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Research Paper

A bibliometric analysis of the Journal of Agrometeorology (JAM) from 2008 to 2022

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ABSTRACT

A quantitative analysis of scientific articles published in the Journal of Agrometeorology (JAM) between 2008 and 2022 was conducted using SCOPUS database and a variety of scientometric indicators. Various metrics were utilized to examine aspects including yearly research output, highly referenced sources, author rankings, contributions and profiles, cooperation trends, highly contributing nations, most cited papers, commonly searched keywords and worldwide collaboration mapping. This study employs biblioshiny for analysis and only looks at data that is available in Scopus database. With an h-index (17), a g-index (21) and 3238 total citations across the study period, the journal demonstrated considerable influence. With the greatest number of research publications (n=46) and the greatest number of citations (236), Pandey V stands out among other authors. In terms of the number of papers and citations, India emerged as the leading nation, with the Punjab Agricultural University in the lead with 744 publications. Four clusters were found by co-citation network analysis, with Allen RG being the most quoted author among them. The study also highlighted the fact that Indian authors worked together the most. This analysis is important for assessing the influence of the JAM and offers insightful information about noteworthy research trends and developments in the scientific community.

***Keywords*:** Agrometeorology, SCOPUS, JAM, Bibliometric analysis, Biblioshiny

Participating in research plays a pivotal role in advancing any field and pushing the boundaries of knowledge. Journals serve as crucial instruments for disseminating fresh insights within a specific discipline. Cole and Eales (1917) conducted the earliest known study on bibliometric topics when they conducted a 'Statistical analysis of literature on the history of comparative anatomy. This study served as an early prototype for employing counting techniques in assessing international endeavors. Alan Pritchard (1969) introduced the term 'Bibliometrics,' defining it as 'the use of mathematical and statistical methods for analyzing books and other forms of communication media. Bibliometrics encompasses the analysis of academic publishing, employing statistical methods to illustrate publishing patterns and unveil connections among published works (Ninkova *et al*., 2022). In recent years, bibliometric analysis has become more prevalent in business research (Khan *et al*., 2021)**.** It utilizes bibliographic data to depict the expansion of knowledge, international collaborations, and the leading nations, institutions, and authors (Kastrin *et al*., 2021). Researchers employ bibliometric analysis for a number of purposes, including examining the intellectual framework of a particular field in the body of existing literature and identifying new trends in article and journal performance, collaboration patterns, and research elements. (Verma and Gustafsson, 2020). Furthermore, it sheds light on how knowledge is organized and communicated, while also delineating publication trends within a specific domain of scientific literature (Rizzi *et al*., 2014). A bibliometric analysis is of immense value for identifying, quantifying, and comparing the impact of research within a specific field. Such studies are instrumental in identifying research trends, authorship patterns, and collaborative initiatives (Parmar and Siwatch, 2016). They also serve as instruments for assessing the influence of scientific journals, evaluating metrics such as citation counts and the h-index of their authors. This data

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aids in the assessment of journal quality and impact, facilitating well-informed decisions regarding publication choices and journal subscriptions.

The Journal of Agrometeorology, published by the Association of Agrometeorologists in Anand, Gujarat, India, is a quarterly publication available both in print (ISSN 0972-1665) and online (ISSN 2583-2980). Previously a biannual publication, it was released in June and December from 1999 to 2016. However, it transitioned to a quarterly format, with issues released in March, June, September and December. The journal features a wide range of content, including original articles, full-length papers, short communications and review articles. Additionally, it accepts invited papers, all of which are exclusively in English. All research contributions undergo a rigorous peer review process and are approved by the Editorial Board before publication. The Association also periodically releases special issues of the journal, which encompass select papers presented during seminar symposia organized by the Association.

An analysis carried out by Bakthavachalam (2017) on the performance of Indian journals in 2016 revealed that the Journal of Agrometeorology was among the top five journals with IF growth of 148.96. Recently, Pandey (2023) evaluated the articles published in the Journal of Agrometeorology during 25 years period (1999–2022). He categorized them into national, international, state wise, centres wise in addition to qualitative analysis and reported that the journal's visibility on a global scale has grown since the online system was implemented, and editing article time has also been reduced. Merely 20% of the articles are accepted for publication. Because the online system allows for higher citations, journals' impact factors have been rising since 2008 and are predicted to keep rising. Since the primary objective of the Journal of Agrometeorology is to serve as a leading platform for the dissemination of cutting-edge research and insights in the interdisciplinary field of agrometeorology. Therefore, there is need to make an assessment of journal quality and impact, facilitating well-informed decisions regarding publication choices and journal subscriptions. Hence, the present study was conducted with following objectives.

(i) Performing a scientometric evaluation of the Journal of Agrometeorology for the period from 2008 to 2022,

(ii) Analyzing the yearly growth of publications and the average number of citations,

(iii) Identifying the most influential authors, highly cited authors and tracking their publication trends over time,

(iv) Determining the most significant affiliations, examining scientific output by country and identifying countries with the highest citation impact,

(v) Identifying highly cited global and local documents and conducting reference analysis,

(vi) Evaluating the distribution of scientific productivity using Lotka's law.

(vii) Employing tools such as Word Cloud, Tree Map, Word Dynamics and Trend Topics to analyze author keywords and their evolving trends.

MATERIALS AND METHODS

This bibliometric investigation centers on the analysis of the "**Journal of Agrometeorology**" and aims to explore the patterns of research article publications within this journal. To accomplish our research goals, data were collected from the widely recognized and extensive repository of peer-reviewed scientific literature, the Scopus database. The data retrieval process took place for three months from September to November 2023, and the identification of JAM was performed using a source search with the ISSN number: 2583-2980. This search yielded a total of 1082 documents published between 2008 and 2022. The comprehensive bibliographic information was extracted from the Scopus database in the form of a comma-separated values file format, commonly known as a delimited text file (.csv). Initially, the R package bibliometrix (Version Rx 64 4.0.3, released on 12-06-2020) was installed and launched in R-studio. The following command was executed in the console window: 'install packages ("bibliometrix")' to install the stable version of bibliometrix from CRAN. Subsequently, the biblioshiny app was initiated by typing 'biblioshiny' in the R console. The biblioshiny, which is the shiny app for bibliometrix from the R Statistical Package, was utilized for the current bibliometric analysis. The app can be accessed at https://bibliometrix.org/Biblioshiny.html. Descriptive statistics, including percentages, averages, and frequencies, were employed for data analysis, and the results were visually presented through tables, figures and charts for improved clarity. It should be noted that this study's scope is limited to documents indexed in the Scopus database and any materials not covered by Scopus were excluded from the analysis.

RESULTS AND DISCUSSION

Table 1 provides a concise overview of the publications featured in the journal. Since 1999, the journal has continuously been indexed in the Scopus database. Over the span of 15 years, from 2008 to 2022, a total of 1082 documents have been included in the Scopus database, accumulating a combined total of 3235 citations, equating to an average of 2.993 citations per document. These documents were written by 2106 individuals, showcasing an average of 2.92 co-authors per document and 3.92% of international co-authorship. The journal's annual growth rate percentage stands at -4.13, while the average age of the documents is 7.82 years. The published papers in the JAM comprise a cumulative total of 1799 author's keywords, including 131 unique keywords.

Types of documents

The range of documents showcased in the journal is demonstrated in Table 2. Predominantly, research articles make up the primary document type, followed by reviews, editorial documents, notes, and conference papers. Out of 1454 documents, 1384 were research articles, 48 were review articles, 14 were editorial documents, 6 were notes and only 2 documents were identified as conference papers.

Table 1: Overview of the JAM publications. (2008-2022)

Description	Results
Timespan	2008:2022
Sources (Journals, Books, *etc.*)	1
Documents	1082
Annual growth rate %	-4.13
Document average age	7.82
Average citations per doc	2.993
References	11784
Keywords plus (ID)	131
Author's keywords (DE)	1799
Authors	2106
Authors of single-authored docs	39
Single-authored docs	53
Co-authors per doc	3.92
International co-authorships %	1.664

Table 2: Varieties of documents published in JAM (2008-2022**)**

Document types	
Research article	924
Review article	1
Editorial document	15
Notes	142
Total	1454

Annual scientific production

The annual scientific output refers to the amount of scientific literature produced by a team of researchers, an institution, or a nation during a specific year, as depicted in Fig. 1 (Musbahi *et al*., 2022). Over the past 15 years, Scopus has recorded 1082 articles from this journal. There is a significant fluctuation in the number of articles published over the years, with a notable peak in 2008 and 2017.The number of articles shows a general decrease from 2008 to 2013, with a sudden increase in 2014, followed by a relatively consistent upward trend until 2017.There appears to be a substantial drop in the number of articles published between

