

# Mapping a Scholarly Footprint of Indian Council of Agricultural Research Institutions: A Decadal Bibliometric Review

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## ABSTRACT

Agriculture is one of the main sources of the Indian economy, and 2/3 of the rural population is still dependent on agriculture for their livelihood (Chakrabarty et al., 2025). Indian Council of Agricultural Institutions campaigns for regular sustainable agriculture practices, facilitates the dissemination of innovations to farmers and stakeholders. ICAR contributions to scholarly publications significantly strengthen India's global scholarly footprint in the agricultural and allied sectors. The present paper attempts to portray the scholarly footprints of the Indian Council of Agricultural Research Institutions during 2015-2024. The study deploys a systematic bibliometric analysis to map the research output of ICAR Institutions. A total of 24,366 relevant results were retrieved from the rich Scopus database using an advanced search technique and were downloaded in CSV format. The extracted results were thoroughly analyzed with various metrics tools, RStudio Package, VOSviewer, and MS Excel to summarize and interpret the dataset. The study reveals there is a consistent rise in the publication output from around 1,000 documents in 2015 to a peak of over 3,500 in 2022 and 2023. The key findings of the study reveal a consistent rise in publication output from around 1,000 documents in 2015 to a peak of over 3,500 in 2022 and 2023. IARI is the most prolific contributor, which is 46.31% of the total publications, and the Indian Journal of Agricultural Sciences publishes the highest volume of articles. The degree of authors' collaboration (C) is approximately 0.97, indicating a high level of collaboration among authors, and international research collaboration, prominently led by the USA (907 collaborations), followed by Australia (443), China (352), and Saudi Arabia (230).

**KEYWORDS:** Indian Council of Agricultural Research (ICAR), Bibliometrics Analysis, Agricultural Research, Scholarly Communication, Research Productivity

## 1. INTRODUCTION

Agriculture serves as a foundational pillar of the Indian economy (Dahlman & Utz, 2005) which employs nearly 46.1% of the population and contributes about 16% of the country's total GDP as per the Economic Survey 2023-

2024. Agriculture in India not only secures the food security for a population of over 1.4 billion but also serves as the backbone of 2/3 of rural livelihoods (*Nutrition and Food Security | United Nations in India*, n.d.). To pay attention to Indian agricultural and allied domains, the Government of India (central and state) consistently develops new innovative plans, schemes, policies, regulations, and recommendations to enhance the productivity, sustainability, and welfare of farmers. (*Union Budget 2024-25 | National Portal of India*, n.d.).

Approximately 2.75% of the total expenditure of the Government of India has been allocated for the Ministry of Agriculture & Farmers Welfare, which accounts for nearly ₹1,32,470 crore.

- ₹60,000 crore for the PM-KISAN income support scheme (PM-Kisan Samman Nidhi, 2018)
- ₹22,600 crore for interest subvention on short-term agricultural credit
- Rashtriya Krishi Vikas Yojana (RKVY) funding for crop insurance (Rashtriya Krishi Vikas Yojana, 2007).
- Krishi Onnati Yojana (*Home | PRSIndia*, n.d.).

The Indian Council of Agricultural Research (ICAR), established on July 16, 1929, as the Imperial Council of Agricultural Research, is an autonomous body under the Ministry of Agriculture and Farmers Welfare, Government of India (*About Us | ICAR*, n.d.). The major objective of ICAR Institutions aims to foster excellence in agricultural research, by developing new technologies to enhance productivity, supporting agricultural education through its network of universities and institutes, and facilitating the dissemination of innovations to farmers and stakeholders to promote sustainable and inclusive growth in the agriculture sector, through its vast network of research institutions and agricultural universities.

ICAR plays a pivotal role in campaigning sustainable agriculture practices by focusing on eco-resilient solutions, transformative crop varieties, and resource-efficient practices (Agrawal & Jaggi, 2023). These initiatives promote sustainable farming systems tailored to diverse agro-climatic zones (Roy et al., 2022). ICAR institutions securing prominent positions in the NIRF under the Agricultural and Allied Sectors, reflecting their academic excellence and research impact (MoE, National Institute Ranking Framework (NIRF), 2024). Their contributions to scholarly publications significantly strengthen India's global scholarly footprint in the agricultural and allied sectors (Wagay et al., 2024). Bibliometrics is recognized as an appropriate quantitative method for studying the diffusion of knowledge (Van Raan, 2019). Consequently, the quality and quantity of scientific literature produced by these institutions underscore their commitment to addressing national and global agricultural challenges through knowledge generation, dissemination, and policy support (Faure et al., 2012).

## **2. REVIEW OF LITERATURE**

Krishnan et al. (2023) conducted a scientometrics study on research publications to identify trends among 19 different Animal Sciences Research Institutes, whose parent organization is the Indian Council of Agricultural Research (ICAR). Research output from 1998 to 2020 was extracted from the WoS database to assess year-wise patterns in publication and citation metrics, types of documents published, collaboration patterns of authors and institutions, and research areas. The result of the study showed that the maximum documents were published in 2017, and the Indian Veterinary Research Institute (IVRI) secured the top positions among Institutions during the time span. Researchers also notice a high collaboration pattern among authors, and the United States ranked as the top collaborator with India, resulting in 417 collaborative research papers.

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Misara et al. (2022) explored the twenty-two years of precision agriculture to evaluate the growth, productivity, and influence of the journal Precision Agriculture during the period of 1999 to 2021. To fulfill the objectives, the researcher attempts a bibliometric study and extracts data from rich Scopus databases. The extracted data was thoroughly analyzed with VOSviewer and Biblioshiny (R Studio). The major findings notices that there is a rise in publication and citation trends i.e., 955 documents receiving 28,151 citations respectively, PRAG has been established as a recognized body of knowledge in the domain of agricultural and biological sciences, most contributing authors are from Europe, followed by North America, and the journal's growing impact and its role in advancing sustainable precision agriculture.

Kumar et al., (2020) conducted a bibliometric study to measure scientific collaborations occurring in the domain of rice crop from 1995-2014; a total of 8663 relevant data points to fulfil the study objectives were gathered from the Scopus database published by Elsevier with the help of using advanced search strategy. The finding of the study highlights the rise in international collaboration indices manifests that the rice scientists in India, a decline in the number of papers written by one, two, three, or four authors, whereas papers written by more the five authors are becoming more common, and weak industry collaboration was noticed. The study also gives insight that State Agricultural Universities, the Indian Council of Agricultural Research, and International Institutes have emerged as core collaborators in the field of rice crop research.

