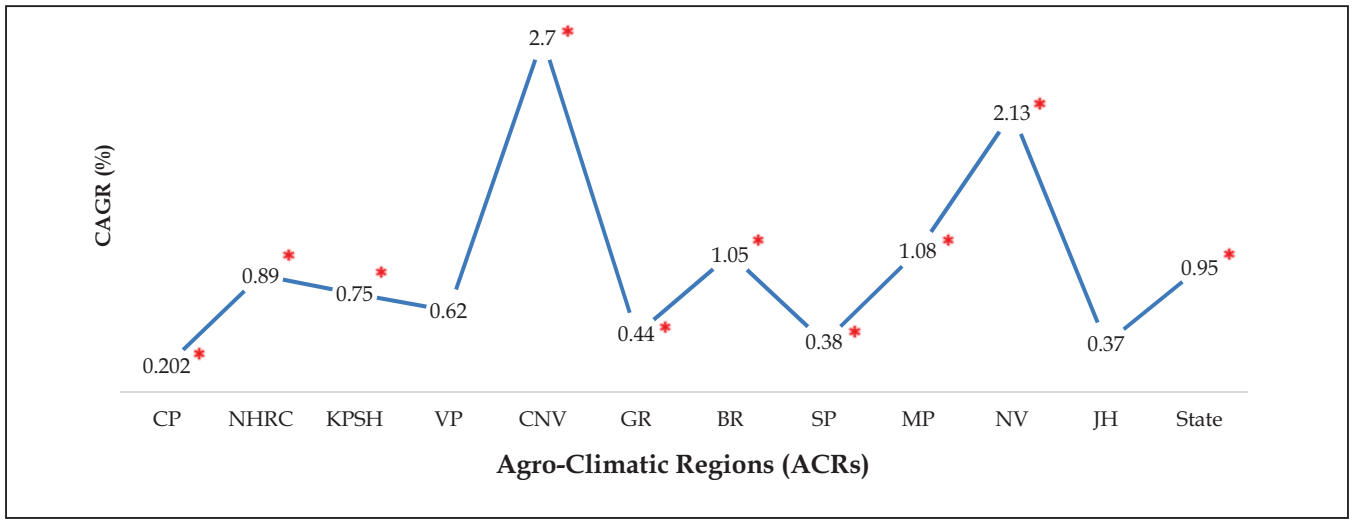


Source: Graphical representation by author
Note: *Significant @ 1%

(ii) The area under non-agril utilize: The decadal growth rate and trend analysis showed an increasing highly significant compound growth of 0.95 percent per annum throughout the years in Madhya Pradesh. A similar trend was also observed in all the ACRs excluding Jhabua hills, wherein the growth was statistically insignificant for the same period.

The highest increasing CAGR was found in Central Narmada Valley (2.70%) and the lowest increasing CAGR was observed in Chhattisgarh plain (0.2%) during the period of 2000-01 to 2019-20. This could be the result of non-agricultural uses such as the construction of roads, buildings, and other infrastructure taking precedence over agricultural ones. There may have been an increase in non-agricultural land use because of the rapid growth in urbanization and industrialization. Urbanization level of the 11 districts is up to the state average (27.63%) and rest of the districts are comparatively less urbanized (Shrivastava and Kumar, 2017). Pandey (2018) also reported the same findings mentioning a rising demand of such category land across the states for sheltering, industrial activities, infrastructure, etc.

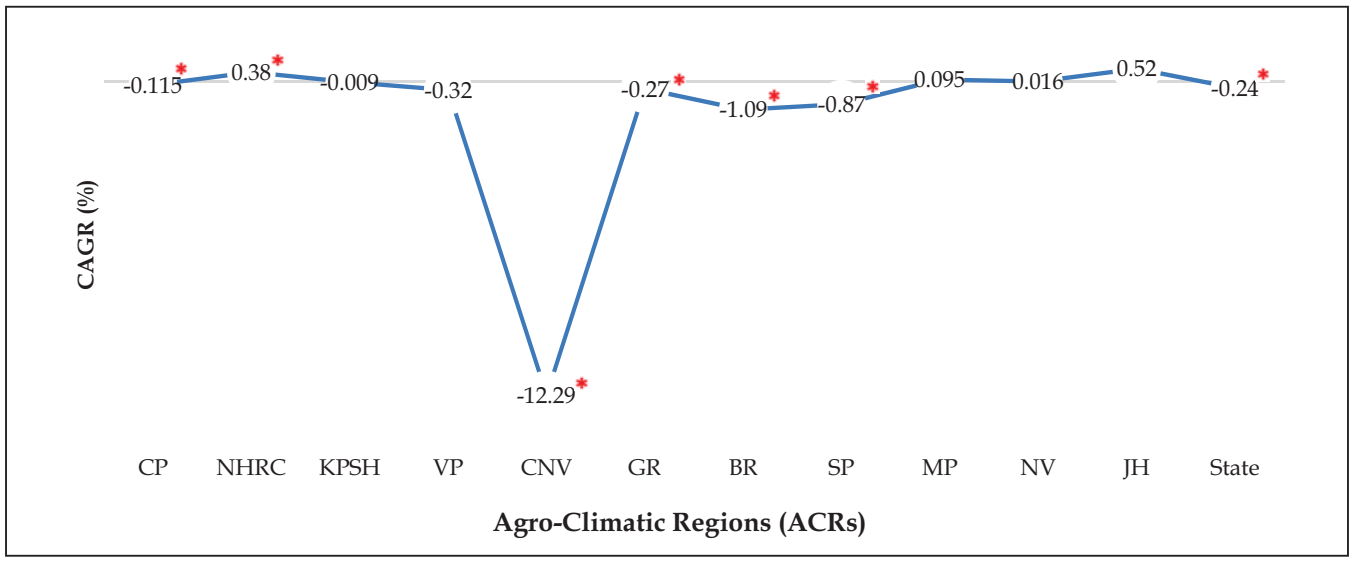
Figure 3: Growth of Area under Non-Agricultural Utilize in different ACRs



Source: Graphical representation by author
Note: *Significant @ 1%

(iii) Area under barren and uncultivated land: The decadal growth rate and trend analysis show the area under barren and uncultivated land to have sharply decreased with a highly significant CAGR of 0.24 percent in Madhya Pradesh during the period under study. This might have happened due to considerable decrease in area under this category in seven of 11 ACRs with highly significant CAGR. The result was confirmed by Deka (2018) and Raveendran *et al.* (2020) in Assam and Tamil Nadu, respectively.

Figure 4: Growth of Area under Barren & Uncultivated Land in different ACRs

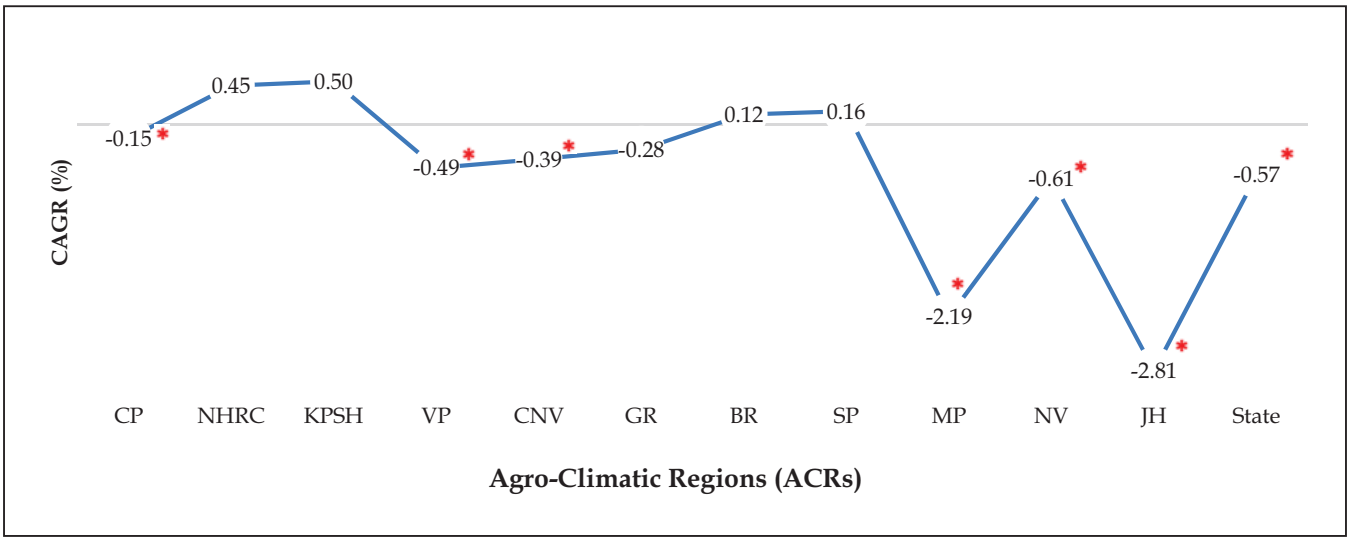


Source: Graphical representation by author
Note: *Significant @1%

The ACRs like Northern hill region of Chhattisgarh, Malwa plateau, Nimar valley, and Jhabua hills showed acceleration with marginal growth rate of 0.38, 0.09, 0.02 and 0.52 percent, respectively. Construction of roads, railways, and buildings on the one hand, and an increase in the area under homestead in response to family position and human carelessness, unethical land activities, and immigration settlements on the other, are the primary factors behind the change.

(iv) Area under permanent pasture & other grazing land: A declining trend of growth rate of area under permanent pasture & other grazing land was recorded with highly significant CAGR of 0.57 percent at the State level during the period.

Figure 5: Growth of Area under Permanent Pasture in different ACRs

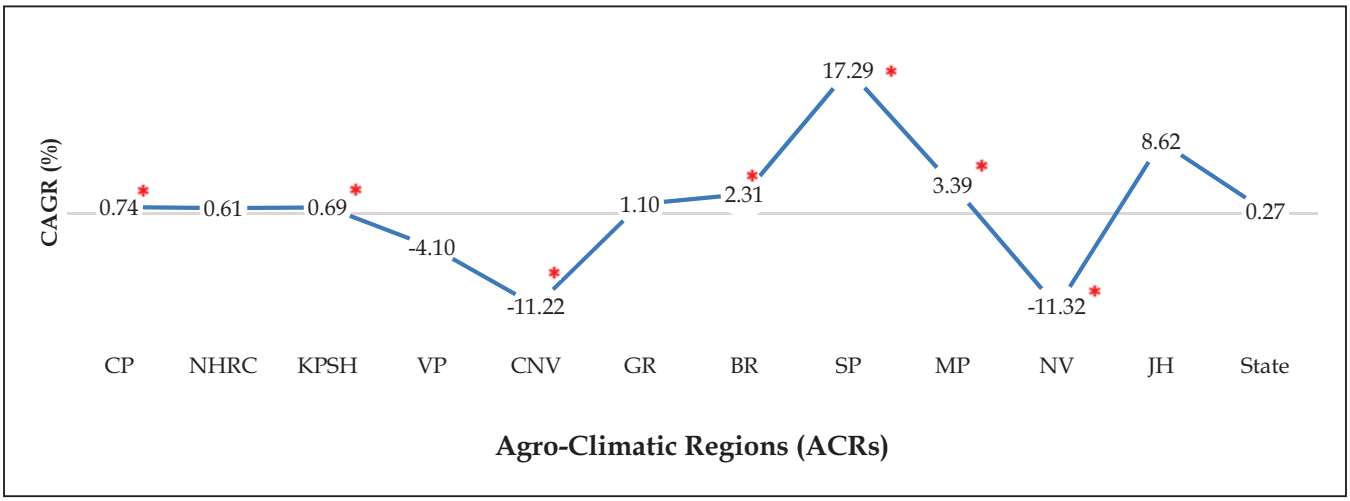


Source: Graphical representation by author
Note: *Significant @ 1%

A similar, decelerated trend was observed in all the ACRs excluding NHRC, KPSH, BR and SP during the period. The negative growth of area was statistically highly significant in all seven but one ACR, namely GR, for the same period. Interestingly, the positive growth was statistically insignificant in all the respective ACRs. This might be due to the switch-over of pasture area into agriculture as well as some other uses through illicit encroachments, followed by conversion of these lands to other utilizations by the Government. Takle *et al.* (2007) reported similar result of decrease in area under same category of land use by 1.47 percent over time in Maharashtra.

(v) Area under tree crops and groves: In Madhya Pradesh, the area under tree crops & groves has increased with an insignificant CAGR of 0.27 percent per annum during the period. A similar trend was possible in all but 3 ACRs, wherein the area of this category dramatically declined with a highly significant CAGR of double digits in 2 of the three ACRs for the same period.

Figure 6: Growth of Area under Tree Crops & Groves in different ACRs

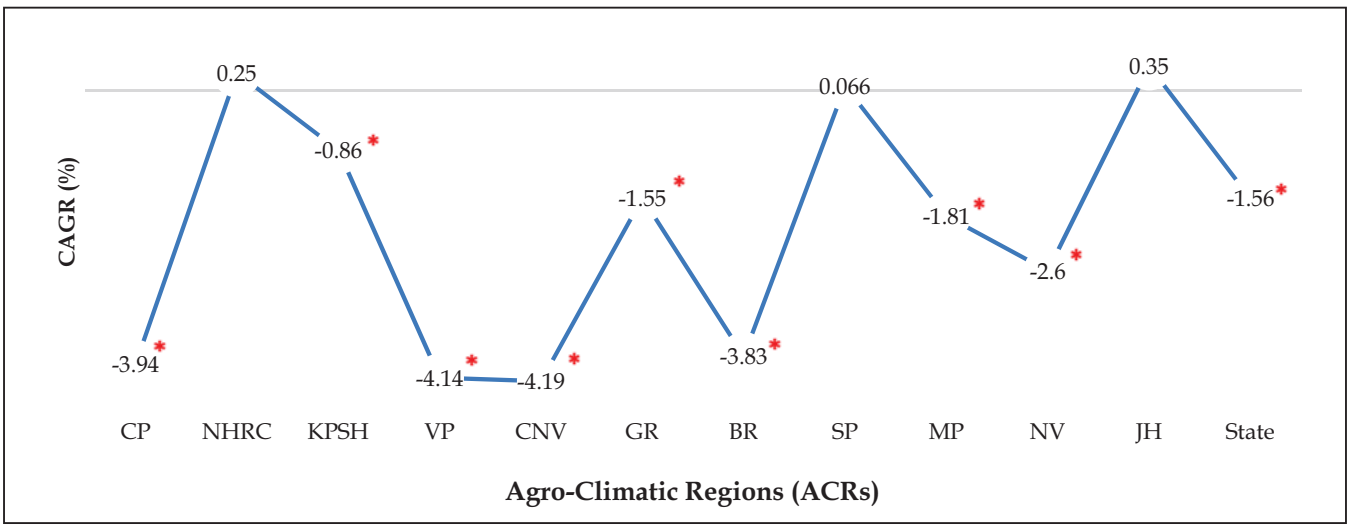


Source: Graphical representation by author
Note: *Significant @ 1%

The acceleration in this area is a result of tree plantation campaign/drives administered by the government organizations as well as NGOs under the "Swachha Bharat Mission". The result is in conformity with Takle *et al.* (2007). However, Gairhe (2011) and Deka *et al.* (2018) reported a negative growth rate of the same category of land use.

(vi) Area under cultivable wasteland: A considerable declining trend of growth was observed in area under cultivable wasteland with a highly significant CAGR of 1.56 percent per annum in Madhya Pradesh during the study period.

