

Scholarly Contribution in Agricultural Sciences: An Analysis

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Abstract

Research is being carried out at global level in varied subject specifications with wide recognition, and many organizations are at the helm of affairs in promoting and supporting such activities. The scientific research in present knowledge based society is deemed to be the driving force for growth and development. Therefore, there is evident shift towards increasing number of research contributions and excellence of research quality and pace. Agricultural sciences stand no exception to this scenario with qualitative research being prioritized and carried out at different levels. In India, Indian Council of Agricultural Research (ICAR) is the apex body for coordinating, guiding and managing research and education in different areas of agricultural sciences including horticulture, fisheries and animal sciences throughout the country. The present paper makes an attempt to explore and analyze the research contributions in the field of agricultural sciences by the fraternity of ICAR at different levels.

Keywords: Research output, research contribution, agricultural research, India, Indian Council of Agricultural Research, ICAR

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INTRODUCTION

The modern-day research is an important aspect of the knowledge based society. It is a continuous process and adds new dimensions and facets to the existing stock of knowledge. Research and allied activities are supported and promoted throughout the world by different governmental agencies, funding bodies through proper support at different levels. Okafor views research as a human activity based on intellectual application in the investigation of matter aiming at discovering and development of methods and systems for the advancement of knowledge [1]. It is defined as a systematic and creative work which aims at enlarging the knowledge and also comprises activities exploring new applications for existing knowledge. The essence of quality research is to set new knowledge, establish the facts and verify the results that can even be applied outside a research setting. This scenario also lays the foundation for time bound research tasks, program development and policies around the universe aiming at solving existing problems of concern. Hong *et al.* put forward two aspects related to research namely input and output [2]. The input is what a researcher puts

in a research program including the intellectual capabilities, time, effort, dedication, persons etc. The research product in terms of research determines what we call research output and can be measured in terms of quality as well as quantity. The quality of research output can be measured by examining the citation count of publications published in a particular discipline. On the other hand, the quantity of research output can be measured by counting the number of research publications published in a particular field. As per McVeigh, research is organized learning, looking for specific things to add to our store of knowledge [3]. It is a process of refining human experience for being embodied in the stock of knowledge. In course of this refining operation, the obvious steps are collection of data, neat filtration and examination of the facts collected under the prescribed procedures and codes of making conclusions. With every new experience added, it again needs reinterpretation to get an insight for identification of truth.

Agricultural research and education in India have been in the public domain for a long time. Indian Council of Agricultural Research

(ICAR) is an autonomous organization under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture, Govt. of India established on 16 July 1929. For the dissemination of research output, the research journal publishing in India has been, for long, primarily a public funded activity and done mostly by Government agencies like ICAR organizations supported by it [4]. The indexing tool used for the study web of science is an online academic service which was earlier provided by Thomson Reuters and now by Clarivate. The tool provides access to several databases including Science Citation Index (SCI), Social Science Citation Index (SSCI), Arts and Humanities Citation Index, Current Chemical reactions, etc. Web of Science is considered as one of the largest citation databases [5].

PROBLEM

Research activities are being carried out in different subject areas throughout the world and many organizations are at the helm of affairs in promoting and supporting such activities. Scientific research is at the zenith with increasing number of research contributions and excellence of research quality and pace. Agricultural sciences stand no exception to this scenario with qualitative research being prioritized and carried out at different levels. In India, ICAR is the apex body for coordinating, guiding and managing research and education in different areas of agricultural sciences including horticulture, fisheries and animal sciences. The present work thus is an attempt to explore and analyze the research contributions in the field of agricultural sciences by the fraternity of ICAR.

SCOPE

The present study attempts to explore and analyze the research contributions from Indian Council of Agricultural Research (ICAR) in the field of agricultural Sciences from 1999 to 2013 indexed by Web of Science, one of the world's largest indexing and abstracting services under variant name ICAR.

OBJECTIVES

The objectives of the study are:

1. To explore the research contributions of various subject fields.

2. To analyze contributions in terms of collaboration patterns.
3. To analyze the authorship patterns.
4. To reveal the preferred document types among authors.
5. To analyze the overall citation pattern.

DATA ANALYSIS

The data analysis was carried using a total of 943 research contributions accessible via Web of Science.