Suresh & Thanuskodi (2019) mapped the research publication of ICAR-Indian Institute of Horticultural Research in India, in which they analyzed the scientific research outputs from 1989 to 2018 that appeared in the Web of Science database by deploying Scientometric analysis. The researchers analyzed a total of 1095 documents to fulfill the study objectives. The key finding of the study highlights that journal articles are the most published form of literature (90.13%), Agriculture and Plant Sciences are the most prominent subject areas, and the study also reflects on collaboration patterns of authors, which shows 90 % as the degree of collaboration.

Raj & Sahoo (2024) conducted a Scientometric study to analyze trends & patterns, and collaborations on Multidisciplinary Food Security Research in India. Addressing the research gap in scientometric mapping of Indian literature, the study aims to provide a macro-level overview using bibliometric tools like VOSviewer and Bibliometrix (R package). The bibliographic data was downloaded from WoS from 1965 to 2021, and was analyzed to evaluate publication performance and map intellectual and collaborative networks. The remarkable finding of the study is that there was a rise in publications over the years, the USA ranked in first position in the most important collaborators, and a thematic shift from crop yield to issues like climate change, nutrition, and gender in food security discourse.

Vazquez et al. (2021) investigated the global research landscape of AI in agriculture using a scientometric approach. To know the publication trends, major contributors, and thematic areas of research. The relevant data was extracted by using Scopus database, and to analyze the dataset, tools like ScientoPy and Bibliometrix were used. The study highlights 3,832 relevant publications. Findings show a publication surge post-2002, with China, the USA, and India as major contributors to the domain. Precision agriculture, IoT, and machine learning emerged as dominant themes, emphasizing AI's growing impact on sustainable agricultural practices.



## 5. RESEARCH METHODOLOGY

The present paper attempts to portray the scholarly footprints of the Indian Council of Agricultural Research Institutions during 2015-2024. The study deploys a systematic bibliometric analysis to map the research output of ICAR Institutions. To fulfill the study's objectives, the bibliographic data of a total of 24,366 relevant results were retrieved from the rich Scopus database using an advanced search technique and were downloaded in CSV format. The extracted results were thoroughly analyzed, scrutinized, and interpreted with the help of metrics tools RStudio Package, VOSviewer, and MS Excel to summarize and interpret the dataset in the form of tables, charts, and graphs.

## 6. DATA ANALYSIS AND INTERPRETATION

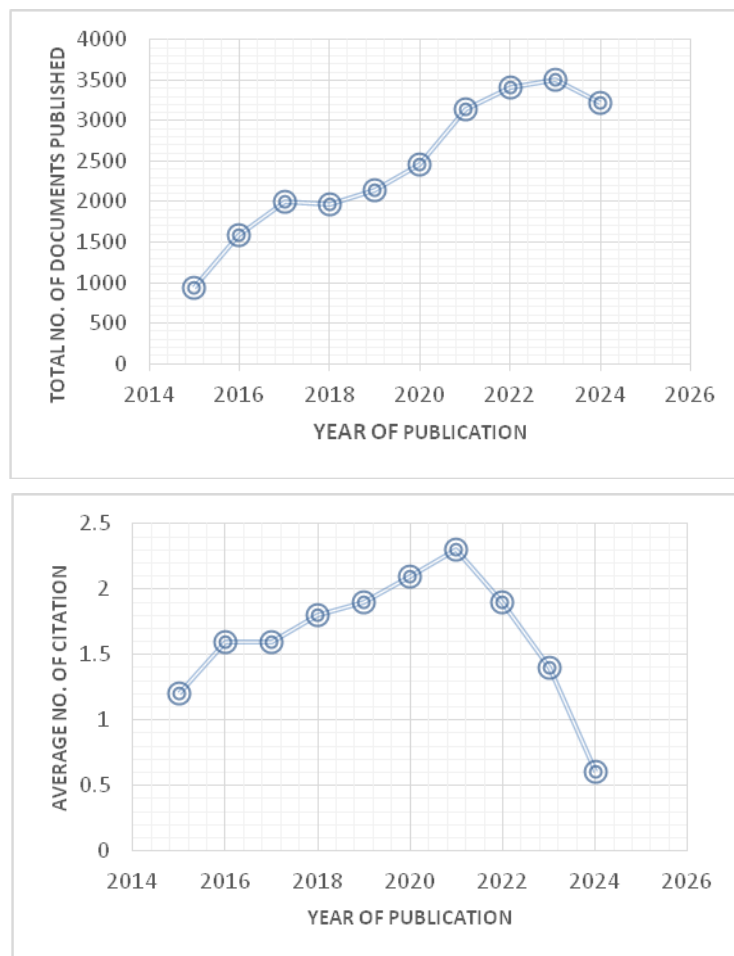
**Table 1:** General Information about Data

Description	Results
<b>MAIN INFORMATION ABOUT DATA</b>	
Timespan	2015:2024
Sources (Journals, Books, etc)	1913
Documents	24366
Annual Growth Rate %	14.73
Document Average Age	4.58
Average citations per doc	9.669
References	1118859
<b>DOCUMENT CONTENTS</b>	
Keywords Plus (ID)	29513
Author's Keywords (DE)	44608
<b>AUTHORS</b>	
Authors	31277
Authors of single-authored docs	503
<b>AUTHORS COLLABORATION</b>	
Single-authored docs	503
Co-Authors per Doc	6.03
International co-authorships %	13.36
<b>DOCUMENT TYPES</b>	
Article	18813
Book	212
book chapter	3368
conference paper	51
Editorial	241
Retracted	3
Review	1678

Table 1 highlights the main information about the dataset which shows, which spans from 2015 to 2024 and comprises 24,366 documents sourced from 1,913 journals, books, and other outlets. The annual growth rate of

14.73% resulted in a healthy and consistent increase in scholarly productivity over the decade. Having a mean document age of 4.58 years and 9.669 citations per document. Over the span, more than 1.1 million citations were noted, highlighting the extensive engagement of researchers in the domain in contributing knowledge worldwide. A rich collection of Keywords Plus and Author’s Keywords, which are 29,513 and 44,608 respectively indicates that research happens in diverse areas. The contribution of authors in a total of 31,277 authors shows there is a trend towards collaborative research and they used to publish there researches in journal articles, covers 77.21% of total publications, followed by book chapters with 13.82%.