Figure 7: Growth of Area under Cultivable Wasteland in different ACR

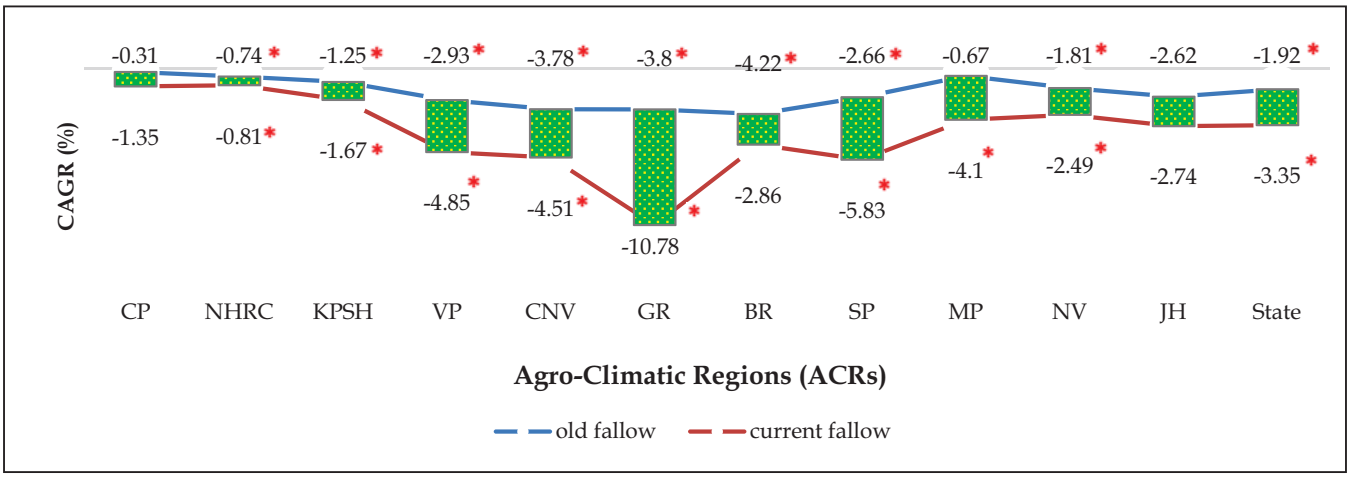


Source: Graphical representation by author
Note: *Significant @ 1%

The same trend could be possible due to negative and highly significant growth rate in this category of area among all the ACRs excluding NHRC, SP and JH, where, the same was positive but insignificant for the same period. The deceleration in this category of land mainly happened due to one or more schemes pertain to land reclamation launched by the government in the state. If the area under cultivable wasteland is brought under the culturable land; this can be a great factor for achieving the doubling of farmers' income as well as agricultural production of the state. However, in the interest of long-term conservation and maintenance of ecological balance, this area of land may be put under afforestation instead of farming. Kolar and Rathi (2020), Raveendran (2020), Pandey (2018), Sule and Barakade (2016), Laxmi *et al.* (2015), Adhikari and Sekhon (2014), Gairhe (2011), Bhandari (2007) reported similar result in different states while Deka (2018) reported acceleration in cultivable wasteland in Assam.

(vii) Area under fallow land: A highly significant decelerated growth has been recorded under this category of land use in Madhya Pradesh. The area under old as well as current fallow land was found to be remarkably decreased with highly significant CAGR of 1.92 and 3.35 percent per annum respectively. The same declining trend of growth of these categories of land-use has been observed in all the ACRs during the period. However, the growth rate was statistically insignificant in three ACRs for the same period.

Figure 8: Growth of Area under Old & Current Fallow Land in different ACRs



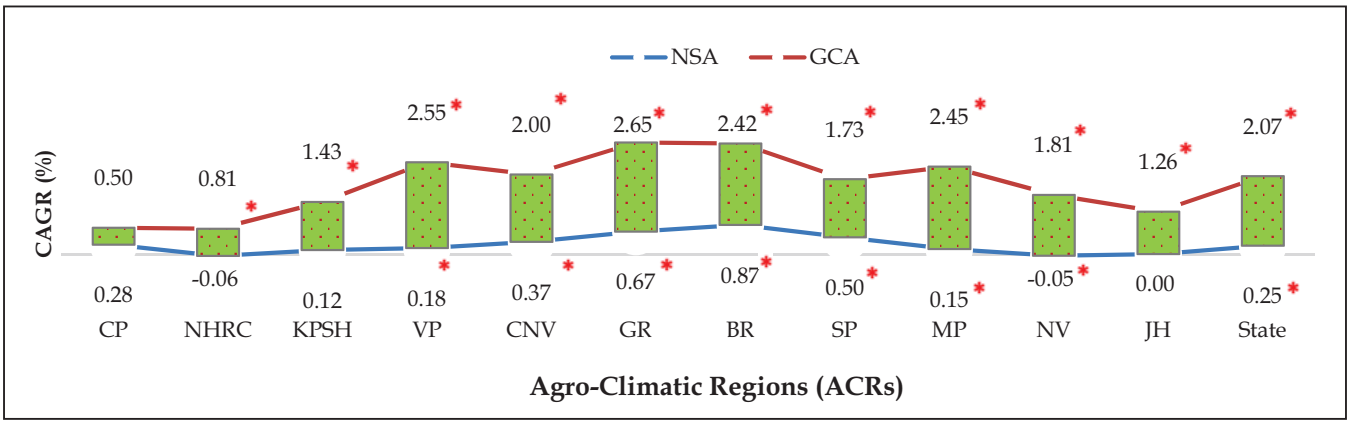
Source: Graphical representation by author
Note: *Significant @ 1%

This remarkable deceleration in area under fallow land is a result of a boon of low-cost technology, planned investment in irrigation facilities, awareness of farmers in respect of intensive and mixed farming, and optimum utilization of scare resources in the state. Factors behind acceleration of this category of land use is erratic rainfall, lack of irrigation and poor mechanization, operational holdings, utilization of fertilizers, etc. as reported by Giri (1966), Nadkarni & Deshpande (1979), Ramasamy *et al.* (2005), Bardhan & Tewari (2010), and Pandey *et al.* (2018).

(viii) Gross Cropped Area (GCA) and Net Sown Area (NSA): A highly significant accelerated growth rate was observed in Gross Cropped Area (2.07%) and Net Sown Area (0.25%) during the past 20 years in Madhya Pradesh. Among the ACRs, the growth rate of GCA was highly significant and positive in all but one ACR, where it was statistically insignificant. The growth rate of NSA was observed to be accelerated in all the ACRs excluding NHRC and NV. The positive growth was statistically highly significant in six ACRs, whereas,

negative growth rate was statistically highly significant in Nimar valley during the period. In Jhabua hills, the CAGR in NSA was registered as stagnant throughout the study years (Figure 9).

Figure 9: Growth of Area under GCA & NSA in different ACRs



Source: Graphical representation by author
Note: *Significant @ 1%

The increase in GCA and NSA was mainly due to a significant decrease in the area under fallow land and the reclamation of cultivable wasteland in the state. Elevated irrigation facilities also played a key role in the increase of GCA and NSA. The growth of GIA and NIA has been observed to be 5.92 percent and 5.42 percent per annum, respectively, in the state as a whole during the past 20 years, resulting in a double cropped area that has accelerated by 6.39 percent per annum for the same period. However, there is a need of efforts to increase the NSA in the regions where it has declined to meet the food and other necessary requirements of ever-increasing population. Kolar and Rathi (2020), Rani (2019), Deka (2018), Pandey (2018), Seema (2013), Kumar *et al.* (2012) support the findings, but Raveendran (2020), Kumar and Najibullah (2013), and Malik (2012) reported negative result in different state of the country.

(ix) Instability index: Instability index is a measure of extent of fluctuations or the volatility in time series data. Instability index in Madhya Pradesh was observed to be low for all the parameters of land use except area under current fallow land. Area under current fallow was found to have medium instability with CDVI value of 21.27 percent (Table 2). Among the ACRs, the fluctuation under forest area, area under non agril utilize, NSA and GCA was low in all the regions except Jhabua hills (26.07%) and Malwa plateau (15.73%), where instability of forest area was found to be medium. In case of barren and uncultivated land, low instability was observed across the ACRs except Jhabua hills (15.21%) and Central Narmada valley (66.79%) where it was found to have medium and high instability, respectively. Instability index for permanent pasture in all the ACRs was recorded as low except in Jhabua hills (59.53%) where the same was found to be high. A zigzag pattern of instability index was observed for area under tree crops and groves across the ACRs. The instability was found to be low in Northern Hill Region of Chhattisgarh, Kaymore plateau & Satpura hills, and Chhattisgarh plain; medium in Bundelkhand region, Gird region and Malwa plateau. Highest instability was found in Satpura plateau, Nimar valley, Central Narmada valley, Jhabua hills and Vindhyan plateau. Instability index for cultivable wasteland was recorded as high in Jhabua hills (34.98%), whereas in Chhattisgarh plain (16.32%), it was medium and in rest of ACRs, instability

was under low category. The instability index for old fallow land was in the low category across the ACRs except for Chhattisgarh plain (23.25%), Gird Region (18.70%) and Bundelkhand Region (17.05%), which had medium instability.

TABLE 2: INSTABILITY OF VARIOUS LAND USE PARAMETERS IN DIFFERENT ACRs OF MP (%)

ACRs / LU parameters	CP	NHRC	KPSH	VP	CNV	GR	BR	SP	MP	NV	JH	State
Forest land	0.07	0.06	2.49	5.97	0.88	0.14	0.54	0.64	15.73	0.13	26.07	0.10
Area under Non-agril utilze	1.02	1.44	4.02	0.86	12.35	0.91	6.67	4.64	4.65	4.44	12.07	1.63
Barren & uncultivated land	0.74	1.67	7.60	6.06	66.79	1.37	11.01	10.72	3.83	3.38	15.21	2.14
Permanent pasture	1.7	6.47	8.67	4.62	2.55	4.49	7.32	6.21	5.50	3.35	59.53	3.88
Land under tree crops	1.94	8.62	7.52	42.39	106.11	27.62	28.08	134	24.36	113	62.27	12.5
Cultivable waste land	16.32	5.72	5.51	9.68	4.75	2.74	5.88	10.86	6.27	4.5	34.98	2.64
Old fallow	23.25	4.2	5.33	9.01	5.21	18.7	17.05	10.78	11.94	4.35	79.95	6.73
Current fallow	41.13	9.12	13.35	27.76	11.6	94.63	56.52	24.69	35.42	16.21	104.03	21.27
NSA	3.89	2.21	1.56	0.38	0.26	3.67	6.1	1.62	0.61	0.44	0.42	1.05
GCA	7.09	4.47	5.09	2.44	5.89	5.55	10.77	4.00	4.24	3.43	3.38	3.15
Area sown more than once	21.75	12.65	15.6	7.19	15.08	16.22	25.83	13.09	10.87	10.87	18.59	8.98
GIA	12.01	26.3	21.39	8.97	14.46	10.22	16.94	11.16	9	8.55	14.38	9.16

Source: Author's calculation

Instability index for old fallow land in Jhabua hills (79.95%) was under high category. Instability index for current fallow land was under high category in Jhabua hills (104.03%), Gird region (94.63%), Bundelkhand region (56.52%), Chhattisgarh plain (41.13%) and Malwa plateau (35.42%), though, the instability index was under medium category for current fallow land in Vindhyan plateau (27.76%), Satpura plateau (24.69%) and Nimar valley (16.21%) and the rest ACRs reported low instability for the same. Instability index for area sown more than once was observed as low across the ACRs except Bundelkhand region (25.83%), Chhattisgarh plain (21.75%), Jhabua hills (18.59%), Gird region (16.22%), Kymore plateau & Satpura hills (15.60%), and Central Narmada valley (15.08%), where the area sown more than once was medium instable. Instability in all the ACRs for gross irrigated area (GIA) was found as low except in Northern Hill Region of Chhattisgarh (26.30%), Kymore plateau & Satpura hills (21.39%) and Bundelkhand region (16.94%).

4. Conclusion and way forward

On the basis of the findings above, it can be concluded that the reason behind the negative growth of forest area observed in some ACRs might be the jhoom cultivation that is practiced in tribal districts and the improper pace of afforestation. Nevertheless, the

increase in the forest area in certain ACRs is an attempt to restore ecosystems and increase the forest cover of the state through afforestation and other tree plantation drives undertaken by the government and forest activists in the state. However, there is a need to take initiatives for some ACRs where the growth was found to be negative. Further, significant decline in area under fallow land is the result of the efforts of the government for the revival of these lands through optimum utilization of land resources, planned investments in agricultural infrastructure. Though, a significant area under this category of land is yet to be revived, this is high time to have a well-thought-out plan for adaptation of strategies based on existing monitoring and assessment of revival of land progress.

There has been a significant increase in the area under non-agricultural use in various ACRs and the State as a whole. Diversion of most of the barren and uncultivable lands for non-agriculture purposes like construction of roads and buildings and rapid growth in urbanization and industrialization during the period are the foremost reasons for this much increase in area under non-agriculture utilization.

The possibilities of area expansion under cultivation are enormous, as 1.58%, 1.41%, and 3.29% of the total geographical area are under old & current fallow and cultivable wasteland, and the same may be transited for cultivation. Effective strategies should be prepared in respect of utilization of area of waste and barren land for high value crops (HVCs) which can help the State in becoming diversified and self-reliant in production of food and feed. The drone technology may be utilized for monitoring the shifting of agricultural land. The government policies & programmes and self-awareness campaigns are very essential for efficient land utilization management.

Consequent upon acceleration of NIA, the GCA considerably goes up. Hence, it is time to fetch the maximum area under irrigation. In this regard, all efficient systems and methods of irrigation, such as fertigation, micro-irrigation, AI-based irrigation, location-specific varieties that are suitable to grow in less water, etc., should be familiarized among the farmers to increase the efficiency of water use in a significant manner in the coming future.

Areas under non-agriculture uses related to development structures, house construction, roads, etc. are permanent in nature and hence hard to change for the usage of land for other purposes. Therefore, instability or changes over time are low.

The high fluctuation in area under tree crops & groves and area under current fallows was observed in 5 out of 11 ACRs. The reason behind this is rainfall variability and global warming, which caused the agricultural land to remain uncultivated.

The volatility in NSA, GCA and GIA is observed to be lowest in all regions. Improving irrigation facilities and investment in projects of irrigation and road connectivity may be the considerable factors.

Policies like improving the groundwater table through the construction of agriculture ponds and contour bonds under MGNREGA might help the farmers shift fallow land to cultivation. The area sowed more than once also showed medium fluctuations in some ACRs, which might be due to erratic rainfall and shifting land uses. The volatility in different classes of land uses is varied across the ACRs in the State. To mitigate the consequences of persisting high volatility in the ACRs, large-scale promotion of stabilization measures, *i.e.* crop insurance, may be vigorously pursued. Adequate input support from the government and the supply of inputs and technology to the farmers, especially the small and marginal ones, might reduce the high and medium fluctuations that persist in the land use pattern.

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Status of Agricultural Land Productivity and its Determinants in Bundelkhand Region of India

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Abstract

Land productivity in the Bundelkhand region has been a matter of concern for a long time due to its semi-arid climate and low and erratic rainfall. This study highlights the status and challenges faced by agriculture of the Bundelkhand region. Furthermore, the cropping pattern of the Bundelkhand region has been compared with that of the non-Bundelkhand region, and results have been derived as to which crops are best suited for the Bundelkhand region. The area under insured irrigation was marginally low in the Bundelkhand region, giving rise to lower productivity; however, there is an adequate amount of groundwater that remains unharnessed and still far from its full utilization capacity. The study suggest that the full utilization of available groundwater resources could change the level of agricultural development in the region.

Keywords: *Bundelkhand, land productivity, agriculture, groundwater, Madhya Pradesh, Uttar Pradesh*

1. Introduction

The Bundelkhand region comprises the districts of Madhya Pradesh and Uttar Pradesh and shares a common culture and traditions, but was portioned after independence on the recommendations of the States Reorganization Commission.

Madhya Pradesh has been the best-performing state in terms of agricultural development during the last decades. However, the existence of regional disparities was observed. Some of the studies (Singh *et al.* 2018; Singh *et al.* 2021; Singh, Singh & Yadav, 2021) clearly point out that the districts of the Bundelkhand region of the state have lagged behind. The Bundelkhand region is a geographical and cultural region in north-central India that spans across the states of Uttar Pradesh and Madhya Pradesh. It is situated between the Indo-Gangetic Plain to the north and the Vindhya Range to the south.

The agricultural sector is a major source of livelihood in the Bundelkhand region. However, the region has faced a number of challenges related to agriculture, including droughts (Gupta *et al.,* 2014), water scarcity, soil degradation (Prakash *et al.,* 1998), low productivity, and a lack of access to modern farming techniques. There is a large area of wasteland available in Bundelkhand, due to which the percentage of land used has fallen considerably (Niranjan, 2018).

Due to its geographical location, the region is prone to drought and receives low and erratic rainfall. This has made agriculture in the region highly dependent on monsoons, leading to frequent crop failures and distress among farmers (Prakash *et al.* 1998).

To address these challenges, the government has initiated a number of programmes and schemes aimed at improving agricultural productivity and promoting sustainable farming practices in the region. Some of these initiatives include the implementation of watershed management programmes (Singh *et al.* 2014), promotion of organic farming, distribution of improved seed varieties and modern agricultural equipment, and provision of credit and other financial support to farmers.

Being a locationally disadvantageous region, Bundelkhand has low irrigation coverage, a high share of wasteland, low rainfall, and poor soil compared to

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the state average in both states, *i.e.* Uttar Pradesh and Madhya Pradesh (Sandhu *et al.*, 2016; Gupta *et al.*, 2014; Anuja *et al.*, 2018). In modern times, the region has faced a number of challenges, including poverty, drought, and lack of development (NITI Aayog, 2015).

The government of Madhya Pradesh has launched a number of initiatives to promote tourism and develop the region's infrastructure, including building new roads and improving access to water and electricity. Despite these efforts, the region continues to face economic and social challenges, and efforts to improve the quality of life for its residents are ongoing.

1.1 Objectives of the study

The present study specifically focuses on the following objectives:

1. Exploring the status and trends of land productivity and its major effecting factors with special reference to the non-Bundelkhand region.
2. To test the convergence/divergence trends of land productivity over time in the study area.
3. Furthermore, potential avenues that can in turn help in the development and advancement of the region, such as land and groundwater uses have been looked into.