Subject wise Research Output

As revealed in Table 1, a total of 943 research contributions indexed by Web of Science were harvested for a time period of 1999 to December 2013. Among these, the most productive subject areas were: agriculture with 496(52.59%), multidisciplinary sciences with 67(7.10%), environmental sciences with 46(4.87%), biotechnology and related fields 42(4.45%), whereas the least productive include fisheries with 39(4.13%), food science and technology with 37(3.92%), veterinary sciences with 35(3.71%), biochemistry and allied fields with 32(3.39%) and microbiology with 11(1.16%). While as the subject category where research output is less than 19 were added together under subject category Others with 138(14.63%) publications and include biology, cell biology, reproductive biology, zoology, entomology, biochemical research methods, genetics and heredity, infectious diseases, behavioral sciences, virology, engineering, meteorology and atmospheric sciences, andrology, public; environmental and occupational health, dermatology, immunology, science and technology-other topics, chemistry, oncology, water resources, mycology, computer sciences, biophysics, oceanography, geography, nanoscience and nanotechnology, law, energy and fuels, nutrition and dietetics, remote sensing, thermodynamics, endocrinology and metabolism, construction and building technology.

Types of Publications

Fig. 1, shows that out of total 943 publications, 876(93%) are articles followed by reviews which are 23(2%) in number, 15(2%) are editorial material, 7(1%) are meeting abstracts, while as the document type where research output was less than 11 were added together under document type, 'Others' which includes letter, news item and correction.

Table 1: Subject wise Research Output.

Subject Category	Output
Agriculture	496(52.59)
Multidisciplinary Sciences	67(7.10)
Environmental Sciences	46(4.87)
Biotechnology and Related fields	42(4.45)
Fisheries	39(4.13)
Food Science and Technology	37(3.92)
Veterinary Sciences	35(3.71)
Biochemistry and Allied fields	32(3.39)
Microbiology	11(1.16)
Others	138(14.63)
Total	943

*Figures in Parentheses Indicate Percentile (N=943).

Research Output in Different Subject Categories in Terms of Document Types

Table 2 shows that subject category agriculture has highest number of articles with a count of 468(94.35%), editorial material count of 5(1.00%), meeting abstract count of 4(0.80%), review count of 10(2.01%) and

others count of 9(1.81%); multidisciplinary sciences with an article count of 48(71.64%), editorial material count of 6(8.95%), review count of 4(5.97%), others count of 9(13.43%); environmental sciences with an article count of 44(95.65%), review count of 1(2.17%), others count of 1(2.17%); biotechnology and related fields with an article count of 38(90.47%), editorial material count of 2(4.76%), review count of 2(4.76%); fisheries with an article count of 39(100%); food science and technology with an article count of 36(97.29%), review count of 1(2.70%); veterinary sciences with an article count of 35(100%); biochemistry and allied fields with an article count of 30(93.75%), meeting abstract count of 1(3.12%), review count of 1(3.12%); microbiology with an article count of 10(90.90%), others count of 1(9.09%); sub category others with an article count of 128(92.75%), editorial material count of 2(1.44%), meeting abstract count of 2(1.44%), review count of 4(2.89%), others count of 2(1.44%).

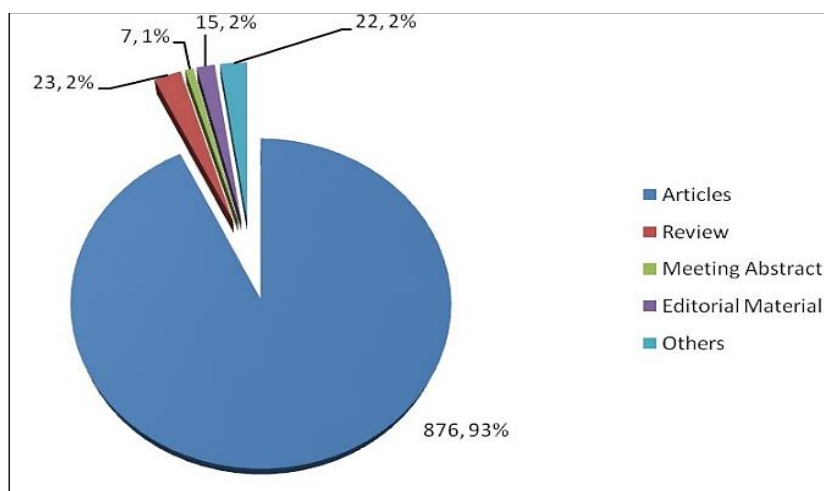


Fig. 1: Types of Publications.

Table 2: Research Output in Different Subject Categories in Terms of Document Types.