**6.1 Chronology of Distribution of Research Papers**



**Fig 2: Annual Scientific Production of Publications**

The bar graph shows the annual scientific production of publications from 2015 to 2024, a continuous rise in publications, which was 934 documents in 2015, 1585 in 2016, and so on, as presented in Figure 2. The publication count was in peak in 2023 with 3502 research outputs; this growth reflects the increasing research productivity and institutional focus on academic publishing over the decade. Whereas, after 2023, a slight downfall of publication count was noted. The second part of the bar graph represents the mean annual citation counts per year, revealing a rise in the mean value of citations from 2015 to 2021, and it reached its peak during the year 2021. After that, a stage comes when the mean citation starts decline and was noted as 0.6 in 2024, which can be expected as newer publications have had less time to accumulate citations.

## 6.2 ICAR Institutions Productivity and Its Ranking

**Table 2:** Most Productive Institutions of ICAR

Rank	Most Productive Institutions of ICAR	Documents (N=24366)	% Share of Total Documents
1	INDIAN AGRICULTURAL RESEARCH INSTITUTE	11285	46.31%
2	NATIONAL DAIRY RESEARCH INSTITUTE	3415	14.01%
3	INDIAN VETERINARY RESEARCH INSTITUTE	2257	9.26%
4	CENTRAL INSTITUTE OF FISHERIES EDUCATION	1967	8.07%
5	CENTRAL POTATO RESEARCH INSTITUTE	1611	6.61%
6	NATIONAL RICE RESEARCH INSTITUTE	1507	6.18%
7	INDIAN INSTITUTE OF HORTICULTURAL RESEARCH	1490	6.11%
8	CENTRAL MARINE FISHERIES RESEARCH INSTITUTE	1183	4.85%
9	NATIONAL BUREAU OF PLANT GENETIC RESOURCES	1119	4.59%
10	INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH	1025	4.20%

Table 2 indicates that the analysis of institutional productivity reveals that the Indian Agricultural Research Institute (IARI) is the most prolific contributor, accounting for 46.31% of the total 24,366 documents, nearly half of ICAR's overall scholarly output. It is followed by the National Dairy Research Institute (14.01%) and the Indian Veterinary Research Institute (9.26%). Other key contributors include institutes specializing in fisheries, potatoes, rice, horticulture, and genetic resources. The top 10 institutions collectively dominate the research landscape, reflecting ICAR's emphasis on crop science, animal science, and food security, with IARI emerging as the central hub of academic excellence.

## 6.3 Most Prominent Sources of Domain

**Table 3:** Prominent Sources Titles of Domain

Source Title	Total No. of Documents	Impact factor	Quartile ranking
INDIAN JOURNAL OF AGRICULTURAL SCIENCES	1396	0.295	Q3
INDIAN JOURNAL OF ANIMAL SCIENCES	999	0.188	Q3
INDIAN JOURNAL OF HORTICULTURE	448	0.171	Q4
FRONTIERS IN PLANT SCIENCE	412	1.163	Q1
INDIAN JOURNAL OF ANIMAL RESEARCH	411	0.188	Q3
INDIAN JOURNAL OF FISHERIES	410	0.188	Q4
INDIAN PHYTOPATHOLOGY	327	0.296	Q3
INDIAN JOURNAL OF GENETICS AND PLANT BREEDING	312	0.283	Q3
3 BIOTECH	275	0.620	Q1
INDIAN JOURNAL OF AGRONOMY	272	0.147	Q3

Table 3 reflects the publication data, which reveal that ICAR researchers predominantly publish in Indian journals, with the Indian Journal of Agricultural Sciences leading the list with 1,396 documents, followed by the Indian

Journal of Animal Sciences (999) and the Indian Journal of Horticulture (448). These journals, despite their lower impact factors (ranging from 0.147 to 0.296), serve as key outlets for domestic agricultural research dissemination and are largely categorized under Q3 and Q4 quartiles, indicating modest international visibility.

Notably, Frontiers in Plant Science and 3 Biotech stand out as internationally reputed, Q1-ranked journals with relatively higher impact factors (1.163 and 0.620, respectively). Their inclusion among the top 10 sources shows that ICAR researchers are increasingly engaging with global platforms for broader visibility and academic impact. While Indian journals dominate numerically, the presence of high-ranking international journals indicates a gradual shift towards publishing in globally competitive venues.

