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Citations Pattern and Research Trend of Accepted Postgraduate Theses of Plant Pathology in College of Agriculture, Central Agriculture University, Manipur 2010–2018

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ABSTRACT

Purpose: *The study aimed to examine citation patterns and research trends in postgraduate theses submitted in Plant Pathology at the College of Agriculture, Central Agricultural University, Imphal, during the period 2010 to 2018. It sought to identify the types of information sources used, authorship characteristics, core journals, and the geographical and temporal distribution of cited literature to support evidence-based academic planning.*

Methodology: *A bibliometric and citation analysis approach was adopted. All 75 accepted postgraduate theses constituted the study population, generating a total of 5,568 citations. Citations were manually extracted and classified by document type, authorship pattern, publication year, country, language, subject area, and journal title. Descriptive statistical techniques were applied, along with established bibliometric indicators for collaboration and journal scattering.*

Findings: *The analysis revealed that journals were the dominant source of information, accounting for nearly two-thirds of all citations, followed by books and reports. Authorship patterns indicated a strong collaborative research culture. Most cited literature was published after 1981, reflecting reliance on contemporary yet established research. India, the United States, and the United Kingdom emerged as the leading contributor countries. A*

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small core set of journals accounted for a substantial share of citations, demonstrating a clear core–periphery structure in scholarly communication.

Implications: *The findings provide valuable guidance for library collection development, postgraduate supervision, and institutional research planning in agricultural sciences. The study highlights the importance of maintaining access to core journals, fostering collaborative research, and aligning academic resources with evolving research trends.*

Keywords: Bibliometrics, Citation Analysis, Research Trends, Authorship Pattern, Bradford's Law, Plant Pathology, Agricultural Sciences, Central Agricultural University

1. INTRODUCTION

Scientific progress and scholarly communication rely on the exchange of information that facilitates the accumulation and sharing. The use of citation analysis of theses is important in the analysis of the interaction of emerging academic employees with literature, the sources used in shaping their work, and the current research trends. The bibliometric methods like citation analysis have become a necessity in researching knowledge creation, sharing and reuse in the scientific disciplines (Price, 1963). Patterns of citation indicate the nature of sources used, the literature age, the fundamental journals within a discipline and the degree of research collaboration. In practical sciences such as Plant Pathology, where the techniques and discoveries develop quickly, citation behaviours demonstrate not only intellectual systematization of the subject, but also the national research priorities as compared to international contributions to science. Although the existence of bibliometric research in the agricultural sciences, most of the researches focus on journal literature, national databases, or doctoral dissertations (Pradhan and Panda, 2010). Conversely, postgraduate theses at the master's level have been largely under-researched in spite of the contributions made to the initial research orientations, methodology and information-searching behaviors. This is a significant lapse as the foundation of scientific training is based on postgraduate research and can oftentimes dictate the course of disciplinary directions.

Central Agricultural University (CAU) has been established with the mandate to provide further impetus to agricultural education and research in the northeastern region of India that would lead to crop improvement, plant protection and capacity building in agricultural sciences (CAU, 2024). The College of Agriculture at CAU has produced a considerable amount of postgraduate research in relation to the field of Plant Pathology regarding the diseases that pose major problems to crops in the region. Nevertheless, systematic research has not been done in the areas of citation behaviors, journal selection, authorship tendencies and topic coverage in such theses. Consequently, the libraries, supervisors, and research planners are deprived of the evidence-based insights. It is therefore pertinent and timely to conduct a dedicated citation analysis of postgraduate theses in Plant Pathology at CAU. Such analysis demonstrates the interaction of students with national and international literature, the sources of their knowledge base, the level of research cooperation, the accumulation of themes, and the countries of the leading contributors. This knowledge can aid libraries in determining resource allocation, faculty in cutting back on reading lists and research

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topics, or administrators in identifying thematic strengths and scholarly hot-growth areas. Therefore, the paper investigates the citation styles in postgraduate theses in plant pathology at CAU between 2010 and 2018. The results fill in an established gap in postgraduate bibliometric research and furnish viable data to library collection development, postgraduate supervision and institutional research planning.

2. LITERATURE REVIEW

Various articles were gathered in journals and electronic databases to understand not only recent events but also previous studies of the subject. The publications that were considered suitable for the study were those published between the years 2000 and November 11, 2018. Citation analysis has been widely researched at the national and international levels; some interesting publications were selected to be discussed in detail. These studies were directly associated with the research at hand since a substantial number of them focused on only dissertations and theses.

Tiew (2002) did a study on Malaysian universities and conducted one of the earliest citation studies of the doctoral theses in agricultural sciences. His study indicated that the citations were made mainly of a relatively small number of core journals, with journal articles being more than books and other types of bibliographies. Also, the research has established that postgraduate students have a tendency to use recent research, which has confirmed the value of half-life studies in determining the currency of sources. This work provides a methodological foundation for subsequent citation analyses based on the thesis in the field of agriculture. Pradhan and Panda (2010) performed a citation analysis of the doctoral theses in agriculture in the Indian context. Journals, according to the results of their findings, were overwhelming as primary sources, followed by books and reports. Alongside the credible foreign titles, citations were also focused on a few Indian society journals, with the most widespread language used being English. The findings of the current study are corroborated by their work in terms of bibliographic superiority of journals, but it is particularly relevant to evaluate the research trends of the Indian agricultural scholars.