Subject Category	Document Types					Total
	Articles	Editorial Material	Meeting Abstract	Review	Others	
Agriculture	468(94.35)	5(1.00)	4(0.80)	10(2.01)	9(1.81)	496
Multidisciplinary Sciences	48(71.64)	6(8.95)	0(0)	4(5.97)	9(13.43)	67
Environmental Sciences	44(95.65)	0(0)	0(0)	1(2.17)	1(2.17)	46
Biotechnology and Related fields	38(90.47)	2(4.76)	0(0)	2(4.76)	0(0)	42
Fisheries	39(100)	0(0)	0(0)	0(0)	0(0)	39
Food Science and Technology	36(97.29)	0(0)	0(0)	1(2.70)	0(0)	37
Veterinary Sciences	35(100)	0(0)	0(0)	0(0)	0(0)	35
Biochemistry and Allied fields	30(93.75)	0(0)	1(3.12)	1(3.12)	0(0)	32
Microbiology	10(90.90)	0(0)	0(0)	0(0)	1(9.09)	11
Others	128(92.75)	2(1.44)	2(1.44)	4(2.89)	2(1.44)	138

*Figures in Parentheses Indicate Percentile.

Citation Profile

Table 3 reveals that subjects falling under agriculture ranked top in terms of recorded 597(47.7%) total citations followed by biotechnology and related fields with 85(6.7%) citations, fisheries with 80(6.3%) citations, food science and technology with 67(5.3%) citations, biochemistry and allied fields with 53(4.2%) citations and environmental sciences with 52(4.1%) citations. However, veterinary sciences, multidisciplinary sciences and microbiology witnessed least number of 31(2.4%), 19(1.5%) and 18(1.4%) citations respectively. Subject category 'Others' recorded a citation count of 249(19.9%).

Table 3 also reveals that fisheries (2.05%) ranked top in average citation per paper whereas multidisciplinary sciences (0.28%) recorded least average citation per paper.

Lustrum-wise Publications

Table 4 indicates four yearly contributions by the institution from the year 2006- till Dec 2013. Phase 2010–2013 has been the most productive period with 683 publications.

Four Yearly Output of Most Productive Categories

2006–2009

The most productive subject area is agriculture with 151(58.07%) while as the least productive areas are biotechnology and related fields and microbiology which contribute 5(2%) and 3(1.15%) respectively.

2010–2013

The most productive subject area is agriculture with 345(50.5%) while the least productive areas are veterinary sciences and microbiology which contribute 13(2%) and 8(1.17%) publications respectively (Table 5).

Table 3: Contribution and Performance of Different Subject Areas.

Rank	Subject Category	Output	Total Citations	Average Citation/Paper
1	Agriculture	496	597(47.72)	1.35
2	Biotechnology and Related fields	42	85(6.79)	2.02
3	Fisheries	39	80(6.39)	2.05
4	Food Science and Technology	37	67(5.35)	1.81
5	Biochemistry and Allied fields	32	53(4.23)	1.65
6	Environmental Sciences	46	52(4.15)	1.13
7	Veterinary Sciences	35	31(2.47)	0.88
8	Multidisciplinary Sciences	67	19(1.51)	0.28
9	Microbiology	11	18(1.43)	1.63
10	Others	138	249(19.90)	1.28
	Total		1251	

*Figures in Parentheses Indicate Percentile.

Table 4: Lustrum-wise Publications.

Time Period	Output	Cumulative Output	Growth Rate
2006–2009	260	260	-
2010–2013	683	943	262.7%

Table 5: Four-Yearly Output of Most Productive Categories.

Subject Category	2006–2009	2010–2013	Total	Cumulative Output
Agriculture	151	345	496	496
Multidisciplinary Sciences	6	61	67	563
Environmental Sciences	7	39	46	609
Biotechnology and Related fields	5	37	42	651
Fisheries	10	29	39	690
Food Science and Technology	13	24	37	727
Veterinary Sciences	22	13	35	762
Biochemistry and Allied fields	6	26	32	794
Microbiology	3	8	11	805
Others	37	101	138	943
Total	260	683		

Profile of Authorship Pattern

It is clear from Fig.2 that more than three author research is favored almost by all which constitutes 596 of the total count 943. The least coalition is found among single authors who constitute 33 of the total count 943.

Authorship Pattern

Table 6 shows the trend in authorship pattern where it is revealed that multi-authorship pattern is preferred almost in all subject categories. Agriculture ranks the highest with 483 multi-author publications followed by multidisciplinary sciences with 61, environmental sciences with 45, fisheries with 39, biotechnology and related fields with 37, food science and technology with 37, veterinary sciences with 34, biochemistry and allied fields with 31, microbiology with 11 and others with 132. Single author research is less

favorable in almost all the subjects, and come in the range of 1–15 with agriculture contributing the highest 13 publications followed by multidisciplinary sciences, biotechnology and related fields and others with 6, 5 and 6 respectively. Environmental sciences, veterinary sciences and biochemistry and allied fields contribute 1 each and a least 0 contributed by microbiology, food science and technology and fisheries.

