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## A Scientometric analysis of Journal of Agronomy and Crop Science (2000 -2019) indexed in Web of Science

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# **A SCIENTOMETRIC ANALYSIS OF "JOURNAL OF AGRONOMY AND CROP SCIENCE" (2000 -2019) INDEXED IN WEB OF SCIENCE**

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## **Abstract**

*The present study attempts to analyze the publication productivity of the "Journal of Agronomy and Crop Science" during the year 2000-2019. The study was based on the data extracted from the Web of Science database. The primary purpose of the study is to analyze the research contributions of the journal under review. Through this investigation, the authors have tried to know the publication trend in the field of agronomy and related areas. The analysis covers the number of articles, year-wise distribution of articles along with citations, authorship pattern, institutions/organizations with the highest contributions, and the study also gives year-wise h-index of the journal. The study reveals that the journal under study had produced a total of 1077 research articles. The publications have received 22,328 citations with which the said journal reached h-index of 63. Average citation per paper is 22.65, and journal impact factor*

2020 is 3.094, which falls under quartile 1 (Q1) category journal. The highest number of contributions were from Germany (142 articles) and The United States (141 articles). Further, the study adopts Lotka's Inverse Square Law of Scientific Productivity to find the recurrence of contributions of authors in agronomy and its related areas. The authors have also used the Journal Citation Report (JCR) to know the impact factor of the journal, and VOSviewer tool was used to represent the results of the study graphically.

**Keywords:** Agronomy, Crop Science, Agriculture Science, Scientometrics, Lotka's Law, Web of Science, Citation Analysis

## **INTRODUCTION**

Agronomy is the study and science of utilizing plants for food, shelter, land reclamation and meeting the needs of humankind. Agronomy is plant-explicit farming, and it utilizes agricultural technology to innovation to work. Agricultural innovation and technology used to operate or advance a farm or agriculture-related activity. It is an applied scientific discipline that incorporates science, biology, botany, chemistry, biochemistry, economics, ecology, earth science, and genetics and how these relate to crop production and the systems that underpin it. Agronomy incorporates the broad open field development of plant species for human food gracefully, animals and poultry feed, filaments, oils and certain mechanical items. It additionally takes a gander at the improvement of yields (grains, protein and oilseed harvests) in an economical way to guarantee adequate food gracefully for an ever-expanding total populace. As a field of study Agronomy incorporates crop science, soil and related sciences (Stellenbosch University 2020).

Agronomy contributes to nearly everything in our daily lives. Our coffee and toast in the morning, the fibers in our clothes, and the gas we put in our cars are all products of agronomy. Agronomy typically works to make the crops used in the food and for consumption, but branches such as horticulture focus on aesthetic plants. Agronomy also operates closely with biotechnology, as biotechnology researches and breeds new characteristics in plants for agronomy. Agroecology and soil conservation both work hand-in-hand with agronomy because they each help in planting more plants and contributing to agronomy. Today, agronomists are dealt with various issues like producing food, handling the environmental effect of agriculture,

crafting healthier food, dissemination of agriculture, and dig out energy from plants and they habitually emphasis more on crop rotation, drainage, soil classification, soil fertility, weed control, irrigation and plant breeding, plant physiology and insect and pest control. Therefore, looking into the importance of *Food Science and Technology* in general and Agronomy and Crop Science, in particular, the study is conducted on the Scientometric analysis of the *Journal Agronomy and Crop Science*.

In the 1960s, the term "scientometric" was used to denote "measurement of information process" especially in the Eastern Europe region. The word 'Scientometrics', was derived from a Russian term which was used as an alternative to the study of quantitative aspects of science which applies the quantitative methods to the history of science. Scientometric studies are mainly concerned with the qualitative and quantitative features and characteristics of science and scientific research. Hence, the scientometrics is a study of evaluating and analyzing science, technology and innovation. Such tasks include the measurement of the impact of the scientific research, references of the article to assess the effect of an individual or organization, mapping the scientific fields and production of various indices for use in policymaking context. In general, there is a substantial overlap between scientometrics and other areas such as bibliometrics, information systems, information science and science policy. It has wide-ranging applications to Library and Information Science Professionals. It helps libraries or organizations in formulating the policies and provides objective data to the administration to take timely decisions.