Ram and Kumar (2013) used bibliometric methods to examine the research trends in the agricultural sciences, with their focus being on both publication and citation trends in various subfields. They found that the number of multi-authored papers was on the rise, which was an indication that agricultural research was collaborative. Their study also revealed that citations were concentrated in a few core journals besides the very important national and international contributions. This paper demonstrates the importance of establishing core journals through the Bradford Law and is significant in putting into perspective the degree of partnership observed in postgraduate theses. Kumar and Kumar (2014) specifically investigated the trends in authorship in the agricultural sciences. In terms of their bibliometric analysis, there was an indication of a steady decline of single-author works over the years and confirmed the usage of multi-authored publications. They argued that specialization, interdisciplinary strategies and tough agricultural research issues inherently result in increased collaboration. Their findings are quite close to the ones of the current study regarding collaboration indices and are useful to understand authorship behaviour in postgraduate theses. Sethi and Panda (2016) focused on the patterns of research in the plant sciences as a focus of their bibliometric analysis, which is directly related to plant pathology. Based on their analysis, most citations were in English-language journals, although there was still a strong representation by both internationally renowned journals and those of the Indian society journals. The interdisciplinary nature of the research in plant science was exemplified by the

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large number of topics explored during the study on agronomy, pathology and plant protection. Directly related to the present study is the fact that it presents the significant contribution of India to the international literature on plant pathology, and that its distribution of citations is comparable in a subject-wise manner.

4. OBJECTIVE OF THE STUDY

The study aims to:

1. Ascertain the average number of citations per thesis and to gain an understanding of the density of reference citations in postgraduate research in Plant Pathology.
2. Determine the most mentioned types of bibliography and list the most used journals in order of frequency of citation.
3. Examine the pattern of authorship and measure the extent of research collaboration indicated by the referenced literature.
4. Look for geographic and linguistic spread of the cited sources, to get a determination about international research impact and communication trends.
5. Use the Law of Scattering of Bradford to find out the core journals that make up the main knowledge base in the research of plant pathology.

5. METHODOLOGY

The present study has employed a bibliometric methodology with citation analysis. The study material included all the postgraduate dissertations submitted to the Department of Plant Pathology, College of Agriculture (CAU), Imphal, from 2010 to 2018. All of the 75 accepted postgraduate theses from which extracts were included constituted our whole population; hence, no sampling was done, and the population formed its own sample. Physical collection of data was obtained from the Thesis Section of CAU, College of Agriculture. For each thesis, all cited works listed in the bibliography or reference section were copied by hand and entered into Microsoft Excel. Each citation was subsequently classified on the basis of bibliographic form (journal, book, report), journal title, authorship pattern, country of publication, year of publication code, subject emphasis and language. Citation patterns were analysed using descriptive statistical methods, including frequency and percentage distribution. The collaboration index was calculated by Subramanyam (1983). Bradford's Law of Scattering was used to identify core journals and to test its distribution across zones. The data were displayed in tables, graphs and diagrams to enable interpretation of patterns and trends in the reviewed literature.

6. FINDING AND ANALYSIS

6.1 Average Citations and Gender Distribution

Table 1 shows the joint distribution of male and female postgraduate scholars and the average number of citations per thesis. 75 theses yielded 5,568 citations (average 74.25 per thesis), which represented good use of the scholarship base. On the other hand, female scholars were more than their male counterparts (52% vs 48%) gender-wise, suggesting an increased percentage of female involvement in postgraduate studies of agriculture at CAU.

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Table 1: Average Citations and Gender Distribution

Variable	Male	Female	Total	Average Citations per Thesis
Researcher	36 (48%)	39 (52%)	75 (100%)	74.25

6.2 Supervisor-wise and Year-wise Distribution of These

Plant Pathology illustrates different contributions of supervisors to different years and also the fluctuation in the yearly production. Amongst the 75 theses, R.K. Tombisana (16) and Ph. Sobita Devi (14), so were Dipali Majumdar and T. Rajesh, who had nine theses each under their fair guidance. Production was highest in 2015 (9) and 2016 (14) and lowest in 2011 (4) and 2017 (13), reflective of differences in student intake and faculty availability. Taken together, the numbers indicate uneven peers' supervision in workload, a varying number of students enrolled and ongoing departmental research activity over the years.

Table 2: Supervisor Year-wise Distribution N=75

Guide ↓ / Year →	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Prof.R. K. Tombisana	2	0	3	1	1	2	2	2	3	**16**
Prof. Ph. Sobita Devi	1	1	1	3	1	3	2	1	1	**14**
Prof. Dipali Majumdar	1	0	1	2	1	1	2	0	1	**9**
Dr.T. Rajesh	0	0	1	1	3	1	2	0	1	**9**
Dr. N. Iboton Singh	2	1	1	0	0	0	2	0	0	**6**
Dr. Satish Chandra	1	0	0	2	0	0	0	0	0	**3**
Dr. Bireswar Sinha	0	0	0	1	1	2	1	0	2	**7**
Dr. Ram Dutta	0	2	1	0	0	0	0	0	0	**3**
Dr. Amrita Banerjee	0	0	0	0	0	1	2	0	0	**3**
Dr. Pankaj Baiswar	0	0	0	0	0	1	2	0	0	**3**
Others	1	0	0	0	0	0	0	1	0	**2**
Total	**8**	**4**	**8**	**9**	**7**	**11**	**14**	**6**	8	**75**

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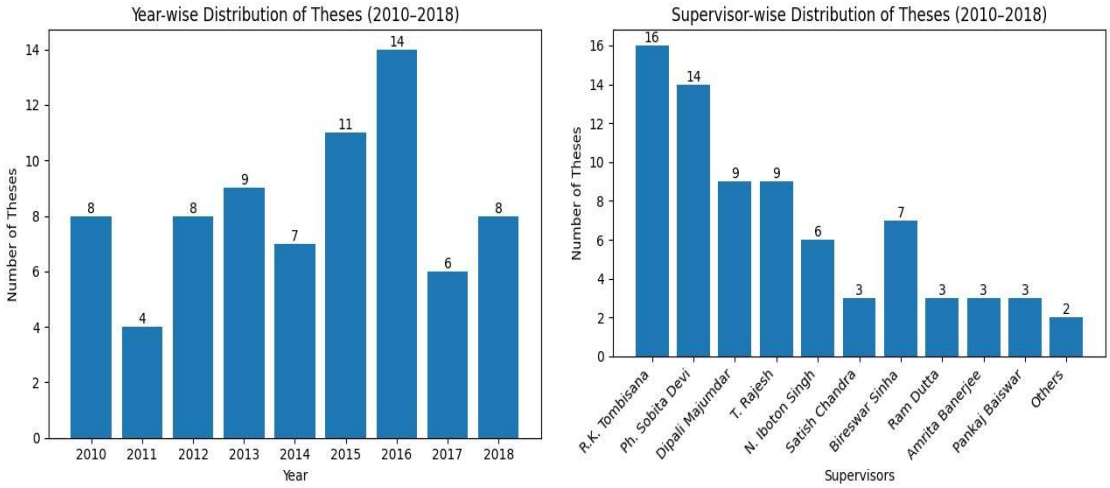