Collaboration Pattern

Collaboration patterns of publications have been investigated under local, national and international captions. The distribution of collaborative publications as enlisted in Table 7 indicates that the share of publications through national collaboration is greater in subjects of agriculture (1949) and lesser in microbiology (67).

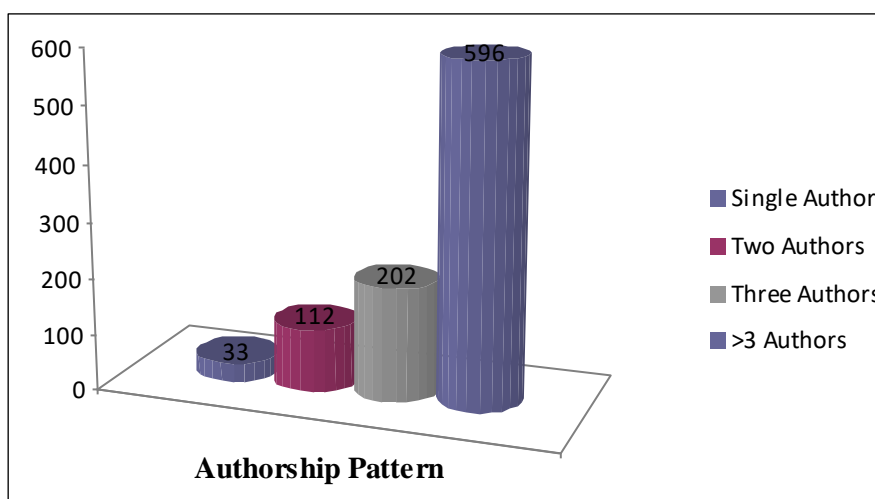


Fig. 2: Profile of Authorship Pattern.

Table 6: Authorship Pattern.

Subject Category	Single Author	Two Authors	Three Authors	>3 Authors
Agriculture	13	61	114	308
Multidisciplinary Sciences	6	10	13	38
Environmental Sciences	1	2	6	37
Fisheries	0	2	4	33
Biotechnology and Related fields	5	4	11	22
Food Science and Technology	0	7	10	20
Veterinary Sciences	1	7	2	25
Biochemistry and Allied fields	1	2	4	25
Microbiology	0	0	0	11
Others	6	17	38	77
Total	33	112	202	596

In local collaboration, highest count is also in agriculture (110) and least count in fisheries and microbiology which contribute two each. In international collaboration, highest count is also in agriculture (136) and least count with four publications in food science and technology and fisheries.

Table 7: Collaboration Pattern.

Subject Category	Local	National	International
Agriculture	110	1949	136
Multidisciplinary Sciences	22	257	15
Fisheries	2	236	4
Environmental Sciences	3	203	29
Biotechnology and Related fields	6	159	49
Biochemistry and Allied fields	6	165	19
Veterinary Sciences	0	159	5
Food Science and Technology	3	146	4
Microbiology	2	67	14
Others	41	580	34
Total	195	3921	309

FINDINGS AND CONCLUSIONS

Scientific research is being carried out at a global level and many organizations have been established for facilitating and conducting research in specific subject areas. Studies are being carried out to reveal the research trends including the output scenario, author preferences, collaboration trends etc. The study is carried in a systematic pattern and the publications were analyzed in order to reveal output in different sub-categories, authorship patterns, collaboration patterns, document types and citation profile of different subject categories. A total of 943 publications were harvested for ICAR India [4]. Out of 943 publications, the field of agricultural sciences witnessed the highest number of publications (496) and the field of microbiology witnessed the least number of publications (11). It was also analyzed that in every subject area the research contributions show an increasing trend with each passing time period. National collaborations are preferred most, as we witnessed increased number of national collaborations in almost all the subjects. Through this variant also, multiple authorship patterns are found to be preferred over single

authorship patterns in almost all the subjects. The preferred contribution types were articles (876) in comparison to other document types. While analyzing citation count, it was revealed that subject field agriculture ranked top with highest number of citations (597) whereas the subject field microbiology witnessed the least number of citations (18).

The above findings clearly predict that research activities in Indian Council of Agricultural Research have witnessed an inclination over time. Adequate funding and partnering with international institutions can promote the quality of research further. This will help in providing conducive environment for researchers with state-of-art research facilities, access to good quality research experiences. International research programs need to be promoted in order to enhance the collaboration trends at international level. The fields like microbiology produce very less research which may be due to the technological difficulties. These difficulties need to be looked into in terms of addressing research issues and availability of quality research infrastructure. It is realized that change in research strategies and methods of the institution is must, especially catering human resources through continuing education, advanced training and implementation of creative technologies for fruition of efforts.

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