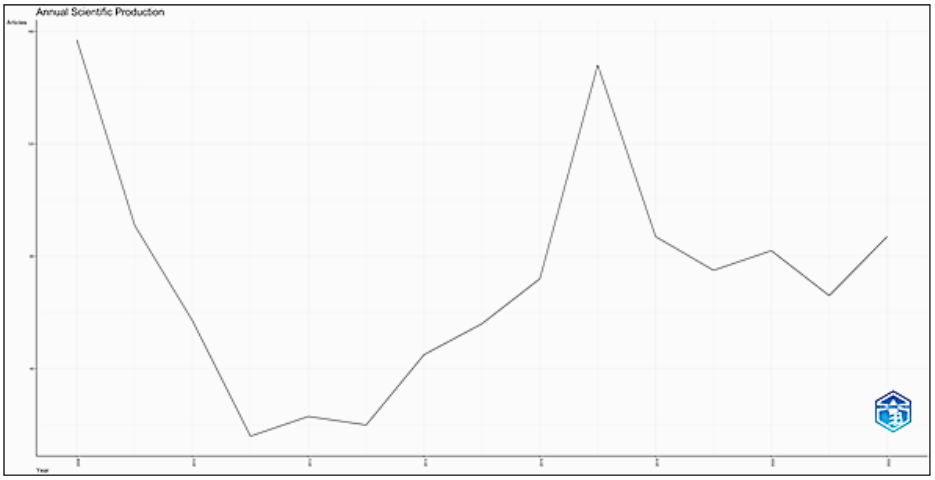

Fig. 1: Annual scientific production of JAM (2008-2022)

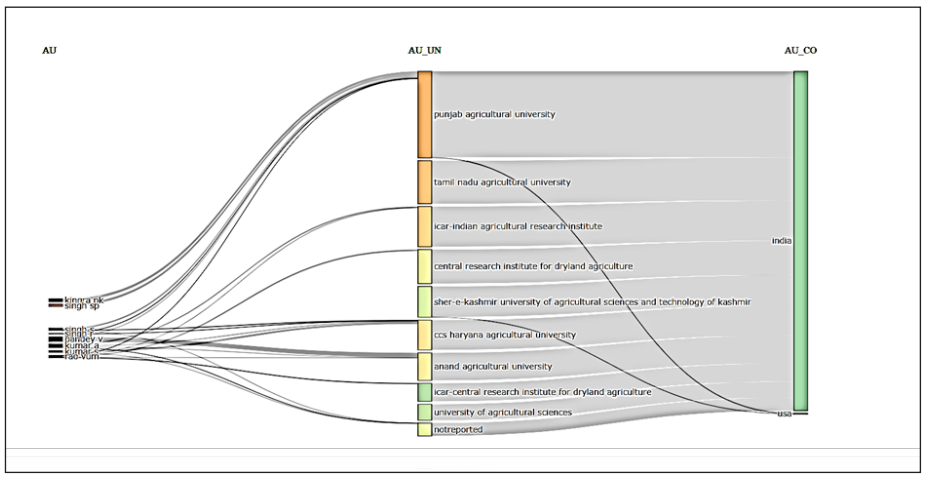

Fig. 2: Three field plots

Table 3: Average citations per year

Year	No. of. Articles	Mean total citations per article	Mean total citations per year	Citable years
2008	157	1.82	0.11	16
2009	91	1.79	0.12	15
2010	57	4.05	0.29	14
2011	16	4.56	0.35	13
2012	23	3.7	0.31	12
2013	20	4.9	0.45	11
2014	45	7.51	0.75	10
2015	56	5.52	0.61	9
2016	72	4.89	0.61	8
2017	148	3.09	0.44	7
2018	87	3.14	0.52	6
2019	75	2.91	0.58	5
2020	82	1.88	0.47	4
2021	66	1.91	0.64	3
2022	87	0.86	0.43	2

Table 4: Local impact factor of JAM

Element	
No. of papers	1082
Total citations	3238
h_index	17
g_index	21
m_index	1.06

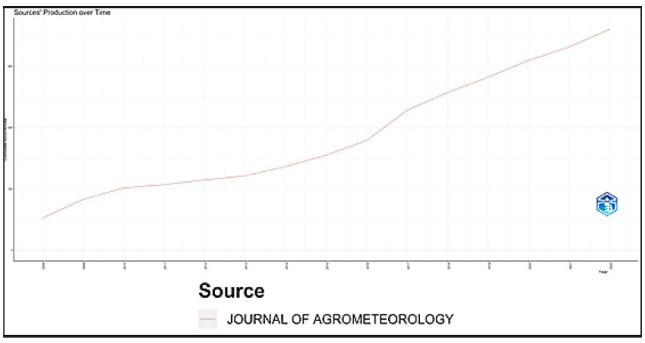

Fig. 3: Sources production over time (2008-2022)

2010 and 2011, followed by a gradual increase in the subsequent years. Further analysis could reveal potential factors contributing to these fluctuations, such as shifts in research interests, changes in the editorial process, or alterations in the journal's focus or policies.

Citations

The average total citations per article exhibit variations over the years (Table 3). The peak means total citations per article, at 7.51, was observed in 2014, signifying a substantial impact of the published work. Subsequently, there is a general decline in the mean total citations per article, reaching its lowest point of 0.86 in 2022. While the mean total citations per year fluctuate, there is an overarching downward trend that commenced in 2014 (0.75 citations per year) and reached its lowest point of 0.11 citations per year in 2008. This decline suggests a potential reduction in the overall influence and impact of the journal's publications over time. Citable years represent the duration for which articles remain eligible for citation. The data indicates a decreasing trend in citable years, commencing at 16 years in 2008 and decreasing to 2 years in 2022. This decline may indicate a decrease in the relevance or impact of the journal's earlier publications over time**.**

Three field plots

Fig. 2 demonstrates the interconnectedness between authors, their countries, and affiliations. The left plot visualizes the authors' institutions (AU), the middle plot showcases their names (AU_UN), and the right plot presents the authors' countries (AU_CO). According to this three-field plot, it is evident that the most prolific authors are associated with the Punjab Agricultural University. Following closely is the Tamil Nadu Agricultural University.

Local impact sources

According to the data in Table 4 of the Journal of Agrometeorology, it is revealed that the h-index of the journal stands at 17, denoting the influence of the published research, with 17 papers having garnered at least 17 citations. The g-index for the journal is 21, indicating that the top 21 articles collectively obtained 3238 citations (21 squared). The journal's m index is 1.06, implying that there are at least 2 articles that have been cited more than 2 times 2m (4 times). In total, the journal has amassed 3238 citations, highlighting its overarching influence and significance in the academic domain. These metrics span a period of 15 years, from 2008 to 2022, reflecting the journal's impact and citation performance throughout this duration.

Sources production over time

Fig. 3 illustrates a continual and gradual rise in the quantity of articles released annually in JAM from 2008 to 2022. This upward pattern implies a growing fascination with the realm of agrometeorology research, as well as an escalating volume of scholarly contributions in this domain. The steady increase in the cumulative article count demonstrates the journal's persistent productivity and likely mirrors an expanding pool of knowledge, advancements in the field, and a mounting number of researchers contributing to the journal. The trend indicates that the Journal of Agrometeorology Research has undergone substantial growth and has emerged as a crucial platform for sharing research discoveries and progress in the realm of agrometeorology research.

Most productive authors in JAM

Table 5 depict the leading ten authors with the highest number of published articles in JAM, alongside the fractionalized representation of the articles. Notably, Pandey has contributed 46 articles, representing 13.68% of the total articles. Similarly, Singh SP has contributed 42 articles, accounting for 9.94% of the total articles.

Table 5: Most productive authors in JAM

Authors	Articles	Articles Fractionalized
Pandey V	46	13.68
Kumar A	42	9.94
Singh S	42	12.79
Kumar S	34	11.60
Rao V U M	27	4.98
Kingra P K	26	9.12
Singh D	25	6.95
Singh R	25	6.78
Singh K K	23	4.28
Singh S P	23	6.09

Author's production over time

Fig. 4 demonstrates the productivity of the top ten authors, examining the quantity of publications and total yearly citations during a defined period. It showcases the highest article output in various years, accompanied by the respective citation counts for each article (Gilani *et al*., 2019). The circle sizes in the graph represent the number of articles produced, while the intensity of the circles quantifies the cumulative citations for the author's body of work throughout time.

Lotka's Law

Lotka's principle of scientific productivity was applied to examine the collected dataset, and the results are presented in Table 6. Lotka's law of scattering was applied to ascertain the productivity of authors and to identify the core journals in this particular field, respectively. (Kumar *et al*., 2015). From the years 2008 to 2022, a total of 1406 authors contributed to the publication of various articles. The corresponding depiction in Fig. 5 illustrates Lotka's Law, which evaluates the distribution of scientific productivity. According to Lotka's Law, it is apparent that around 0.668% of the authors (1746 authors) have one publication, while roughly 0.168% of the authors (354 authors) have two publications.

Top 10 most prolific authors

A higher H-Index signifies a larger number of extensively cited papers. Presently, Pandey V holds the highest H-Index of 8 and also by Singh KK with an H-Index of 8. The G-Index assesses an author's citation impact by examining how citations are dispersed across their publications. Pandey V boasts the highest G-Index of 13, while several authors maintain a G-Index of 8. The M-Index, a combination of the H-Index and G-Index, provides an assessment of an author's overall productivity and impact. Das B achieves the highest M-Index at approximately 0.63, closely followed by Yadav MK with an M-Index of 0.6. (refer to Table 7).

Primary affiliations of significance

Fig. 6 illustrates the leading 10 notable affiliations from JAM. Leading the list is the Punjab Agricultural University, with an impressive 191 publications, closely followed by Tamil Nadu Agricultural University, with 71 publications respectively, closely trailed by ICAR – Indian Agricultural Research Institute (61).