#### **ABOUT "JOURNAL OF AGRONOMY AND CROP SCIENCE"**

The *Journal Agronomy and Crop Science* are a leading bi-monthly (ISSN-Print: 0931-2250 and e-ISSN: 1439-037X), published by John Wiley and Sons since 1986. *Journal Agronomy and Crop Science* publish original articles, reviews, book reviews and short communications in the areas like plant production in general and special as well, abiotic plant stress, including grassland cultivation under specific features of substance production in crop plants. The Journal produces research publications in basic research and applied research particularly. The said Journal continuously offers a proficient review on research contributions and its findings, new methods and techniques and acts as a forum for the exchange of a variety of information on all facets of agronomy and crop sciences. As per the 'Journal Citation Report (2019)', the impact factor of the Journal was 2.960. The Journal was indexed in more than 57 indexing and abstracting tools such

as Academic Search published by EBSCO publishing, AGRICOLA (AGRICultural OnLine Access) developed by US National Agricultural Library, BIOBASE: Current Awareness in Biological Sciences (CABS) by Elsevier, AgBiotech News & Information, CAB Abstracts® and Horticultural Science Abstracts by CABI publishing, Chemical Abstracts Service (CAS) by American Chemical Society, Journal Citation Reports/Science Edition and Science Citation Index by Clarivate Analytics.

## **REVIEW OF LITERATURE**

The study presents a brief overview of research literature represented on Scientometric/Bibliometric/Citation Analysis studies. The subsequent studies associated with the objectives of this study have been reviewed.

(Thanuskodi 2012) analyzed the research contributions of the journal "Indian Journal of Agricultural Research" published during the period of 2001-2010 based on the data retrieved from the publisher's website. The study shows that multi-authorship (564 articles) contributions took the lead out of 602 total articles rests (38) were contributed by a single author. The journal understudy had published 60 research papers per year on an average. Further, the study also reveals that 98.67 percent of the contributions are from India, and 1.33 percent was from foreign countries.

(Suresh, Hema, and Sankarasubramaniam 2015) conducted a scientometric analysis study on the publications of the journal "Indian Journal of Horticulture" for the period 2010-2014 based on the data reflected through the Scopus database. The study reveals that there were a total of 714 articles published during the period under study. Out of 714 research publications, 233 articles published in 2010 followed by 121 papers in 2011. 120 paper each in 2012, 2013 and 2014 respectively. It was observed that most of the contributions were made by more than three authorship (341 articles) followed by three authorship (202 articles) two authorship (152 articles) and single authorship (19 articles). Further, the study also reveals that India made most of the contributions (688 out of 714 articles).

(Reddy and Shankarappa, 2015) investigated scientific literature published in "Indian Journal of Agricultural Sciences" during the period 2006-2015. The study was based on the data retrieved from the Web of Science database. The analysis of the study reveals that the journal under study

had published a total of 2348 articles during the period. The year 2006 had 207 articles to its credit followed by 264 in the year 2014 and there was a decline in the number of the article in the year 2015 (248 articles). Further, the study shows that Kumar A was the most productive author, and the top ten authors had contributed 27.08 percent of the total publications.

(Bagalkoti and Hosamani 2015) conducted an analysis study on Indian Agriculture literature published during 1999-2013. The analysis shows that there were 23,233 research articles published during the period having 1548 average publication per year. The highest number of publications were made to the discipline plant science (2017), followed by Biotechnology and Applied Microbiology (1756) and Energy Fuels (1518). Further, the study also shows that Indian Agriculture Research Institute, New Delhi had most contributions having 1438 articles followed by Indian Veterinary Research Institute, Bareilly (1385 articles) and 1242 articles from Council of Scientific and Industrial (CSIR), New Delhi.

(Alemaw 2015) analyzed the contributions of the "Ethiopian Journal of Agricultural Sciences" published from Volume 1 to Volume 24. The data for the study were retrieved from the publisher's website of the Journal. The research shows that there were a total of 279 articles published covering all areas of agriculture sciences. Most of the articles were published on areas like plant protection (18 percent), field crops breeding (13 percent) and agronomy (11 percent). Further, the study also shows that most of the contributions were made with multi-author collaboration (70 percent), indicating the journal understudy promote a high degree of collaboration.

