# MAPPING RESEARCH OUTPUT OF FACULTY OF AGRICULTURE, ASSAM AGRICULTURAL UNIVERSITY: A BIBLIOMETRIC ASSESSMENT FROM 2009 TO 2018

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The study explores the research performance of the Faculty of Agriculture under Assam Agricultural University, Jorhat. It examines total publications, yearwise distribution of papers, authorship patterns, h-index, highly preferred journals, and validity of Lotka's Law and Bradford's Law. A total of 378 articles were published from 2009 to 2018, retrieved from the Scopus database. The study reveals that the maximum number of 77 (20.37%) journal articles were published in 2017. The maximum number of journal articles with more than five authors is 25.4%. Lotka's law is valid in the present study. The degree of collaboration "C" is 0.96, and the distribution of core journals does not fit into Bradford's Law.

**Keywords:** Bibliometric analysis, Research output, Agricultural Research, Lotka's Law, Bradford's Law, ICAR

## **INTRODUCTION**

Bibliometrics has become an essential method for tracking the research output of an author, institution, country, a journal, or a specific topic, along with their impact. Bibliometrics analysis is not only restricted to the quantitative investigation but also analyses the impact of research output using qualitative measures such as citation counting, journal impact factor, metrics, etc. Pritchard defined Bibliometric in 1969 as "the application of mathematics and statistical methods to books and other media of communication." In the same year, another definition was given by Fairthorne as "quantitative treatment of the properties of recorded discourse and behaviour appertaining to it". Over the past decades, bibliometrics has transformed into a standard science policy and research management tool. Generally, all the important compilations of science indicators depend on publication, citation statistics, and other bibliometric approaches (Krishnamoorthy et al., 2009).

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System Assistant, IIM Shillong – 793 012 Meghalaya – 793 012 Email: narayanchhetry@gmail.com Numerous bibliometric studies have assessed the research productivity of institutions (Sharma, 2006; Kolle et al., 2016), universities (Aggarwal and Kaur, 2017; Sevukan and Sharma, 2008; Sevukun et al., 2007). Agricultural universities were likewise no exemption for this. There are significantly fewer studies conducted on agricultural universities compared to different institutions. In this way, an endeavor has been made to assess the research performance of the only State Agricultural University in North-East India, i.e., Assam Agricultural University, Jorhat.

# ABOUT ASSAM AGRICULTURAL UNIVERSITY, JORHAT

Assam Agricultural University, Jorhat is the first agricultural university in North-East India, established on April 1, 1969, under The Assam Agricultural University Act, 1968. It is responsible for teaching, research, and extension education in the field of agriculture and allied sciences in Assam. The university has performed consistently since its inception and stood at 36th position according to ICAR All India Ranking 2018. AAU Jorhat has six faculties: Faculty of Agriculture, Veterinary Science, Community Science, Fisheries Science, Horticulture, and Sericulture.

# **REVIEW OF LITERATURE**

Many bibliometric studies have been conducted to assess the research output of several organizations, educational institutions, departments, etc. Jeyshankar and Grace (2019) did a bibliometric analysis of the research output of India in the ecology field during 1964 – 2013 to examine literature growth and authorship patterns based on the Scopus database. Relative growth rate (RGR) and Doubling Time (DT) were used to measure the growth decade-wise. Gradual research communications and literature increase doubled in 5-6 years except for 1994-2003. Collaboration effort was observed and increased each decade. Lotka's law also applied to author productivity, but it does not fit into the dataset. Author mapping was done using VOSviewer software applied.

Tadasad and Deepthi (2019) attempted to study the University of Agricultural Sciences, Dharwad's collaborative pattern at the national and international levels by analyzing 357 research papers retrieved from Google Scholar and CABI Abstracts in 2017. It was found that 90.76% of the first authorship belonged to the USAD researchers' group. It was also observed that collaboration within the same departments is more prominent and the Department of Plant Pathology produces maximum articles, and very few authors contributed internationally. University of Horticulture Science, Bagalkot was the largest collaborator at the state level. USAD has collaborated maximum with Kazusa Research Institute, Chiba, Japan, internationally.