2. Data sources and methodology

This study uses secondary data to fulfill the objectives. Area, production, and yield data and land use statistics at district level were taken from Ministry of Agriculture and Farmers Welfare, Government of India for the period of 2010-11 to 2019-20. District-wise gross value added by different economic activity have been taken from Central Statistical Office, for the same period. Groundwater level and stage of groundwater data has been taken from Central Ground Water Board, Ministry of Jal Shakti.

2.1 Estimation of agricultural land productivity

Agricultural land productivity has been estimated using the formula given below, as done by other authors (Chand & Shinoj, 2012; Singh *et al.*, 2019).

$$\text{Agricultural and productivity } (\text{Rs./ Ha}) = \frac{\text{GDDP}_{it}}{\text{NSA}_{it}}$$

where,

$GDDP_{it}$ = Gross District Domestic Product of 'i^{th}' district in 't^{th}' time and

NSA_{it} = Net Sown Area of 'i^{th}' district in 't^{th}' time.

2.2 Growth rate analysis

The compound growth rate of agricultural land productivity has been estimated for selected periods of time. The compound growth rates are estimated to study the growth with the following exponential model.

$$Y = ab^t$$

$$\text{Log } Y = \log a + t \log b$$

$$CGR = (\text{Antilog } b-1)*100$$

where,

t = time period in year

Y = Agricultural land productivity (Rs./per Ha of NSA)

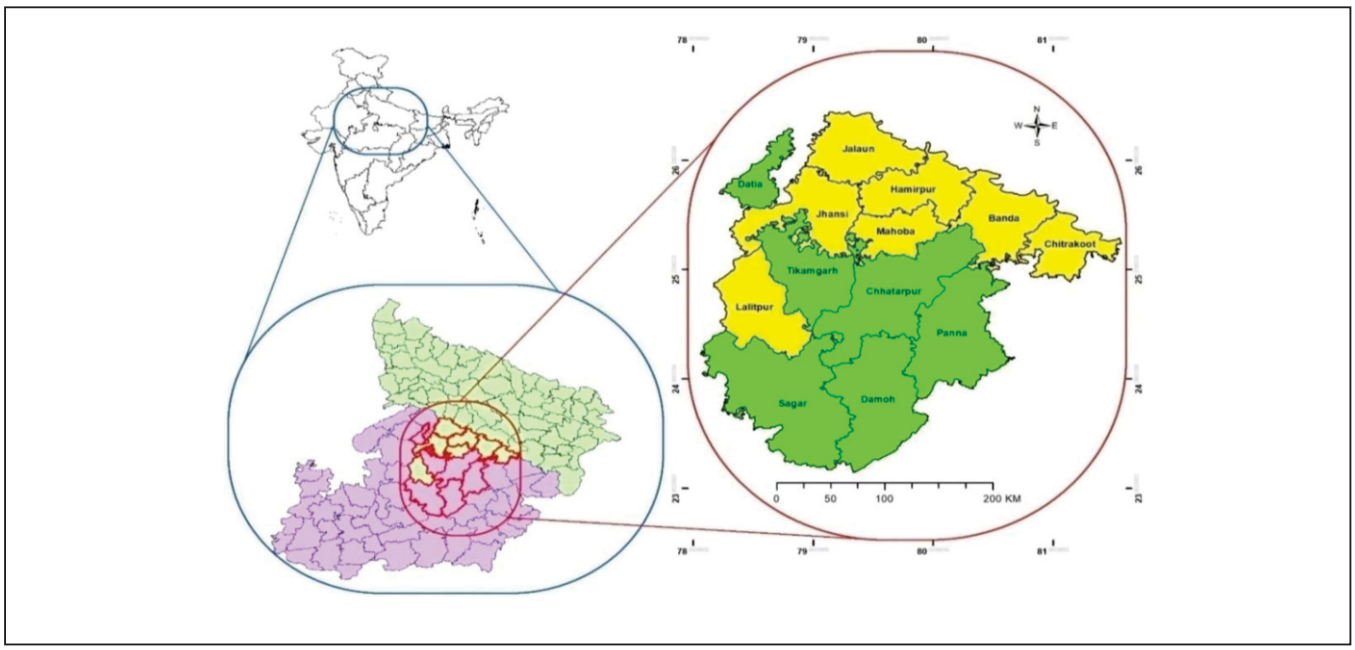
a & b = Regression parameters and

CGR = Compound Growth Rate

2.3 Study area

The Bundelkhand region is located in Central India and encompasses seven districts of Uttar Pradesh, *i.e.* Banda, Chitrakoot, Hamirpur, Jalaun, Jhansi, Lalitpur, and Mahoba, and six districts of Madhya Pradesh, *i.e.* Chhatarpur, Datia, Damoh, Panna, Sagar, and Tikamgarh (Map 1), covering around 69.6 lakh hectares of geographical area. The area is encompassed by the Central Plateau and Hills agro-climatic region. This region is amongst the most degraded ecosystems characterized by undulating and rugged topography, highly eroded and dissected land, poor soil fertility and low water holding capacity. Bundelkhand's northern boundary is defined by the Yamuna; the western boundary is defined by the Sind; in the south, the Narmada flows a few kilometers from the boundaries of Sagar district. But none of these rivers play a direct and significant role in Bundelkhand economy. So, from an economic point of view, Bundelkhand's main rivers are the south-to-north flowing Ken, the Betwa and their various tributaries, along with several other streams, of which the most important is the Baghain.

Map 1: Locational Position of Study Area Map of Bundelkhand Region



Source: Author's creation using ArcMap software

3. Results and discussion

3.1 Contribution of Bundelkhand and non-Bundelkhand regions in state income

According to the Department of Economic and Statistical Affairs, state income is a measure in monetary terms of the volume of all goods and services produced within the boundaries of the state during a given period of time, accounted for without duplication. This covers all the goods and services produced within the state. So, the contribution of Bundelkhand to state income is significantly low, at 10% in MP and 5% in UP compared to the non-Bundelkhand region, whereas this region covers around 12.7 % of the geographical area of both states.

TABLE 1: CONTRIBUTION OF BUNDELKHAND IN STATE INCOME AND RELATIVE COMPOSITION OF AGRICULTURE SECTOR

State	Region	Contribution (%) to state economy	Agri. & allied share (%) in economy	Crops share (%) in agriculture	Livestock share (%) in agriculture
Madhya Pradesh	Bundelkhand	10	43.7	76.5	23.5
	Non-Bundelkhand	90	41.0	81.1	18.9
	Madhya Pradesh	100	41.3	80.7	19.3
Uttar Pradesh	Bundelkhand	5	31.1	82.1	17.9
	Non-Bundelkhand	95	24.3	69.4	30.6
	Uttar Pradesh	100	24.6	70.2	29.8

Source: Estimates based on National accounts data, MoSPI, GoI

Bundelkhand is predominantly an agrarian economy, with around 60% of the workforce engaged in agriculture, but the contribution of Bundelkhand (Madhya Pradesh) was a meager 10% as compared to 90% by the non-Bundelkhand region. Relative to Bundelkhand Madhya Pradesh, its counterpart, Bundelkhand Uttar Pradesh, contributes a significantly lower proportion of 5% as compared to 95% in the non-Bundelkhand region. Behind this lopsided contribution, the main reason could be the under-development of Bundelkhand regions as compared to non-Bundelkhand, as well as the lack of modern techniques of technology to be used for irrigation and farming purposes. The spatial differences among the Bundelkhand and non-Bundelkhand regions are hampering crop productivity as Bundelkhand is a rainfed area, therefore crops in this area are dependent on monsoons, but Bundelkhand is considered to be a drought-prone area as normally, this region witnesses 52 rainy days in a year, but in the last couple of years, rainy days have only been 25, less than half the normal number of rainy days (Skymet Weather Team).

3.2 Cropping pattern in Bundelkhand and non-Bundelkhand regions

Cropping pattern refers to different crops cultivated at different times on the area that has been assigned to cultivation, and in the Bundelkhand region, cereals, oilseeds, and pulses contribute significantly to crop production.

Bundelkhand, being an agro-region, supports a diverse variety of crops (Table 2). Apart from wheat, other major crops grown in this area were rice, pulses, maize, sesamum, gram, soybean, cotton, etc. Cereals, pulses, and oilseeds were three major crops that were primarily grown in the Bundelkhand region. Wheat production in both the Bundelkhand and non-Bundelkhand regions of Madhya Pradesh and Uttar Pradesh, respectively, contributed the same percentage, but it was a serious concern as wheat being a relatively water-intensive crop and Bundelkhand being a drought-prone region could have devastating effects in the future. On the same hand, UP and MP Bundelkhand regions were predominantly pulse-growing regions, as MP Bundelkhand allocated 21.3 percent of the area compared to the meagre 7.3 percent by the non-Bundelkhand region. On similar grounds, MP Bundelkhand counterpart UP Bundelkhand allocated 17% as compared to 2.5% of non-Bundelkhand, as pulses require a dry climate and less water, require a moderate climate, and are suitable to grow on all types of soil. Soybean was also a promising crop in the non-Bundelkhand region of Madhya Pradesh with 23% area compared to 11.6 in Bundelkhand region. There could be multiple reasons behind the promotion of soybean production, as soybeans require less water and are a cash crop that could be used by farmers to increase their income. Cropping of other crops such as maize, gram, sesamum, and cotton was also improving.

TABLE 2: COMPARATIVE CROPPING PATTERN IN BUNDELKHAND AND OTHER AREA OF THE STATE (in %)

State	Madhya Pradesh			Uttar Pradesh		
Crop	Bundelkhand	Non-Bundelkhand	State	Bundelkhand	Non-Bundelkhand	State
Wheat	34.1	34.1	34.1	38.1	37.7	37.8
Rice	6.2	11.0	10.4	6.6	27.2	25.2
Sugarcane	0.4	0.5	0.5	0.2	9.9	8.9
Other pulses	21.3	7.3	9.2	17.0	2.5	3.9
Bajra	0.1	1.3	1.1	1.7	3.5	3.3
Fodder crops	0.2	0.3	0.3	0.4	3.1	2.8
Maize	9.2	4.8	5.4	0.6	2.9	2.7
R & M	0.9	2.6	2.3	3.2	2.6	2.7

State	Madhya Pradesh			Uttar Pradesh		
Crop	Bundelkhand	Non-Bundelkhand	State	Bundelkhand	Non-Bundelkhand	State
Potato	0.1	0.3	0.3	0.2	2.7	2.4
Sesamum	1.5	1.0	1.1	11.0	0.5	1.6
Other plantation crops	0.0	0.2	0.1	2.6	1.3	1.4
Gram	9.4	6.3	6.7	7.7	0.5	1.2
Soybean	11.6	22.9	21.3	0.6	0.01	0.1
Cotton	1.5	2.3	2.2	0.0	0.04	0.04
Other crops	3.5	5.1	4.9	10.1	5.4	5.9

Source: Estimates based on District-wise land use statistics, Ministry of Agriculture and Farmer's Welfare, GoI.

3.3 Status of productivity in Bundelkhand and non-Bundelkhand regions

Land productivity in Bundelkhand is on the decline because of the disproportional use of fertilizers, poor soil quality, and inefficient management of water resources.

Crop productivity in MP Bundelkhand is less than that in non-Bundelkhand by 35.50%. Similarly, productivity for UP Bundelkhand is lower by 42.43% compared to the non-Bundelkhand region. This could be because in the UP Bundelkhand region, nitrogen (N) availability is low to very low, phosphorus (P) is also very deficiently available, potassium (K) availability is medium to high, and sodium (Na) is marginal to deficient. Among the micronutrients, zinc (Zn) is marginally available, whereas Cu, Fe, and Mn are found to be sufficient. In the MP Bundelkhand region, the status of nitrogen (N) availability is low; phosphorous availability is medium in some districts and low in others, while the level of potassium is between low and high, along with a significant deficiency in zinc (Singh *et al.*, 2018).

In other words, the soil of the Bundelkhand region is very poor in fertility because of extreme climatic variability, high temperatures, and undulating topography. The farmers of this region are mostly using N and P fertilizers and FYM and compost to some extent, but are not aware of other organic sources of fertilizers like green manure, biofertilizers, etc. But the integrated use of inorganic and organic fertilizers, *i.e.* integrated nutrient management (INM) is very important for maintaining soil fertility status as well as sustaining agricultural productivity in the long run. Indiscriminate use of fertilizers has led to a reduction in crop productivity and crop intensity. In order to increase crop productivity, there is a need to educate farmers regarding the adequate use of fertilizers along with other technological requirements.

In the Bundelkhand region of MP, around 58.9% of the workforce is engaged in agriculture, whereas in UP Bundelkhand, the percentage of the workforce engaged in agriculture is higher, *i.e.* 62.5%. If we compare the trends of fertilizer use in the Bundelkhand and non-Bundelkhand regions of MP, it shows that the fertilizer usage in the non-Bundelkhand region (107.2%) is almost double when compared to that in the Bundelkhand region (53.4%). Similar for the UP region, the Bundelkhand region witnessed 102.4% usage of fertilizer, whereas it was 222.4% in the non-Bundelkhand region. Due to disparities in fertilizer usage, crop productivity is also showing a declining trend.

TABLE 3: RELATIVE STATUS OF PRODUCTIVITY AND USE OF INPUTS IN BUNDELKHAND

State	Region	Agri. worker to total workforce %	Fertiliser Use (Kg./Ha)	Cropping intensity %	GIA as % of GCA	Crop productivity (Rs./ha)
Madhya Pradesh	Bundelkhand	58.9	53.4	191.3	48.14	135475
	Non-Bundelkhand	60.9	107.2	180.9	52.61	183572
	Madhya Pradesh	60.7	101.1	182.3	52.00	177285
Uttar Pradesh	Bundelkhand	62.5	102.4	134.4	68.56	92351
	Non-Bundelkhand	50.1	222.4	169.9	86.59	160405
	Uttar Pradesh	51.2	211.2	165.6	84.82	152183

Source: Estimates based on district-wise fertilser use statistics, PLFS, Ministry of Agriculture and Farmers Welfare, GoI.

Table 4 highlights the agricultural land productivity of both the Bundelkhand and non-Bundelkhand regions over the last decade. On comparing, it came out that productivity in the MP Bundelkhand region has increased over a period of time, as it was Rs. 39645 per hectare in 2011–12, which increased to Rs. 64964 per hectare in 2019–20. So, it witnessed an overall increase of 38.97%. Its counterpart region of UP Bundelkhand witnessed a declining trend as productivity decreased from Rs. 63,582 per hectare in 2011–12 to Rs. 53,763 per hectare in 2019–20. Inversely, productivity in the non-Bundelkhand region of both UP and MP increased over a period of time. For the non-Bundelkhand region of MP, it increased to 46.19%, and for UP non-Bundelkhand, it increased to 22.65%. On comparing both states, the Bundelkhand region of MP is performing far better than its counter region of UP Bundelkhand because of the better availability of resources in the MP region as compared to the UP region. If efforts are put in to improve productivity through better irrigation facilities, resources, and training, then the Bundelkhand region of both states has the potential to outshine the non-Bundelkhand region.

TABLE 4: AGRICULTURAL LAND PRODUCTIVITY AT CONSTANT 2011-12 PRICES

Year	Madhya Pradesh			Uttar Pradesh		
	Bundelkhand	Non-Bundelkhand	State	Bundelkhand	Non-Bundelkhand	State
2011-12	39645	46190	45310	63582	75940	74688
2012-13	54657	58591	58063	55487	81964	78729
2013-14	46321	60443	58524	39509	82327	77040
2014-15	43944	62102	59654	42838	76046	71929
2015-16	42149	60712	58305	39005	81648	76806
2016-17	57113	78610	75781	51946	85865	81855
2017-18	53982	77790	74700	50337	90988	86200
2018-19	65083	75653	74281	49745	93716	88552
2019-20	64964	85835	83107	53763	98181	92815

Source: Estimates based on National accounts and LUS data, MoSPI, GoI.

Bundelkhand, despite being in close proximity to the midland of the Green Revolution (Western Uttar Pradesh), still continues to lag behind India's overall agricultural development. The Bundelkhand region of UP showed a relatively low level of agricultural land productivity when compared to its MP counterpart, which stood at -0.53%. On intra-state comparison, the Bundelkhand region of MP witnessed land productivity of 5.25% compared to 6.87% of the non-Bundelkhand region and 6.70% of the overall state (Table 5). There could be several reasons behind low land productivity, such as low rainfall, less use of fertilizers, unfavorable climatic conditions, and infertile soil texture, as it exhibited great variation ranging from highly impoverished, shallow and low water-retentive red soils to highly productive, deep and good water retentive black soil (Shakeel *et al.*, 2012), distorted land lease arrangements, etc. (Awasthi, 2005). Similarly, the Bundelkhand region of UP also suffers from low land productivity, which stood at -0.53% compared to 2.96% of the non-Bundelkhand region and 2.66% of the overall state. Thus, productivity in the Bundelkhand region of both states is below average state productivity. Low land productivity is a serious cause for concern as it results in a decline in food security. Various studies have been conducted regarding the inadequate availability of foodgrains, which leads to malnourishment and instability in food availability (Shakeel *et al.*, 2012).