Table 6: Frequency distribution of scientific productivity applied by Lotka's Law

Documents written	No. of authors	Proportion of authors (%)
1	1406	0.668
2	354	0.168
3	122	0.058
4	68	0.032
5	33	0.016
6	31	0.015
7	25	0.012
8	12	0.006
9	10	0.005
10	10	0.005
11	2	0.001
12	3	0.001
13	6	0.003
14	6	0.003
15	2	0.001
16	1	0
17	1	0
18	1	0
19	2	0.001
22	1	0
23	2	0.001
25	2	0.001
26	1	0
27	1	0
34	1	0
42	2	0.001
46	1	0

Affiliations production over time

Based on the data provided, Fig. 7 illustrates the number of articles published by various agricultural universities and research institutes over the years. Here are some observations. Anand Agricultural University shows a consistent increase in the number of articles published from 2008 to 2022, indicating a growing research output over time. CCS Haryana Agricultural University demonstrates a gradual increase in publications, with a notable rise from 2017 to 2022, suggesting a significant boost in research activity during these years. Punjab Agricultural University exhibits a substantial and consistent growth in the number of articles published, showing a steep increase particularly from 2016 to 2022. Tamil Nadu Agricultural University had a relatively low publication count until 2016, after which there was a substantial increase, reaching 71 publications in 2022.ICAR-Indian Agricultural Research Institute shows a steady rise in the number of publications from 2017 to 2022, indicating a growing research output in recent years. This data could be used to assess the research productivity and

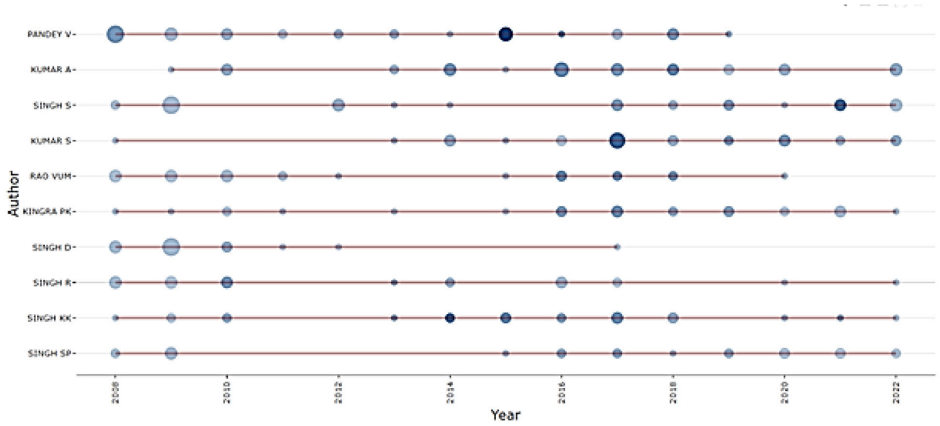

Fig. 4: Top 10 Author's production over time (2008-2022)

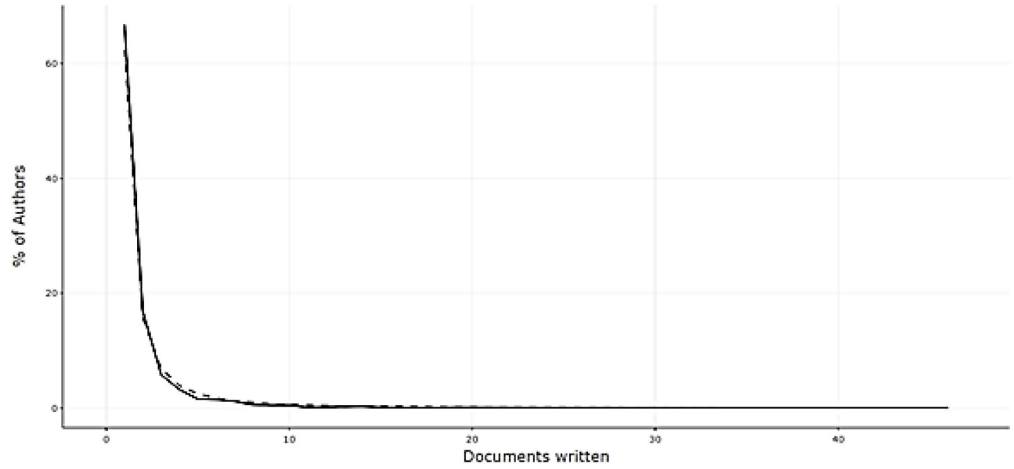

Fig. 5: Author productivity through Lotka's Law

trends within the agricultural domain, as well as the contributions of these institutions to the field.

Prolific of most corresponding author's country

Table 8 provides insights into the research productivity and collaborative tendencies across different countries. With 531 articles, India emerges as the leader in research output. Notably, India also boasts a substantial Single Country Publications (SCP) count of 522. In contrast, China, despite having fewer articles (7) than India, demonstrates a lower SCP and a relatively higher Multi-Country Publications (MCP) ratio, signaling a proclivity for collaborative research on an international scale, since the number of articles are dismally modest a better MCP ratio was noticed. Bangladesh, with 3 articles, exhibits a modest SCP but stands out with a noteworthy MCP ratio, suggesting a considerable level of engagement in global research collaborations. Australia, Ethiopia, Germany, Iran, Iraq and Nigeria while having smaller research outputs, showcase diverse levels of international collaboration, as indicated by their respective MCP ratios.

Country scientific production

Table 9 and Fig. 8 illustrate the distribution of research publications across different regions or countries. India leads with the highest research output, totaling 4039 publications, followed by China with 35 publications. The USA, Bangladesh, and Pakistan also demonstrate significant research activity. In contrast, Ethiopia, Germany, Iran, Iraq, and Nigeria contribute fewer publications, yet their research contributions are noteworthy

Prolific countries production over time

Fig. 9 illustrates the annual count of research articles published by different countries. India consistently shows a high number of research articles across the years, with a notable increase from 2008 (501 articles) to 2022 (4039 articles). China also exhibits consistent growth in research output, with a significant increase from 2008 (3 articles) to 2022 (35 articles). Australia maintains a stable contribution, with 2 articles per year from 2008 to 2019 and a slight increase to 3 articles per year from 2019 onwards. Other countries like Ethiopia, Germany, Switzerland, the USA, Austria, Bangladesh, the United Kingdom, Iraq, Pakistan, Iran, Nigeria, Saudi Arabia, Turkey, and Thailand show diverse patterns in research output, ranging from consistent contributions to fluctuations and some countries, like Ethiopia, show an increasing trend in research output over the years, while others, like the United Kingdom and

Table 7: Top 10 most prolific author's indices

Element	H_Index	G_Index	M_Index	Total Citations	Number of Publications	Per Year Start
Pandey V	8	12	0.5	236	46	2008
Singh KK	8	13	0.5	193	23	2008
Kumar A	7	9	0.467	143	42	2009
Patel HR	7	8	0.438	97	19	2008
Singh RS	7	10	0.467	108	12	2009
Kumar S	6	8	0.375	109	34	2008
Rao VUM	6	8	0.375	95	27	2008
Yadav MK	6	7	0.6	75	7	2014
Das B	5	6	0.625	41	8	2016
Kaur S	5	7	0.357	56	13	2010