(Hadimani, Mamdapur, and Mavin 2016) carried out a bibliometric analysis study on the research articles contributed to the journal "Indian Journal of Agronomy" during the period 2009-2013. The data for the study was extracted from both print and online version of the Journal under review. The study shows that there were five volumes (54 to 58) containing 20 issues with 379 research papers of the Journal under study. The highest numbers of articles (115) were produced in the year 2013 and the lowest (61) in the year 2010. Further, the study also depicts that three authored contributions positioned top publishing 110 articles, followed by four authors (83 articles) two authors (80 articles) and five authors with 57 articles.

(Ravi and Yeshawant 2016) studied the growth and development of the world literature on agronomy with particular reference to India published during 2006-2015. The data for the study was retrieved from CABI a gateway to the world's applied life sciences. The research shows that there were a total of 2844 articles published out of which 2723 were journal articles, 60 conference proceedings and 19 book chapters. The study also reveals that Kumar A was the most prolific author contributing 100 articles out of the total articles published. Kumar A was followed by Kumar S and Singh S with 70 articles each and Singh A.K. with 63 articles.

(Partap 2018) studied the scientific contributions of the "Indian Journal of Agricultural Library and Information Services" during the period 2008-2016. The required data for the study were retrieved from the print version of the Journal under review. It is observed from the survey that a total of 161 research articles were published during the period, with an average of 18 articles per year. The maximum number of articles (22 articles) were published in the year 2014 and the minimum (14 articles) in the year 2014. Further, the study shows that the maximum number of articles were two (39.75 percent) authored, followed by a single (32.36 percent) authored.

(Shukla, Yadav, and Verma 2018) studied the publication pattern of the "Journal of the Agricultural Extension" for the period 2008-2017. The study shows that there were 303 papers published during the period chosen for the study. The number of published articles were high (47) in the year 2017, followed 2013 (40 articles). Highest number of articles (47) published in the year 2017. Most of the contributions were made with three authorship (92 articles).

(Mnzava and Chirwa 2019) analyzed the literature published in 'Tanzania Journal of Agricultural Science' during the period 1998-2017. The required data for the study was collected from the Website of African Journal Online (AJOL). The results of the study show that the journal understudy had published a total of 197 articles during the period. Three authored papers were highest in collaboration with 138 articles, two written (41 articles) and single-authored (18 articles). Further, the study also shows that Tanzania was the most productive (65.9 percent) country followed by the United Kingdom (10.1 percent) and Norway (4.7 percent).

(Mamdapur et al. 2019) studied the research output of the "Journal of Horticultural Science and Biotechnology" during the period 2008-2017 based on the data extracted from the Web of Science database. The study shows that the journal understudy had published 1059 articles.

Highest numbers of articles (150) were published in the year 2009, and the lowest (74) was published in the year 2017. Most of the articles are contributed with three authors (203 articles) followed by five authors (199 articles), four authors (188 articles) and six authors (153 articles). Further, the study also reveals that Indian Agricultural Research Institute, New Delhi was the highest contributing institute with 113 research papers followed by Indian Institute of Horticultural Research, Bangalore (51 articles) and National Research Centre for Banana, Thiruchirapalli (22 articles).

(Mamdapur et al. 2020) investigated the scholarly communication of the "Journal of the American Society for Horticultural Science" published during the period 2010-2019. The journal understudy had published a total of 594 research papers covering ten volumes and 60 issues. The study shows that the average publication per year was 59. The highest number (74) of articles published in the year 2014, followed by the year 2015 (70 papers) and lowest (44 papers) in the year 2019. Further, the investigation reveals that four authored (112 articles) papers contributed more compared to three (109 articles), two (97 articles) and five (94 articles) authored documents.

## **OBJECTIVES OF THE STUDY**

The primary objectives of the study are mentioned below:

1. To know the year-wise distribution and citations pattern of the *Journal Agronomy and Crop Science* studies during 2000-2019
2. To inspect the volume-wise distribution of contributions and to find the average number of contribution per volume including the identification of the authorship pattern of the research papers;
3. To study author productivity and to see the average length of papers;
4. To apply and test the Lotka's inverse square law of scientific productivity and to determine the degree of collaboration among single and multiple authors;
5. To identify and prepare the ranked list of authors, journals, and institutions;
6. Determine the author keywords analysis of publications in the *Journal Agronomy and Crop Science*.