In their paper, Kumar and Senthilkumar (2018) studied the applicability of Bradford's law of distribution of literature in Astronomy & Astrophysics by Indian scientists during 1988-2017 and data for the study were retrieved from the Web of Science. Siwach and Parmar (2018) investigated the research output of CCS Haryana Agricultural University, Hisar, from 2001-2015 and found that the total publications have received 15282 citations. The results revealed that N. Khetarpaul from Food and Nutrition Department was the most productive author with 63 publications; the h-index is highest for N. Narula, i.e., 13. Aggarwal and Kaur (2017) examined the research output of eight universities of Punjab in science indexed in Scopus for two time periods, i.e., between 1991-2002 and 2003-2014 for each university. Results showed that Guru Nanak Dev University and Panjab University had shown notable growth in research output during 1991-2002. 2 or 3 authored papers contributed the maximum number of publications. During both periods, i.e., 1991-2002 and 2003-2014, PU has the highest h-index, followed by GNDU.

Parabhoi, et al. (2017) analyzed 560 documents produced by Dr. Yashwant Singh Parmar University of Horticulture and Forestry indexed in Scopus between 2006 to 2015. DYSPUHF produces maximum collaborative papers with the Indian Agricultural Research Institute (IARI). The journal "Indian Journal of Agricultural Sciences" was the most preferred. The most prolific author was N. Sharma, who received an H-index of 8, G-index of 10, and Mindex of 0.66. The researcher suggested that the University should organize training, workshops, seminars, etc., to improve research activities and also focus on qualitative research to increase citations to upgrade the profile of the university and researchers.

A study was carried out by Naqvi and Fatima (2017) to test the validity of Lotka's Law in the context of international business literature published from 2012 to 2014. The data were retrieved from the Journal of World Business and analyzed 11202 unique citations found in the

research articles using MS-Excel. The validity of Lotka's Law was determined using K-S statistical test and Chi-square test and found that Lotka's Inverse Square Law fits into international business literature. Biradar and Tadasad (2016) studied the authorship patterns and the collaborative research in the field of Economics over 15 years between 2000-2014. 3610 data were extracted from the Social Science Citation Index of ISI Web of Knowledge. Out of 3610 articles, 2106 (48.33%) are multi-authored papers. The extent of collaboration in research is measured with the help of multi-authorship of papers; the formula given by Subramanyam (1983) for determining the Degree of Collaboration (DC), Collaborative Index (CI) derived by Lawani, Collaborative Coefficient (CC) is given as by Ajiferuke et al. were calculated in a subject. Kolle and Shankarappa (2016) investigated the research publications of the University of Horticultural Sciences, Bagalkot, Karnataka, during 2009-2015 through the Indian Citation Index. It is identified that publications kept increasing from 2009- 2014, except in 2015. The degree of collaboration was 0.994, which showed that the level of collaborative research is higher.

Kasa et al. (2014) studied the Faculty staff's output in terms of formats, year-wise distributions, and prominent authorship patterns of faculty members of Agriculture and Veterinary Complex of Agriculture and Veterinary Complex, Ahmadu Bello University, Zaria, between 2002 to 2012. Maharana (2013) studied the growth trend, contribution, and impact of researchers' output of Orrisa University of Agricultural Technology during 2008-2012 as indexed in Scopus. The findings showed that Agricultural and Biological Sciences was the most favored research area; the degree of collaboration was 0.96.

Sarkhel and Choudhury (2010), in their paper, describe the research contributions of Bidhan Chandra Krishi Viswavidyalaya to the agricultural area. The publication details of this institute were retrieved from the CAB Abstracts during 1993-2007. The 15-year publication data of the BCKV indicated that a total of 2807 papers were published, comprised of 2670 journal articles, 91 conference publications, 42 books/book chapters, and one report. Publications by BCKV have been categorized in different journals as per the National Academy of Agricultural Sciences (NAAS) rating. Results revealed that the Faculty of Agriculture secured the highest publications, with three authors collaborating on the BCKV research. Sevukan and Sharma (2008) attempted to study the performance of 20 Indian Central Universities' faculties' research in the biotechnology field during 1997-2006. The data were extracted from PubMed, NCBI (National Centre for Biotechnology Information), and ISI Web of Science database—Science Citation Index Expanded (SCIE). It was observed that the literature on biotechnology had increased gradually. Banaras Hindu University (BHU) contributed a maximum (42.55 %), two-authored papers trend was observed; Lotka's law is fit into this study, whereas the dataset did not fit Bradford's law.