TABLE 5: COMPARATIVE GROWTH RATE (%) IN AGRICULTURAL LAND PRODUCTIVITY

State	Region	Growth rate of productivity
	Bundelkhand	5.25
Madhya Pradesh	Non-Bundelkhand	6.87
	Madhya Pradesh	6.70
	Bundelkhand	-0.53
Uttar Pradesh	Non-Bundelkhand	2.96
	Uttar Pradesh	2.66

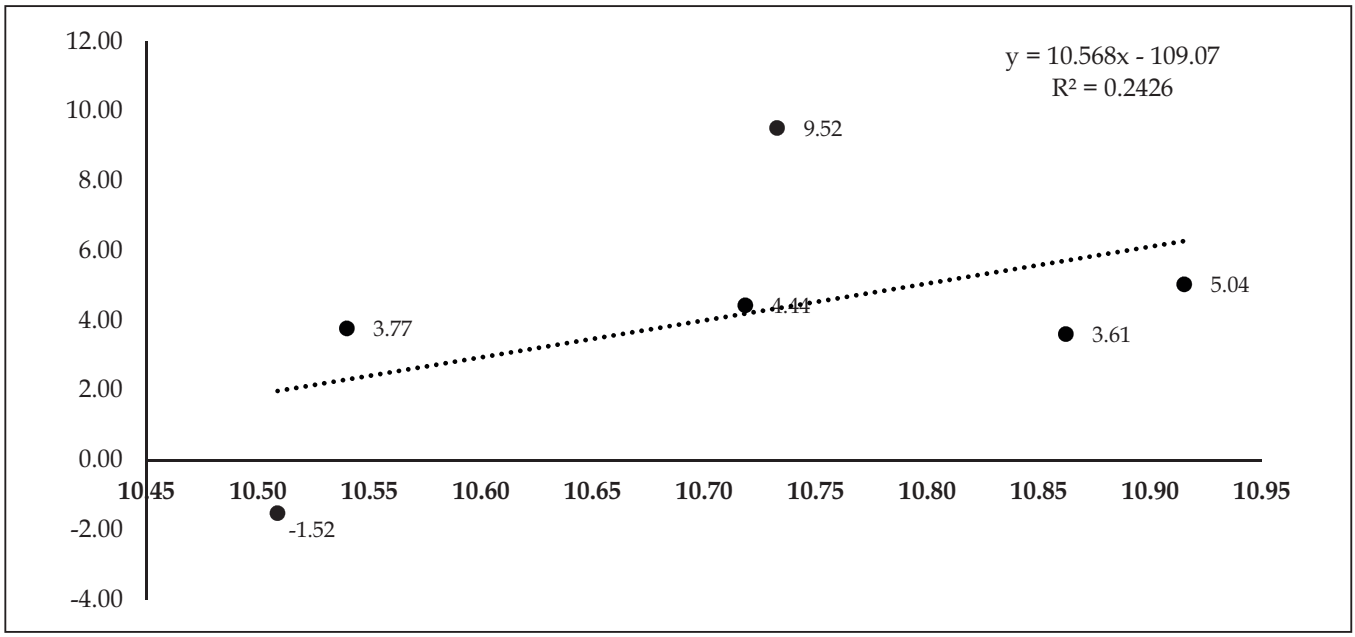
Source: Estimates based on National accounts and LUS data, MoSPI, GoI.

3.4 Trends in land productivity

Agricultural land productivity among districts of the Bundelkhand region of Madhya Pradesh was found to have diverging trends (Figue 1). The land productivity of district Chhatarpur was at a relatively lower level in 2011–12, and the growth rate between 2011–12 and 2020–21 was also negative. On the other side, districts Sagar and Tikamgarh were in the top position both in level and growth of productivity during the same period. Similarly, agricultural land productivity among districts in the Bundelkhand region of Uttar Pradesh was found to have converging trends (Figure 2). The land productivity of district Jalaun, Hamirpur had a lower level in 2011–12 but showed a higher growth rate. On the other hand, Chitrakoot district has a higher level but a negative growth rate.

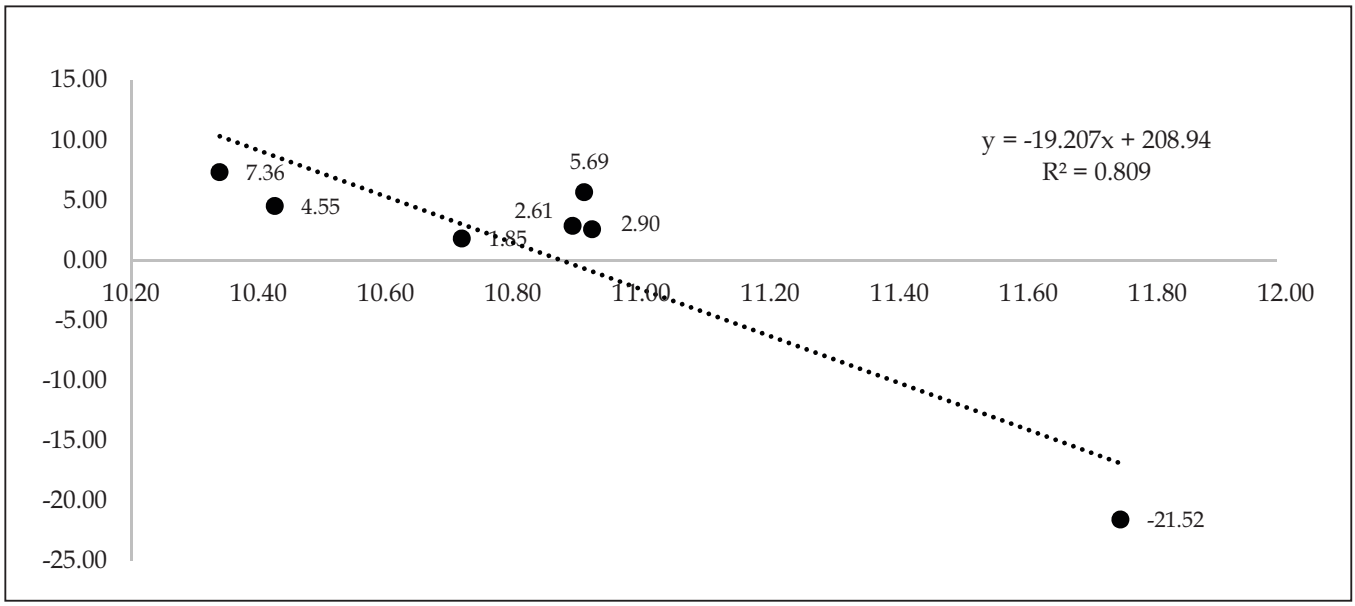
Bundelkhand is considered a drought prone area, and agriculture in the Bundelkhand region is highly rainfed and largely dependent on monsoons, but infrequent rain showers cause uncertainty among farmers in terms of crop production and productivity.

Figure 1: Diverging Trend in Productivity Bundelkhand Region of Madhya Pradesh



Source: Authors creation based on own estimation

Figure 2: Converging Trend in Productivity in Bundelkhand Region of Uttar Pradesh



Source: Authors creation based on own estimation

3.5 Groundwater development in districts of Bundelkhand region

According to many studies conducted on groundwater in the Bundelkhand region, it was concluded that groundwater resources could be used for domestic and agricultural uses, but due to the hard-rock geology, groundwater recharge mainly occurs in shallow and unconfined aquifers characterized by poor specific yields (1–3%) (Singh *et al.*, 2014). Groundwater development in most regions of Bundelkhand fell in the

safe category, signaling potential to explore this opportunity, as according to ground water availability in 2011 and 2022, districts of MP (Chhatarpur, Damoh, Datia, Panna, and Sagar) fell under the category of safe zone, and similarly, districts of UP Bundelkhand (Banda, Hamirpur, Jalaun, and Jhansi) also fell in the same category, depicting underutilization of available resources and inadequate knowledge regarding water resources and management. But Mahoba district, which was earlier in the overexploited category, shifted to the critical category, so the practice of groundwater couldn't be promoted in this region.

According to a study conducted by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and their collaborators, it was highlighted that farmers in the Bundelkhand region, out of which half of them subsisted below the poverty line, live in villages that traditionally had an earthen rainwater harvesting tank called a haveli. These havelis acted as reservoirs during the monsoon (June to September), and after draining, they were used for crop cultivation during the post-monsoon (October to February). By facilitating groundwater recharge, the system ensured water security for households, livestock, and agriculture. Farmers maintained their havelis together for hundreds of years, but many of the structures had collapsed along with the rural institutions that created them. When the monsoon came, rainwater quickly flowed downhill as surface runoff. But due to negligence in the maintenance of traditional sources of water resources and improper drainage, it resulted in water logging instead of infiltration, resulting in inefficient utilization of natural resources.

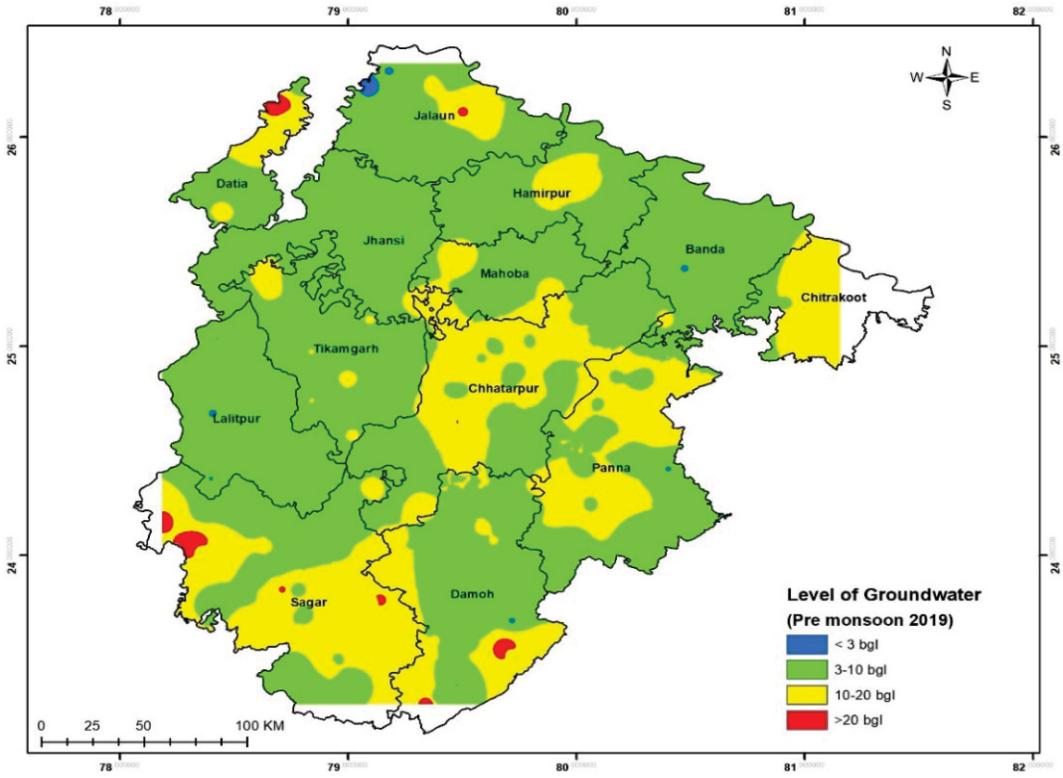
TABLE 6: CHANGE IN STAGE OF GROUNDWATER DEVELOPMENT (%) AND CATEGORY AMONG DISTRICTS OF BUNDELKHAND REGION

State	District	2011		2022	
		GW Dev. stage (%)	Category	GW Dev. stage	Category
Madhya Pradesh	Chhatarpur	67.17	Safe	64.90	Safe
	Damoh	62.27	Safe	58.64	Safe
	Datia	48.00	Safe	36.17	Safe
	Panna	26.27	Safe	36.91	Safe
	Sagar	59.04	Safe	58.77	Safe
	Tikamgarh	72.16	Semi-critical	82.27	Semi-critical
Uttar Pradesh	Banda	54.63	Safe	66.73	Safe
	Chitrakoot	66.12	Safe	82.91	Semi-critical
	Hamirpur	64.12	Safe	67.81	Safe
	Jalaun	28.61	Safe	57.09	Safe
	Jhansi	68.04	Safe	68.62	Safe
	Lalitpur	61.62	Safe	85.24	Semi-critical
	Mahoba	112.17	Overexploited	91.91	Critical

Source: Estimates based on data collected from Central Ground Water Board, Ministry of Jal Shakti

Map 2 depicts the level of groundwater in the different districts that comprise the Bundelkhand region. In most districts, the level of groundwater lies between 3-10 bgl which shows that groundwater could be easily fetched in these regions and has the potential to solve the pressing issue of water scarcity. These regions were the districts of Jalaun, Lalitpur, Damoh, Tikamgarh, Banda, Jhansi, Datia, Hamirpur, and some areas of Panna and Sagar.

Map 2: Level of Groundwater in 2019 during Pre-monsoon in Bundelkhand Region



Source: Author's creation using ArcMap software

4. Conclusion

Bundelkhand has become synonymous with drought and distress as the region is facing the worst of water shortages, lower productivity, improper utilization of fertilizers, and poor geographical terrain. Moreover, climate change is also an issue of distress as it results in lower rainfall, causing a water shortage. So, holistic planning of the water resources in the region is necessary. Groundwater potential varies across the region owing to the diversity in geology and hydrogeology.

But "one-size-fits-all" state policies would not help in mitigating the current water crisis. For holistic water management, knowledge of groundwater is essential, along with rainwater and surface water mismanagement, misuse of water, negligence of environmental problems, neglect of traditional sources of water resources, etc. which results in water logging instead of infiltration.

Despite the water shortage, land productivity is also an emerging issue that needs to be tackled; otherwise, soon there will be a shift in workforce from the agriculture sector to other sectors without any guarantee that other sectors can absorb additional labour and can provide livelihood. So, policies need to be implemented so that the Bundelkhand region can contribute a significant portion to the state's economy and, to a greater extent, contribute to the country's economy.

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Agro-Economic Research

Movement, Traceability and Uses of Imported Palm Oil

SAKSHI SAINI[1] AND RUCHI KUMARI[2]

Abstract

Palm oil holds significant importance in the global edible oil market, primarily because of its cost-effectiveness and adaptability. However, India, the largest importer of palm oil, faces challenges due to heavy reliance on imports, making it vulnerable to international price fluctuations. The study examines palm oil trends in India, focusing on port-wise landing, end-uses and strategies for boosting domestic production. Most of India's palm oil imports are in crude form, mainly sourced from Indonesia and Malaysia. Sea ports like the Kandla Sea are vital entry points for palm oil imports. Palm oil is primarily used in the food sector in India, with minimal industrial applications. Large manufacturing companies dominate palm oil utilization, mainly in cooking oil and fats production for household and institutional use. However, there is potential for expanding palm oil cultivation to meet domestic demand, alongside promoting awareness about alternative oils like mustard or coconut oil. Government initiatives can play a crucial role in encouraging the adoption of alternatives and reducing dependency on palm oil. By addressing these challenges, India can enhance its edible oil sector's resilience and sustainability.

Keywords: *Palm oil, export, import, industrial sectors, edible oil, India.*

1. Introduction

In the vegetable oil market, palm oil maintains its pivotal position worldwide; its narrative evolves through effective cultivation methods, diverse applications and its significance for nations like India. Amidst the challenges posed by increasing imports and shifting consumption patterns, a pressing demand arises for sustainable approaches and inventive solutions within the palm oil industry to secure a resilient and prosperous future. Within India's vibrant culinary and industrial sectors, palm oil emerges as a key player, enriching our kitchens and useful in various industries. As a nation, our reliance on imported palm oil is substantial, exposing us to the unpredictable surges of international price fluctuations. Palm oil is no ordinary ingredient; it is a versatile player, finding its way into our cooking pots and seamlessly blending with oils like soybean, groundnut, rapeseed, sesame, sunflower and safflower (Sheil *et al.*, 2009). Beyond the kitchen, its importance extends to cosmetics, personal care products, pharmaceuticals, animal feed and biofuel. The breadth of its applications necessitates nuanced understanding to shape policies effectively and pave the way for self-sufficiency in palm oil production.

1.1 Objectives of the study

(i) Analyze the trends of palm oil trade and production in India and globally.

(ii) Understand the dynamics of port-wise landings of palm oil and refined palm oil flows into our nation.

(iii) To illuminate the diverse roles palm oil plays in our daily lives.