## **METHODOLOGY**



The required data for the study were retrieved from the Web of Science database between August 24<sup>th</sup>, 2020 and September 7<sup>th</sup>, 2020, using the ISSN of the Journal i.e., (Your query string as: (IS=0931-2250) AND Timespan=2000-2019. All the papers published in the "*Journal of Agronomy and Crop Science*" were examined to give a delegate and enlightening point of view of the data. All items in citation data (e.g., title, authors, source title, publication date, volume, issue, year, beginning page, ending page, DOI, citation count and Average per year), bibliographical data (e.g., affiliations) and abstract & keywords (e.g., abstract, author keywords) of documents published from 2000 to 2019 were selected and exported in CSV format. Journal Citation Report (JCR) used to check the quality and quartile level of the Journal. (GunnMap 2020) a free source was used to create the info-map and for visualization of similarities. VOS Viewer software (VOSviewer 2020) was used to develop co-occurrences of author keywords, terms of papers published in *Journal of Agronomy and Crop Science* and co-authorship network of authors and countries that distributed in the Journal within a similar timespan.

## DATA ANALYSIS AND INTERPRETATION

Following sections discuss the investigation of the data collected and the analysis is presented under the different table headings.

### *Distribution of publications: Volume and Year-wise*

Table 1 depicts the year-wise distribution of papers produced during 2000-2019. The analysis of the table shows that the highest number of (74, 7.03 percent) articles are published in the year 2001, followed by (73, 6.93 percent) articles in the year 2000. The lowest numbers of (43, 4.08 percent) articles are published in the year 2015, followed by (44, 4.18 percent) research papers in the year 2012. Hence, in 22 volumes covering 124 issues, a total of 1077 research papers were published during the period 2000-2019. On an average, the journal had published eight research papers per issue. Overall, 22,328 citations were found from 1077 documents, which is highest in terms of citations in the field of agronomy.

**Table-1: Year-wise distribution of publications, citations and h-index**

Year	Volumes	Issues	Average Publication Per Issue	No. of Articles	Percentage of Articles	Total no. of Citations	Average citations per item	H-Index of the Journal
2000	184-185	8	9	73	6.93	1360	18.6	21
2001	186-187	8	9	74	7.03	1542	20.8	22
2002	188	6	7	57	5.41	1308	23	22

2003	189	6	7	56	5.32	1352	24.1	20
2004	190	6	7	52	4.94	1394	26.3	21
2005	191	6	7	56	5.32	1493	26.2	24
2006	192	6	7	54	5.13	1104	20.4	20
2007	193	6	6	45	4.27	1322	28.7	21
2008	194	6	7	54	5.13	1851	34.3	25
2009	195	6	6	50	4.75	1618	32.4	26
2010	196	6	6	47	4.46	1363	29	24
2011	197	6	6	46	4.37	1501	32.6	23
2012	198	6	6	44	4.18	1032	23.5	20
2013	199	6	6	47	4.46	980	20.9	19
2014	200	6	6	45	4.27	801	17.8	18
2015	201	6	5	43	4.08	672	15.6	16
2016	202	6	6	48	4.56	621	12.9	14
2017	203	6	7	52	4.94	563	10.8	14
2018	204	6	7	53	5.03	322	6.08	9
2019	205	6	7	78	5.41	129	1.65	4
<b>Total</b>	<b>22 Volumes</b>	<b>124 Issues</b>	<b>APPI - 8</b>	<b>1077</b>	<b>100</b>	<b>22328</b>	<b>20.7</b>	<b>63</b>

### *Authorship Pattern*

Table 2 depicts the authorship pattern of the journal under study. The table reveals that authored contributions have dominated with 222 research articles (21.08 percent) closely followed by three authored research papers (215, 21.42 percent), two authored research papers are (191, 18.14 percent), five authored research papers are (149, 14.15 percent). More than or equal to six authored research papers are (230, 21.84 percent). Altogether, there are (1007, 95.63 percent) multiple-authored research papers compared to (46, 4.37 percent) single authored research papers published during the study period.