Sevukan, et al. (2007) analyzed 348 bibliographic records published by plant sciences faculties of central universities of India between

1997 and 2006, which were indexed in ISI Science Citation Index - Extended (SCIE). It was also found that journal articles occupied the primary source of publications, and the collaboration pattern is fair. Results showed that the productivity of authors fits Lotka's distribution, whereas the scattering of journal articles does not fit into Bradford's distribution. In their paper, Arunachalam and Umarani (2001) studied agricultural research in India using CAB Abstracts for the year 1998. A sum of 11,855 documents was found to be indexed, out of which 10,412 were journal articles scattered over 854 journals, 838 and 132 were conference papers and books/ book chapters, respectively. Indian Veterinary Journal contributed the highest number of papers. The leading area of research in India was 'Plants of economic importance. Chaudhary Charan Singh Haryana Agricultural University topped the institution's list in publishing papers.

The literature review reflects that there were no studies on Assam Agricultural University, Jorhat research productivity. Therefore, this paper attempts to study and analyze the publication productivity of the Faculty of Agriculture under Assam Agricultural University, Jorhat.

## **OBJECTIVES OF THE STUDY**

- 1. To analyze the publication trend of the Faculty of Agriculture under AAU, Jorhat
- 2. To identify the authorship pattern.
- 3. To identify the preferred journals by faculty members and analyze Bradford's Law of Scattering.
- 4. To find out the most prolific authors of the Faculty of Agriculture under AAU, Jorhat.

5. To investigate Lotka's law of author productivity.

## SCOPE OF THE STUDY

The scope of the present study is limited to analyzing the research productivity of the Faculty of Agriculture under Assam Agricultural University, Jorhat, indexed in the Scopus database. The study is confined to 10 years, i.e., between 2009 and 2018.

## METHODOLOGY

The present study aimed to analyze the research productivity of the Faculty of Agriculture under AAU, Jorhat. There are six faculties under AAU, Jorhat viz. Faculty of Agriculture, Veterinary Science, Community Science, Fisheries Science, Horticulture, Sericulture. The faculty of Agriculture is the largest among them. There are three colleges under this faculty, i.e., College of Agriculture, Jorhat; Biswanath College of Agriculture, Biswanath Chariali and Sarat Chandra Singha College of Agriculture, Chapar. The research output of these three colleges was selected for the investigation. Research publications of other faculties such as veterinary science, community science, fisheries science, horticulture, and sericulture were excluded. The papers covered by the Scopus database were selected for this study. Using the search terms "Assam Agricultural University" and "India" (AAU Affiliation ID: 60021252), the data was limited to the articles only for ten years (2009-2018). A total of 2090 documents belong to AAU, Jorhat, of which the Faculty of Agriculture produced 378 journal articles. The data were retrieved and scrutinized using MS-Excel. Bibliometric laws such as Bradford's Law, Lotka's Law, etc., have been applied to analyze data to fulfill the study's objectives.

## DATA ANALYSIS AND INTERPRETATION

#### Year-wise publications

The Table 1 depicts the year-wise publications of faculty members of the Faculty of Agriculture under Assam Agricultural University, Jorhat. From 2009 to 2018, the faculty members published 378 journal articles. It is evident from the table that

Year	Number of Publications	Percentage (%)	Annual Average Growth rate percent (%)
2009	18	4.76	
2010	19	5.03	5.26
2011	19	5.03	
2012	31	8.20	38.71
2013	19	5.03	-63.16
2014	35	9.26	45.71
2015	37	9.79	5.41
2016	67	17.72	44.78
2017	77	20.37	12.99
2018	56	14.81	-37.50

Table 1:	Year-wise	publications
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Figure 1: Year-wise publications

2017 has the highest number of articles, i.e., 77 (20.37 %) titles, and in 2009, the least number of articles were published, i.e., 18 (4.76 %). The annual growth rate witnessed a negative in 2013 and 2018.