Fig. 1 Supervisor-wise and Year-wise Distribution of These

6.3 Cited Sources by Scholars

In Table 3 and Fig. 2 below, the references cited by scholars into different bibliographic formats. Journals were the most frequently cited source, contributing 3648 citations (65.48%), followed by books (8.84%) and reports (8.20%). Proceedings (4.58%) and theses (3.99%) were relatively low, followed by Government publications (2.11%), records (2.14), and newspapers (0.39%). Miscellaneous (3.23%) covered a group of document types, including technical bulletins, leaflets, guidelines, catalogues, unpublished notes, and personal communications (they were nonstandard), not falling within the conventional bibliographic categories. This clearly establishes journals as the dominant and most influential source of information for postgraduate research in plant pathology.

Table 3 Cited Sources by Researcher

Source Type	**No. of Citations**	**Citation %**	**Cumulative Citations**	**Cumulative %**
Journals	3,648	65.48	3,648	65.48
Books	492	8.84	4,140	74.32
Theses	222	3.99	4,362	78.31
Proceedings	255	4.58	4,617	82.89
Reports	456	8.20	5,073	91.09
Govt. Publications	118	2.11	5,191	93.20
E-/Web Resources	58	1.04	5,249	94.24
Records	119	2.14	5,368	96.38
Newspaper	22	0.39	5,390	96.77
Miscellaneous	178	3.23	**5,568**	**100.00**
Total	**5568**	100	_	_

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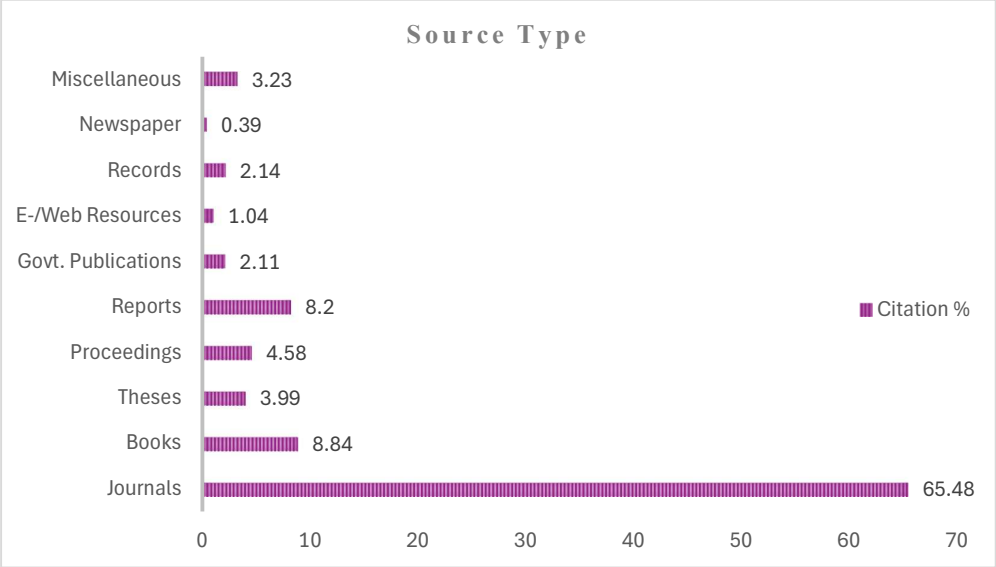

Fig 2 Graphical representations of sources of Bibliography.

6.4 Authorship Pattern

The pattern of authorship cited (Table 4) exhibits considerable differences across formats, reflecting two regimes of production of knowledge in Plant Pathology. 2-authorship, 3-author and >4-author groups are the major contributors to journal citation (30.39% vs 17.62% and 20.96%), which shows that experimental research is mainly conducted cooperatively. By contrast, books (116) and theses (178) are mostly single-authored. In general, multi-authored references comprise around 71% of all citations, signifying a high level of collaborative culture related to both laboratory and field-based research activities.

Table No.4: Form-wise authorship

Source Type	Single	Two	Three	Four+	Org	Total
Books	116	60	141	114	60	**492**
Journals	879	1,322	645	802	0	**3,648**
Reports	108	84	61	175	28	**456**
Proceedings	75	56	42	44	37	**255**
Theses	178	44	0	0	0	**222**
Records	81	0	25	13	0	**119**
Govt. Publications	94	24	0	0	0	**118**
Miscellaneous	43	75	50	4	6	**178**
Newspaper	5	9	6	1	1	**22**
Grand Total	**1596**	**1692**	**981**	**1166**	**133**	**5568**
Percentage (%)	**28.69**	**30.39**	**17.62**	**20.96**	**2.39**	**100.00**

