Literature Output on Rice in India: A Scientometric Study

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Abstract

This study analyses the research output in India in Rice during the period 2001-2013 and the analyses included research growth, rank, LCS, GCS. It also analyses the characteristics of most productive institutions, authors and high - cited papers. The study was conducted using data from the Web of Science database over the time period of 2001–2013. India's global publications' share in rice during the study period was 10.6 percent (with 6,447 papers) and it ranked 4th among the top 10 countries in rice. It includes 92.63 percent of articles, 3.55 percent of reviews etc., the growth rate of publications varied from 0.91 percent to 1.35 percent per year. India is far behind in terms of publication output, citation quality and share of international collaborative papers in rice when compared to other countries with an emerging economy.

Keywords

Literacy, information and communication technology, University Libraries.
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INTRODUCTION

The journey of rice around the world has been slow, but once it took root it stayed and became a major agricultural and economic product for the people. Based on production volume, the third most cereal in world is Rice after than corn and wheat. More than 460 million metric tons of husked rice was produced in the past two harvesting years worldwide. Traditionally, countries in Asia have the largest share in world rice production. With over 200 million metric tons, China is the world's leading rice producer, while India is the country with the largest area where rice is harvested. 106.1 million hectares cultivated rice in world and 719.74 million metric tons production of worldwide. In the Indian subcontinent more than a quarter of the cultivated land is given to rice. In 2014 the production of rice is 106.54 metric tons rice from 34.98 million hectares. It is a very essential part of the daily meal in many parts of the country.

OBJECTIVES

- To identify and analyze the exponential growth rate of research literature on Rice in Indian Contributions.
- To analyze the authorship pattern and examine the extent of research collaboration.
- To analyze the source wise distribution on Rice research output.
- To apprehend and test the applicability of Lotka's law of author productivity in the field of Rice research.
- To assess the Institution wise research concentration in rice literature in India.
- To identify the journal's contribution on rice literature with their impact factors.

METHODOLOGY

The data has collected from the web of Science database and using Histcite software for making on tables.

Analysis and Interpretations

Table 1: Yearly Output and Exponential Growth Rate on Rice Literature

S. No	Year	Records	Percent	GR	TLCS	TGCS	Rank
1	2001	294	4.56	-	665	5239	12
2	2002	269	4.17	0.91	636	4444	13
3	2003	319	4.95	1.18	758	6319	10
4	2004	297	4.61	0.93	584	4954	11
5	2005	355	5.51	1.19	709	7228	9
6	2006	398	6.17	1.12	573	6737	8
7	2007	539	8.36	1.35	736	7453	7
8	2008	578	8.97	1.07	701	6836	5
9	2009	552	8.56	0.95	777	1396	6
10	2010	618	9.59	1.11	601	5501	4
11	2011	705	10.94	1.14	435	3832	3
12	2012	748	11.60	1.06	236	2332	2
13	2013	775	12.02	1.03	58	1001	1
	Total	**6447**	**100.00**	**13.04**	**7469**	**63272**	

The above table shows that the year wise research productivity of rice during the study period from 2001 to 2013 and the exponential growth rate. The year 2013 has the highest number of publications (12.02%) followed by 2012 (11.60%), 2011 (10.94%) and 2010 (9.59%) respectively. The year of 2002 is the lowest publication among the 13 years. The year 2007 has got the highest citation scores (7453) and the year 2013 has got very lowest citation scores (1001). The average of exponential growth rate is 1 percent.

Table 2: Countries output on Rice literature

S. No	Country	Records	Percent of 60806
1	Peoples R china	12474	20.51
2	USA	11029	18.14
3	Japan	10047	16.52
4	**India**	**6447**	**10.60**
5	S Korea	3472	5.71
6	Brazil	2474	4.07
7	Germany	2385	3.92
8	England	2010	3.31
9	Australia	2007	3.30
10	France	1800	2.96
	Total	**54145**	**89.05**

More than 100 Collaborated countries across the globe produced the rice research during the study period. It is found that China, USA, Japan are three top nations having a collaborations with a outcome of 12474, 11029 and 10047 publications forming 20.51 percent, 18.14 percent and 16.52 percent respectively. India is the fourth position has produced 10.60 percent of research output. The top 10 countries produced 89.05 percent of research literature on Rice.