2. Data source and methodology

The study conducted at the national level combines primary and secondary data sources. Secondary data

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*This paper is based on report "Movement, Traceability and Uses of Imported Palm Oil" submitted to Ministry of Agriculture and Farmers' Welfare, Government of India, New Delhi.

from the Foreign Agricultural Service (FAS) and the United States Department of Agriculture (USDA) provide insights into global palm oil production, consumption and trade. Data on India's palm oil imports has been gathered from the Export-Import Data Bank of the Ministry of Commerce and Industry. In contrast, information regarding imports arriving at different ports has been obtained from the Directorate General of Commercial Intelligence and Statistics (DGCI&S). Online questionnaires and structured interviews were conducted with palm oil importers to understand the various uses of palm oil. Publicly available information has also been reviewed. Importers were surveyed to identify different crude and refined palm oil applications across sectors like food, personal care, pharmaceuticals, chemicals, animal feed and biofuel. FAS and USDA data have been analyzed to assess palm oil's utilization in India and globally, focusing on descriptive statistics.

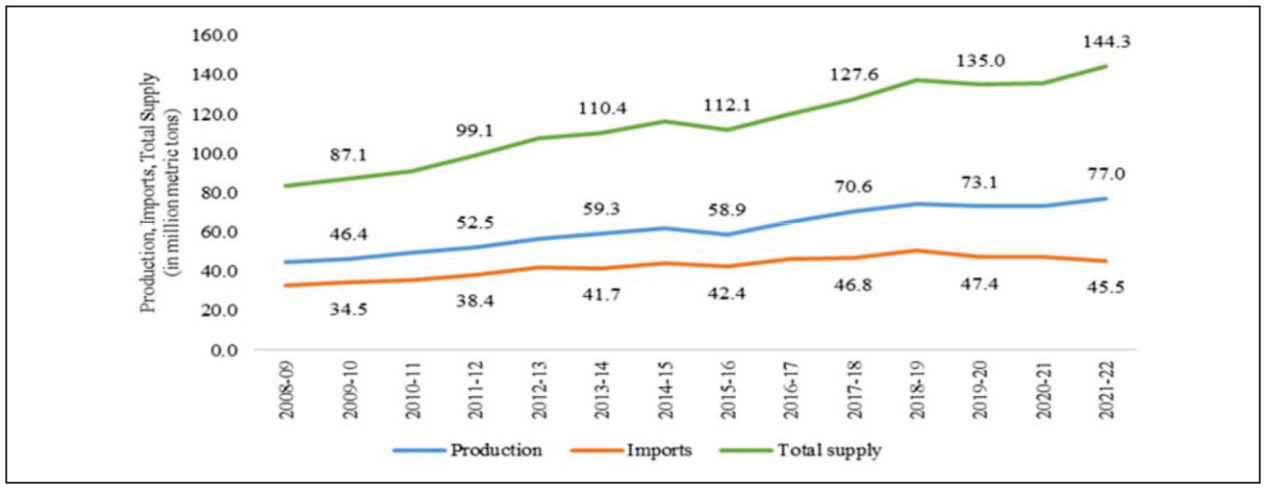
3. Results and discussion

This section analyzes global palm oil dynamics, comparing production, consumption, and trade with other vegetable oils. It scrutinizes major global players in palm oil, including producers, consumers, and traders, palm oil imports, and domestic production trends, highlighting the nation's reliance on imports due to limited palm oil cultivation, the arrival of imported palm oil at various Indian seaports, the end uses of palm oil, and its diverse applications in India.

3.1 Global scenario of palm oil

Palm oil stands out as one of the most produced and consumed vegetable oils globally due to its efficiency in land use, affordability, and versatility. It dominates the international vegetable oil trade, being both the most exported and imported oil among vegetable oils. In 2020-21, 48.19 million metric tons of palm oil was exported, followed by 46.88 million metric tons in 2021-22, constituting approximately 57% of total vegetable oil exports. Similarly, palm oil imports amounted to 47.5 million metric tons in 2020-21 and 45.5 million metric tons in 2021-22, representing around 58% of total vegetable oil imports. Over the past decade, there has been a significant surge in global production, imports, and total palm oil supply. Production has escalated from 44.5 million metric tons in 2008-09 to 77 million metric tons in 2021-22, marking a remarkable growth of approximately 73%. Similarly, palm oil imports have also surged, experiencing a notable increase of about 38%, rising from 32.9 million metric tons in 2008-09 to 45.5 million metric tons in 2021-22 (Figure 1). This surge in palm oil supply can be attributed to the increasing demand driven by its affordability and versatility across various countries (Shigetomi *et al.*, 2020).

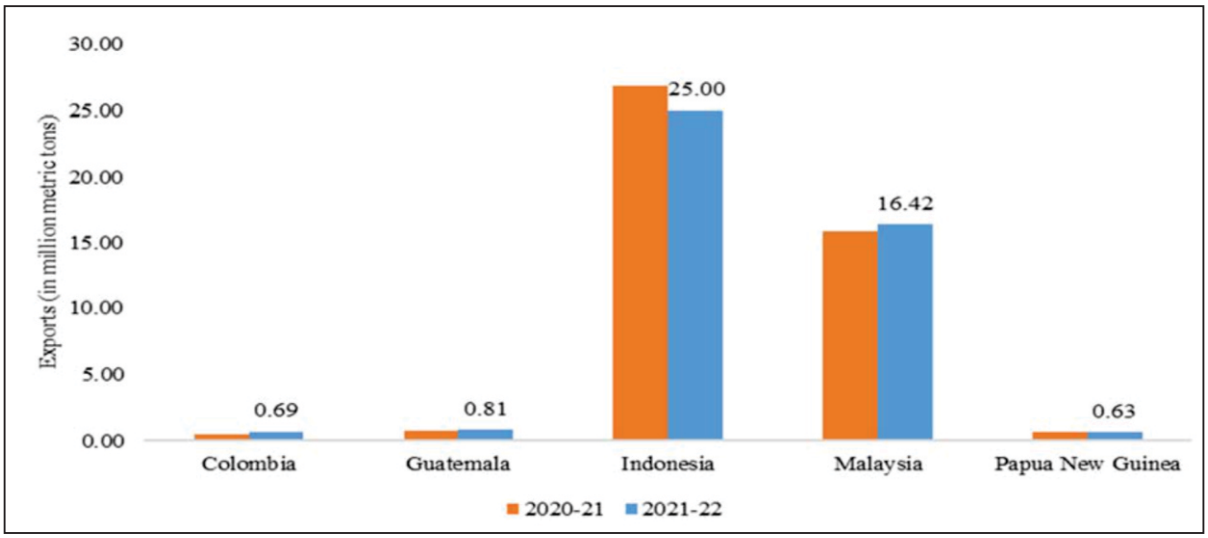
Figure 1: Production, Imports and Total Supply of Palm Oil



Source: FAS, USDA

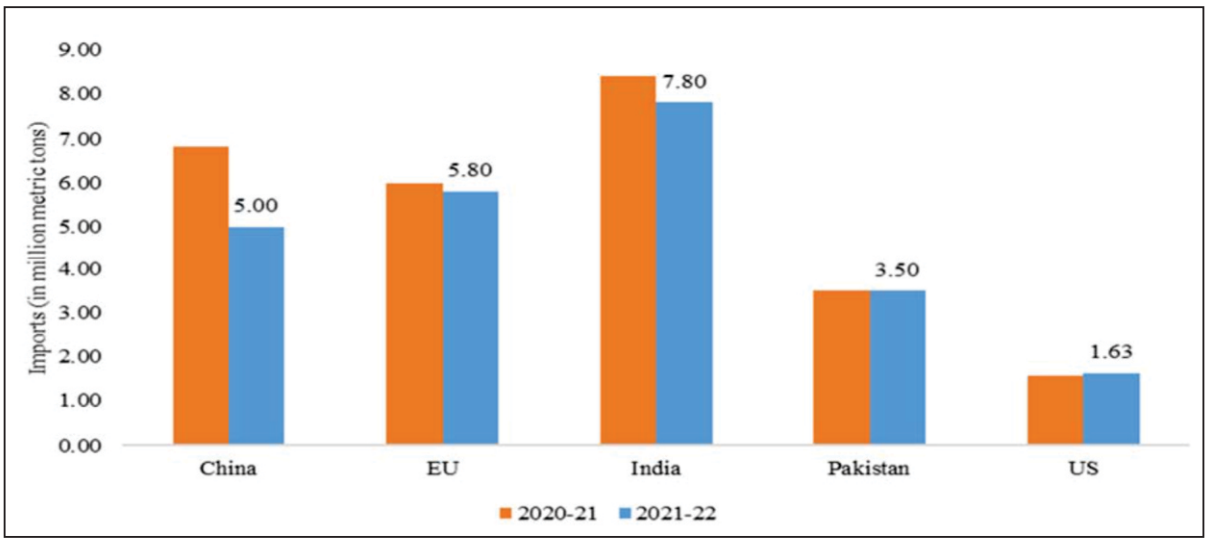
Indonesia and Malaysia, as the largest palm oil producers, also serve as the primary suppliers to the world market. In 2021-22, Indonesia exported 25 million metric tons, while Malaysia exported 16.4 million metric tons of palm oil, collectively fulfilling about 88% of global demand. Guatemala, Colombia, and Papua New Guinea have also emerged as significant suppliers (Figure 2). Among the top consumers of palm oil globally, India, China, and the EU stand out as the largest importers due to their low domestic production levels. 2021-22, India imported 7.8 million metric tons, while China and the EU imported 5 million and 5.8 million metric tons, respectively (Figure 3). The US and Pakistan also import significant quantities to meet their domestic demands. These top five importers contribute over 50% of the world's palm oil trade.

Figure 2: Top Exporters of Palm Oil



Source: FAS, USDA

Figure 3: Top Importers of Palm Oil

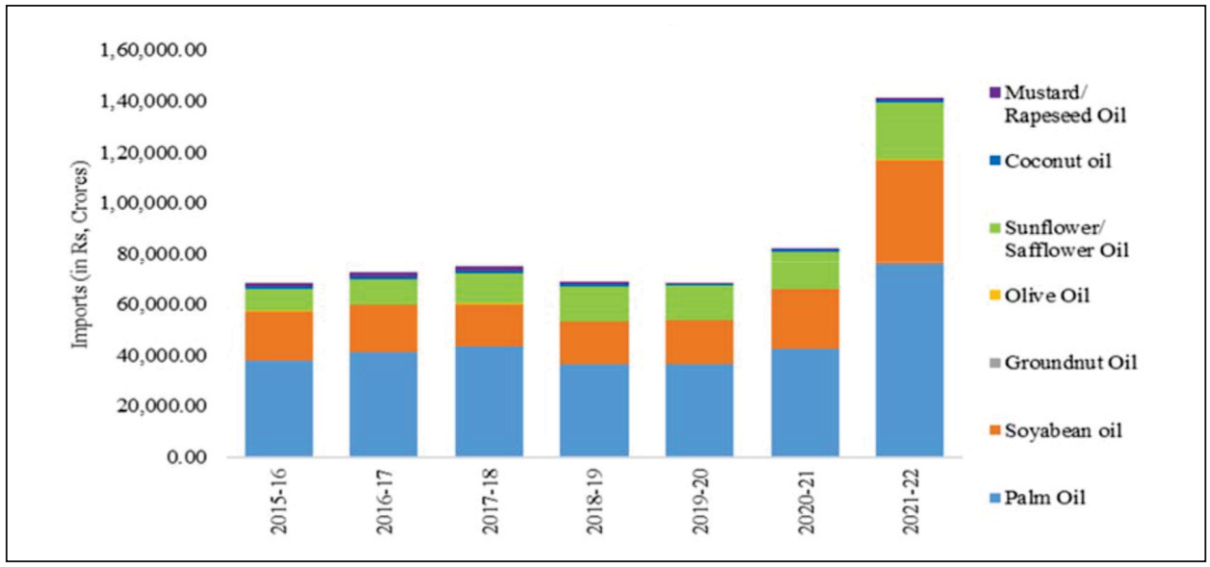


Source: FAS, USDA

3.2 Domestic production and consumption of palm oil in India

India is the world's leading palm oil importer, with imports reaching 8411 thousand metric tons in 2020-21, representing about 18% of global palm oil imports. Alongside India, significant demand comes from China, the EU, Pakistan, and the US, all ranking among the top five importing countries. Palm oil dominates India's vegetable oil imports, comprising over 50% of the total. In 2021-22, India imported Rs. 75,727 crore worth of palm oil, accounting for approximately 54% of total edible oil imports. Soyabean oil and sunflower/safflower oil follow, with imports valued at Rs. 41,277 crore and Rs. 21,901 crore, respectively (Figure 4). Other oils like coconut, mustard, olive, and groundnut make up a negligible share of total imports (Barcelos *et al.*, 2015; Prado & Block, 2012). India predominantly imports palm oil in crude form, mainly due to high trade barriers imposed by the government on refined palm oil imports to protect domestic refineries. Among the refined palm oil categories, refined, bleached, and deodorized (RBD) palm oil constitutes most imports, with minimal shares of RBD palm oil and RBD palm stearin. Table 1 outlines the production of edible oils in India. Notably, groundnut oil production has significantly risen from 17.02 lakh tonnes in 2014-15 to 28.28 lakh tonnes in 2019-20. Similarly, soybean oil production increased notably from 16.6 lakh tonnes to 22.9 lakh tonnes during the same period. In contrast, palm oil production remains relatively low compared to other major vegetable oils, slightly increasing from 1.7 lakh tonnes in 2014-15 to 2.8 lakh tonnes in 2019-20. This inadequate palm oil production necessitates heavy import dependence to meet domestic demand.

Figure 4: Import of Edible Vegetable Oils in India



Source: : Export Import Data Bank, Ministry of Commerce and Industry, GoI

TABLE 1: PRODUCTION OF EDIBLE OILS

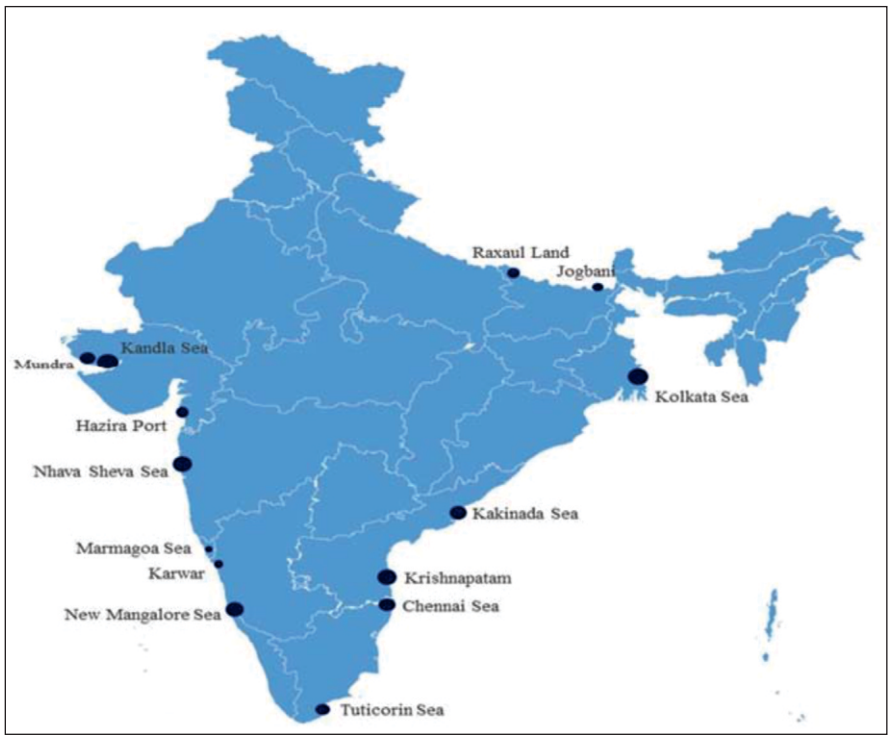
(in lakh tonnes)

Types of oil	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Palm oil	1.71	1.98	2.3	2.2	2.7	2.77
Groundnut oil	17.02	15.27	24.74	25.81	28.97	28.28
Rapeseed/Mustard oil	19.47	21.08	22.1	17.59	22.09	17.97

Types of oil	2014 -15	2015 -16	2016 -17	2017 -18	2018 -19	2019 -20
Soybean oil	16.6	13.73	17.16	20.82	15.18	22.9
Sunflower oil	1.43	0.98	0.8	0.7	0.73	0.72
Coconut oil	4.8	4.32	5.2	6.01	5.9	5.95
Cottonseed oil	12.15	10.05	12.24	12.64	11.23	12.71