### 6.3.1 Bradford's Law Implementation and Assessment

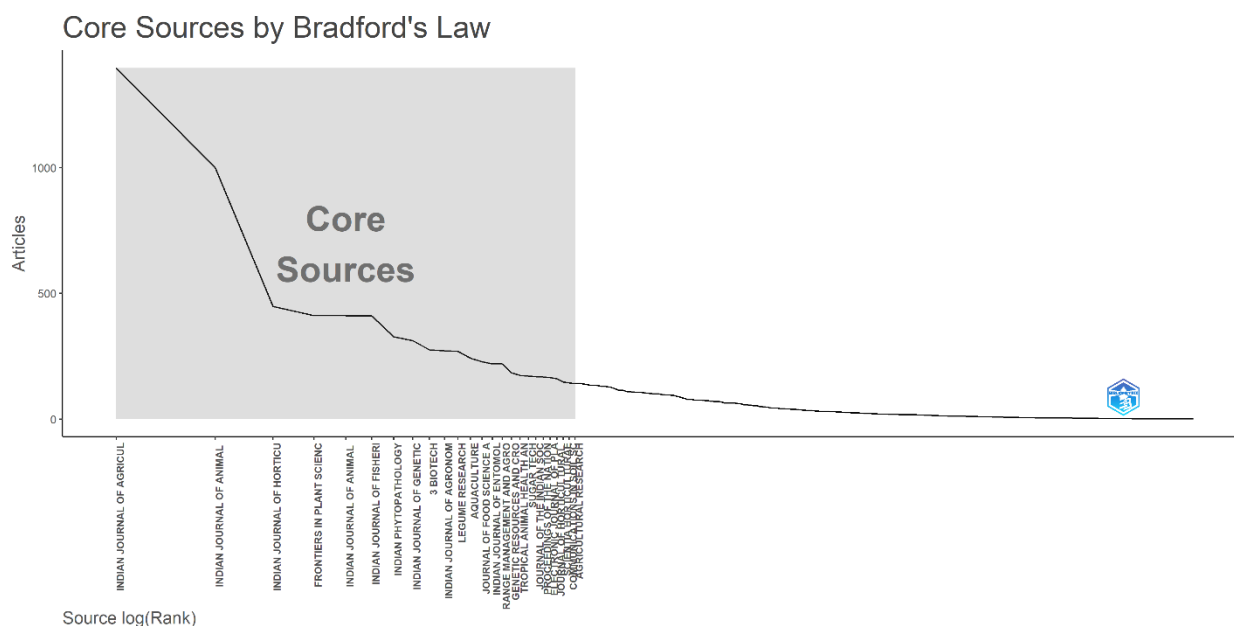


Fig 3: Core Sources by Bradford's Law

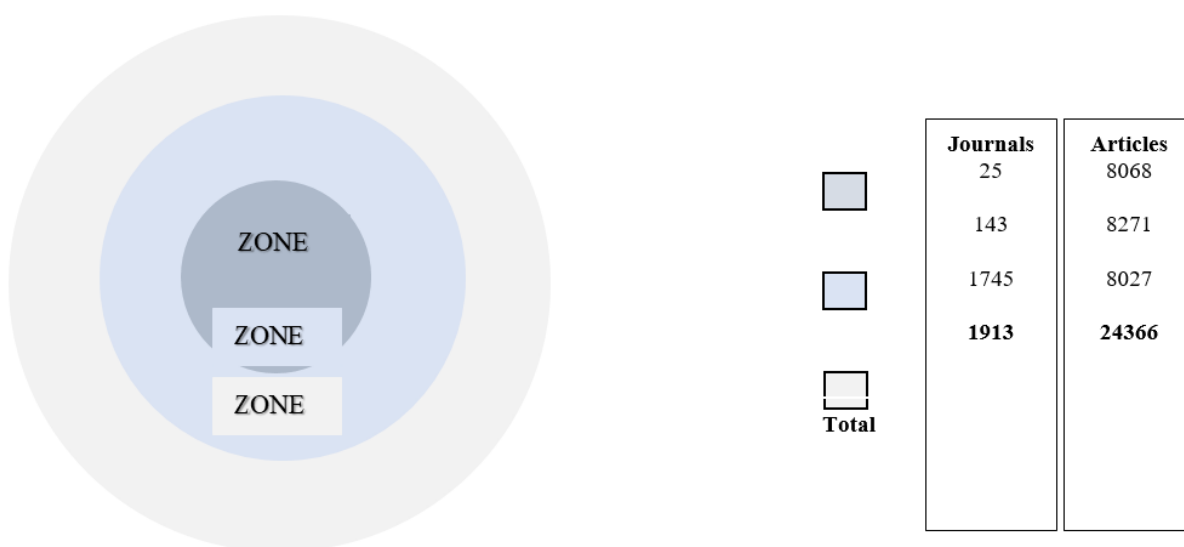


Fig 4: Implementation and Assessment of Bradford's Law

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Figure 3 & 4 state the integration of Bradford’s Law in this study divides the 24,366 articles across 1,913 journals into three productivity zones. Zone 1, comprising only 25 core journals, accounts for 8,068 articles—a clear demonstration of a few sources contributing the most. Zone 2 includes 143 journals (8,271 articles), while Zone 3 spans 1,745 journals (8,027 articles). The figure also reveals that the Indian Journal of Agricultural Sciences contributes the highest volume of articles, and the graphical curve confirms Bradford’s model, showing a steep drop-off in productivity after the core sources, highlighting concentration and dispersion in scholarly publishing.

### 6.4 Word Cloud of Trendy Topics

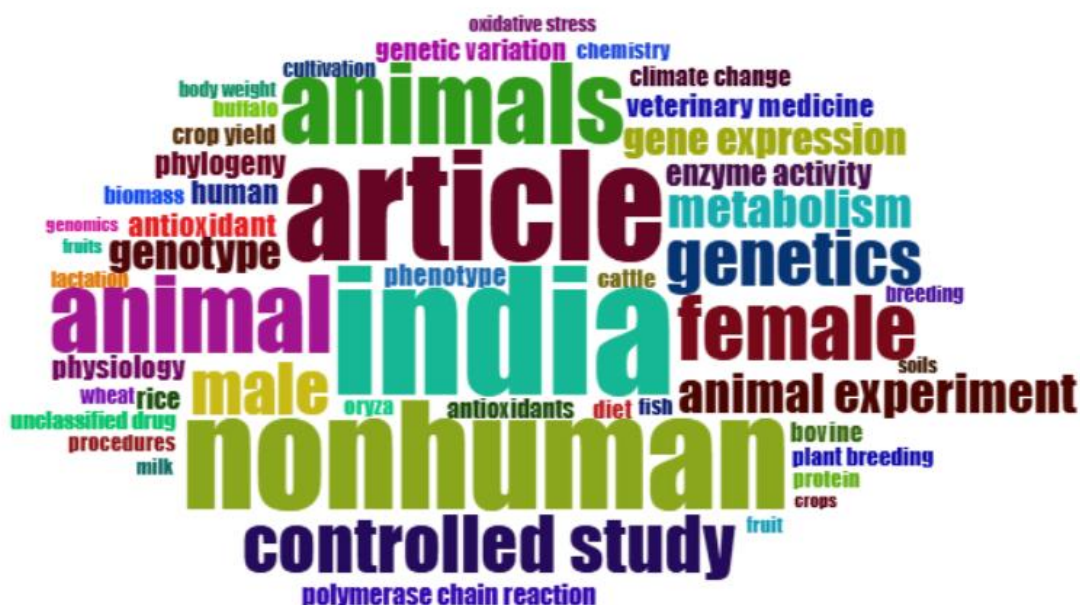


Fig 5: Word Cloud of Trendy Topics

Figure 5 provides insights into the word cloud via biblioshiny, highlighting the dominant research themes in ICAR publications over the past decade. Prominent terms like “article,” “India,” “nonhuman,” “animal,” “controlled study,” and “genetics” suggest a strong focus on animal-based research, experimental studies, and genetic science. Keywords such as “gene expression,” “metabolism,” “veterinary medicine,” and “plant breeding” reflect interdisciplinary interests spanning biotechnology, physiology, and crop science. The presence of terms like “climate change” and “antioxidant” points toward emerging concerns in environmental and health-related agricultural research.