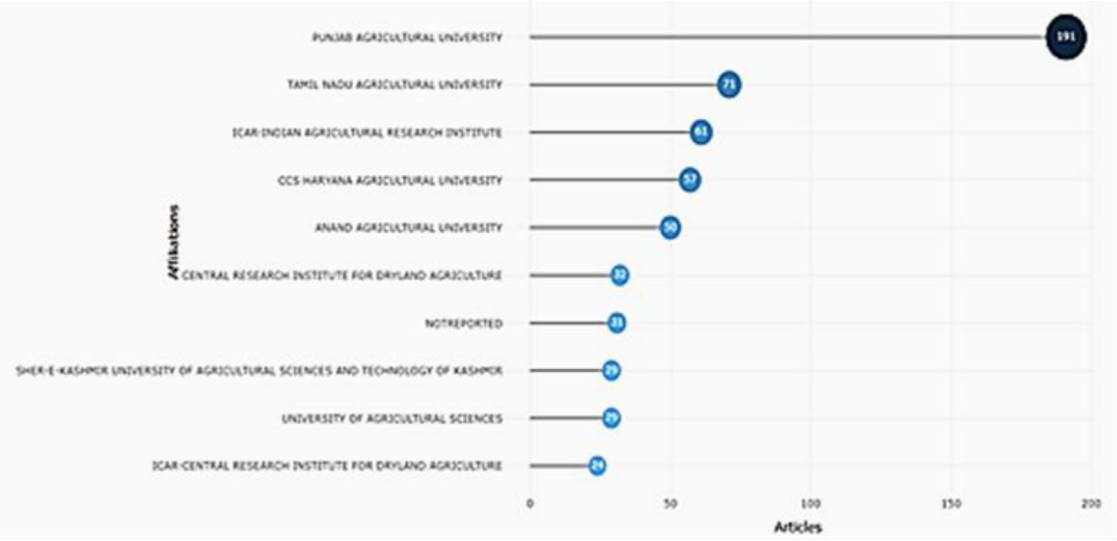

Fig. 6: Top 10 affiliations in JAM

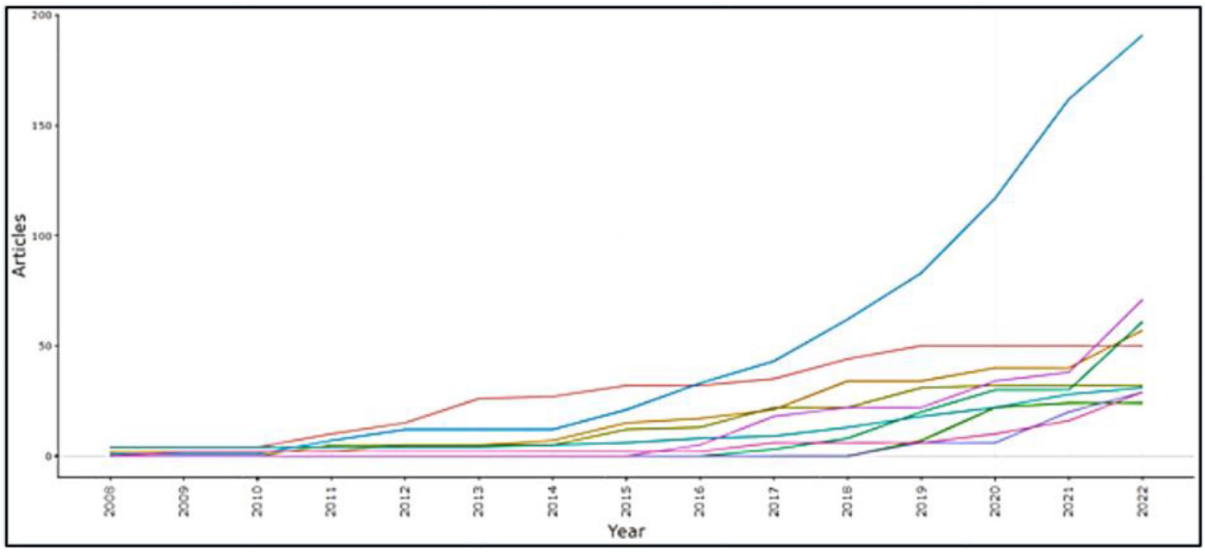

Fig. 7: Top 5 affiliations production over time

Table 8: Frequency (MCP/SCP) of most corresponding author countries

Country	Articles	SCP	MCP	Frequency	MCP ratio
India	531	522	9	0.491	0.017
China	7	6	1	0.006	0.143
Bangladesh	3	3	0	0.003	0
Australia	2	1	1	0.002	0.5
Ethiopia	2	2	0	0.002	0
Germany	2	1	1	0.002	0.5
Iran	2	2	0	0.002	0
Iraq	2	2	0	0.002	0
Nigeria	2	2	0	0.002	0

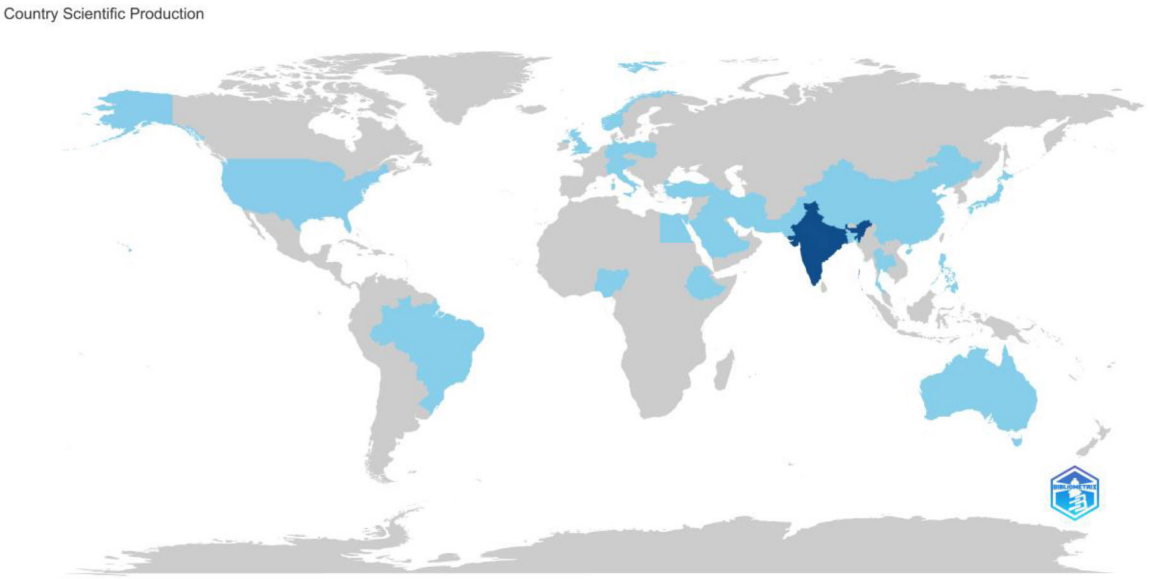

Fig. 8: Country scientific production

Iraq, exhibit a growth in recent years. Collaboration patterns can be inferred by observing the change in the number of multi-country publications (articles involving more than one country) over the years.

Most cited countries and average article citations

Table 10 and Fig. 10 illustrate the nations that have garnered the highest total citations and the average article citations, respectively. From the provided data, we can make several inferences: India has the highest total citations with 1569, indicating a substantial overall impact or recognition of its research articles. Bangladesh has the highest average article citations with 7.70, suggesting that, on average, each of its research articles is cited more frequently compared to other countries in the list. Germany, Egypt, Philippines, Thailand, Ethiopia, Iraq and Switzerland all have an average article citation count, indicating varying degrees of impact for their research publications. China, despite having a relatively lower average article citation (2.60), still contributes significantly with a total of 18 citations. The data suggests a diverse range of research impact across the listed countries, with some nations having a high total citation count, while others have a higher average citation per article. Bangladesh stands out not only in terms of the total number of citations but also in the quality of citations per article, reflecting a potentially impactful research output. Ethiopia, Iraq, and Switzerland have lower total citation counts and average article citations, indicating a medium to low impact of their research publications.

Most global cited documents

Table 11 and Fig. 11 includes research papers with varying degrees of citation impact. The paper by Yadav R in 2014 has a total of 55 citations, with an average of 5.50 citations per year. The normalized total citations for this paper are 7.32. Ghosh K 2014 has 36 total citations, averaging 3.60 citations per year. The normalized total citations for this paper are 4.79. Mehta R 2015 paper has 30 total citations, with an average of 3.33 citations per year. The normalized total citations for this paper are 5.44. Mehta R 2016 paper has 27 total citations, averaging 3.38 citations per year. Boomiraj K 2010 has lower total citations (20), averaging 1.43 citations per year. The normalized total citations for this paper are 4.94.

Most local cited references

In Fig. 12, depicting the top 10 references cited locally, the work "Kendall M.G., rank correlation methods, (1975)" stands out as

Table 9: Country scientific production

Region	Frequencies
India	4039
China	35
USA	19
Bangladesh	14
Pakistan	13
Ethiopia	7
Nigeria	7
Australia	6
Germany	6

Table 10: Most cited countries

Country	No. of citations
India	1569
Bangladesh	23
China	18
Germany	12
Egypt	7
Philippines	5
Thailand	5
Ethiopia	4
Iraq	4
Switzerland	4

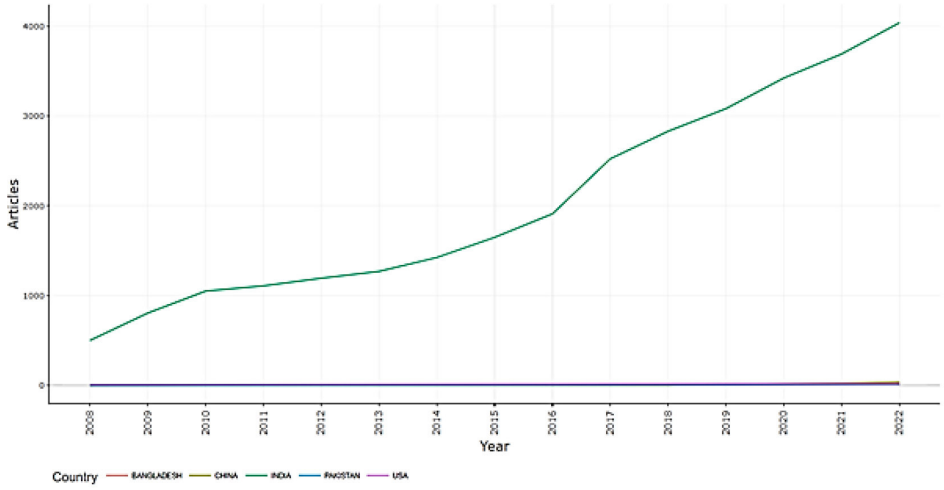

Fig. 9: Top 5 countries production over time (2008-2022)