Table 3: Distribution of year wise H-index, Cited records and Number of Authors in Rice research productivity

The above table shows that distribution of year wise h-index, cited scores and number of authors contributed the research publications. The year 2007 got highest h-index (41) followed by the year 2001 (39). The years 2003-2006 has got the equal h-index (38) and got third position during the study period. In 2013, the highest number of authors (3580) contributed 775 publications followed by 2012 (3214 authors contribute 748 publications) and 2011 (3120 authors contribute 705 publications) respectively. It is quite interesting note that the year 2013 has got very low h-index (9) among 13 years. The average cited reference per author is 33.70.

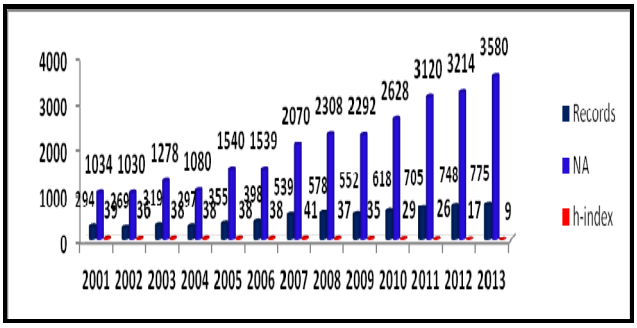


Fig 1: year wise records, number of authors and h-index

Table 4: Source wise distribution on Rice research output

	2001	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**Total**	**%**
Articles	277	252	298	280	327	374	493	526	507	560	662	694	722	5972	92.63
Reviews	10	10	9	11	10	14	26	5	12	37	26	35	35	229	3.55
Proceeding papers	3	4	7	3	6	4	15	27	19	8	3	5	8	123	1.91
Meeting Abstracts	1	0	1	0	2	2	2	10	5	4	3	2	6	38	0.59
Editorial Materials	1	1	2	1	2	2	1	2	2	4	4	3	2	27	0.42
Letters	0	2	0	1	2	1	1	1	2	1	2	1	1	15	0.23
Others	2	0	2	1	6	1	1	7	5	4	5	8	1	43	0.67
Total	**294**	**269**	**319**	**297**	**355**	**398**	**539**	**578**	**552**	**618**	**705**	**748**	**775**	**6447**	**100**

The distribution of the publications from India is in 7 formats. Of which the research Articles in journals is the most preferred format of publication in Rice research as it form 92.63 percent of the total literature output. The other preferred forms by the Indian researcher as Reviews (3.55%), Proceeding Papers (1.91%), Meeting Abstracts (0.59%), Editorial Materials (0.42%), Letters (0.23%) and Others (0.67%).

Table 5: Author's Productivity in the Field of Rice research

	2001	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**Total**	**%**
Single authors	20	14	19	18	20	18	23	34	25	25	21	26	14	277	4.3
Two authors	69	67	77	74	85	83	127	128	114	115	136	133	130	1338	20.75
Three authors	90	76	71	76	96	98	149	151	148	146	162	193	198	1654	25.65
Four authors	42	51	67	44	69	74	97	109	101	126	137	133	149	1199	18.6
Five authors	33	21	35	28	39	45	61	73	69	82	101	103	106	796	12.35
Six authors	19	15	16	18	18	39	30	31	34	40	59	65	64	448	6.95
Seven authors	8	10	12	18	15	24	22	18	17	24	27	30	43	268	4.16
Eight authors	10	5	2	9	2	7	12	7	15	24	13	26	28	160	2.48