#### Distribution of authorship pattern year-wise

The detailed analysis of authorship patterns of the journal articles is shown in Table 2. It is analyzed that the maximum number, i.e., 96 journal articles have more than five authors (25.4 %), followed by three authors publication 85 (22.49 %), four authors publication 83 (21.96 %), two authors journal articles 52 (13.76 %), five authors publication 48 (12.70 %). In contrast, one author-publication accounted for only 14 (3.70 %) of the complete publication.

#### **Author Productivity**

The Table 3 depicts authors' productivity during the period 2009 to 2018; it is found that a total of 1271 authors have produced 378 articles

Year	One	Two	Three	Four	Five	>Five	Total
2009	1	6	3	4	0	4	18
2010	1	4	5	4	2	2	19
2011	2	8	1	3	2	3	19
2012	3	8	6	5	3	6	31
2013	0	0	6	2	3	8	19
2014	0	3	8	10	2	12	35
2015	1	2	8	7	5	14	37
2016	0	8	18	14	12	15	67
2017	4	5	14	24	13	17	77
2018	2	8	15	10	6	15	56
Total	14	52	85	83	48	96	378
Total %	3.70	13.76	22.49	21.96	12.70	25.40	100

 Table 2: Authorship pattern of Faculty of Agriculture, AAU (2009-2018)

with an average of 3.36 authors per paper, and productivity per author is 0.30. Further out of 1271, only 803 authors are associated with AAU, Jorhat, and the average authors per paper of AAU, Jorhat is calculated as 2.12 and 0.47 papers per author of AAU, Jorhat. Findings also revealed that Total AAPP ranges between 3.01 to 4.42 and Total PPA from 0.23 to 0.33.

Year	Total number of papers	Total number of authors	Total AAPP	Total PPA	Authors (AAU)	AAPP (AAU)	PPA (AAU)
2009	18	58	3.22	0.31	38	2.11	0.47
2010	19	58	3.05	0.33	41	2.16	0.46
2011	19	58	3.05	0.33	46	2.42	0.41
2012	31	105	3.39	0.30	86	2.77	0.36
2013	19	84	4.42	0.23	37	1.95	0.51
2014	35	120	3.43	0.29	58	1.66	0.60
2015	37	145	3.92	0.26	84	2.27	0.44
2016	67	202	3.01	0.33	143	2.13	0.47
2017	77	241	3.13	0.32	156	2.03	0.49
2018	56	200	3.57	0.28	114	2.04	0.49
Total	378	1271	3.36	0.30	803	2.12	0.47

Table 3:	Authors'	Produ	ctivity

\*Average Authors Per Paper (AAPP)= No. of authors/ No. of papers \*Productivity per author (PPA)= No. of papers/ No. of authors

#### Lotka's Law of Author's Productivity

 $x^n y = c$ .....equation (1)

Where x= number of publications,

In bibliometric studies, Lotka's Inverse Square Law of Scientific Productivity has been extensively used as it helps to find out the pattern of authors' productivity in a specific field over a given period. Alfred J. Lotka (1926) proposed the inverse square law of scientific productivity to find the quantitative relationship between authors and their scientific productivity. It states that "the number of making *n* contribution is about  $1/n^2$  of those making one; the proportion of all contributions that make a single contribution is about 60%".

The following formula is used to calculate Lotka's Law :

y = frequency of authors making x contributions each and

c=constant

An attempt was made to verify the appropriateness of Lotka's law in the productivity of Faculty members of the Faculty of Agriculture under AAU, Jorhat. The value of n, c, and critical value has been determined to examine the applicability.