Source: Directorate of Vanaspati, Vegetable Oils and Fats

Figure 5: Top Ports of Palm Oil Imports in India



Source: Designed by author

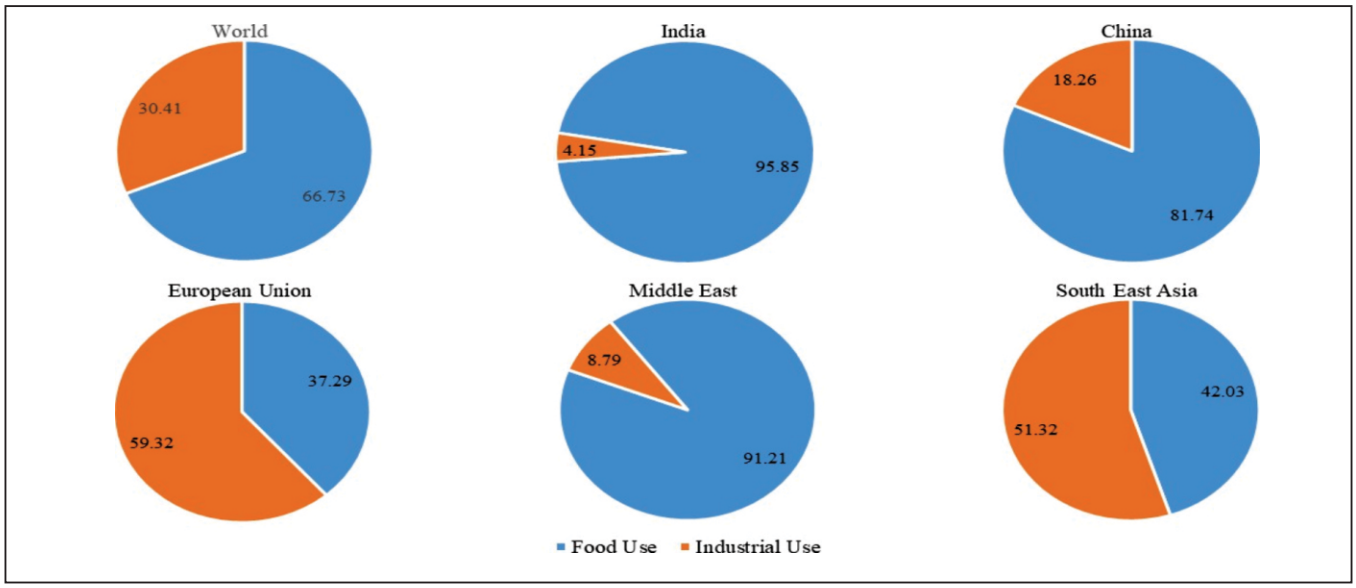
3.3 Landing ports of imported palm oil in India

India predominantly sources its palm oil requirements from South-East Asian countries, particularly Indonesia and Malaysia. Upon arrival, palm oil shipments are directed to various stakeholders, including traders, refiners, manufacturers, or retailers via Indian seaports (OECD/FAO, 2021). Significant ports for palm oil imports in India include the Kandla Sea, Kolkata Sea, Krishnapatnam Sea, Nhava Sheva Sea, New Mangalore Sea, Kakinada Sea, Chennai Sea, Mundra Sea, Tuticorin Sea, among others (Figure 5). Kandla Sea in Gujarat is the largest port for palm oil imports, receiving 30% of total shipments. In 2020-21, palm oil imports at Kandla Sea were valued at Rs. 12.66 thousand crore. Kolkata sea port in West Bengal and Krishnapatnam Sea in Andhra Pradesh are also significant ports, accounting for 18.7% and 18.2% of total imports, respectively.

Palm oil finds extensive usage across various industries, particularly in food and non-food sectors. In food applications, it is used for cooking oil, bakery fats, margarine, spreads, confectionary fats, and ice cream. Its balanced composition of saturated and unsaturated fatty acids eliminates the need for hydrogenation,

making it suitable for various culinary purposes. Refined palm oil is favoured in the food industry due to its neutral taste, colour, odour and stability at high temperatures, ensuring longer shelf life. Fractionated RBD palm olein is commonly used in processed food manufacturing, while RBD palm stearin is employed in bakery fats, shortening, and industrial fatty acid production (Thomas *et al.*, 2015). By-products like palm kernel meal, palm fatty acid distillate, and glycerol have applications in life (Pacheco *et al.*, 2017). Palm oil is a versatile edible vegetable oil with diverse uses in the food and industrial sectors. Middle Eastern countries rely on palm oil for food (91 percent). In China, palm oil is extensively used in the food sector (around 82 percent) but has notable industrial applications (18 percent). Conversely, the European Union (EU) predominantly employs palm oil in industrial settings, particularly for biofuel feedstocks, accounting for 59 percent of its usage (Pacheco *et al.*, 2017; Voora *et al.*, 2019). South-East Asia also utilizes over half of its palm oil for industrial purposes, partly due to increased biofuel mandates (Figure 6).

Figure 6: Proportion (in percent) of Food and Industrial Use of Palm Oil across the World, 2021-22



Source: : FAS, USDA

India relies heavily on importing palm oil to meet domestic demand as it only produces a small quantity locally. Most of this palm oil comes in its crude form. Traders, refiners, or manufacturers handle the importation of crude palm oil. Traders mainly bring it to supply refineries or manufacturers who process it into various products (Murphy *et al.*, 2021). A few big corporate groups mainly do this processing and refining. They import crude palm oil mainly from Indonesia and Malaysia. These corporations also own their refining capacity and are involved in refining and manufacturing goods using imported crude palm oil. These palm oil products enter the wholesale and retail market, and are used in various applications across different industries. The palm oil based products in India are used for cooking oil, bakery and confectionery, oleochemicals, personal care and cosmetics, pharmaceuticals, animal feed and bioenergy. Different companies are involved in different sectors, with some focusing on food manufacturing, while others produce fats, shortening, margarine, and oleochemicals for various industries. The top 30 importing companies handle about 90% of the palm oil imports in India, with Emami Agrotech,

Adani Wilmar, Ruchi Soya Industries, Gokul Agro-Resources, and South India Krishna Oils and Fats being key players. These companies cater to various sectors such as food, bakery, personal care, cosmetics, pharmaceuticals, etc. The use of palm oil in India is mainly dominated by the food manufacturing sector, followed by bakery and confectionery.

4. Conclusions and policy recommendations

India stands as the world's leading importer of palm oil, with a staggering 7.8 million metric tons imported in the fiscal year 2021-22. The bulk of India's palm oil imports arrive in the crude form, constituting about 70% of total imports, while the remaining 30% is in refined form. The significant dominance of crude palm oil imports can be attributed to a notable reduction in import duties, leading to a considerable price gap between crude and refined palm oil, thus incentivizing higher imports of the former. Indonesia and Malaysia emerge as India's primary palm oil suppliers, fulfilling about 93% of the country's palm oil requirements. These two nations, renowned for their palm oil production, are the dominant sources of crude and refined palm oil imports. Upon arrival, imported palm oil is distributed to various stakeholders, including traders, refiners, manufacturers, or retailers. Kandla Sea is the largest port for palm oil imports, receiving 30% of total shipments worth approximately Rs. 12.66 thousand crore in the fiscal year 2020-21. Kolkata and Krishnapatnam Sea also play significant roles in handling substantial shipments of crude palm oil. In the case of refined palm oil, the Nhava Sheva Sea emerges as the major port of entry, followed by Mundra Port and Raxaul Land. Palm oil, known for its versatility, finds extensive utilization across various sectors, notably in the food and industrial domains. The food sector in India predominantly utilizes palm oil, accounting for approximately 95.75% of its usage, while its industrial applications remain relatively limited, constituting only 4.25%. Notable palm oil importation and utilization landscape players include Emami Agrotech, Adani Wilmar, Ruchi Soya Industries, Gokul Agro-Resources, and South India Krishna Oils and Fats. These companies, primarily sourcing, refining, and manufacturing palm oil-based products, collectively contribute to about 50% of India's total crude palm oil imports. In India, the food manufacturing sector drives the utilization of palm oil, with major companies primarily focused on producing cooking oil and fats for household and institutional use. These companies predominantly manufacture fats, shortening, and margarine, catering to bakery and confectionery applications. Additionally, some firms venture into producing oleochemicals, which find diverse applications in personal care, cosmetics, pharmaceuticals, and other industries.

India heavily depends on imported palm oil, making it vulnerable to price fluctuations globally. Despite protective measures, it remains the world's top importer. The EU's increased use of palm oil for biofuels also affects India's prices. Farmers suffer from uncertain prices, discouraging them from growing oil palm. To solve this, farmers need stable prices to protect them from global changes. Oil palm competes with other crops and takes years to yield profits, so farmers need incentives. Post-harvest practices are also crucial for fair prices, so farmers should have easy access to mills. Mills and refineries need technology to boost production. India can use domestically produced oils like mustard or coconut to reduce dependency on palm oil. Substituting oils in food is possible, and educating manufacturers and consumers about alternatives can help. Soybean or sunflower oil can replace palm oil for cooking, and coconut oil is a good option for speciality fats and personal care products.

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Commodity Review

Foodgrains

Procurement of Rice

The total procurement of rice during kharif marketing season 2022-23 up to 10.09.2023 is 56947 thousand metric tonnes as against 57588 thousand metric tonnes in marketing season 2021-22. The details are given in Table 1. A comparative analysis of procurement of rice for the period of marketing season 2022-23 (up to 10.09.2023) and the corresponding period of last year is given in figure 1. The percentage share of different states in procurement of rice has been given in figure 2.

TABLE 1: PROCUREMENT OF RICE IN MAJOR STATES

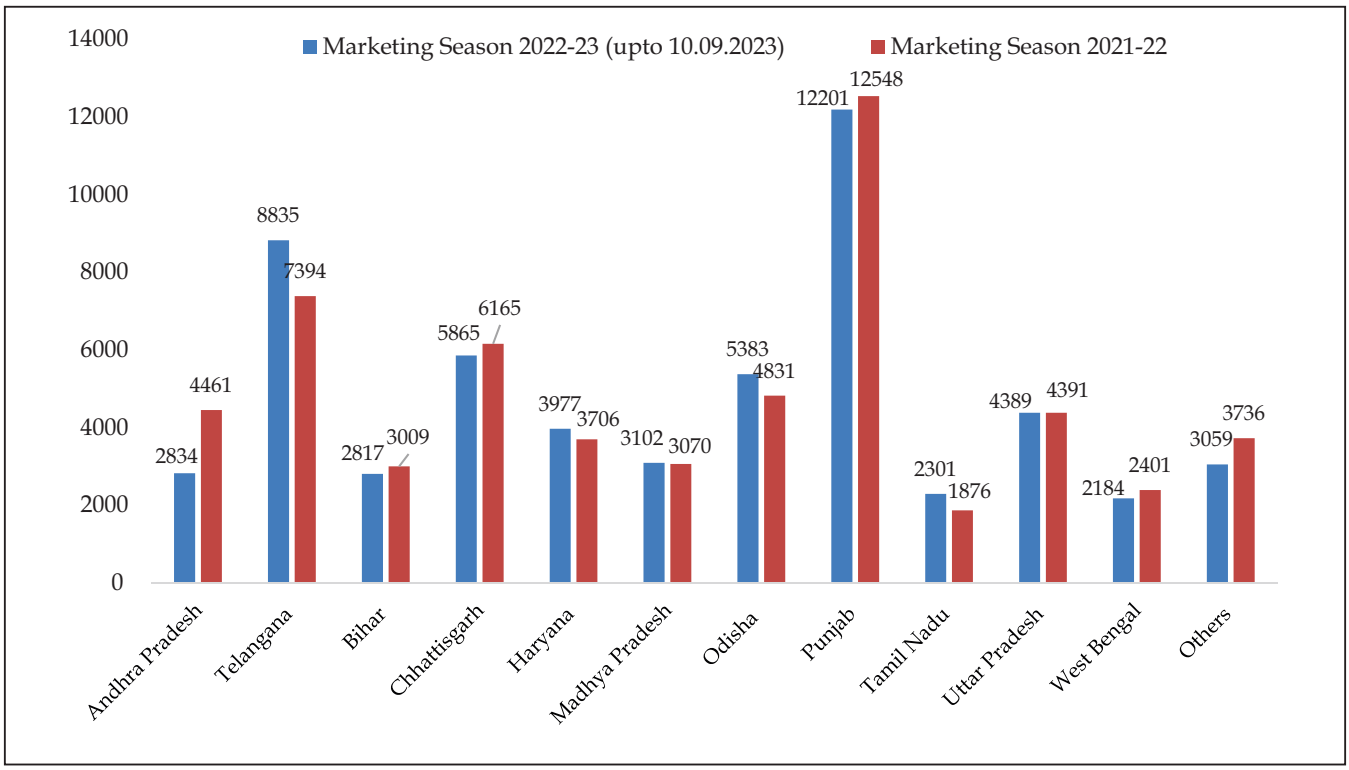
(In thousand metric tonnes)

State	Marketing Season 2022-23 (up to 10.09.2023)		Marketing Season 2021-22	
	Procu rement	Percentage to total	Procurement	Percentage to total
1	2	3	4	5
Andhra Pradesh	2834	5.0	4461	7.7
Telangana	8835	15.5	7394	12.8
Bihar	2817	4.9	3009	5.2
Chhattisgarh	5865	10.3	6165	10.7
Haryana	3977	7.0	3706	6.4
Madhya Pradesh	3102	5.4	3070	5.3
Odisha	5383	9.5	4831	8.4
Punjab	12201	21.4	12548	21.8
Tamil Nadu	2301	4.0	1876	3.3
Uttar Pradesh	4389	7.7	4391	7.6
West Bengal	2184	3.8	2401	4.2
Others	3059	5.4	3736	6.5
All-India Total	**56947**	**100.0**	**57588**	**100**

Source: Department of Food & Public Distribution, Govt. of India.

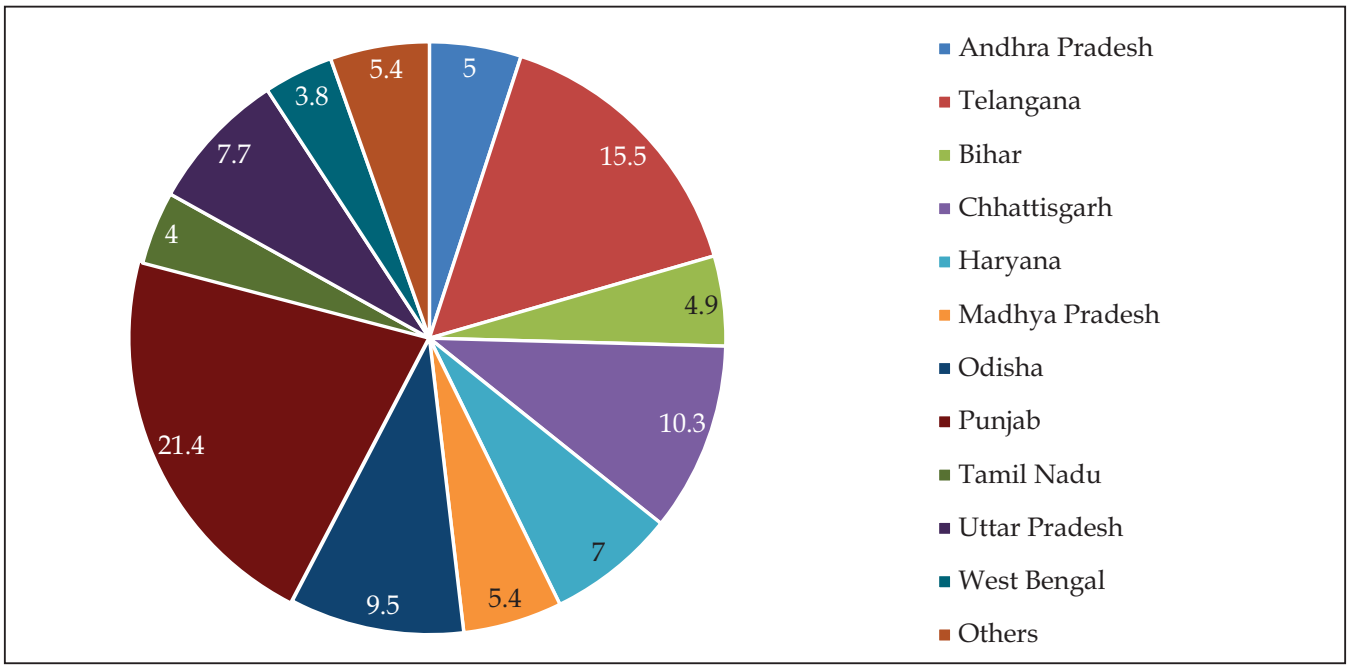
Figure 1: Procurement of Rice in Major States

(In thousand metric tonnes)



Source: Department of Food & Public Distribution, Govt. of India.

Figure 2: Percentage Share of Different States in Procurement of Rice during Marketing Season 2022-23 (up to 10.09.2023)



Source: Department of Food &Public Distribution, Govt. of India.

Procurement of Wheat

The total procurement of wheat during rabi marketing season 2023-24 up to 14.07.2023 is 26202 thousand metric tonnes as against 18792 thousand metric tonnes in marketing season 2022-23. The details are given in Table 2. Figure 3 depicts the comparison of procurement of wheat during the marketing season 2023-24 (up to 14.07.2023) with the corresponding period of last year. The percentage share of different states in procurement of wheat has been given in figure 4.