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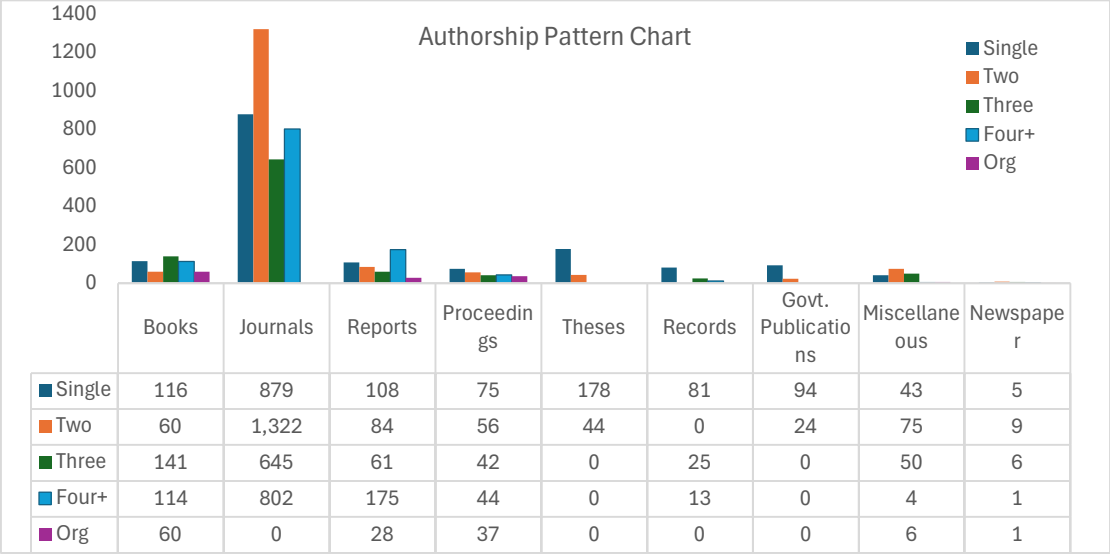

	Books	Journals	Reports	Proceedings	Theses	Records	Govt. Publications	Miscellaneous	Newspaper
Single	116	879	108	75	178	81	94	43	5
Two	60	1,322	84	56	44	0	24	75	9
Three	141	645	61	42	0	25	0	50	6
Four+	114	802	175	44	0	13	0	4	1
Org	60	0	28	37	0	0	0	6	1

Fig 3 Graphical representations of authorship pattern.

6.5 Collaboration Indicators Derived from Authorship Data

The analysis of collaboration shows that some 71% tend to work with more than one author, which is a clear testimony to having a strong teamwork nature in the research (Degree of Collaboration =0.713and Collaborative Coefficient =0.44). (ASTM: Collaboration Index) because publications tend to have more than two authors, as is typical for the group-oriented, laboratory-centred research popular in Plant Pathology.

6.5.1 Degree of Collaboration (DC)

The Degree of Collaboration proposed by Subramanyam (1983) was used to assess the extent of multi-authored works. It is defined as:

$$DC = \frac{N_m}{N_m + N_s}$$

Where:

- N_s= number of single-authored items & N_m= number of multi-authored items

In the present study:

- $N_s = 1596$ & $N_m = 1692 + 981 + 1166 + 133 = 3972$

$$DC = \frac{3972}{3972 + 1596} = \frac{3972}{5568} = 0.713$$

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A DC value of **0.713** indicates a strong multi-author culture within the field.

6.5.2 Collaboration Index (CI)

The Collaboration Index (CI) developed by Lawani (1986) measures the average number of authors per contribution. It is expressed as:

$$CI = \frac{1 \cdot N_1 + 2 \cdot N_2 + 3 \cdot N_3 + 4 \cdot N_4 + \cdots}{N}$$

Using the present data and treating the highest authorship class as four-or-more:

- $N_1 = 1596, N_2 = 1692, N_3 = 981$ & $N_4 = 1166$

$$CI = \frac{(1 \cdot 1596) + (2 \cdot 1692) + (3 \cdot 981) + (4 \cdot 1166)}{5568}$$

$$CI = \frac{1596 + 3384 + 2943 + 4664}{5568} = \frac{12{,}587}{5568} = 2.26$$

The CI value of **2.26** indicates that, on average, each cited work involved more than two authors.

6.5.3 Collaborative Coefficient (CC)

The Collaborative Coefficient (Ajiferuke et al., 1988) provides a refined estimate of co-authorship patterns. It is computed as:

$$CC = 1 - \sum_{i=1}^{k} \frac{1}{i}\left(\frac{f_i}{N}\right)$$

Where:

- f_i= frequency of works with i authors & $N = 5568$= total number of works

Using the present data (treating organisational authorship as a three-author class):

$f_1 = 1596, f_2 = 1692, f_3 = 981 + 133 = 1114$ and $f_4 = 1166$

Substituting values:

$$CC = 1 - \left[\frac{1}{4}\left(\frac{1166}{5568}\right)\right]$$

Converting proportions:

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- $\frac{1596}{5568} = 0.2869$, $\frac{1692}{5568} = 0.3039$, $\frac{1114}{5568} = 0.2001$, $\frac{1166}{5568} = 0.2096$

Weighting:

$$CC = 1 - [0.2869 + 0.1519 + 0.0667 + 0.0524]CC = 1 - 0.5579 = 0.4421$$

A CC value of **0.44** reflects a moderate to high level of collaborative research activity.

6.6 Distributions Cited Books

In terms of citation distribution, 18 core papers are responsible for 58.82% of overall book citations, and the remaining 63 contribute to the remaining share (41.06%), which indicates that a long-tail bibliometric pattern was present here. It shows a dependence on a small range of standard methodological and plant pathology books, combined with many specific sources for more advanced work.

Table 5: Distribution of Cited Book

Rank	Book Title	Citation	Cita. %	Cum. Cita.	Cum. %
	Research Methodology: Methods & Techniques	26	5.24	26	5.24
	Plant Pathology (Pathogen & Disease)	23	4.64	49	9.88
	Research in Agriculture: Planning & Execution	22	4.44	71	14.32
	Statistical Methods	21	4.36	92	18.68
	Plant Pathology	21	4.28	113	22.96
	Scientific Writing & Communication in Agriculture	18	3.64	131	26.60
	Plant Diseases	17	3.45	148	30.05
7	Plant Pathology and Plant Diseases	17	3.40	165	33.45
	Concepts of Plant Pathology & Disease Management	16	3.26	181	36.71
8	Plant Bacteriology	16	3.21	197	39.92
	Statistical Methods for Agricultural Sciences	15	3.05	212	42.97
.	Plant–Microbe Interactions (Vol. 1 & 2)	14	2.85	226	45.82
.	Design and Analysis of Experiments	13	2.64	239	48.46
.	Plant Pathology	12	2.44	251	50.90
.	Research Methods in Agricultural Sciences	11	2.24	262	53.14
.	Plant Pathogens: Detection and Diagnostics	10	2.03	272	55.17
.	Designing & Conducting Agricultural Research	9	1.83	281	56.99
15	Principles of Plant Disease Management	9	1.83	290	58.82
.	Other (63 Books)	202	41.06	492	100.00
.	Total	492	100	-	-

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6.7 Publisher-wise Distribution of Citation (Books)

In the table below, it is clear that Book citations come from a few leading publishers, including S. Chand, AgriAcademic/BS Publications, New Age International, Kalyani and Springer/CRC Press. Local Indian publishing is mainly used for the provision of methodological and theoretical texts; where international publishers are most commonly cited is in relation to advanced scientific literature, which illustrates a balance between local and global scholarship.