### 6.5 Most Prominent Publishers of Domain

Table 4: Most Prolific Publishers of Domain

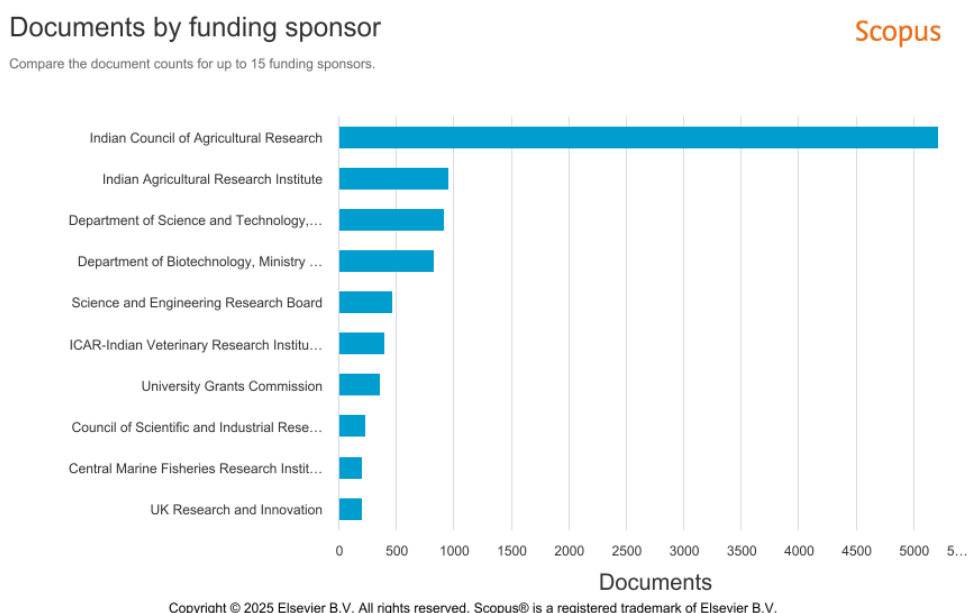
Rank	Publishers	Documents (n=24366)	% Share of Total Documents
1	Indian Council of Agricultural Research	2746	11.26
2	Elsevier B.V.	1702	6.98

3	Springer	1574	6.45
4	Springer Nature	985	4.04
5	Springer Science and Business Media Deutschland GmbH	850	3.48
6	Taylor and Francis Ltd.	841	3.45
7	Agricultural Research Communication Centre	802	3.29
8	Springer Singapore	718	2.94
9	Elsevier Ltd	681	2.79
10	John Wiley and Sons Inc	640	2.62

Table 4 reflects the analysis of publisher-wise distribution of publications, revealing that the Indian Council of Agricultural Research (ICAR) itself is the leading publisher, contributing 11.26% of the total publications, underscoring its central role in disseminating institutional research. International publishers such as Elsevier B.V. (6.98%) and Springer (6.45%) follow closely, indicating a strong presence of ICAR research in globally recognized academic outlets.

Further analysis shows diversification across various imprints of major publishers like Springer Nature, Springer Singapore, and Springer Science and Business Media, collectively contributing a significant share. Other global players like Taylor & Francis and Wiley also feature prominently, demonstrating that ICAR scholars are increasingly targeting high-visibility platforms to enhance research outreach and global academic engagement.

### 6.6 Top Funding Agency of the Decade



**Fig 6:** Most Prominent Funding Agency of the Decade

Figure 6 highlights the Indian Council of Agricultural Research (ICAR) as the most prolific funding sponsor, supporting nearly 5,000 publications, which significantly outpaces all other agencies. The Indian Agricultural Research Institute (IARI) ranks second, which plays a dual role as both a research institution and a major funder within the ICAR system. The figure also shows some other key national sponsors, i.e., Department of Science &

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Technology, Department of Biotechnology, and Science and Engineering Research Board, which these rich organizations promoting India's agricultural research ecosystem. Apart from the above organizations, some other organizations, such as UGC and CSIR, also contribute their support to fund agricultural and allied sciences research.

### **6.7 Highly Cited Documents during a Decade**

**Table 5:** Highly Cited Documents during 2015-2024

<b>Document</b>	<b>DOI</b>	<b>Year</b>	<b>Local Citations</b>	<b>Global Citations</b>	<b>LC/GC Ratio (%)</b>
PARIHAR CM, 2016, SOIL TILLAGE RES	10.1016/j.still.2016.04.001	2016	64	169	37.87
BHATTACHARYYA R, 2015, EUR J AGRON	10.1016/j.eja.2015.06.006	2015	52	117	44.44
JAT HS, 2018, ARCH AGRON SOIL SCI	10.1080/03650340.2017.1359415	2018	51	201	25.37
CHOUDHARY M, 2018, GEODERMA	10.1016/j.geoderma.2017.10.041	2018	51	151	33.77
BHATT R, 2016, INT SOIL WATER CONSERV RES	10.1016/j.iswcr.2015.12.001	2016	51	254	20.08
KUMAR V, 2018, AGRIC ECOSYST ENVIRON	10.1016/j.agee.2017.10.006	2018	43	170	25.29
GUPTA DK, 2016, AGRIC ECOSYST ENVIRON	10.1016/j.agee.2016.05.023	2016	43	155	27.74
PARIHAR CM, 2016, FIELD CROPS RES	10.1016/j.fcr.2016.03.013	2016	41	131	31.30
DAS TK, 2018, FIELD CROPS RES	10.1016/j.fcr.2017.10.021	2018	38	93	40.86
SINGH VK, 2016, SOIL TILLAGE RES	10.1016/j.still.2015.08.001	2016	38	145	26.21

Table 5 examines highly cited documents at research institutions affiliated with ICAR over the last ten years, demonstrating significant engagement in areas such as soil management, tillage, and agroecological practices. The most locally cited document is Parihar, CM (2016) article in Soil & Tillage Research, which has 64 local citations (LCs) and 169 global citations (GCs), resulting in a LC/GC ratio of 37.87%. The next most cited documents, also particularly influential, are Bhattacharyya, R. (2015), and Jat HS (2018), which correspond with notable research influence on soil conservation and sustainable farming systems and indicate solid relevance locally and globally.