X	У	X=Log x	Y=Log y	XY	$\mathbf{X}^2$	1/x <sup>n</sup>
1	185	0.000	2.267	0.000	0.000	1.000
2	63	0.301	1.799	0.542	0.091	0.306
3	37	0.477	1.568	0.748	0.228	0.153
4	21	0.602	1.322	0.796	0.362	0.093
5	17	0.699	1.230	0.860	0.489	0.064
6	13	0.778	1.114	0.867	0.606	0.047
7	9	0.845	0.954	0.806	0.714	0.036
8	3	0.903	0.477	0.431	0.816	0.029
9	4	0.954	0.602	0.575	0.911	0.023
10	1	1.000	0.000	0.000	1.000	0.019
11	2	1.041	0.301	0.313	1.084	0.017
12	5	1.079	0.699	0.754	1.165	0.014
13	1	1.114	0.000	0.000	1.241	0.012
15	3	1.176	0.477	0.561	1.383	0.010
17	1	1.230	0.000	0.000	1.514	0.008
18	1	1.255	0.000	0.000	1.576	0.007
19	1	1.279	0.000	0.000	1.635	0.007
23	1	1.362	0.000	0.000	1.854	0.005
27	1	1.431	0.000	0.000	2.049	0.004
34	1	1.531	0.000	0.000	2.345	0.002
244	370	19.059	12.812	7.254	21.062	1.855

Table 4: Lotka's Law

In this study, the least square method has been used, as defined by Pao (1985). It can be expressed as follows:

 $n = \frac{N\sum XY - \sum X\sum Y}{N\sum X^2 - (\sum X)^2}$  .....equation (2)

where N = number of data pairs considered;

x = number of articles

y = number of authors

X = logarithm of x and

Y = logarithm of y

$$n = \frac{(20*7.254) - (19.059*12.812)}{20*21.062 - (19.059*19.059)}$$
$$n = -1.71$$

Taking absolute value of -1.71 i.e. |-1.71| = 1.71The value of 'c' is determined by substituting the value in the following equation:

$$C = \frac{1}{\Sigma^{1/x^{n}}}$$
.....equation (3)  
 $C = \frac{1}{1.855}$   
 $C = 0.539$ 

The critical value (c.v.) can be calculated by the equation determined by Nicholls (1986). By putting the values in the following equation, the critical value (c.v.) is calculated:



Figure 2: Log of authors with no. of publications

Pao (1986) advised applying the non-parametric Kolmogorov Smirnov (K-S) goodness of fit test to confirm the applicability of the Lotka's law to the observed values. Based on the results, the maximum difference  $(D_{max})$  is witnessed, and then the  $D_{max}$  value needs to be compared with the critical value, which can be calculated using equation no. (4).

It is evident from Table 5 that the maximum difference between observed and expected cumulative distributions, i.e., the  $D_{max}$  value is 0.017. Since the  $D_{max}$  value is lower than that of the critical value, i.e., 0.084, it is clear that the present study follows Lotka's Law of author's productivity.

		Observed		Exp	D	
x	у	% of authors $(y_x/\sum y_x)$	Cumulative %	% of authors (C*1/x <sup>n</sup> )	Cumulative %	Obs. Cum Exp. Cum
1	185	0.500	0.500	0.539	0.539	-0.039
2	63	0.170	0.670	0.165	0.704	-0.033
3	37	0.100	0.770	0.082	0.786	-0.016
4	21	0.057	0.827	0.050	0.836	-0.009
5	17	0.046	0.873	0.034	0.871	0.002
6	13	0.035	0.908	0.025	0.896	0.012
7	9	0.024	0.932	0.019	0.915	0.017
8	3	0.008	0.941	0.015	0.931	0.010
9	4	0.011	0.951	0.013	0.943	0.008
10	1	0.003	0.954	0.011	0.954	0.000
11	2	0.005	0.959	0.009	0.963	-0.003
12	5	0.014	0.973	0.008	0.970	0.002
13	1	0.003	0.976	0.007	0.977	-0.002
15	3	0.008	0.984	0.005	0.982	0.001
17	1	0.003	0.986	0.004	0.987	0.000
18	1	0.003	0.989	0.004	0.991	-0.001
19	1	0.003	0.992	0.004	0.994	-0.002
23	1	0.003	0.995	0.003	0.997	-0.002
27	1	0.003	0.997	0.002	0.998	-0.001
34	1	0.003	1.000	0.001	1.000	0.000