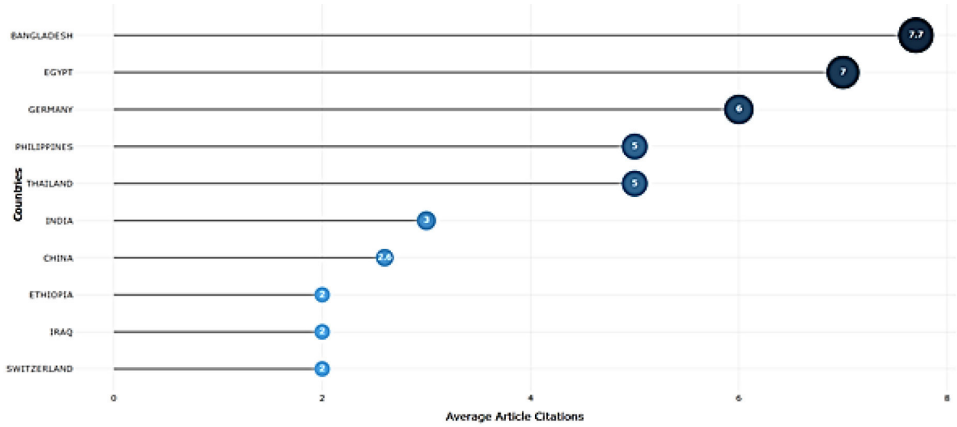

Fig. 10: Most average article citations

the most frequently referenced source, with a total of 15 citations. In close succession, "Gomez K.A., Gomez A.A., Statistical procedures for agricultural research, (1984)" maintains a substantial presence in the field, having been cited 12 times. Furthermore, both "Allen R.G., Pereira L.S., Raes D., Smith M., Crop evapotranspiration: Guidelines for computing crop water requirements, (1998)" and "Bal S.K., Minhas P.S., Atmospheric Stressors: Challenges And Coping Strategies, Abiotic Stress Management For Resilient Agriculture, PP. 9-50, (2017)" as well as "Mann H.B., Nonparametric Tests Against Trend, Econometrica, 13, PP. 245-259, (1945)" have each garnered 7 citations, underscoring their significance and impact within the research community.

Most frequent author's key words

The Word Cloud and Tree map were generated using the 'Biblioshiny App' within the 'Bibliometrix' software. When

Table 11: Top 10 global cited documents

Paper	Total citations	Total citation per year	Normalized total citation
Yadav R, 2014	55	5.50	7.32
Ghosh K, 2014	36	3.60	4.79
Mehta R, 2015	30	3.33	5.44
Mehta R, 2016	27	3.38	5.52
Zacharias M, 2014	22	2.20	2.93
Kesava Rao AVR, 2013	21	1.91	4.29
Dar EA, 2018	20	3.33	6.37
Yadav MK, 2015	20	2.22	3.62
Bhuvaneswari K, 2014	20	2.00	2.66
Boomiraj K, 2010	20	1.43	4.94

configuring the visual parameters, a deliberate decision was made to concentrate on author keywords. Opting for author keywords provides a crucial advantage by illuminating primary subjects and current trends in research. To ensure clarity, a maximum of 50 keywords was employed. The visual representation of the Word Cloud took the shape of a circle. The top 10 author keywords, along with their respective frequencies, are as follows: Climate change (80 times), wheat (65), temperature (49 times), weather parameters (42), rainfall (41), yield (39), rice (37), correlation (29), maize (19) and simulation (18). Fig. 13 and 14 depict the evolution of the most significant terms and words utilized over time, illustrating the research focal points characterized by a noteworthy frequency of keywords within the Journal of Documentation (Javid *et al*., 2019).

Author's key words frequency over time

The provided data in Fig. 15 appears to represent various numerical values associated with different categories over the years

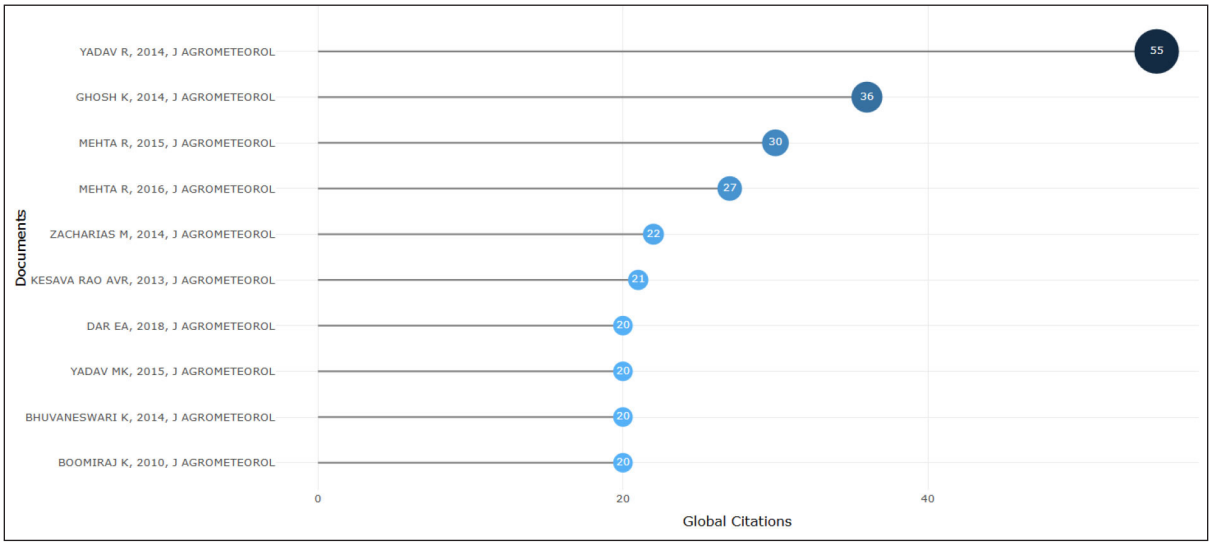

Fig. 11: Top 10 global cited documents

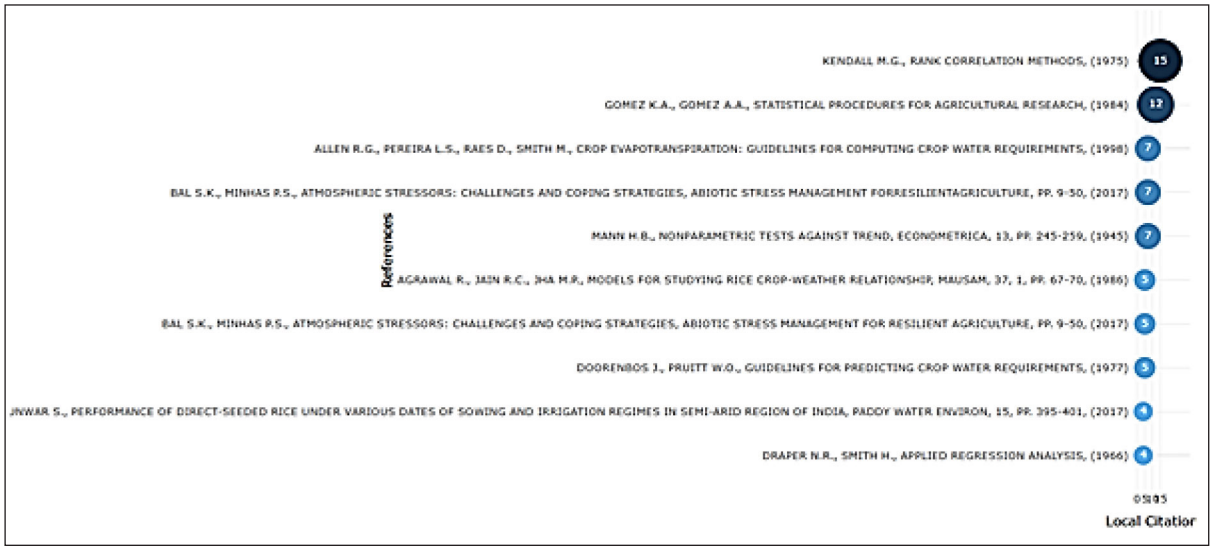

Fig. 12: Top 10 local cited references

from 2008 to 2022. Each row corresponds to a specific year, and each column represents a different variable or parameter. Here's a brief inference based on the data. The values for "climate change" seem to be increasing over the years, indicating a general upward trend in the consideration or impact of climate change. The values for "wheat" show some fluctuations, but there might be an overall increasing trend. The values for "temperature" appear to be on the rise, suggesting a trend of increasing temperatures over the years. The values for "weather parameters" also seem to be increasing, indicating a growing consideration of various weather-related factors. The "rainfall" values show fluctuations, with some years experiencing higher rainfall than others. The "yield" values seem to increase over the years, indicating a potential improvement in agricultural yield. The values for "rice" display variations, and there might be a trend of increase, especially in the later years. The values for "correlation" seem to increase, suggesting a growing interest or consideration of correlations between different variables. The values for "maize" indicate some variability, but there might be an overall increasing trend. The values for "simulation" are present, but it's not immediately clear what these values represent without additional context.