Table 6: Distribution of Publishers

Sl. No.	Publisher	Titles	Citations	Citation %	Cumulative	Cumulative %
1	S. Chand Publishing	2	44	8.94	44	8.94
2	AgriAcademic / BS Publications	2	38	7.72	82	16.67
3	Kalyani Publishers / Agri Stats Series	2	32	6.50	114	23.17
4	Springer / CRC Press	2	30	6.10	144	29.27
5	New Age International (P) Ltd.	1	26	5.28	170	34.55
6	Academic Press / Elsevier	1	21	4.27	191	38.82
7	Scientific Publishers (India)	1	18	3.66	209	42.48
8	Scientific / Academic House India	2	18	3.66	227	46.14
9	CABI Publishing	1	17	3.46	244	49.60
10	Wiley / John Wiley & Sons	1	13	2.64	257	52.24
11	Tata McGraw-Hill (India Edition)	1	12	2.44	269	54.68
12	ICAR / SAU Publication Units	1	11	2.24	280	56.91
13	Other Indian & Foreign Publishers	36	212	43.09	492	100.00
Total	—	81	492	100.00	—	—

6.8 Ranking of Journal Citation by Researcher

Table 7 indicates the journal citation geographic distribution, which has a broad global coverage. India is the leading contributor (18.65%), followed by the USA (12.88%) and the UK (5.76%), which means the equal utilisation of national and international literature. Asia and Europe also contribute significantly (e.g. China (4.93%), Japan (5.21%), the Netherlands (4.11%), and France (3.84%)), which underlines the global nature of the plant science research. The 10 leading countries of contribution constitute over 65 percent of the total citations, indicating a dependency on the few research-intensive countries. The lower-rank countries and multi-country partnerships (4.43) also contribute less but present valuable contextual information. In general, this distribution highlights the global nature of the Plant Pathology and the related agricultural sciences.

Table 7: Most cited 20 Journals

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Rank	Journal Title	Citation	Cita. %	Cum. Cita	Cum. Cita. %
1.	Indian Phytopathology	260	7.13	260	7.13
2.	Phytopathology	198	5.42	458	12.55
3.	The Indian Journal of Genetics and Plant Breeding	171	4.69	629	17.24
4.	Physiological and Molecular Plant Pathology	156	4.28	785	21.52
5.	Journal of Mycology of Plant Pathology	141	3.86	926	25.38
6.	Plant Disease	134	3.67	1060	29.05
7.	Phytopathology Research	127	3.48	1187	32.53
8.	Indian Journal of Plant Protection	111	3.03	1298	35.56
9.	Archives of Phytopathology and Plant Protection	94	2.58	1392	38.14
10.	Mushroom Research	93	2.55	1485	40.69
11.	Crop Protection	85	2.33	1570	43.02
12.	Phytoparasitica	80	2.20	1650	45.22
13.	Plant Pathology (Europe)	77	2.10	1727	47.32
14.	Biological Control	73	2.00	1800	49.32
15.	Annual Research Paper	70	1.92	1870	51.24
16.	New Phytologist	68	1.86	1938	53.10
17.	Annals of Plant Protection Science	65	1.78	2003	54.88
18.	Mycologia	63	1.73	2066	56.61
19.	Journal of Entomology and Zoology Studies	59	1.63	2125	58.24
20.	Journal of Oilseeds Research	59	1.63	2184	59.87
21.	Remanning (180 Journals)	1464	40.13	3648	1000

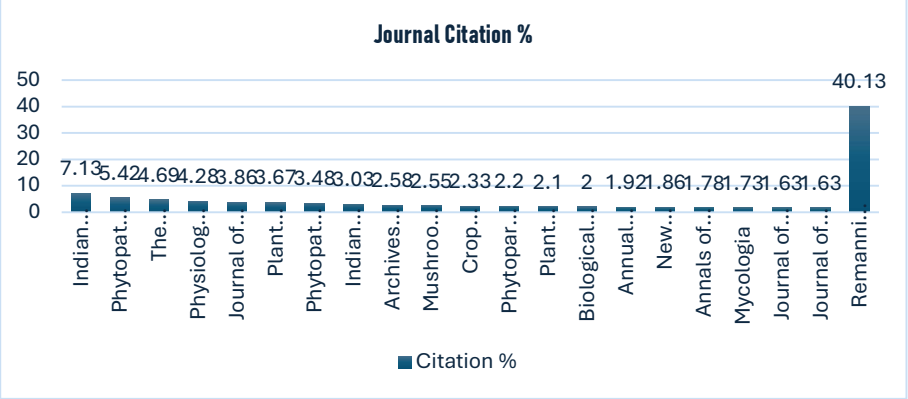

Fig 4 Graphical representations of the top 20 cited journals

6.9 Country-wise Distribution of Journal

The geographical distribution of the bibliometrically indexed publications is presented in Table 7 and indicates a large international spread. The highest is observed in the written work of Indian faculty (18.65%), followed by those from the US (12.88) and UK (5.76), suggesting an appropriate use of national and international literature. Asia and Europe also make strong contributions, including countries such as China (4.93%), Japan (5.21%), the Netherlands (4.11%) and France (3.84%), indicating that plant science is a truly international field of research. The top 10 contributing nations comprise over 65% of all the citations and thus depend on a limited number of research-intensive countries. Countries with lower ranking

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and multi-country collaboration (4.43%) contribute in a lesser proportion but offer significant contextual information. Taken together, the geographic distribution emphasises the global nature of Plant Pathology and related agricultural disciplines.