**Table-2: Authorship Pattern**

<b>Authors</b>	<b>No. of articles</b>	<b>Cumulative no. of articles</b>	<b>Percentage</b>	<b>Cumulative percentage</b>
Single	46	46	4.37	4.37
Joint	191	237	18.14	22.51
Three	215	452	20.42	42.92
Four	222	674	21.08	64.01
Five	149	823	14.15	78.16
Six	105	928	9.97	88.13

Seven	60	988	5.70	93.83
Eight	29	1017	2.75	96.58
Nine	17	1034	1.61	98.20
Ten	4	1038	0.38	98.58
Eleven	6	1044	0.57	99.15
Twelve	2	1046	0.19	99.34
Thirteen	3	1049	0.28	99.62
Fourteen	1	1050	0.09	99.72
Seventeen	1	1051	0.09	99.81
Eighteen	2	1053	0.19	100.00

***Average and Productivity per Authors***

To assess the author productivity such as Average Author Per Paper (AAPP) and Productivity Per Author, the formulae given by (Yoshikane et al. 2009) (Yoshikane, Nozawa, Shibui, & Suzuki, 2009) in the paper published in Scientometrics journal was used. The formula is mathematically represented as below:

$$\text{Average Author per Paper} = \text{No. of Authors} / \text{No. of Papers}$$

$$\text{Productivity per Author} = \text{No. of Papers} / \text{No. of Authors}$$

Table 3 represents the information about the authorship productivity and average number of authors per paper. It is revealed from the table that the average author per paper was 4.24 for 1077 papers published and ranges between 2.97 to 5.68 for the period of study. The average productivity per author was 0.25 and ranges from 0.18 to 0.34 for the period 2000-2019.

**Table-3: Average and Productivity per Authors**

<b>Years</b>	<b>No. of articles</b>	<b>No. Authors</b>	<b>Average of no. authors</b>	<b>Productivity per author</b>
2000	73	226	3.10	0.32
2001	74	220	2.97	0.34
2002	57	170	2.98	0.34
2003	56	189	3.38	0.30
2004	52	165	3.17	0.32
2005	56	199	3.55	0.28
2006	54	199	3.69	0.27
2007	45	191	4.24	0.24
2008	54	226	4.19	0.24
2009	50	217	4.34	0.23

2010	47	212	4.51	0.22
2011	46	191	4.15	0.24
2012	44	221	5.02	0.20
2013	47	214	4.55	0.22
2014	45	218	4.84	0.21
2015	43	229	5.33	0.19
2016	48	233	4.85	0.21
2017	52	264	5.08	0.20
2018	53	269	5.08	0.20
2019	57	324	5.68	0.18

**Lotka's Law of Scientific Productivity**

Lotka's Inverse Square Law of Scientific Productivity depicts the recurrence of contributions of authors in any given field or subject. Table 4 expresses that, the quantity of authors producing 'n' contributions is approximately equal to 1/n<sup>2</sup> of the number of authors that produce only one contribution. For instance, if sixty out of hundred authors in a subject area produce only one article, then fifteen out of a hundred will produce two papers, seven authors will produce three articles and so on. Lotka's Law is mathematically expressed as:

$$Y_x = \frac{C}{X^n}$$

Where, Y is the number of authors credited with X (1, 2, 3, 4.....) papers; therefore, C is the number of authors contributing one paper and n is a rate

$$X^n (*) Y_x = C \quad (\text{Where } X = 1)$$

i.e., 1 (\*) 2357 = C                      (C = 2357, number of authors contributing one paper)

When X=2                                      2n (\*) 2357 = C.                      (C = 2357)

2n = 2357/423 = 5.5721                      (by applying log)                      nlog (2) = log (5.5721)

n = log (5.5721) / log (2)                      (Where log (5.5721) = 0.7460 & log (2) = 0.3010)

Therefore n = 2.48

Where, Y is the number of authors credited with X (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 18, 24 & 29) a paper, C is the number of authors contributing one paper.