Trend words

Fig. 16 presents a thorough representation of the evolution of topics over time, organized by year. This visual representation provides valuable insights into both the enduring and recent nature of specific topics. Furthermore, the arrangement of topics on the chart corresponds to their frequency in the study, with larger circles representing higher frequency and smaller circles denoting lower frequency

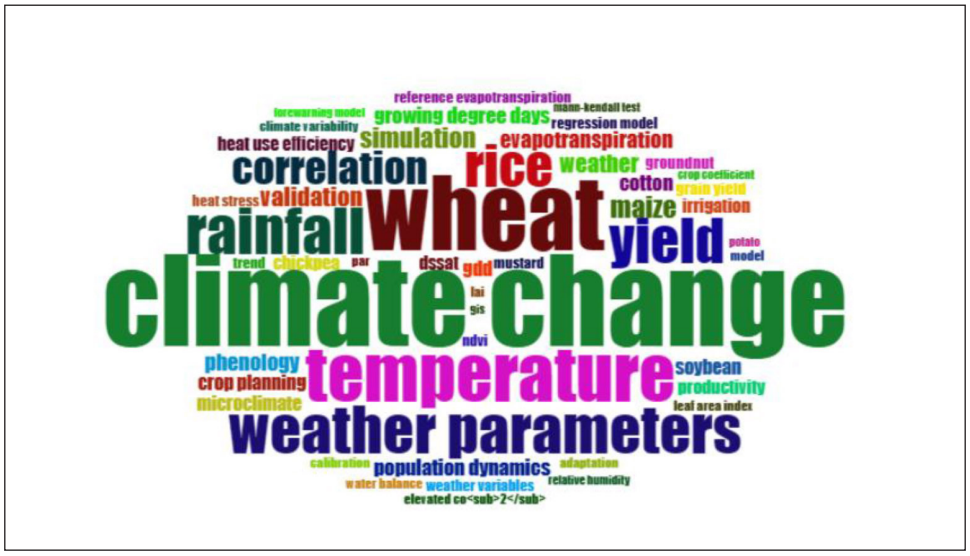

Fig. 13: Word cloud of most frequent author's key words

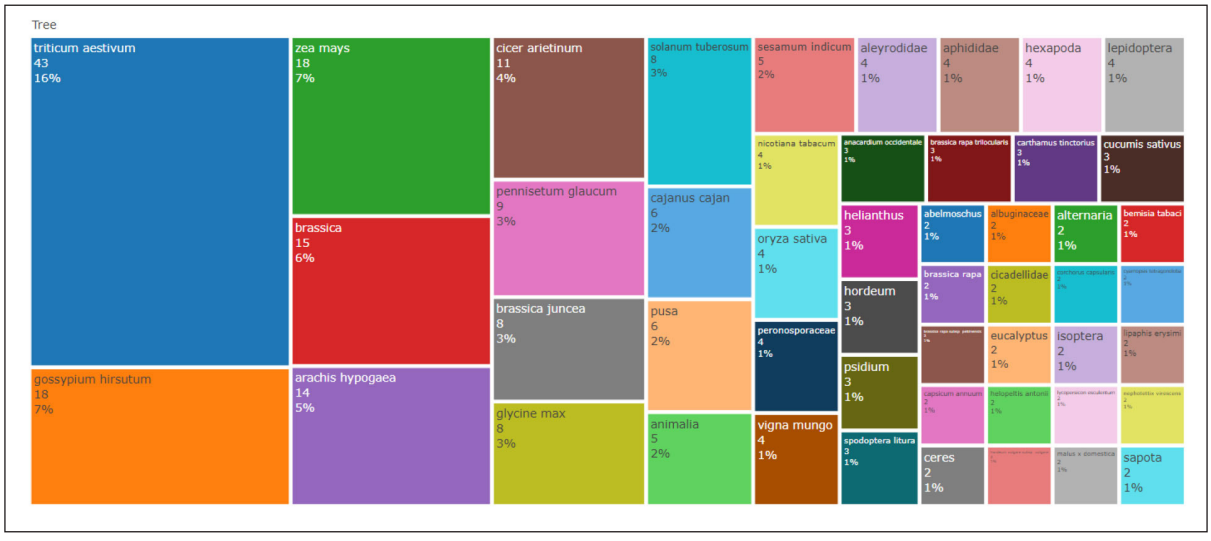

Fig. 14: Tree map of most frequent author's key words

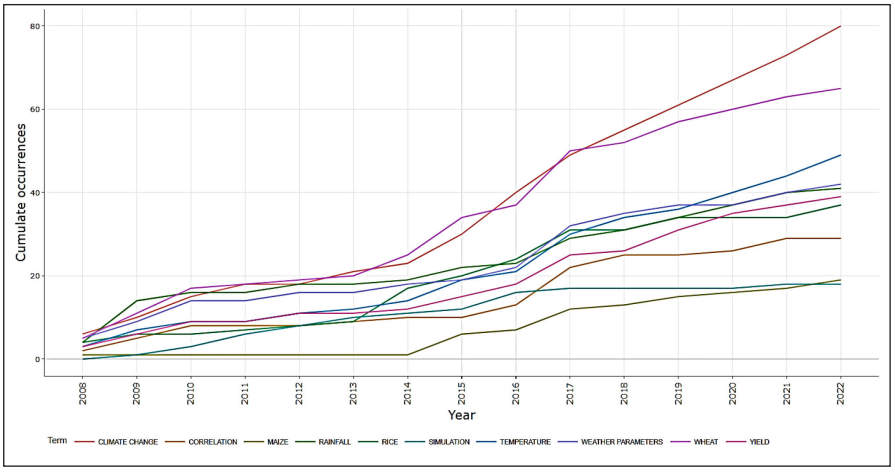

Fig. 15: Author's key words frequency over time (2008-2022)

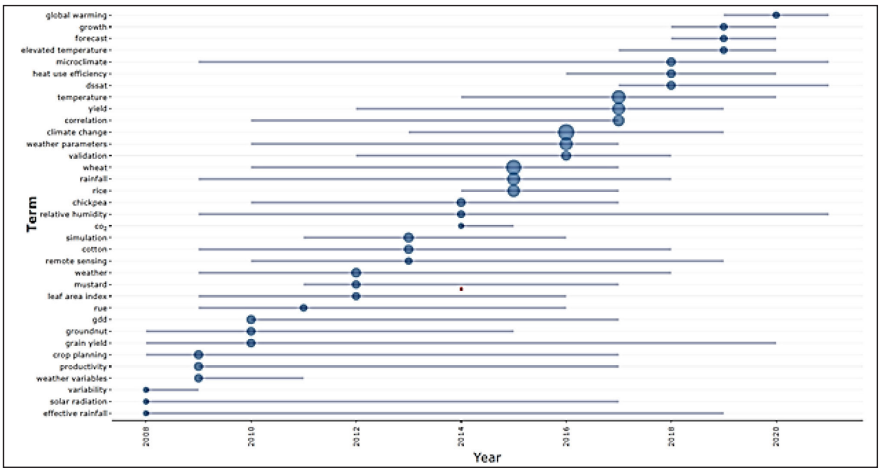

Fig. 16: Trending topics (2008- 2022)

Network of co-occurring author's keywords

The co-occurrence network of keywords serves the purpose of revealing the conceptual structure and knowledge organization within a scientific or technical field by exploring the relationships between keywords identified in academic works. In Fig. 17, the focus is on analytical methods that leverage Keyword Co-occurrence Networks (KCNs) in both theoretical and empirical studies to examine research subjects and their interrelationships within distinct scientific domains. The clustering of keywords indicates a higher likelihood of representing related topics when grouped together. Each cluster encompasses a variable number of subject keywords.

Thematic mapping of JAM

In Fig. 18, a thematic quadrant within the JAM articles is presented, defined by two half-axes. This configuration serves as a visual representation of specific topics and concepts introduced in these articles using "author's keywords" (Zhang *et al*., 2018). The first quadrant characterizes motor themes, the second quadrant highlights well-established themes, the third quadrant signifies emerging and declining themes, and the fourth quadrant encompasses fundamental and cross- cutting themes. The importance of these research themes can be gauged through their centrality, while the evolution of themes is reflected in their density (Cobo *et al*., 2011). In the first cluster, the focal point is the term "Forecast and Weather indices," which holds a significant betweenness centrality of 305.52. This cluster encompasses related terms such as "Crop planning," "rainfall probability," and "Potential yield." Moving on to cluster 2, "Temperature" takes center stage as the most pivotal term, demonstrating a noteworthy betweenness centrality of 2251.10. Additionally, this cluster includes terms like "rainfall," "ndvi," "trend," and "Climate variability," among others. Cluster 3 revolves around the theme of "evapotranspiration," with the term itself possessing a substantial betweenness centrality of 865.40. Other terms within this cluster comprise "reference evapotranspiration," "crop coefficient," "water requirement," and "trends," among others. In cluster 4, "population dynamics" emerges as the central term, with a betweenness centrality of 265.06. This cluster encompasses associated terms such as "microclimate," "okra," and "tomato." Moving to cluster 5, "growing degree days" assumes centrality with a betweenness score of 279.09. The cluster also includes terms like "heat use efficiency," "water use efficiency,"