Table. 8: Country-wise Distribution of Journal

Rank	Country	Citations	%	Cumulative Citations	Cumulative %
1.	India	680	18.64	680	18.64
2.	United States	470	12.88	1150	31.52
3.	United Kingdom	210	5.76	1360	37.28
4.	Japan	190	5.21	1550	42.49
5.	China	180	4.93	1730	47.42
6.	Netherlands	150	4.11	1880	51.54
7.	France	140	3.84	2020	55.37
8.	Australia	135	3.70	2155	59.07
9.	Italy	120	3.29	2275	62.36
10.	Canada	115	3.15	2390	65.52
11.	Spain	110	3.02	2500	68.53
12.	Germany	105	2.88	2605	71.41
13.	Brazil	95	2.60	2700	74.01
14.	South Africa	90	2.47	2790	76.48
15.	Iran	85	2.33	2875	78.81
16.	Turkey	80	2.19	2955	81.00
17.	Pakistan	75	2.06	3030	83.06
18.	Bangladesh	70	1.92	3100	84.98
19.	Israel	65	1.78	3165	86.76
20.	South Korea	60	1.64	3225	88.40
21.	Sweden	55	1.51	3280	89.91
22.	Denmark	50	1.37	3330	91.28
23.	Switzerland	45	1.23	3375	92.52
24.	Belgium	40	1.10	3415	93.61
25.	Mexico	36	0.99	3451	94.60
26.	Thailand	35	0.96	3486	95.56
27.	Indonesia	23	0.63	3509	96.19
28.	Ukraine	18	0.49	3527	96.68
29.	Romania	15	0.41	3542	97.09
30.	Nigeria	13	0.36	3555	97.45
31.	Taiwan	12	0.33	3567	97.78
32.	Kenya	11	0.30	3578	98.08
33.	Malaysia	9	0.25	3587	98.33
34.	Austria	8	0.22	3595	98.55
35.	Czech Republic	7	0.19	3602	98.74
36.	Philippines	7	0.19	3609	98.93
37.	UAE	6	0.16	3615	99.10

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38.	Singapore	4	0.11	3619	99.21
39.	Poland	3	0.08	3622	99.29
40.	Georgia	3	0.08	3625	99.37
41.	Finland	3	0.08	3628	99.45
42.	Russia	2	0.05	3630	99.51
43.	Hungary	2	0.05	3632	99.56
44.	Colombia	2	0.05	3634	99.62
45.	Sri Lanka	2	0.05	3636	99.67
46.	Croatia	2	0.05	3638	99.73
47.	Nepal	2	0.05	3640	99.78
48.	Bulgaria	2	0.05	3642	99.84
49.	Croatia	1	0.03	3643	99.86
50.	Chile	1	0.03	3644	99.89
51.	Georgia	1	0.03	3645	99.92
52.	Peru	1	0.03	3646	99.95
53.	Slovenia	1	0.03	3647	99.97
54.	Lithuania	1	0.03	3648	100.00
		3648	100.00		

6.9.1 Country Concentration Ratio (CCR_{10})

The Country Concentration Ratio for the top ten contributing countries (CCR_{10}) was calculated to assess the extent to which citations are concentrated among the highest-output nations. CCR_{10} is defined as:

$$CCR_{10} = \frac{Citations\ of\ Top\ 10\ Countries}{Total\ Citations}$$

In this study, the top ten countries (India, the United States, the United Kingdom, China, Japan, the Netherlands, France, Australia, Italy, and Canada) collectively contributed 2,390 citations out of a total of 3,648 citations. Therefore:

$$CCR_{10} = \frac{2390}{3648} = 0.655\ (65.5\%)$$

The top ten countries account for **65.5%** of all citations, indicating a high concentration of research influence within a relatively small number of scientifically productive nations. This reflects the dominant role of these countries in generating relevant literature for the field.

6.10 Language-wise Journal Country Citation Rank

The language-wise analysis indicates that English takes the largest share in the scholarly communication background with 94.57 of total citations, which can also be attributed to the fact that English is the main tool of scientific publication in the world and in India in particular. The Indian regional languages alone have a total of less than 1% of the citations, with other international languages like Chinese, Japanese, Spanish, and French making less

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than 5%. The cumulative steep curve also proves the linguistic concentration of the cited literature.

Table 9: Language -wise distribution of journals

Sl. No.	Language	Citations	Citation %	Cumulative Citations	Cumulative %
1	English	3457	94.76%	3457	94.76%
2	Hindi	28	0.77%	3485	95.53%
3	Bengali	22	0.60%	3507	96.13%
4	Telugu	14	0.38%	3521	96.52%
5	Japanese	12	0.33%	3533	96.85%
6	Dutch	11	0.30%	3544	97.15%
7	Malayalam	10	0.27%	3554	97.42%
8	Marathi	9	0.25%	3563	97.67%
9	Chinese	8	0.22%	3571	97.89%
10	Kannada	7	0.19%	3578	98.08%
11	French	6	0.16%	3584	98.25%
12	Tamil	6	0.16%	3590	98.41%
13	Hebrew	5	0.14%	3595	98.55%
14	Gujarati	5	0.14%	3600	98.68%
15	German	4	0.11%	3604	98.79%
16	Spanish	3	0.08%	3607	98.88%
17	Thai	3	0.08%	3610	98.96%
18	Portuguese	2	0.05%	3612	99.01%
19	Korean	2	0.05%	3614	99.07%
20	Turkish	1	0.03%	3615	99.10%
21	Others	33	0.90%	3648	100.00%
Total	—	3648	100.00%	—	—

6.11 Chronological Distribution of Journal Articles

The year distribution shows that over half of the references (51.55%) were published between 1981 and 2003, suggesting that the study is based less on old research. In addition, citations between 2004 and 2009 also occupy a large proportion (30.06%), whereas the period of time from 2010 to 2017 is at the lowest level, a mere 9.06%. Not many citations are from literature before 1930 (<3%), and Plant Pathology research relies mainly on current primary sources with little history. In total, 90.9% of the citations are dated within the range from 1981 to 2017, indicating a recency-driven academic communication in this discipline.