S. No	**Year**	**Records**	**h-index**	**Average Citation**	**CR**	**ACRPA**	**NA**
1	2001	294	39	17.82	8275	28.15	1034
2	2002	269	36	16.47	6962	25.88	1030
3	2003	319	38	19.81	9295	29.14	1278
4	2004	297	38	16.68	8933	30.08	1080
5	2005	355	38	20.36	11291	31.81	1540
6	2006	398	38	16.93	12634	31.74	1539
7	2007	539	41	14.29	11147	31.14	2070
8	2008	578	37	11.83	18500	32.01	2308
9	2009	552	35	11.64	18795	34.05	2292
10	2010	618	29	8.90	23321	37.74	2628
11	2011	705	26	5.44	29267	41.51	3120
12	2012	748	17	3.12	31188	41.70	3214
13	2013	775	9	1.29	33471	43.19	3580
	Total	**6447**			**2,23,079**	**33.70**	**26713**

Nine authors	1	2	7	4	2	3	2	9	5	10	18	22	30	115	1.78
Ten &Abvoe	2	8	13	8	9	7	16	18	24	26	31	17	13	192	2.98
Total	**294**	**269**	**319**	**297**	**355**	**398**	**539**	**578**	**552**	**618**	**705**	**748**	**775**	**6447**	**100**

In identifying the research performance in any area of particular science, it is vital to analyze the author's productivity. The author's efficiency is determined by the scientists in a specific field. Here the authors are classified according to their number of research contribution. From this data the three author's productivity is the highest (25.65%) compared to other collaborative authorship. Followed by two authors contribution has 20.75 percent of articles, four authors contribution has 18.6 percent, five authors contribution has 12.35 percent and remaining collaborative authorship pattern productivity having below 10 percent of articles respectively. It is quite interesting note that single author's contribution has 4.3 percent only

Table 6: Lotka's Law of Author productivity in Rice

No. of contribution X	No. of contributoires	Y	∑X = log x	∑Y = log y	∑X*Y	∑X*X
1	277	277	0	5.624	0.000	0
2	1338	2676	0.693	7.892	5.469	0.480
3	1654	4962	1.098	8.509	9.343	1.206
4	1198	4792	1.386	8.474	11.745	1.921
5	796	3980	1.609	8.289	13.337	2.589
6	448	2688	1.791	7.896	14.142	3.208
7	268	1876	1.945	7.536	14.658	3.783
8	160	1280	2.079	7.154	14.873	4.322
9	115	1035	2.197	6.942	15.252	4.827
10	54	440	2.302	6.086	14.010	5.299
11	45	385	2.397	5.953	14.269	5.746
12	32	360	2.484	5.886	14.621	6.170
13	22	260	2.564	5.560	14.256	6.574
14	15	210	2.639	5.347	14.111	6.964
15	11	165	2.708	5.105	13.824	7.333
16	13	208	2.772	5.337	14.794	7.684
17	4	68	2.833	4.219	11.952	8.026
18	5	90	2.890	4.499	13.002	8.352
19	2	38	2.944	3.637	10.707	8.667
20	1	20	2.995	2.995	8.970	8.970
21	2	42	3.044	3.737	11.375	9.266
22	1	22	3.091	3.091	9.554	9.554
23	4	92	3.135	4.521	14.173	9.828
25	3	75	3.218	4.317	13.892	10.356
28	1	28	3.332	3.332	11.102	11.102
29	1	29	3.367	3.367	11.337	11.337
31	1	31	3.433	3.433	11.785	11.785
32	1	32	3.465	3.465	12.006	12.006
35	1	35	3.555	3.555	12.638	12.638
37	1	37	3.610	3.610	13.032	13.032
39	1	39	3.663	3.663	13.418	13.418
43	1	43	3.761	3.761	14.145	14.145
45	1	45	3.806	3.806	14.486	14.486
91	1	91	4.510	4.510	20.340	20.340
262	1	262	5.568	5.568	31.003	31.003