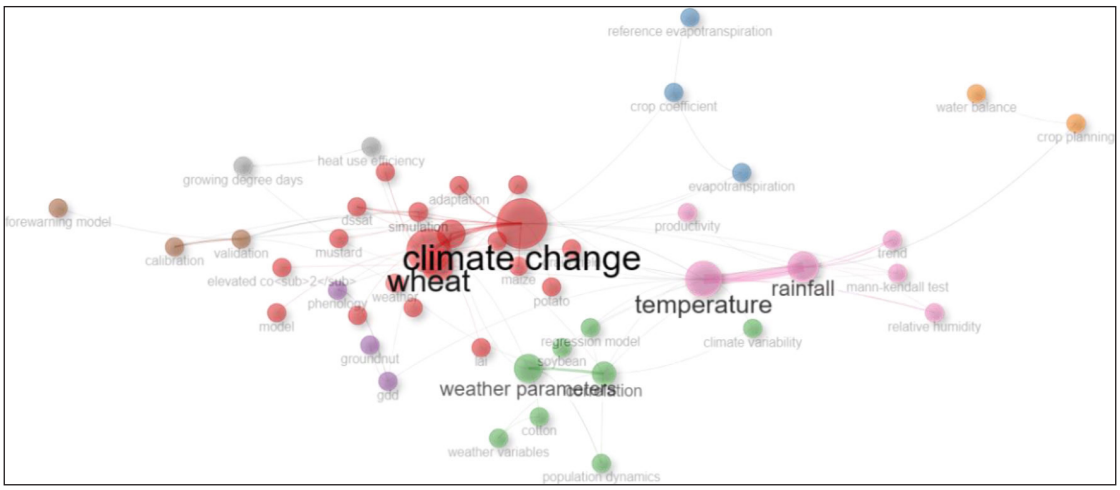

Fig. 17: Co-occurrence network of author's keywords

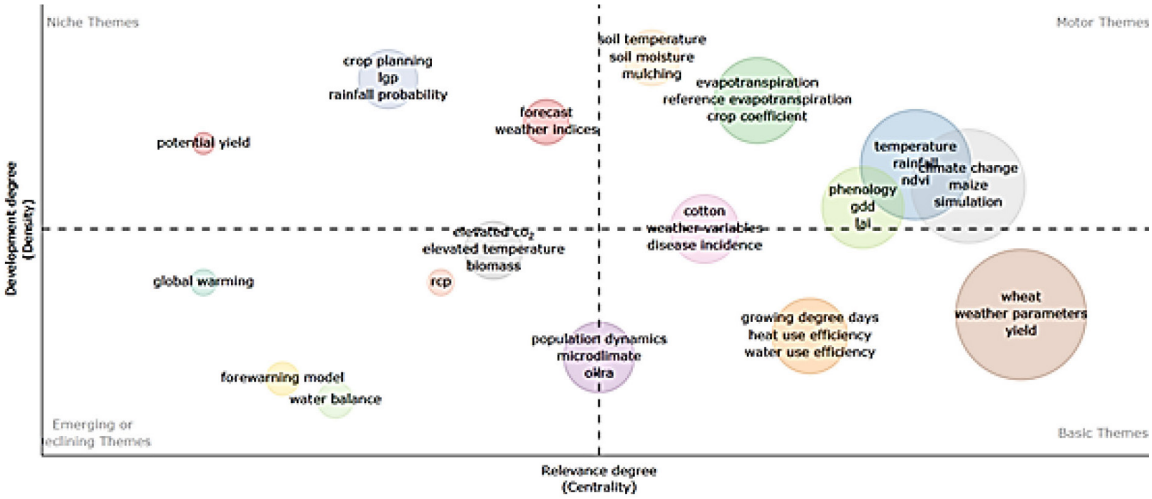

Fig. 18: Thematic map of JAM

"mango," and "sowing dates." Finally, in cluster 6, identified by "wheat" as the central term, it boasts a substantial betweenness centrality of 3082.51. Other terms within this cluster encompass "weather parameters," "yield," "rice," and "correlation".

Two-plot diagram for the evolution of author's keywords over the years

Fig. 19 presents the distribution and diversity of topics related to the evolution of author's keywords in the textile or fabric industry over two distinct periods: 2008-2017 and 2018-2022. In the initial period (2008-2011), the emphasis was predominantly on specific subjects such as evapotranspiration, crop planning, chickpea, wheat, growing degree days, mango, temperature, elevated carbon dioxide, weather parameters, and weather indices. The subsequent period (2012-2022) witnessed research that explored topics including temperature, forecast, PAR, regression, GIS, precipitation, weather parameters, climate change, crop coefficient, elevated temperature, global warming, water use efficiency, microclimate, cucumber, and soil moisture.

Co-citation networks

A co-citation network, also referred to as bibliographic coupling, provides a method for gauging the semantic similarity among documents that share references. Co-citation specifically pertains to the frequency with which multiple documents are cited together by various sources (Aria and Cuccurullo, 2017). The configuration of the co-citation network reveals the authors who are cited most frequently. This network structure comprises clusters, each color-coded to represent a distinct component (Fig. 20). The nodes are organized into different clusters. Nodes in Cluster 1 include prominent figures such as Allen RG, Kingra PK, Singh S, and others. These nodes demonstrate varying levels of betweenness centrality, indicating their influence in connecting different parts of the network. Cluster 2 features nodes like Bal SK, Jalota SK, and Mall RK. Bal SK stands out with the highest betweenness centrality in this cluster. Cluster 3 comprises a diverse set of nodes, including Hundal SS, Aggarwal PK, and Neog P. Nodes like Aggarwal PK and Hundal SS exhibit high betweenness centrality, suggesting their importance in connecting different parts of the network. Cluster 4 has only one node, Mann HB, with a non-zero

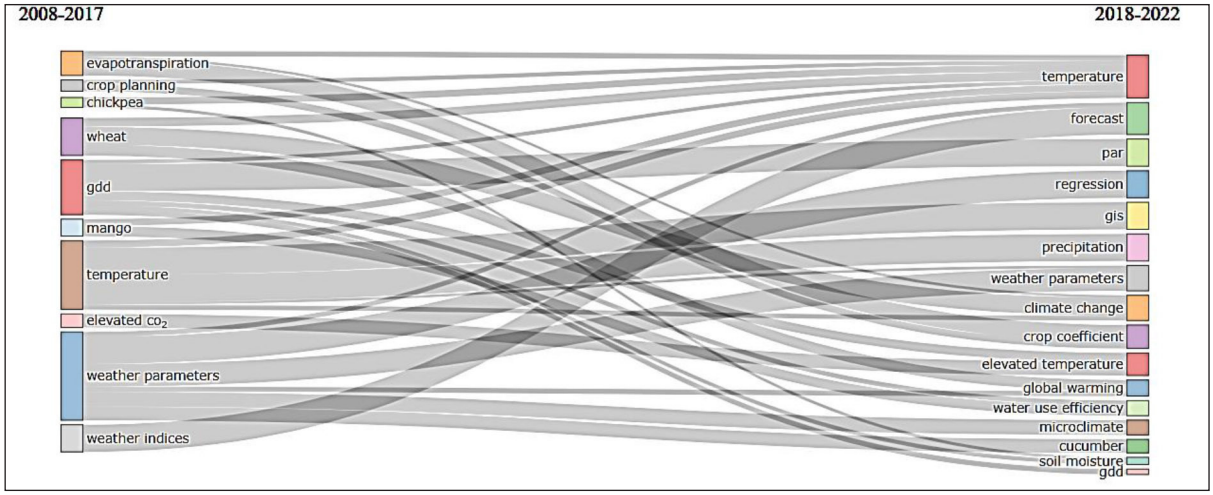

Fig. 19: Two-plot diagram for the evolution of author's keywords

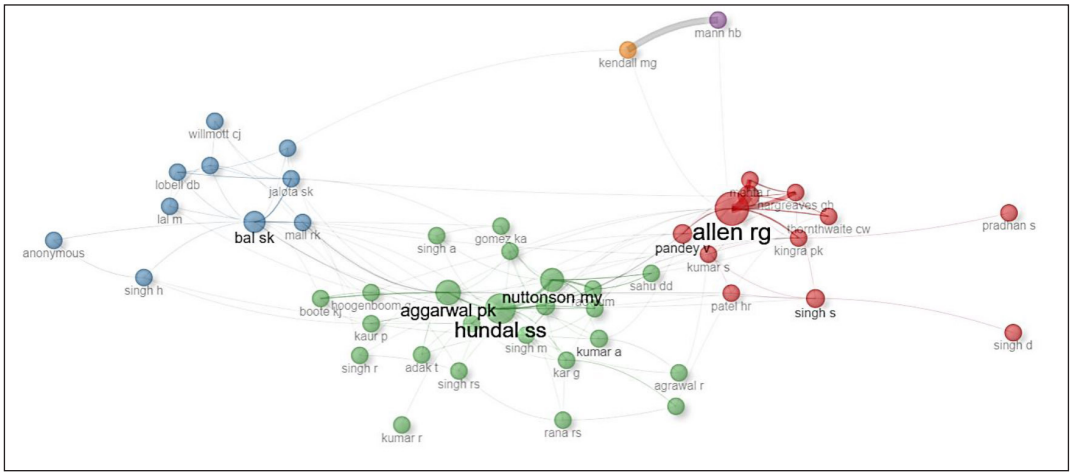

Fig. 20: Co-citation network of author

betweenness centrality. Cluster 5, represented by Kendall MG, also has a significant betweenness centrality. Different metrics, such as closeness centrality and PageRank, provide additional perspectives on the nodes' importance within their respective clusters

Network of collaborating countries

In order to discern countries engaged in active collaboration, Fig. 21 offers a visualization of collaboration networks. This network depicts the interconnectedness of authors through their co-authorships (Gururaj *et al*., 2022). The figure showcases colored circles within each node, indicating the total number of articles. It becomes evident that authors from India demonstrate a notable level of collaboration with other countries (Gupta *et al*., 2022). Collaborating network countries engage in cooperative efforts across various domains to achieve common goals and address shared challenges. This collaborative approach requires diplomatic negotiations, commitment to common values, and the establishment of effective mechanisms for coordination and cooperation.