Table 10: Chronological Distribution of Journal

Year Range	Citations	Citation%	Cumulative Citations	Cumulative%
1840–1890	16	0.452	16	0.452
1891–1930	89	2.446	105	2.898
1931–1980	235	6.432	340	9.330
1981–2003	1880	51.548	2220	60.878
2004–2009	1097	30.059	3317	90.937
2010–2017	331	9.063	3648	100.000
Total	3648	100.00	—	—

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6.11.1 Obsolescence Analysis

(A) Price's Index

Price's Index measures the proportion of citations from the most recent decade of the study period.

- Study endpoint: 2017
- Most recent decade: 2008–2017

From Table data:

- Citations from 2010–2017 = 9.063%
- Block 2004–2009 = 30.059% over 6 years

To extract 2008–2009 (2 years within that block):

$$2008-2009\ share = \frac{2}{6} \times 30.059\% = 10.0196\% \approx 10.02\%$$

Therefore:

$$Price's\ Index = 10.02\% + 9.063\% = 19.083\% \approx 19.08\%$$

A Price's Index of ~19% shows that less than one-fifth of cited works are from the most recent decade, indicating moderate recency with substantial reliance on older foundational research.

(B) Citation Half-life

Citation half-life = period in which 50% of citations accumulate.

From cumulative distribution:

- Up to 1981–2003 → 60.878%

Since 50% falls within 1981–2003, the half-life lies within this range.

`Result: Citation Half-life ≈ 20–35 years`

Plant Pathology literature remains influential over multiple decades, reflecting the enduring value of foundational research.

6.12 Subject-wise distribution of Journal

The biggest proportion of citations (27.13) belongs to Agronomy, which is the central topic of the research on the topic of Plant Pathology, and there are also strong inter-disciplinary connections with Botany, Forestry, Plant Diseases and Plant Pathology (approximately 6-8 each). The top seven subjects alone form approximately 68% of the total number of citations, which is how far thematic concentration and a well-defined disciplinary cluster are concerned.

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Table 11: Subject-Wise Distribution of Journal Citations

Subjects	Citations	Cumulative Citations	Citation %	Cumulative %
Agronomy	990	990	27.13	27.13
Botany	279	1269	7.65	34.78
Forestry	272	1541	7.46	42.24
Plant Diseases	251	1792	6.88	49.12
Plant Pathology	251	2043	6.88	56.00
Entomology	237	2280	6.51	62.51
Plant Protection	206	2486	5.65	68.16
Soil Science	124	2610	3.41	71.57
Agriculture	117	2727	3.22	74.79
Crop Science	110	2837	3.03	77.82
Biotechnology	94	2931	2.58	80.40
Horticulture	89	3020	2.45	82.85
Biology	70	3090	1.93	84.78
Soil Biology	70	3160	1.93	86.71
Agricultural Economics	64	3224	1.74	88.45
Biochemistry	59	3283	1.61	90.06
Microbiology	59	3342	1.61	91.67
Mycology	49	3391	1.35	93.02
Genetics	31	3422	0.84	93.86
Nematology	21	3443	0.58	94.44
Criminology	19	3462	0.52	94.96
Haematology	14	3476	0.39	95.35
Bacteriology	14	3490	0.39	95.74
Hyperacutes	12	3502	0.32	96.06
Crop Ecology	12	3514	0.32	96.38
Virology	12	3526	0.32	96.70
Molecular Biology	7	3533	0.19	96.89
Plant Anatomy	4	3537	0.12	97.01
Others	111	3648	2.99	100.00
Total	3648	—	100.00	—

6.14 Bradford Law of scattering and analysis of Bradford's Zone

According to the law, Bradford divides journals cited in core journals into three zones, each of which has approximately one-third of the total citations. The first third is generated with a small nucleus, and the rest of the areas are obtained with increasingly large numbers of journals, forming the typical

$$1: n: n^2$$

Bradford Constant (K) Calculation

Using Egghe's (1986) formulation:

- Highest cited journal (Y) = 260 citations, Total journals (T) = 200
- Number of zones (p) = 3, Euler's constant (y) = 0.57772

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$$K = \left(e^{(y \times ln\ Y)}\right)^{1/p} K = \left(e^{(0.57772 \times ln\,(260))}\right)^{1/3} ln\,(260) = 5.5607, 0.57772 \times 5.5607$$
$$= 3.2102 e^{3.2102} = 24.79, K = 24.79^{1/3} \approx 2.96$$

Thus, Bradford Constant (K) ≈ 2.96

Zone Formation

- Total citations = 3648, Citations per zone (approx.) = 3648/3 ≈ 1216

Based on cumulative citation data, three Bradford zones were identified:

Table 12: Bradford Zone

Zone	No. of Journals	Citations	% of Total
Zone 1 (Core)	7	1254	34.38%
Zone 2	28	1222	33.51%
Zone 3	165	1172	32.12%
Total	200	3648	100%