Many of the cited documents are published in high-impact internationally recognized journals such as Geoderma, Field Crops Research, and Agricultural Ecosystems & Environment, notably indicating that ICAR research and capabilities are globally recognized. In general, LCs are moderate relative to GCs, but the LCs/GC ratios of 44.44% (Bhattacharyya, R) and 40.86% (Das, TK) provide meaningful references for national influence. Together, these documents show that ICAR is significantly contributing to climate-smart agriculture, soil health and ecological sustainability issues and responding to both national priorities and global research trends.

### 6.8 Patterns of Authors Contributions

**Table 6:** Authors Productivity and Ranking

No. of Authors	Paper Contributed	Cf	Percent Contribution
Single Author	503	503	2.06
Double Authors	1737	2240	7.12
Triple Authors	2927	5167	12.01
Four Authors	3680	8847	12.01
More Than 4 Authors	15519	24366	63.69

Table 6 reveals a dominant trend of collaborative authorship in ICAR publications. A significant 63.69% of papers involved more than four authors, indicating a strong preference for teamwork and multidisciplinary research. In contrast, single-authored papers account for just 2.06%, highlighting the rarity of solo contributions. The data suggests increasing research complexity and inter-institutional cooperation, with author groups of three and four contributing modest yet steady shares of 12.01% each.

#### 6.8.1 Degree of Collaboration

K. S. Subramanyam (1983) gave a formula for evaluating the level of discipline-specific collaboration to gauge the level of Degree of collaboration of single and multi-authorship articles.

The formula is

$$C = \frac{NM}{NS + NM}$$

Where,

C = Collaboration

NS = No. of Single-Authored Research Papers in the Discipline Published During a Year

NM = Number of Multiple-Authored Research Papers in the Discipline Published During the Same Year

DC = Degree of collaboration in a discipline.

In the present study, the value of DC is

$$C = \frac{23863}{503 + 23863}$$

Therefore, the DC is approximately **0.97**. This indicates a high level of collaboration among authors.

#### 6.8.2 Most Prolific Authors

**Table 7:** Most Prominent Authors among ICAR Institutes

Rank	Authors	Affiliation	Articles	Articles Fractionalized
1	KUMAR S	NDRI	1642	263.43
2	KUMAR A	IARI	1459	225.45
3	KUMAR R	NRCE	1033	167.70
4	SINGH AK	IIRR	793	136.06

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5	KUMAR P	PAU	597	100.76
6	SINGH S	CU	575	98.65
7	KUMAR M	CCSHAU	565	88.45
8	SINGH A	BHU	496	84.61
9	SINGH R	IARI	493	82.40
10	SINGH M	AU	414	76.97

(Abbreviations: National Dairy Research Institute (NDRI), Indian Agricultural Research Institute (IARI), National Research Centre on Equines (NRCE), Indian Institute of Rice Research (IIRR), Punjab Agriculture University (PAU), Chitkara University (CU), Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Banaras Hindu University (BHU), University of Allahabad (AU))

Table 7 highlights the top 10 most prolific authors based on article count and fractionalized contributions. *Kumar S* leads with 1,642 articles (263.43 fractionalized), followed by *Kumar A* and *Kumar R*. Notably, the surnames *Kumar* and *Singh* dominate the list, reflecting common Indian surnames and potential collaboration trends. Fractionalized counts, which account for co-authorship, significantly reduce the total, indicating high levels of collaborative publishing among these authors.

### 6.8.3 Highly Cited Authors

**Table 8:** Highly Cited Authors among ICAR Institutes

Rank	Author	Affiliation	Documents Contributed	Total Citations	Avg Citation Per Article	Total Link Strength
1	Kumar, Manoj	NRCM	261	5378	20.60536398	833
2	Pandiselvam, R.	IARI	135	3598	26.65185185	203
3	Lal, Milan Kumar	NRRI	137	2773	20.24087591	544
4	Dhama, Kuldeep	IVRI	114	2606	22.85964912	179
5	Varshney, Rajeev K.	MU	69	2600	37.68115942	202
6	Meena, Vijay Singh	IARI	78	2493	31.96153846	131
7	Singh, A.K.	IARI	274	2480	9.051094891	551
8	Kothakota, Anjineyulu	NIIST	68	2364	34.76470588	107
9	Jat, M.L.	ADBI	58	2280	39.31034483	209
10	Bhattacharyya, Ranjan	IARI	77	2224	28.88311688	246

(Abbreviations: National Research Centre for Makhana (NRCM), Indian Agricultural Research Institute (IARI), National Rice Research Institute (NRRI), Indian Veterinary Research Institute (IVRI), Murdoch University (MU), National Institute for Interdisciplinary Science and Technology (NIIST), Asian Development Bank Institute (ADBI))

Table 8 highlights the most highly cited authors in ICAR research over the past decade. Manoj Kumar ranks first with 261 documents and 5,378 citations, reflecting his significant productivity and influence, supported by a strong total link strength (833). Pandiselvam R. and Milan Kumar Lal follow, with high average citations per article (26.65 and 20.24, respectively), showing both impactful and sustained scholarly presence. Authors like Rajeev K. Varshney

and M.L. Jat, though having fewer publications, boast exceptionally high average citations per article (37.68 and 39.31), indicating high-quality, widely recognized work. Similarly, Vijay Singh Meena and Kothakota Anjineyulu also reflect strong citation averages and collaborative strength. Overall, the data reveals a mix of high-output researchers and niche-impact scholars contributing significantly to ICAR's global research visibility.