Network of affiliation collaborations

The network depicted in Fig. 22 features colored nodes, as explained by Gururaj *et al.,* (2022), indicating collaborative interactions among universities and colleagues from various countries. Specifically, the red node signifies collaboration among four institutes: ICAR-Indian Agricultural Research Institute, University of Agricultural Sciences, ICAR-Central Research Institute for Dryland Agriculture, and ICAR-Indian Institute of Soil and Water Conservation. The green color represents collaboration between Punjab Agricultural University, CCS Haryana Agricultural University, Anand Agricultural University, and the Central Research Institute for Dryland Agriculture. Additionally, the violet color indicates collaboration involving the India Meteorological Department and Agricultural Meteorology Division, the blue color involves ICAR-Indian Institute of Soil Science, and the orange color pertains to collaboration within ICAR Research Complex for NEH Region and Mizoram Centre.

Global collaboration map

In Fig. 23, it is evident that a significant portion of collaborations involves authors from one country collaborating

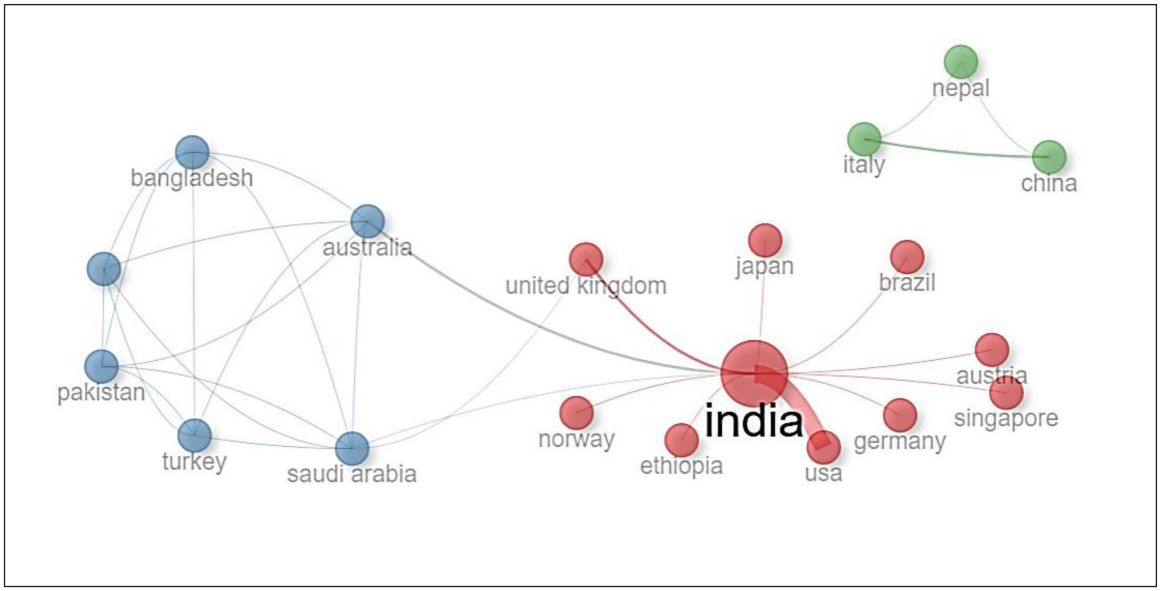

Fig. 21: Collaboration network of countries

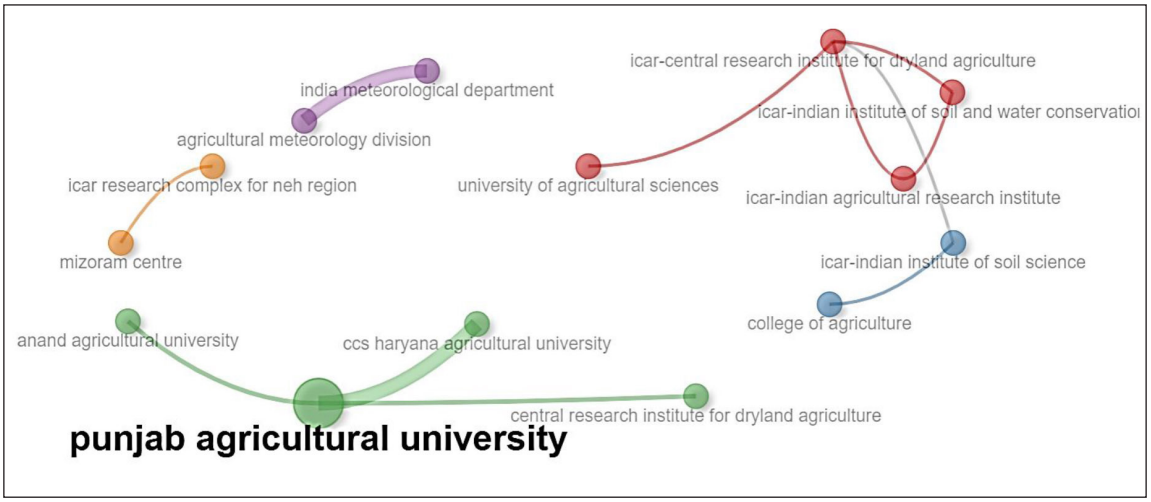

Fig. 22: Collaboration network of affiliation

with those from other nations. India connected with Australia twice, Austria, Brazil, Ethiopia, Germany, Japan, Norway, Saudi Arabia, Singapore, the United Kingdom twice, and the USA five times.

CONCLUSION

In this research, the Journal of Agrometeorology (JAM) was subjected to bibliometric analysis using the R software. A comprehensive dataset comprising 1082 articles from the Scopus database was examined through descriptive and network analyses. The descriptive analysis unveiled a consistent upward trend in publications since 1999, signaling a significant growth in research dissemination. The primary goal of this exploration was to track the thematic evolution across diverse categories and observe the progression of these themes over time. The shift to an online publication platform in January 2021 has helped the journal's growth to a larger extent. This transition might have helped the submission and publication process, leading to a boost in the number of published articles. The journal exhibited substantial impact, boasting an h-index of 17 and a g-index of 21, accumulating a total of 3238 citations over a fifteen-year span. Pandey V and Singh KK emerged as the leading contributors with an h-Index of 8, indicating their prolific contribution to the Journal of Agrometeorology from 2008 to 2022. These findings suggest that the "Journal of Agrometeorology" functions as a productive and impactful research journal. It plays a vital role in research by publishing original, innovative, cutting-edge and state-of-the-art works from distinguished educators, scholars, and information science professionals across various academic and professional disciplines related to recorded information.

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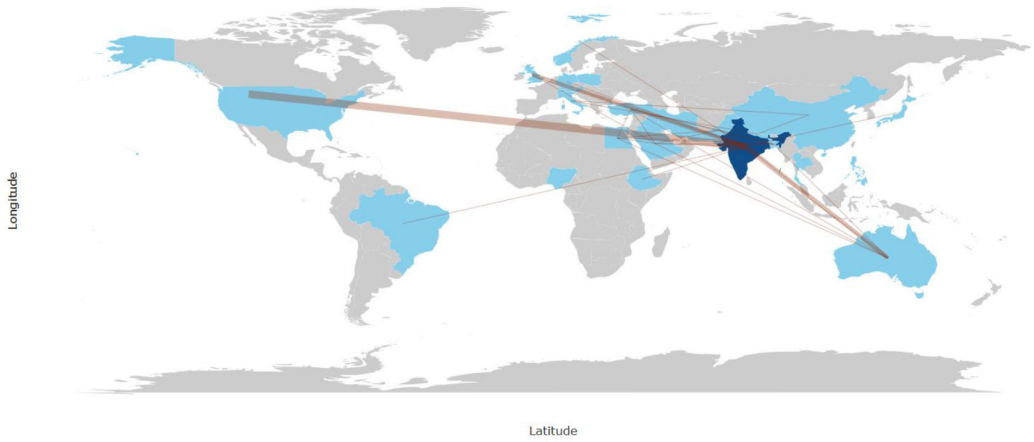

Fig. 23: Collaboration network of world map

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***Conflict of interests*:** The authors declare that there is no conflict of interests

Data availability: All the data have been added in the manuscript.

Authors' contribution: **CS** and **VG**: Conceived and planned the study. **VK**: carried out the study and analysed data. **VG, PP, PK** and **CS**: contributed to the interpretation of the results. **CS** and **VK**: took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis and manuscript.

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