TABLE 2: PROCUREMENT OF WHEAT IN MAJOR STATES

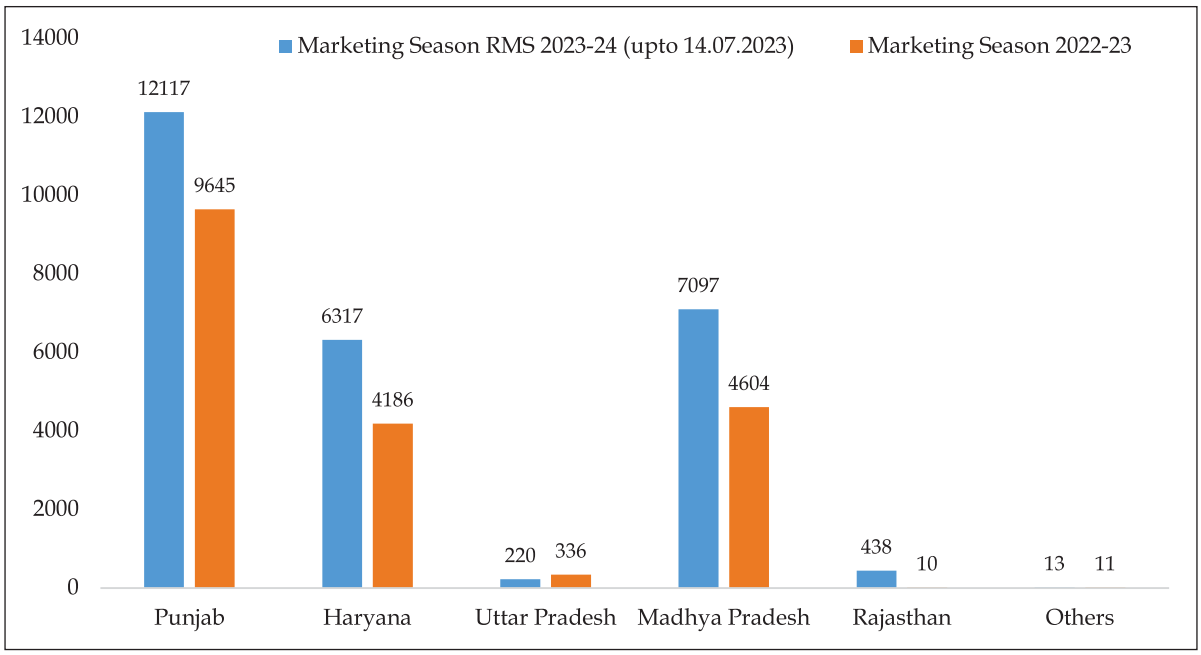
(In thousand metric tonnes)

State	Marketing Season RMS 2023-24 (up to 14.07.2023)		Marketing Season 2022-23	
	Procurement	Percentage to total	Procurement	Percentage to total
1	2	3	4	5
Punjab	12117	46.2	9645	51.3
Haryana	6317	24.1	4186	22.3
Uttar Pradesh	220	0.8	336	1.8
Madhya Pradesh	7097	27.1	4604	24.5
Rajasthan	438	1.7	10	0.1
Others	13	0.1	11	0.1
All India	**26202**	**100**	**18792**	**100**

Source: Department of Food & Public Distribution, Distribution, Govt. of India

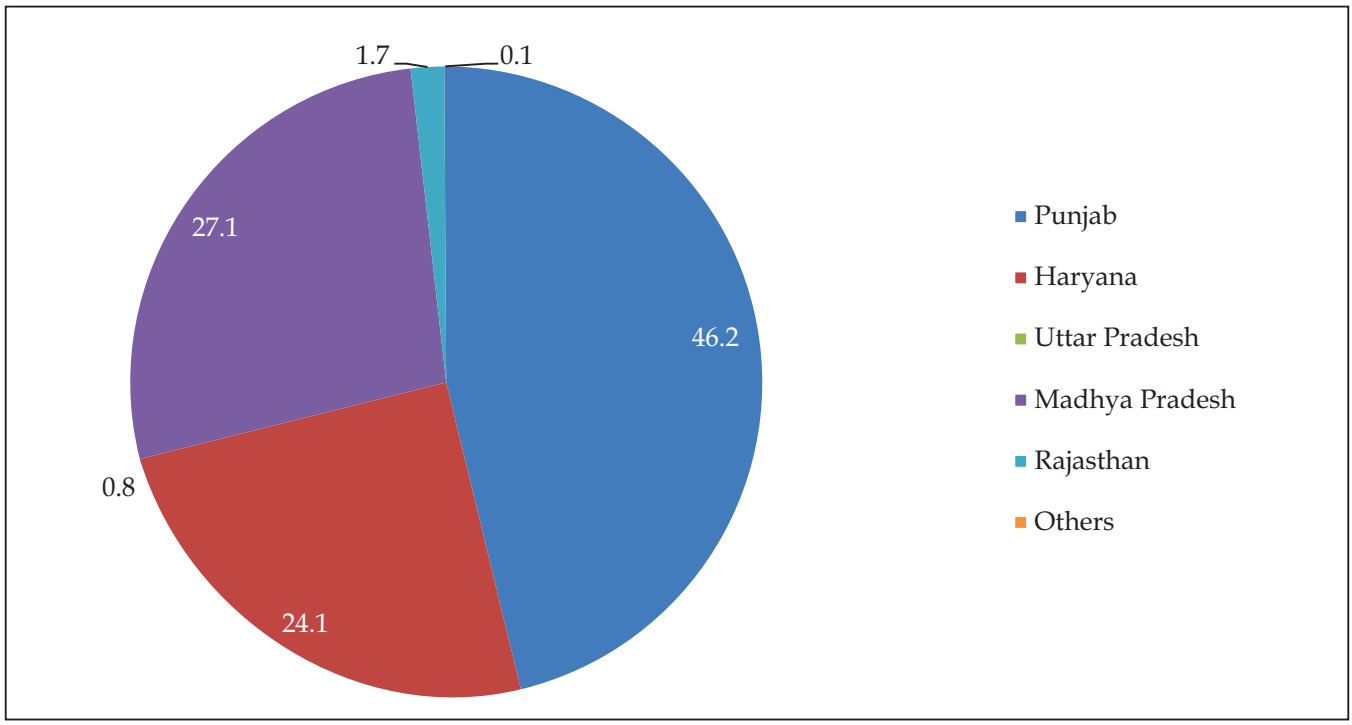
Figure 3:Procurement of Wheat in Major States

(In thousand metric tonnes)



Source: Department of Food &Public Distribution, Govt. of India.

Figure 4: Percentage Share of Different States in Procurement of Wheat during Marketing Season 2023-24 (up to 14.07.2023)



Source: Department of Food & Public Distribution, Govt. of India.

Commercial Crops

Oilseeds

The Wholesale Price Index (WPI) of nine major oilseeds as a group stood at 203.9 in July, 2023, showing an increase of 1.90 percent over the previous month and increased by 18.55 percent over the corresponding month of the previous year.

The WPI of all individual oilseeds showed a mixed trend. The WPI of groundnut seed (1.11 percent), cotton seed (2.02 percent), copra (coconut)(3.15 percent), safflower (2.24 percent), and soybean (1.03 percent) increased over the previous month. However, the WPI of rape & mustard seed (3.87 percent), gingelly seed (sesamum) (0.82 percent), niger seed (4.64 percent) and sunflower (0.77 percent) decreased over the previous month.

Manufacture of Vegetable and Animal Oils and Fats

The WPI of vegetable and animal oils and fats as a group stood at 147.3 in July, 2023 which shows an increase of 1.03 percent over the previous month. However, it decreased by 22.60 percent over the corresponding month of the previous year. The WPI of mustard oil (4.17 percent), soybean oil (1.07 percent), sunflower oil (0.87 percent), groundnut oil (2.57 percent), rapeseed oil (4.71percent), and cotton seed oil (3.66 percent) increased over the previous month. However, the WPI of copra oil (1.11 percent) decreased over the previous month.

Fruits & Vegetable

The WPI of fruits & vegetable as a group stood at 277.1 in July, 2023, showing an increase of 42.61 percent over previous month and an increase of 32.58 percent over the corresponding month of the previous year.

Potato

The WPI of potato stood at 220.3 in July, 2023, showing an increase of 7.99 percent over the previous month. However, it decreased by 24.40 percent over the corresponding month of the previous year.

Onion

The WPI of onion stood at 184.8 in July, 2023, showing an increase of 27.98 percent over the previous month and an increase of 7.13 percent over the corresponding month of the previous year.

Condiments & Spices

The WPI of condiments & spices (group) stood at 234.5 in July, 2023, showing an increase of 11.83 percent over the previous month and an increase of 28.21 percent over the corresponding month of the previous year. The WPI of black pepper increased by 4.42 percent over the previous month, WPI of chillies (dry) increased by 2.35 percent and for turmeric, it increased by 14.50 percent over the previous month.

Tea

The WPI of tea stood at 145.7 in July, 2023, showing no change over the previous month and a decrease of 6.72 percent over the corresponding month of the previous year.

Coffee

The WPI of coffee stood at 210.1 in July, 2023, showing no change over the previous month. However, there is an increase of 5.16 percent over the corresponding month of the previous year.

Sugarcane

The WPI of sugarcane stood at 157.6 in July, 2023, showing a decrease of 2.54 percent over the previous month. Moreover, there is a decrease of 22.59 percent over the corresponding month of the previous year.

Raw cotton

The WPI of raw cotton stood at 249.6 in July, 2023, showing an increase of 1.67 percent over the previous month and a decrease of 9.92 percent over the corresponding month of the previous year.

Raw jute

The WPI of raw jute stood at 188.1in July, 2023, showing an increase of 1.02 percent over the previous month and a decrease of 9.61 percent over the corresponding month of the previous year.

Wholesale Price Index of commercial crops is given in Table 3. A graphical comparison of WPI for the period of July, 2023 and June, 2023 is given in figure 5 and the comparison of WPI during July, 2023 with the corresponding month of last year has been given in

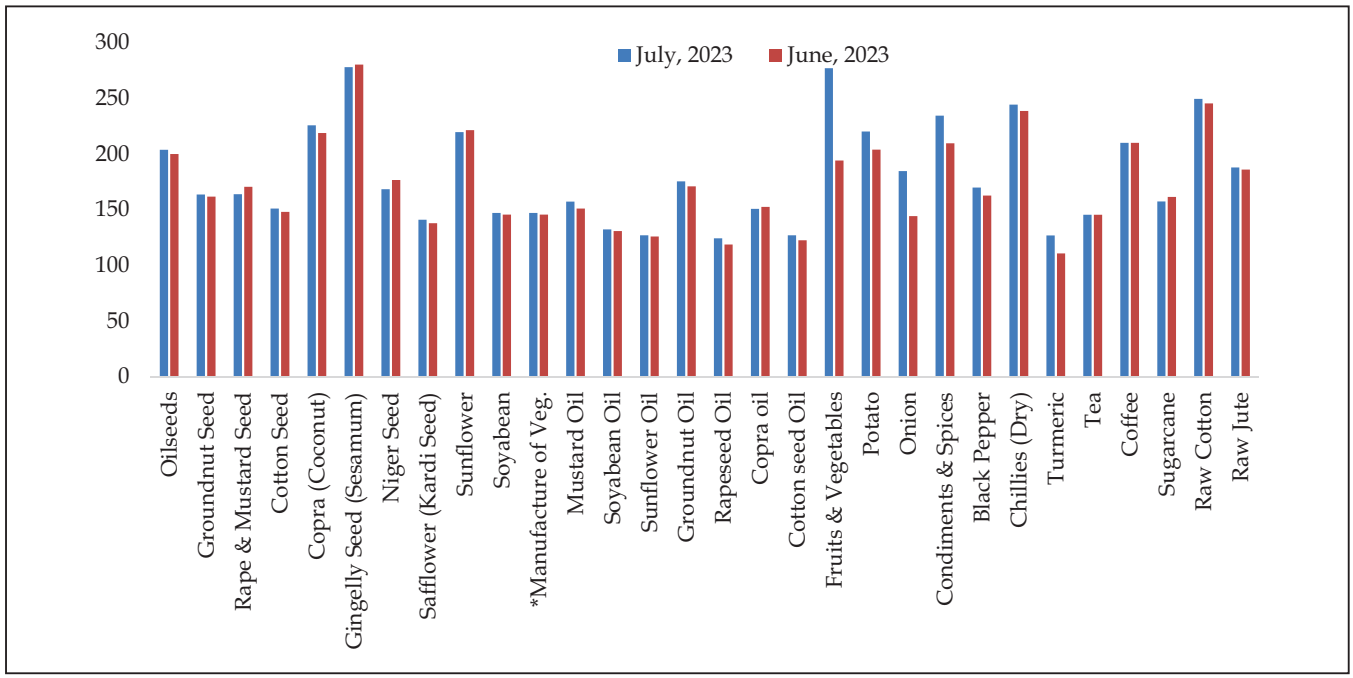
TABLE 3: WHOLESALE PRICE INDEX OF COMMERCIAL CROPS

(Base Year: 2011-12)

Commodity	July, 2023	June, 2023	July, 2022	Percentage variation over the	
				Month	Year
Oilseeds	203.9	200.1	172.0	1.90	18.55
Groundnut seed	163.8	162.0	204.0	1.11	-19.71
Rape & Mustard seed	164.1	170.7	180.9	-3.87	-9.29
Cotton seed	151.2	148.2	184.1	2.02	-17.87
Copra (Coconut)	225.9	219.0	177.4	3.15	27.34
Gingelly seed (Sesamum)	278.1	280.4	237.8	-0.82	16.95
Niger seed	168.6	176.8	199.3	-4.64	-15.40
Safflower (Kardi seed)	141.2	138.1	180.0	2.24	-21.56
Sunflower	219.8	221.5	261.5	-0.77	-15.95
Soyabean	147.3	145.8	190.3	1.03	-22.60
Manufacture of vegetable and animal oils and fats	147.3	145.8	190.3	1.03	-22.60
Mustard oil	157.5	151.2	202.5	4.17	-22.22
Soyabean oil	132.5	131.1	179.9	1.07	-26.35
Sunflower oil	127.3	126.2	175.1	0.87	-27.30
Groundnut oil	175.6	171.2	177.3	2.57	-0.96
Rapeseed oil	124.6	119.0	166.0	4.71	-24.94
Copra oil	151.0	152.7	171.8	-1.11	-12.11
Cotton seed oil	127.3	122.8	184.9	3.66	-31.15
Fruits & Vegetables	277.1	194.3	209.0	42.61	32.58
Potato	220.3	204.0	291.4	7.99	-24.40
Onion	184.8	144.4	172.5	27.98	7.13
Condiments & Spices	234.5	209.7	182.9	11.83	28.21
Black Pepper	170.1	162.9	164.0	4.42	3.72
Chillies (Dry)	244.4	238.8	224.2	2.35	9.01
Turmeric	127.1	111.0	117.9	14.50	7.80
Tea	145.7	145.7	156.2	0.00	-6.72
Coffee	210.1	210.1	199.8	0.00	5.16
Sugarcane	157.6	161.7	203.6	-2.54	-22.59
Raw Cotton	249.6	245.5	277.1	1.67	-9.92
Raw Jute	188.1	186.2	208.1	1.02	-9.61

Source: Department of Food & Public Distribution, Govt. of India.

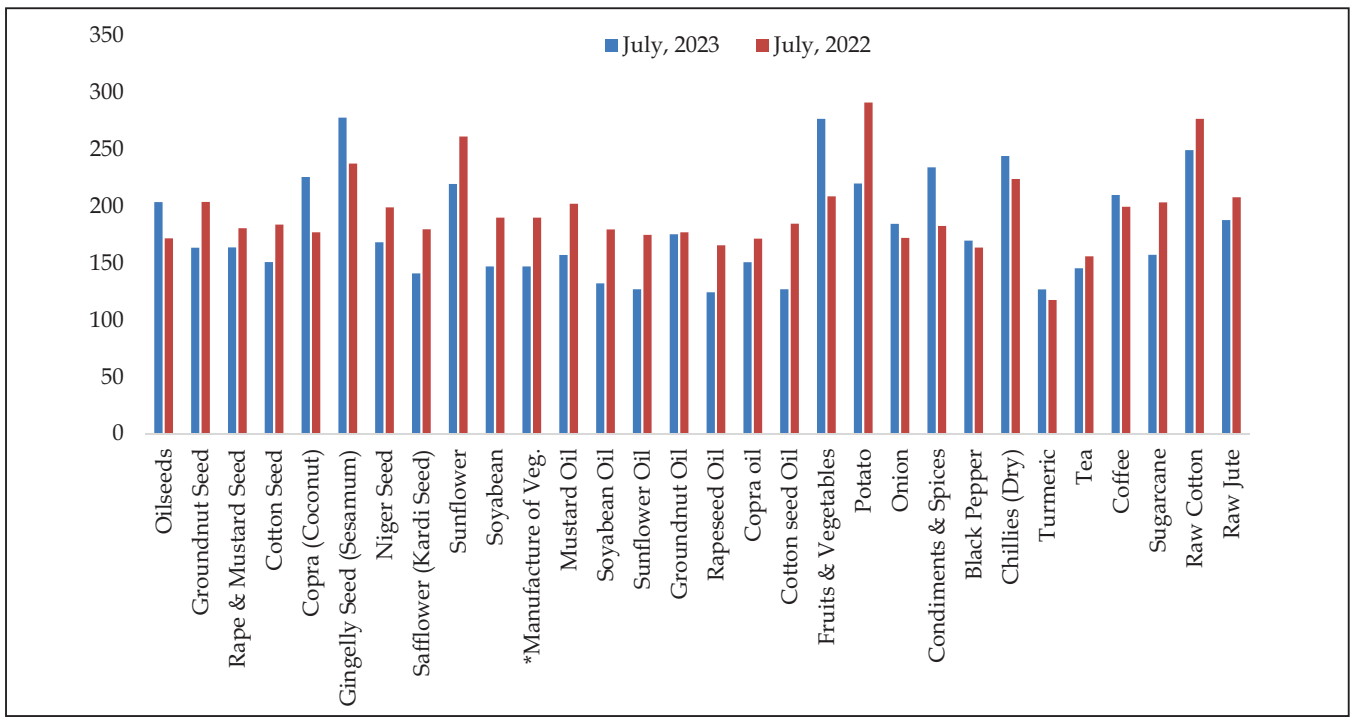
Figure 5: WPI of Commercial Crops during July, 2023 and June, 2023



*Manufacture of Vegetable, Animal Oils and Fats.