#### Table 5: K-S Test on observed and expected distribution of authors

#### **Degree of Collaboration**

In bibliometric studies, the degree of collaboration is an important area that helps to measure the trend in the publication pattern of single-authored and multi-authored papers. Here the collaboration pattern of the Faculty of

 $C = \frac{N_M}{N_M + N_s}$ 

Where C= Degree of Collaboration  $N_M$  = No. of multiple authors  $N_S$  = No. of single authors

Agriculture, AAU, from 2009 to 2018, is calculated using the following formula given by Subramanyam (1983). Table 6 shows the particulars of the degree of collaboration "C" for this study is 0.96, which indicates that the multi-authored papers have dominance. The degree of collaboration ranges from 0.89 to 1.

Year	Number of Single Authored Paper (N <sub>S</sub> )	Number of Multi Authored Paper (N <sub>M</sub> )	Total (N <sub>M+</sub> N <sub>S</sub> )	Degree of Collaboration (C)
2009	1	17	18	0.94
2010	1	18	19	0.95
2011	2	17	19	0.89
2012	3	28	31	0.90
2013	0	19	19	1.00
2014	0	35	35	1.00
2015	1	36	37	0.97
2016	0	67	67	1.00
2017	4	73	77	0.95
2018	2	54	56	0.96
Total	14	364	378	0.96

#### Table 6: Degree of Collaboration

#### Most Prolific Authors during 2009 - 2018

The Table 7 reveals the list of most productive authors according to their number of contributions indexed in the Scopus database. Prof. Madhumita Barooah from the Department of Agricultural Biotechnology was found to be the most productive author study with 34 (8.99 %) contributions, followed by Mahendra Kumar Modi with 27 (7.14 %) publications, Priyabrata Sen with 23 (6.08 %), R.N. Sarma with 19 (5.03 %), Dhruba Jyoti Nath with 18 (4.76 %), Anjali Basumatary with 17 (4.50 %), Budheswar Dehury with 15 (3.97 %), Jagajjit Sahu with 15 (3.97 %), Badal Bhattacharyya with 15 (3.97 %), and Pranab Dutta with 13 (3.44%). The highest ACPP is for Jagajjit Sahu (9.93), followed by Budheswar Dehury (9.67) and Mahendra Kumar Modi (6.96). Madhumita Barooah, Mahendra Kumar Modi, and Priyabrata Sen have the highest h-index, i.e., nine each.

Author	Affiliated Department(AAU)	No. of Contributions (N=378)	Percentage (%)	тс	ACPP	h-index
Madhumita	Agricultural	34	8.99	202	5.94	9
Barooah	Biotechnology					-
Mahendra Kumar	Agricultural	27	7 14	188	6.96	9
Modi	Biotechnology	27	/.14	100	0.70	,
Privabrata Sen	Agricultural	23	6.08	184	8.00	9
T Hydorada Sen	Biotechnology	25	0.00	101	0.00	,
R N. Sarma	Plant Breeding and	19	5.03	93	4 89	6
K.IV. Barina	Genetics	1)	5.05	/5	1.05	0
Dhruba Jyoti Nath	Soil Science	18	4.76	49	2.72	4
Anjali Basumatary	Soil Science	17	4.50	16	0.94	2
Budheswar Dehury	Agricultural	15	3 97	145	9.67	8
Budileswar Denary	Biotechnology	15	5.71	175	2.07	0
Jagaijit Sahu	Agricultural	15	3.07	140	0.03	Q
Jagajjit Sallu	Biotechnology	15	5.97	149	9.95	0
Badal	Entomology	15	3.07	20	1 22	3
Bhattacharyya	Entomology	15	5.71	20	1.55	5
Pranab Dutta	Plant Pathology	13	3.44	73	5.62	4

Table 7: Top ten most prolific author

\* TC= Total Citations

\* ACPP= Average Citations Per Paper

#### Top ten papers with the highest citation from the Faculty of Agriculture, AAU

In Table 8, the top 10 highly cited paper has been listed. As it is clear from the table that these highly cited journal articles appeared in 10 different journals. The articles authored by Hazarika, L.K., Bhuyan, M. & Hazarika, B.N. received the highest citations, i.e., 127 citations, and were published in "Annual Review of Entomology" in 2009.