Total	**26713**	**96.884**	**180.676**	**457.621**	**306.417**

P = number of X items in table = 36
N =maximum number of contributors = 26713
N: Observed value

Pao (1989) proposed the way to calculate n-value and c- value of Lotka's law as in (1) and (2)

$$n = \frac{N\Sigma XY - \Sigma X\Sigma Y}{N\Sigma X^2 - (\Sigma X)^2} \quad (1)$$

N = 36 (457.621) – (96.884)(180.676)/36 (306.417) – (96.884)(96.884)
N = - 0.626
N is the maximum contribution of an author. X is log(x) and Y is log(y) where y are the authors who have x number of contribution.

$$c = \frac{1}{\sum_{1}^{p-1}\frac{1}{x^n} + \frac{1}{(n-1)(p^{n-1})} + \frac{1}{2p^n} + \frac{1}{24(p-1)^{n+1}}} \quad (2)$$

Where p is the number of publication groups which authors were contributed the same amount of publications. Besides, Pao also used Kolmogorov–Smirnov (K–S) test to verify if Lotka's law is matched or not under the condition that p-value is greater than thirty five.

$$\text{K-S} = \frac{1.63}{\sqrt{N}}$$

Square root of 26,713 is 163.441, and verifies K-S statistic value to see if Lotka's law be capable of hold for Renewable Energy related Publications. For N value is greater than 36, therefore, K-S statistics method can be used to verify if Lotka's law could hold for the sample area publications.

K – S = 1.63 / 163.441
K-S = 0.009 for N = 26,713

Totally 26,713 authors were contributed to the area of Rice research productivity. 2226.1 authors were calculating the mean value of every year author's contribution and 2.27 numbers of authors were calculated at individual articles. It emphasizes the fact that the more number of publications by a researcher in any field requires a high degree of inquisitiveness, competency, efficiency, insistence, and exposure to literatures. That is why majority of authors have contributed to more number of papers.

Table 7: Top 10 Authors contribution on Rice Literature in India based on records output with h-index

S. No	Author	Records	TLCS	TGCS	ACPI	H-Index
1	Kumar A	150	148	657	5.70	17
2	Singh S	121	194	942	10.54	16
3	Singh AK	116	235	780	8.03	16
4	Singh A	107	284	2303	24.55	17
5	Kumar S	99	139	530	7.37	16
6	Singh N	75	147	1355	19.91	22
7	Singh R	66	111	503	9.15	12
8	Singh NK	64	272	2304	40.22	18
9	Kumar V	62	127	349	59.31	23
10	Tyagi AK	62	298	3222	7.24	14
	Total	**922**	**1955**	**12945**		

The analysis of the author's productivity examines the prevailing trend in understanding the research process in any discipline of science. It is evident from the above table that there are 402 publications from Indian authors affiliated to academic institution and research organization in India. This publications were contributed 26,713 authors both as single and joint authors. There are very few prolific authors, who have published a moderate number of publications. Of which, Kumar A, Singh S and Singh AK are having the highest contributions with 150, 121 and 116 publications respectively for the study period. Only four authors contributed more than 100 records and remaining contributed below 100 records. The analysis also revealed that h-index of the prolific authors, the ranges between 12 and 23.

Table 8: Organization's Contribution on Rice Research

S. No	Name of the Organization	Record	%	TLCS	TGCS
1	Indian Agricultural Research Institute	530	8.221	961	5661
2	Punjab Agricultural University	270	4.188	435	2226
3	Indian Institute of Technology, Delhi	258	4.002	258	3698
4	Tamilnadu Agricultural University	244	3.785	294	2231
5	Banaras Hindu University	225	3.490	358	3104
6	University of Delhi	178	2.761	367	4128
7	International rice research institute	170	2.637	695	4671
8	Centre for Food Technology Research Institute	169	2.621	130	1492
9	Central rice research institute, India	156	2.420	187	1043
10	Council of Scientific Industrial Research, India	154	2.389	142	1419