### 6.8.4 Lotka’s Law Implementation and Assessment

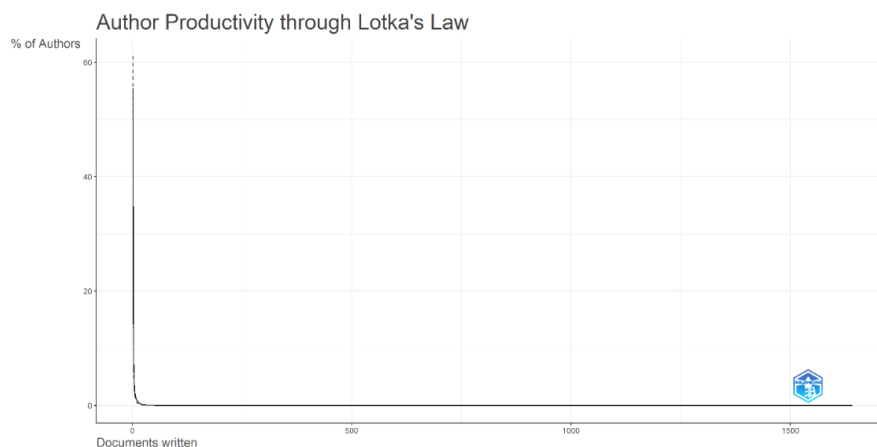


Fig 7: Implementation and Assessment Lotka’s Law

Figure 7 reflects the application of Lotka’s Law, which postulates that a large proportion of authors contribute only one publication, while a smaller group is responsible for a greater number of works. Here, over 55.5% (17,363 authors) contributed just one document, illustrating the classic inverse square law distribution. As the no. of publications increases, the no. of contributing authors declines sharply, validating Lotka’s principle.

This trend signifies that research productivity is highly skewed, with a small fraction of prolific authors producing the majority of scholarly output. For instance, while a handful of authors have authored over 20 papers, the percentage of such contributors is minimal. This emphasizes the importance of a core group of researchers in driving ICAR’s scholarly output over the decade, highlighting both specialization and leadership in agricultural research domains.

### 6.8.5 Authors Keyword

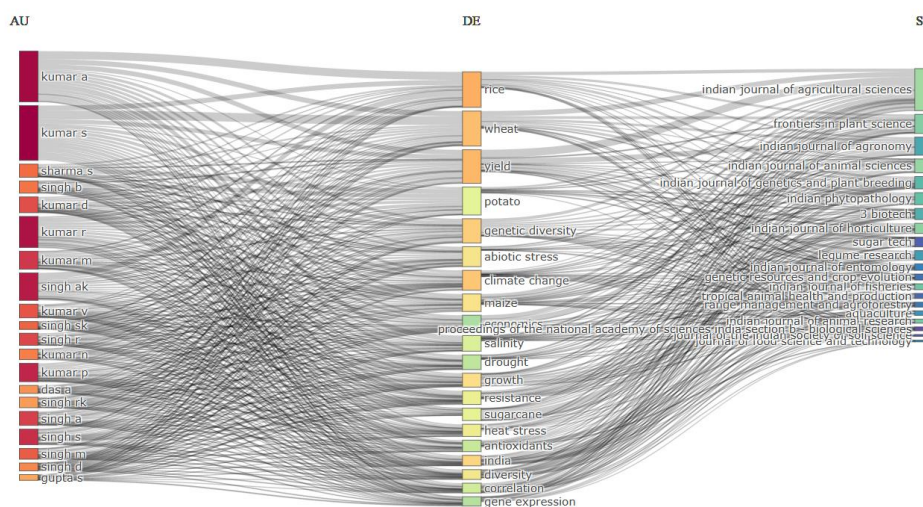


Fig 8: Author's keywords through Sankey Diagram

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Figure 8 Sankey diagram presented via biblioshiny, which shows a three-dimensional view connecting authors (AU), keywords (DE), and journals/sources (SO) in ICAR research. Authors like Kumar A, Kumar S, Sharma S, and Singh B are shown as prolific contributors, with their work spanning diverse themes such as rice, wheat, abiotic stress, genetic diversity, and climate change. These topics reflect priority areas in Indian agricultural research, especially in crop improvement and environmental resilience.

The research outputs are published in widely recognized journals like the Indian Journal of Agricultural Sciences, Frontiers in Plant Science, and 3 Biotech, indicating both national and international dissemination. The visualization effectively shows how specific authors are linked to recurring thematic keywords and preferred publication outlets, emphasizing collaborative and domain-focused publishing patterns. It reflects ICAR's strong engagement in food security, crop productivity, and sustainable agricultural practices.