Resulting journal distribution:

$$7 : 28 : 165$$

Bradford multiplier:

$$n = \frac{28}{7} = 4$$

Thus, the empirical Bradford pattern becomes:

$$1 : 4 : 16$$

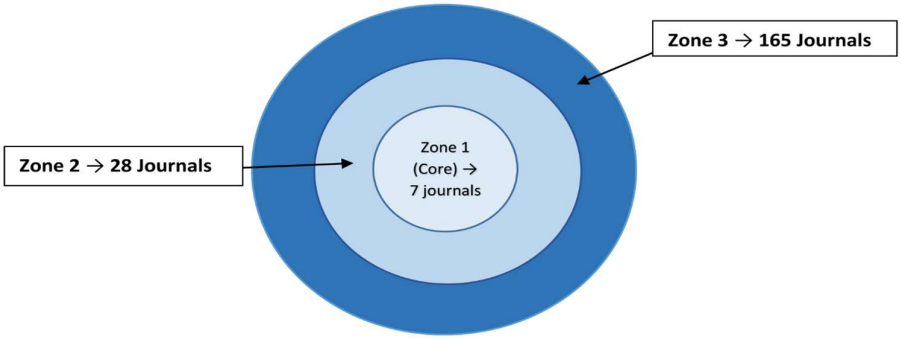

Fig 5: Bradford Zone

Bradford's Law analysis divided the 200 journals (3648 citations) into three zones of similar citation yield: Zone 1 (7 journals), Zone 2 (28), and Zone 3 (165), forming a Bradford

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distribution of **7: 28: 165**. This approximate multiplier of 4 confirms a pronounced core–periphery structure, where a few journals supply dense citation output while a large peripheral set contributes the remainder.

7. MAJOR FINDINGS

The specific journals in which postgraduate research is published are highly skewed,> 65% of citations coming from published articles, and a small core set of seven journals accounted for over one third of total usage in the Plant Pathology subject. The most cited article was from CABI: Sir Alister Hardy Foundation for Ocean Science. DAA showed a team working structure (DC=0.713) with two or more scientists in response to papers as the most extensively cited items. Geographical analysis indicated a high concentration of contributions in a small number of research-intensive countries such as India, the USA and the UK and that English dominated as the single most popular language for scholarly communication (94.76%). Temporal trends evidenced intermediate recency (Price's Index≈19%) and perishing 20–35 years, suggesting steady use of the sources. In summary, the citation patterns represent a global transnational collaborative journal-centric research and innovation environment mitigated by domestic and international scientific cultures.

Discipline wise Both Agronomy, Botany, Forestry and two core sub-fields of Plant Pathology account for most of the citation activity by accounting for nearly 70% in journal references, indicating a strong link within agricultural and biological sciences. Citation patterns for books followed a similar long-tail pattern, with only a few methodological and diagnostic books being cited in more than half of the references to books. By publisher, Indian academic publishers provided foundational and methodological sources, and international publishers contributed higher-level scientific and experimental literature, thus indicating a balanced blended dependence on the domestic foreign knowledge orders.

8. CONCLUSION

Journal is an integral aspect of the communication of research findings. The 65% of citations were covered by journals, further confirming their leading role in knowledge transfer, diagnostic methods and plant disease research. The key source of information in the study library is Indian Phytopathology and other international literature, such as Phytopathology, showing equal use of both national and international literature. We referred to books, reports and conference proceedings for the theoretical and institutional context, but still they constituted supplementary sources.

There are strong credits (DC = 0.713, CI = 2.26, CC = 0.44) indicating that there is a culture of collaboration appropriate to the laboratory and field-based plant pathology research, which demands a multidisciplinary work-group approach. Single-author texts are predominant in books and theses: a legacy of their pedagogical and practice-led heritage. Geographically, references other than India are coming from relatively a few research-intensive countries, with the highest contribution being made by India (18.65%); USA (12.88%) and UK (5.76%) were next; the top 10countries contributed over 65%. English was the most used language (94.76%) for publication and remained the common language of scientific research in agricultural sciences. Chronologically, 90.9% of the citations stem from the period ranging from 1981 to 2017, and Price's Index (≈19%) indicates a medium recency with continuing usage of primary underlying works. The half-life of citation (≈20–35years) serves as an indicator for the increased importance of the old theoretical literature (Figure 1). The international journal

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Bradford's Law identified a small core of seven journals accounting for one-third of citations with a clear core-periphery division, useful in library collection decisions.

Generally speaking, postgraduate research in Plant Pathology at CAU is characterised by a high reliance on journals, strong co-joint works, international influence and relatively constant use of classic documents. Such findings may be used to justify evidence-based improvements in library subscriptions, and research-training and supervision programs. Future comparative studies in other agricultural sectors or universities would offer more extensive information on research trends and resource requirements in the nation.

9. SCOPE FOR FURTHER STUDIES

Further studies can be developed out of this research by incorporating other fields such as Agronomy, Horticulture and others in the same line related to this study to make comparative studies. Incorporating doctoral theses and discussing the effect of digital and open-access resources would be more enlightening. A longitudinal study could also indicate how the trends of citation change over time. Further research might be conducted by expanding the analysis to additional CAU departments and comparing the patterns of citation across the disciplines. Changes in the use of digital resources can be tracked in a longitudinal analysis after 2017. Further similar studies, including comparative analysis of other agricultural universities in India, can reveal regional differences in research and citation behaviour.

REFERENCE

Ajiferuke, I., Burrel, Q., & Tague, J. (1988). Collaborative coefficient: A single measure of the degree of collaboration in research. *Scientometrics, 14*(5–6), 421–433.Central Agricultural University. (2024, July 8). *University profile*. https://cau.ac.in/university-profile

Kumar, A., & Kumar, R. (2014). Authorship patterns in agricultural sciences: A bibliometric analysis. *Annals of Library and Information Studies, 61*(2), 112–120.

Price, D. J. de S. (1963). *Little science, big science*. Columbia University Press.

Pradhan, J., & Panda, K. C. (2010). Citation analysis of doctoral theses in agriculture. *DESIDOC Journal of Library & Information Technology, 30*(6), 387–393.

Ram, S., & Kumar, S. (2013). Bibliometric analysis of research trends in agricultural sciences. *Library Philosophy and Practice*, Article 928.

Sethi, B., & Panda, K. C. (2016). Research trends in plant sciences: A bibliometric study. *International Journal of Library and Information Science, 8*(2), 20–28.

Subramanyam, K. (1983). Bibliometric studies of research collaboration: A review. *Journal of Information Science, 6*(1), 33–38.

Tiew, W. S. (2002). Citation analysis of doctoral theses in agricultural sciences. *Malaysian Journal of Library & Information Science, 7*(1), 43–56.

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