Table 8 indicates the institution wise research activity in the field of rice research output. Totally 2891 institutions were brought out the research output of the selected field of whole 6447 sample data in India. The first 10 higher publication take by priority of their highest research output institutions only. It could be observed that Indian Agricultural Research Institute have the high (8.221%) productivity of this field during the study period with 961 LCS and 5661 GCS measured. This is followed by 'Punjab Agricultural University' (4.188%) with 435 LCS and 2226 GCS and 'Indian Institute of Technology, Delhi' (4.002%) with 258 LCS and 3698 GCS respectively

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Table 9: Top 10 Journals contribution on Rice research in India (1105)

S. No	Journal	Records	%	TLCS	TGCS	IF	Publisher
1	Indian Journal of Agricultural Sciences	336	5.21	146	317	0.17	ICAR, India
2	Current Science	180	2.79	254	1103	0.93	IISc, Bangalore
3	Journal of Food Science And Technology-Mysore	108	1.68	37	197	1.12	Association of Food Scientists and Technologists, India
4	Indian Journal of Agronomy	102	1.58	106	226	0.982	Elsevier
5	Research on Crops	90	1.40	3	4	0.881	Springer
6	Field Crops Research	88	1.36	342	1441	2.957	Elsevier
7	Agricultural Water Management	71	1.10	184	835	2.822	Elsevier
8	Euphytica	71	1.10	170	639	1.692	Springer
9	Bioresource Technology	68	1.05	143	2038	5.172	Elsevier
10	Indian Journal of Genetics And Plant Breeding	68	1.05	22	33	0.198	The Indian Society of Genetics & Plant Breeding
Total		**1182**	**18.33**	**1407**	**6833**		

It is found from analysis that the Indian literature output on rice has been proliferated in to 1,105 journals. Among them top 10 journals alone could contribute 18.33 percent of literature output (1182 publications). The top 3 positions in terms of the number of publications for the publishers 'Indian Council of Agricultural Research, India' (6.7%), 'Indian Institute of Science, Bangalore' (2.79 %) and 'Association of Food Scientists and Technologists' (1.68%) respectively. It is also found that the Impact Factor of journals, 'Bioresource Technology' has 5.172, followed by 'Field Crops Research' (2.957) and 'Agricultural Water Management' (2.822) respectively.

Table 10: Top 10 Highly Cited papers on Rice Literature in India

S. No	Paper/Author/Journal	Times Cited
1	The map-based sequence of the rice genome By: Matsumoto, T; Wu, JZ; Kanamori, H; et al. Group Author(s): Int Rice Genome Sequencing Project NATURE Volume: 436 Issue: 7052 Pages: 793-800	1507
2	The Sorghum bicolor genome and the diversification of grasses By: Paterson, Andrew H.; Bowers, John E.; Bruggmann, Remy; et al. NATURE Volume: 457 Issue: 7229 Pages: 551-556	759
3	Kinetics and mechanism of removal of methylene blue by adsorption on various carbons - a comparative study, By: Kannan, N; Sundaram, MM, DYES AND PIGMENTS Volume: 51 Issue: 1 Pages: 25-40	586
4	Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants, By: Gill, Sarvajeet Singh; Tuteja, Narendra PLANT PHYSIOLOGY AND BIOCHEMISTRY Volume: 48 Issue: 12 Pages: 909-930	564
5	Equilibrium, kinetics, mechanism, and process design for the sorption of methylene blue onto rice husk By: Vadivelan, V; Kumar, KV JOURNAL OF COLLOID AND INTERFACE SCIENCE Volume: 286 Issue: 1 Pages: 90-100 Published: JUN 1 2005	443
6	Use of activated carbons prepared from sawdust and rice-husk for adsorption of acid dyes: a case study of Acid Yellow 36 By: Malik, PK DYES AND PIGMENTS Volume: 56 Issue: 3 Pages: 239-249 Published: MAR 2003	361
7	Greenhouse gas mitigation in agriculture By: Smith, Pete; Martino, Daniel; Cai, Zucong; et al. PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES Volume: 363 Issue: 1492 Pages: 789-813	354
8	Morphological, thermal and rheological properties of starches from different botanical sources By: Singh, N; Singh, J; Kaur, L; et al. FOOD CHEMISTRY Volume: 81 Issue: 2 Pages: 219-231 Article Number: PII S0308-8146(02)00416-8 Published: MAY 2003	324
9	Validation of housekeeping genes as internal control for studying gene expression in rice by quantitative real-time PCR, By: Jain, Mukesh; Nijhawan, Aashima; Tyagi, Akhilesh K.; et al. BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS Volume: 345 Issue: 2 Pages: 646-651	285
10	Bioconversion of lignocellulosic biomass: biochemical and molecular perspectives, By: Kumar, Raj; Singh, Sompal; Singh, Om V. JOURNAL OF INDUSTRIAL MICROBIOLOGY & BIOTECHNOLOGY Volume: 35 Issue: 5 Pages: 377-391	283