### 6.8.6 Collaboration Network of Authors

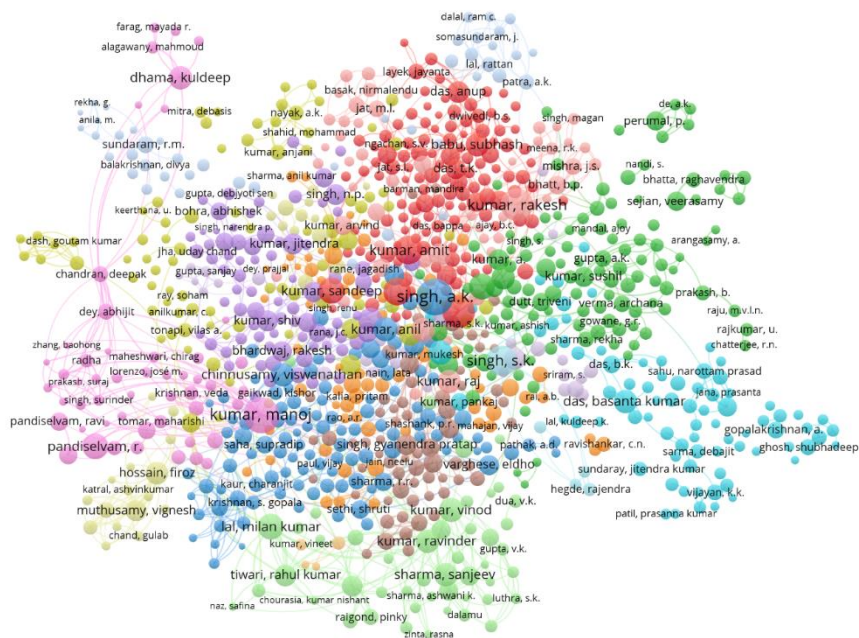
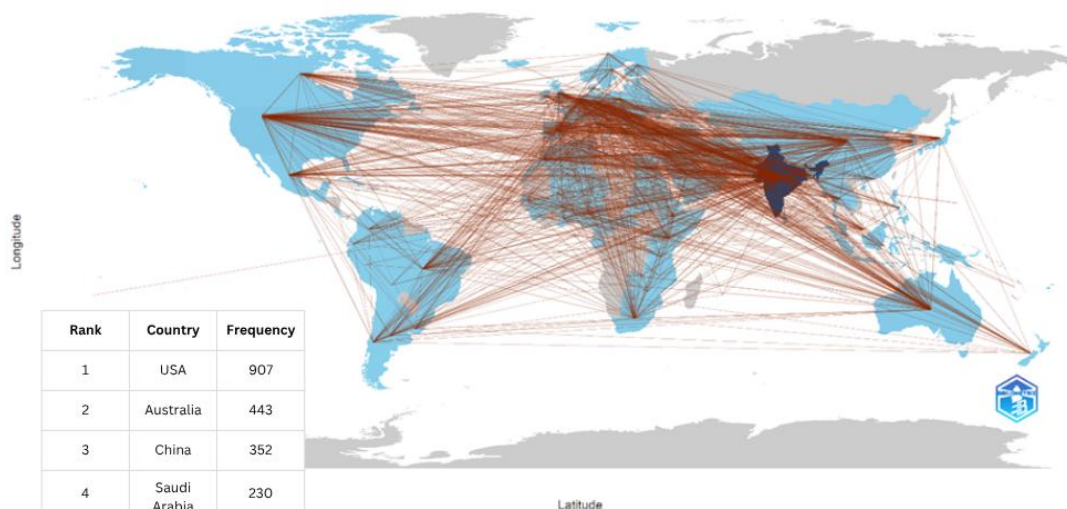


Fig 9: Collaboration Network of Authors

Figure 9 visualizes the authors' collaboration network through VOSviewer network visualization shows densely clustered communities, indicating strong intra-group collaboration among ICAR researchers. Each color-coded cluster represents a group of authors frequently linked by shared research themes. Prominent researchers like Singh A.K., Dhama Kuldeep, Kumar Manoj, and Pandiselvam R. appear central, indicating high connectivity. The color-coded groups suggest disciplinary or institutional collaboration patterns. The network's high density and interconnectedness reflect a robust scholarly ecosystem with well-established co-authorship among Indian agricultural researchers.

## 6.9 International Collaboration Network



**Fig 10:** International Collaboration Map

Figure 10 reflects India's extensive international research collaboration, prominently led by the USA (907 collaborations), followed by Australia (443), China (352), and Saudi Arabia (230). Strong ties are also evident with the UK, Egypt, Germany, and Bangladesh. Collaborations span across continents—Asia, Europe, Africa, and the Americas—indicating India's globally integrated research efforts. Notably, neighboring countries like Pakistan, Nepal, and Bangladesh show active engagement, reflecting regional cooperation. While most collaborations are with developed nations, India also engages with several developing and smaller countries, highlighting its inclusive and diverse global research footprint across 100+ nations.

## DISCUSSION

The major findings of the study highlight that the Indian Council of Agricultural Research (ICAR) has a notable rise in scientific productivity over the last decade, strengthening India's position on the global stage in the agricultural science domain. The significant rise in publication notices during the 2015-2023 which indicates ICAR's emphasis on not only the dissemination of research outputs but also promoting research collaboration and networks within the domain. ICAR-IARI is dominating as a leading contributing institute, which underscores the major role of the flagship ICAR institutions in enhancing agricultural research (Krishnan et al., 2023). The prominent publisher of the domain is the Indian Journal of Agricultural Sciences, demonstrating the effective circulation of research in ICAR's ecosystem. Suresh & Thanuskodi (2019) noted the high collaborations among authors, i.e., ( $C \approx 0.97$ ), whereas Kumar et al. (2020) state that the ICAR Institutes adopted a collective approach to knowledge creation and generation.

Furthermore, ICAR has a strong international collaboration with countries like the USA and Australia, aligning with similar international collaboration noted by Misara et al. (2022) and Raj & Sahoo (2024). This transition towards wider and multidisciplinary research highlights the transformation of research priorities from classical crop yield to cutting-edge topics like food security, smart agriculture practices, and environmental resilience. Overall, this study analyzes not only the scholarly contribution of ICAR institutions over the decade but also highlights the strategic

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plans for allocating the research funds, collaborators, and spreading innovative knowledge of agricultural sciences in India.

### **CONCLUSION**

Agriculture acts as the main livelihood of 2/3<sup>rd</sup> of Indian rural areas and also contributes a big share to the Indian GDP. This decadal bibliometric study evaluates the ICAR institutions scholarly publications during 2015-2014, which remarks a robust and continuous rise in the research pattern in Indian agricultural sciences. The present study notes a remarkable 14.73% annual growth rate with over 24,366 publications across various publication sources. ICAR is the major contributor of scholarly output in agricultural sciences research in India, which has strong collaborative connections within India and over 100 foreign countries, highlighting a high degree of multi-authorship (0.97), which defines collaboration as a key feature in this ecosystem.

IARI secured first position among ICAR institutions, accounting for 46.31% of total publications, which is approximately half of the overall scholarly publications, whereas The Indian Journal of Agricultural Sciences ranked 1 as a prominent source title, which indicates it is a part of the core journals. The lists of most prolific authors and highly cited publications state the globally high dominance of ICAR institutions in the agricultural sector.

Furthermore, the present study reflects that ICAR's strategic transitions from classical research areas to internationally emerging and recognized research areas, which were shown in Figure 5 (Word Cloud of Trendy Topics) that highly emphasize environmental resilience, sustainable farming, metabolism, veterinary medicine, animal sciences, and plant breeding. The ICAR itself has a leading publisher, followed by international publishers like Elsevier and Springer, which also demonstrates that ICAR is a globally recognized academic institution. Whereas, Robust funding grants are supported by ICAR itself, along with DST and DBT, to promote scholarly research momentum in India. The current study also underscores ICAR's important role in tackling issues such as food security in India and addressing sustainability and rural livelihoods through evidence-based agricultural research that has relevance and impact.

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