## Bradford's law and distribution of Most Productive (CORE) journals during 2009-2018

It is evident from Table 9 that 378 journal articles were published in 151 journals. The study

revealed that 97 journals published a single article each, 24 published two articles each, 6 published three articles each, 4 published four articles each, other four journals published five articles each, and so on. Research on Crops found out to be the most productive journal with 23 articles. It is also found in Table 9 that seven journals identified in the nuclear or core zone with 117 (30.95%) articles; in the second zone, there are 23 journals with 116 articles, and the third zone has 145 articles in 121 journals. As per Bradford's Law of distribution, the relation between the zones is  $1:n:n^2$ . As per the data set, the actual distribution over zones is 7: 23: 121:: 7: 7\*3.28: 7\*(3.28)<sup>2</sup> \*1.6, which does not fit into the distribution

Title	Authors	Public ation Year	Journal Title	Citations
Insect pests of tea and their management	Hazarika, L.K., Bhuyan, M., Hazarika, B.N.	2009	Annual Review of Entomology	127
Use of next-generation sequencing for the identification and characterization of maize chlorotic mottle virus and sugarcane mosaic virus causing maize lethal necrosis in Kenya	Adams, I.P. et al.	2013	Plant Pathology	57
Transgenic chickpeas (Cicer arietinum L.) expressing a sequence- modified cry2Aa gene	Acharjee, S. et al.	2010	Plant Science	51
Carrot yellow leaf virus is associated with carrot internal necrosis	Adams, I.P. et al.	2014	PLoS One	34
Endophytes: Exploitation as a tool in plant protection	Dutta, D. et al.		Brazilian Archives of Biology and Technology,	32
In silico identification and characterization of conserved miRNAs and their target genes in sweet potato (Ipomoea batatas L.) expressed sequence tags (ESTs)	Dehury, B. et al.	2013	Plant Signaling and Behavior	31
Trends and fluctuations of rainfall regime in the Brahmaputra and Barak basins of Assam, India	Deka, R.L. et al.	2013	Theoretical and Applied Climatology	30
Decaffeination of tea extracts by using poly(acrylamide-co-ethylene glycol dimethylacrylate) as adsorbent	Lu, JL. et al.	2010	Journal of Food Engineering	30
Control of post-harvest pericarp browning of litchi (Litchi Chinensis Sonn)	Neog, M., Saikia, L.	2010	Journal of Food Science and Technology	30
Analysis of the rice ADP-glucose transporter (OsBTI) indicates the presence of regulatory processes in the amyloplast stroma that control ADP-glucose flux into starch	Cakir, B. et al.	2016	Plant Physiology	29
rotai				431