Source: Office of the Economic Advisor, DPIIT, Ministry of Commerce, Govt. of India.

Figure 6: WPI of Commercial Crops during July, 2023 and July, 2022



*Manufacture of Vegetable, Animal Oils and Fats.

Source: Office of the Economic Advisor, DPIIT, Ministry of Commerce, Govt. of India.

Statistical Tables

1. Wages

State-Wise Prevailing Average Daily Wages

(Value in Rs)

Sr. No.	State	Month & Year	Normal Working Hours	Field Labour								Other Agri. Labour		Tractor Driver		* Field Labour		Non-Agri. Occupation		
				Ploughing		Sowing		Weeding		Reaping & Harvesting								Carpenter	Blacksmith	Mason
				M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	M	M
1	Andhra Pradesh	March, 23	8	573	-	419	372	505	340	485	383	549	372	664	-			675	581	695
2	Assam	March, 23	8	464	436	455	411	450	412	462	411	451	422	530	-			546	490	530
3	Bihar	April, 23	8	396	332	360	318	368	321	384	-	378	344	471	-			565	537	552
4	Chhattisgarh	April, 23	8	342	240	240	210	223	196	232	203	252	212	404	-			423	331	421
5	Goa	Feb, 23	8	834	800	584	425	712	469	688	494	680	492	1225	-			1079	800	967
6	Gujarat	Feb, 23	8	312	NR	277	249	251	248	258	252	170	170	391	-			500	500	499
7	Haryana	Feb, 23	8	625	500	537	463	504	449	504	448	481	436	602	-			728	667	781
8	Himachal Pradesh	Feb, 23	8	569	-	487	471	478	465	485	501	461	439	620	-			649	623	633
9	Jharkhand	Feb, 23	8	309	280	301	271	298	264	308	267	298	259	399		Not Required		456	444	474
10	Karnataka	April, 23	8	627	-	392	282	370	276	395	296	439	308	601	-			560	519	695
11	Kerala	Feb, 23	8	901	NR	NR	602	NR	597	802	638	753	620	NR				1019	989	1013
12	Madhya Pradesh	May, 23	8	350	263	294	254	268	242	303	272	336	299	410	-			481	461	492
13	Maharashtra (P*)	June, 22	8	406	283	381	256	356	244	490	NR	378	244	607	-			500	450	472
14	Odisha	Jan, 23	8	414	381	384	305	351	302	360	260	389	324	525	-			591	554	596
15	Punjab	March,23	8	510	413	483	433	460	412	487	NR	475	411	495	-			601	577	597
16	Rajasthan	Feb, 23	8	456	328	439	301	384	341	381	339	403	297	503	-			511	485	595
17	Tamil Nadu	April, 23	8	675	-	653	327	632	326	734	326	666	345	865	-			797	707	853
18	Telangana	April, 23	8				Not Required					434	343	NR		452	232	461	444	NR
19	Tripura	Feb, 23	8	419	NR	369	319	364	313	357	300	303	251	491	NR			458	378	361
20	Uttar Pradesh	March, 23	8	345	-	334	317	323	310	339	317	330	313	NR		Not Required		555	-	584
21	Uttarakhand	April, 23	8	701	NR	434	396	455	419	460	420	492	432					717	NR	725
22	West Bengal	Feb, 23	8	437	327	347	317	322	290	355	308	331	302	568	-			489	459	520

Source: State Governments

Note: 1 Other agricultural labour include field waterping, carrying load, well diggers, cleaning silt from waterways and embankment, etc.

2. *States of Telangana do not give operation–wise details as they furnish data for the group

3. P* - Provisional as the State has not furnished data for its all districts.

4. NR: Not Reported

2. Prices

WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA

(All Prices in Rupees)

Commodity	Variety	Unit	State	Centre	Jul-23	Jun-23	Jul-22
Wheat	PBW 343	Quintal	Punjab	Amritsar	2050	2050	NA
Wheat	Dara	Quintal	Uttar Pradesh	Chandausi	2315	2280	2040
Wheat	Lokvan	Quintal	Madhya Pradesh	Bhopal	2325	2489	2019
Jowar	-	Quintal	Maharashtra	Mumbai	4800	4150	3500
Gram	No III	Quintal	Madhya Pradesh	Sehore	4965	4612	4451
Maize	Yellow	Quintal	Uttar Pradesh	Kanpur	1950	1950	2170
Gram Split	-	Quintal	Bihar	Patna	6700	6730	6460
Gram Split	-	Quintal	Maharashtra	Mumbai	6200	6200	6000
Arhar Split	-	Quintal	Bihar	Patna	12350	11950	9520
Arhar Split	-	Quintal	Maharashtra	Mumbai	12500	12500	9500
Arhar Split	-	Quintal	NCT of Delhi	Delhi	11900	11000	9600
Arhar Split	Sort II	Quintal	Tamil Nadu	Chennai	12300	12200	9000
Gur	-	Quintal	Maharashtra	Mumbai	4900	4800	4650
Gur	Sort II	Quintal	Tamil Nadu	Coimbatore	4700	4700	4800
Gur	Balti	Quintal	Uttar Pradesh	Hapur	3600	3200	2960
Mustard Seed	Black (S)	Quintal	Uttar Pradesh	Kanpur	5380	5400	6620
Mustard Seed	Black	Quintal	West Bengal	Raniganj	6600	6500	6600
Mustard Seed	-	Quintal	West Bengal	Kolkata	5750	5650	7150
Linseed	Bada Dana	Quintal	Uttar Pradesh	Kanpur	5400	5300	7300
Linseed	Small	Quintal	Uttar Pradesh	Varanasi	5250	5300	7250
Cotton Seed	Mixed	Quintal	Tamil Nadu	Virudhunagar	2700	2750	3200
Cotton Seed	MCU 5	Quintal	Tamil Nadu	Coimbatore	3750	3750	3625
Castor Seed	-	Quintal	Telangana	Hyderabad	NT	NT	NT
Sesamum Seed	White	Quintal	Uttar Pradesh	Varanasi	13700	12850	9800
Copra	FAQ	Quintal	Kerala	Alleppey	7950	7700	8300
Groundnut	Pods	Quintal	Tamil Nadu	Coimbatore	7000	7000	6500
Groundnut	-	Quintal	Maharashtra	Mumbai	11200	11200	10500
Mustard Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1815	1885	2465
Mustard Oil	Ordinary	15 Kg.	West Bengal	Kolkata	1810	1825	2400
Groundnut Oil	-	15 Kg.	Maharashtra	Mumbai	2800	2550	2450
Groundnut Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	2900	2800	2700
Linseed Oil	-	15 Kg.	Uttar Pradesh	Kanpur	2185	2215	2320
Castor Oil	-	15 Kg.	Telangana	Hyderabad	2400	2625	2700
Sesamum Oil	-	15 Kg.	NCT of Delhi	Delhi	2560	2400	2600
Sesamum Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	4300	4400	3600
Coconut Oil	-	15 Kg.	Kerala	Cochin	1860	1815	2070
Mustard Cake	-	Quintal	Uttar Pradesh	Kanpur	2870	2700	3150

WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA - *Contd.*

Commodity	Variety	Unit	State	Centre	Jul-23	Jun-23	Jul-22
Groundnut Cake	-	Quintal	Telangana	Hyderabad	NT	NT	NT
Cotton/Kapas	NH 44	Quintal	Andhra pradesh	Nandyal	6350	6600	10200
Cotton/Kapas	LRA	Quintal	Tamil Nadu	Virudhunagar	6000	6000	8300
Jute Raw	TD 5	Quintal	West Bengal	Kolkata	5775	5750	6450
Jute Raw	W 5	Quintal	West Bengal	Kolkata	5775	5750	6600
Oranges	Big	100 No	Tamil Nadu	Chennai	2200	2000	2200
Oranges	Nagpuri	100 No	West Bengal	Kolkata	NT	NT	NA
Banana	-	100 No.	NCT of Delhi	Delhi	500	500	500
Banana	Medium	100 No.	Tamil Nadu	Kodaikkanal	585	610	540
Cashewnuts	Raw	Quintal	Maharashtra	Mumbai	60000	60000	65000
Almonds	-	Quintal	Maharashtra	Mumbai	75000	75000	55000
Walnuts	-	Quintal	Maharashtra	Mumbai	100000	100000	120000
Kishmish	-	Quintal	Maharashtra	Mumbai	20000	20000	16000
Peas Green	-	Quintal	Maharashtra	Mumbai	7800	7800	7500
Tomato	Ripe	Quintal	Uttar Pradesh	Kanpur	7600	3800	2600
Ladyfinger	-	Quintal	Tamil Nadu	Chennai	3500	3000	1800
Cauliflower	-	100 No.	Tamil Nadu	Chennai	2300	4500	2200
Potato	Red	Quintal	Bihar	Patna	1360	1380	1620
Potato	Desi	Quintal	West Bengal	Kolkata	1700	1500	2300
Potato	Sort I	Quintal	Tamil Nadu	Mettuppalayam	5763	4626	4503
Onion	Pole	Quintal	Maharashtra	Nashik	1000	1000	950
Turmeric	Nadan	Quintal	Kerala	Cochin	11000	11000	10500
Turmeric	Salam	Quintal	Tamil Nadu	Chennai	16000	11800	12000
Chillies	-	Quintal	Bihar	Patna	22500	22350	19500
Black Pepper	Nadan	Quintal	Kerala	Kozhikode	56500	47400	48000
Ginger	Dry	Quintal	Kerala	Cochin	27000	27000	16000
Cardamom	Major	Quintal	NCT of Delhi	Delhi	57650	57600	57600
Cardamom	Small	Quintal	West Bengal	Kolkata	185000	160000	135000
Milk	Buffalo	100 Liters	West Bengal	Kolkata	7500	7500	6500
Ghee Deshi	Deshi No 1	Quintal	NCT of Delhi	Delhi	62000	62031	60030
Ghee Deshi	-	Quintal	Maharashtra	Mumbai	82000	78000	55000
Ghee Deshi	Desi	Quintal	Uttar Pradesh	Kanpur	47000	47400	48300
Fish	Rohu	Quintal	NCT of Delhi	Delhi	12100	12000	13000
Fish	Pomphrets	Quintal	Tamil Nadu	Chennai	70000	70000	74000
Eggs	Madras	1000 No.	West Bengal	Kolkata	4980	5630	4380
Tea	-	Quintal	Bihar	Patna	25700	25400	27400
Tea	Atti Kunna	Quintal	Tamil Nadu	Coimbatore	10143	10682	10182
Coffee	Plant-A	Quintal	Tamil Nadu	Coimbatore	44000	46000	48000
Coffee	Rubusta	Quintal	Tamil Nadu	Coimbatore	28000	28000	23000

WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA - - *Concld.*

Commodity	Variety	Unit	State	Centre	Jul-23	Jun-23	Jul-22
Tobacco	Kampila	Quintal	Uttar Pradesh	Farukhabad	9800	9650	8500
Tobacco	Raisa	Quintal	Uttar Pradesh	Farukhabad	4800	4650	4200
Tobacco	Bidi Tobacco	Quintal	West Bengal	Kolkata	13300	13300	13200
Rubber	-	Quintal	Kerala	Kottayam	12700	13000	15000
Arecanut	Pheton	Quintal	Tamil Nadu	Chennai	92000	95000	91000
Paddy	2716	Quintal	Andhra pradesh	Vijayawada	2330	2300	2200
Paddy	Basmati	Quintal	Punjab	Amritsar	NA	NA	NA
Paddy	No III	Quintal	Uttar Pradesh	Kanpur	2080	2150	1475
Paddy	Common	Quintal	West Bengal	Kolkata	2040	2040	1940

Source: DPIIT, Ministry of Commerce and Industry, Govt. of India.

Crop Production

SOWING AND HARVESTING OPERATIONS NORMALLY IN PROGRESS DURING AUGUST, 2023

State	Sowing	Harvesting
(1)	(2)	(3)
Andhra Pradesh	Winter Rice, Jowar (K), Bajra, Maize (K), Ragi (K), Small Millets (K), Urad (K), Tur (K), Mung (K), Other kharif pulses, Chillies (Dry), Groundnut, Castor seed, Cotton, Mesta, Sweet Potato, Niger seed.	Autumn Rice, Small Millets (K), Mung (K), Other Kharif Pulses, Sesamum.
Assam	-	Autumn Rice, Maize, Jute, Mesta.
Bihar	Winter Rice, Jowar (K), Bajra, Small Millets (K), Tur (K), Groundnut, Castor seed.	Jute, Mesta.
Gujarat	Winter Rice, Chillies (Dry), Tobacco, Castor seed, Sesamum, Cotton.	-
Himachal Pradesh	Bajra.	Sesamum.
Jammu & Kashmir	Small Millets (K), (Late).	Maize, Small Millets (K), (Early), Sannhemp.
Karnataka	Autumn Rice, Winter Rice, Bajra, Ragi, Small Millets (K), Tur(K), Urad (K), Mung (K), Other Kharif Pulses, Potato (Plains), Chillies (Dry), Tobacco, Castor seed, Groundnut, Cotton, Sweet Potato, Niger seed.	Maize (K), Urad (K), Mung (K), Summer Potato (Hills), Tobacco, Sesamum, Sweet Potato, Sannhemp Onion (1st crop).
Kerala	Winter Rice, Tur (K), Other Kharif Pulses (Kulthi), Sesamum, (2nd Crop), Cotton, Tapioca (3rd Crop).	Autumn Rice, Ragi, Small Millets (K), Tur(K), Urad (K), Mung (K), Other Kharif Pulses, Lemon Grass, Tapioca (1st Crop).
Madhya Pradesh	Autumn Rice, Jowar (K), Bajra, Small Millets (K), Urad(K), Mung (K), Other Kharif Pulses, Summer potato, Ginger, Chillies (Dry), Tobacco, Castor seed, Sesamum, Sweet Potato, Niger seed.	Maize.
Maharashtra	Tobacco, Castor seed, Cotton.	Maize (K).
Manipur	Sweet Potato.	Autumn Rice, Maize, Jute.
Orissa	Winter Rice, Summer Potato (Plains), Chillies (Dry.	Chillies (Dry), Jute.
Punjab and Haryana	Autumn Rice, Bajra, Ragi, Castor seed.	Small Millets (K), Winter Potato (Hills).
Rajasthan	Autumn rice, Jowar (K), Small Millets (K), Urad (K), Mung (K), Other Kharif Pulses, Winter Potato (Plains), Chillies (Dry), Tobacco (2nd Crop), Groundnut, Castor seed, Sesamum, Sannhemp.	-

SOWING AND HARVESTING OPERATIONS NORMALLY IN PROGRESS DURING AUGUST, 2023

State	Sowing	Harvesting
(1)	(2)	(3)
Tamil Nadu	Autumn Rice, Jowar (K), Bajra, Ragi, Small Millets, Tur (K), Urad (K), Mung (K), Sugarcane, Chillies (Dry) (Early), Groundnut (Late), Castor seed, Sesamum (Late), Cotton, Sannhemp, Tapioca.	Summer Potato, Sugarcane, Chillies (Dry), Sesamum (Early), Cotton (Early), Sannhemp, Onion
Tripura	Winter Rice.	Autumn Rice, Sesamum, Jute.
Uttar Pradesh	Winter Rice, Bajra, Chillies (Dry), Sesamum, Sweet Potato, Turmeric, Tapioca (1stCrop).	Maize, Chillies (Dry), Jute.
West Bengal	Winter Rice, Tur (K), Ginger, Chillies (Dry) Sesamum (Early).	Autumn Rice, Maize, Chillies (Dry), Jute.
Delhi	Tur (K).	-
Andaman & Nicobar Island	-	Autumn Rice.

(K)- Kharif (R)- Rabi

Note to Contributors

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