The research publications on rice 2001- 2013 has downloaded from the source database and classified based on the citations. The top10 highest cited papers tabulated, it is found that only one paper got more than 1000 citations, and three papers got more than 500 citations during the study period.

FUNDING AGENCIES

Research funding agencies should encourage institutions to develop and implement policies and systems to promote integrity in all aspects of the research enterprise. It will work cooperatively with partners to support and facilitate research integrity worldwide. The following are the major funding agencies in India contribute to rice research output. Department Of Biotechnology, Government Of India (163 records), Council Of Scientific And Industrial Research (88), Indian Council Of Agricultural Research, New Delhi (74), University Grants Commission New Delhi and Department Of Science And Technology Government Of India (33).

CONCLUSION

Rice research in India has shown the importance of understanding the Agricultural for the sustainable development. Based from this analysis the research

productivity of rice is a regular growth during 2001-2013. 25.65 percent of research publication contributed by three authors. Journal Article has the dominating documentation source than others. The average of exponential growth rate is one percent. The organization of Indian Agricultural Research Institute has contribute 530 records and the journal Indian Journal of Agricultural Sciences 336 records with impact factor 0.17. the The paper 'The map-based sequence of the rice genome' by Matsumoto, T; Wu, JZ et al., in the journal 'Nature' has got highest citations (1507) during the study period.

REFERENCES

1. Sivasekaran, K. & Srinivasaragavan, S. (2013). Mapping of Research Publications on Himalayas : A Scientometrics Exploration. *International Journal of Scientific Research*. 3: 58-60.

2. Amsaveni, N., Vasanthi, R. & Sivasekaran, K. (2013). Open Access of E-Journals in Technology and Engineering to DOAJ: A scientometric study. *Global Research Analysis*. 3: 87-89.

3. Ramasamy, R.U., Sivasekaran,K. & Navasakathi, C. (2013). Scientometric Analysis of Thorium Research in India: A Case study. *Global Research Analysis*. 4:80-82.

4. Ashok Kumar, P., Santosh A Navalur. & Sivasekaran,K. (2013). A scientometric study of Biodiversity Research in India: A special Reference to Authors Productivity. *International Journal of Scientific Research.* 3: 58-60.

5. International rice research institute. http://irri.org/rice-today.

6. World rice acreage from 2008/2009 to 2013/2014. http://www.statista.com/statistics/271969/world-rice-acreage-since-2008/

7. India Government Projects 2013-2014 Rice Production. http://www.oryza.com/tags/india-rice-production

8. Role of research funding agencies in the enforcement of research integrity. http://www.sciforum.hu/cms/upload/docs/slides2013/14h_00_Paulo_Beir_o_sala_Angra_1__25_11.pdf