# Table 8: Top ten highly cited papers

		Number of		Percenta	Cumulative	Cumulativ
Sl. No	Name of the Journals	articles	Rank	ge	No. of	е
		articles		(%)	Articles	%
1	Research on Crops	23	1	6.08	23	6.08
2	Pestology	20	2	5.29	43	11.38
2	Journal of the Indian Society of Soil	10	2	5.02	62	16.40
3	Science	19	3	5.05	02	10.40
4	Indian Journal of Agricultural	17	4	4.50	70	20.00
4	Research	17	4	4.30	19	20.90
5	Indian Journal of Horticulture	15	5	3.97	94	24.87
6	Asian Journal of Chemistry	12	6	3.17	106	28.04
7	Indian Journal of Agricultural	11	7	2.01	117	20.05
/	Sciences	11	/	2.91	117	30.93
0	Indian Journal of Genetics and Plant	11	7	2.01	129	22.96
0	Breeding	11	/	2.91	120	55.80
9	Indian Journal of Nematology	8	8	2.12	136	35.98
10	Ecology, Environment and	7	0	1.95	1/2	27.92
10	Conservation	/	9	1.05	145	57.65
11	Current Science	6	10	1.59	149	39.42
12	Indian Journal of Agricultural	6	10	1.50	155	41.01
12	Biochemistry	0	10	1.39	155	41.01
13	Indian Journal of Biotechnology	6	10	1.59	161	42.59
14	Indian Journal of Traditional	6	10	1 50	167	44.18
14	Knowledge	0	10	1.39	107	44.10
15	Journal of Entomological Research	6	10	1.59	173	45.77
16	PLoS ONE	6	10	1.59	179	47.35
17	Indian Journal of Agronomy	5	11	1.32	184	48.68
18	Indian Journal of Plant Physiology	5	11	1.32	189	50.00
19	Legume Research	5	11	1.32	194	51.32
20	Research Journal of Biotechnology	5	11	1.32	199	52.65
21	3 Biotech	4	12	1.06	203	53.70
22	Biopesticides International	4	12	1.06	207	54.76
23	Journal of Agrometeorology	4	12	1.06	211	55.82
24	Journal of Molecular Graphics and	4	10	1.06	215	56 00
24	Modelling	4	12	1.00	215	50.00
25	Electronic Journal of Plant Breeding	3	13	0.79	218	57.67
26	International Journal of Vegetable	2	12	0.70	221	59 17
20	Science	5	15	0.79	221	30.47
27	Journal of Food Science and	2	12	0.70	224	50.26
27	Technology	5	15	0.79	224	39.20
28	Mausam	3	13	0.79	227	60.05
20	OMICS A Journal of Integrative	2	12	0.70	220	60.85
29	Biology	3	13	0.79	230	00.05
20	World Journal of Microbiology and	2	12	0.70	222	61.64
50	Biotechnology	3	15	0.79	233	01.04
31	24 Journals with 2 articles	48	-	12.70	281	74.34
32	97 Journals with 1 article	97	-	25.66	378	100.00
Total		378		100%		

#### Table 9: Distribution of Most Productive (CORE) journals during 2009-2018

sequence of journals under Bradford's law of scattering. Now, the mean value of the Bradford multiplier is n=4.28 [(3.29+5.26)/2]. So, 1:n:n<sup>2</sup> :: 7:7\*4.28:7\*(4.28)<sup>2</sup> :: 7: 29.96: 128.22 >>165.18. The percentage of error = [(165.18-151)/151] \*100 = 9.39 %. Based on this calculation, it is found that the distribution of journals doesn't follow Bradford's law.

Zone	Number of Journal	Number of Articles	Multiplier Factor
1	7 (4.64)	117 (30.95)	-
2	23 (15.23)	116 (30.69)	3.29
3	121 (80.13)	145 (38.36)	5.26
Total	151	378	4.28*

Table 10: Distribution of Journals in Bradford Zones



Figure 3: Graphical Presentation of Bradford's Law of Scattering

## FINDINGS AND CONCLUSION

India is an agrarian country, and agriculture is the backbone of the Indian economy. India's agricultural research system is considered one of the world's largest and most complex research systems. Several agricultural institutions coordinate, direct, and promote education and research related to agricultural science at local, state and national levels. Assam Agriculture University, Jorhat is also one of its kind. This study enlightens the research performance of the Faculty of Agriculture under Assam Agricultural University, Jorhat, in terms of publication growth, authorship pattern, and collaboration. Bibliometric techniques have been applied to evaluate the development of literature in

quantitative terms. Over the last decade, the publication pattern of Faculty member of AAU, Jorhat, has been erratic. This paper has analyzed only journal articles obtained from Scopus Database for ten years. Collaborative research is indicated as the majority of documents are multiauthored. A total of 1271 authors contributed 378 publications with 3.36 average authors per paper and 0.30 productivity per author. The majority of contributions are from AAU. Lotka's law of scientific productivity fits into this study. The Degree of Collaboration indicates that multiauthored paper has dominance. This study does not fit into Bradford's distribution of core journals. The current study might assist in assessing Assam's contributions to the agricultural sciences and allied areas. The major limitation is that the data collected for the present research is confined to the Scopus database. It is recommended that a comprehensive study on the research output of other faculties of AAU, Jorhat can be undertaken, and data can be collected from different databases.

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