**Table-4: Lotka's Law of Scientific Productivity**

No. of papers, X	No. of authors (Observed)	Observed %	No. of authors (Expected)	Expected %
---------------------	------------------------------	---------------	------------------------------	---------------

	3044		3142	
1	2357	77.43	2357	75.02
2	423	13.90	422	13.45
3	129	4.24	155	4.92
4	54	1.77	76	2.41
5	37	1.22	44	1.39
6	15	0.49	28	0.88
7	10	0.33	19	0.60
8	5	0.16	14	0.43
9	5	0.16	10	0.32
10	3	0.10	8	0.25
13	1	0.03	4	0.13
14	2	0.07	3	0.11
18	1	0.03	2	0.06
24	1	0.03	1	0.03
28	1	0.03	1	0.02

### ***Top fifteen Prolific Authors***

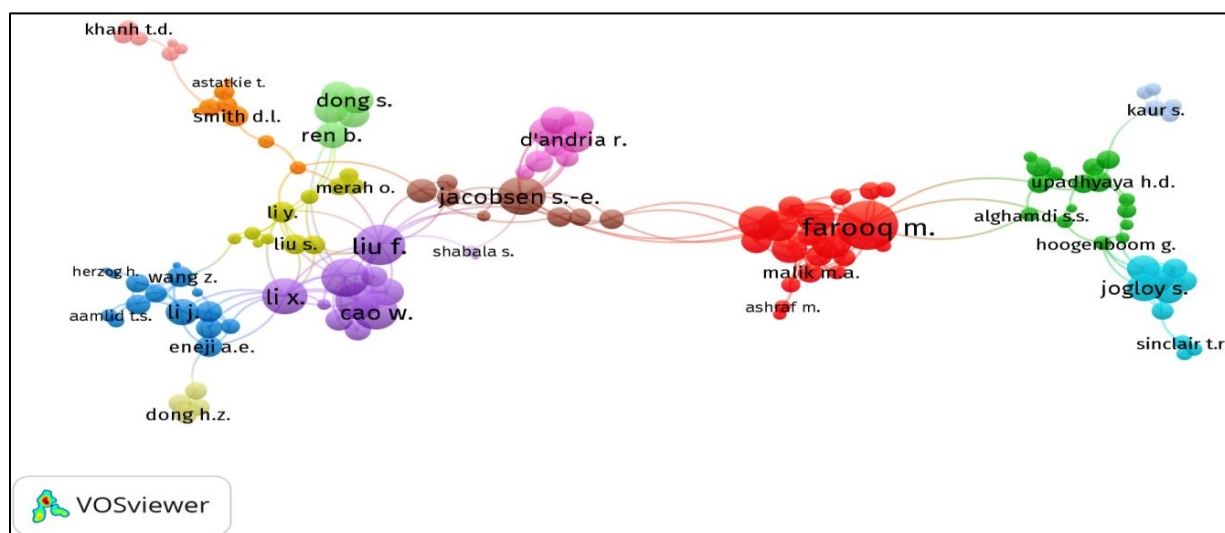
The significant contribution of prolific authors reflected in Table 5 which shows that top author who has contributed at least eight or more publications. There were 3044 authors contributed 1077 publications during the period. Farooq M leading the table with 28 research papers followed by Jacobsen SE. with 24 research papers. Liu F., Smith DL., and Jiang D contributing 18, 14 and 13 papers each. There are three authors Basra SMA., Monneveux P., and Piepho HP. with ten articles each. Farooq M. has more citations with 1547 followed by Basra SMA with 746 citations received. Basra SMA has the highest number of average citations per paper with 74.60 followed by Wahid A., with 56.33 of the top ten author's, four have more than 500 citations and 6 have at least 208 citations of their *Journal Of Agronomy And Crop Science* publications.

**Table-5: Top Fifteen Prolific Authors**

Authors	Affiliation	Country	Total papers	Citation received	Average article per paper
Farooq, M	University of Agriculture, Faisalabad	Pakistan	28	1547	55.25
Jacobsen, SE	University of Copenhagen, Taastrup	Denmark	24	526	21.91
Liu, F	University of Copenhagen, Taastrup	Denmark	18	318	17.66
Smith, DL	McGill University, Quebec	Canada	14	166	11.85
Jiang, D	Nanjing Agricultural University, Nanjing	China	13	374	28.76
Basra, SMA	University of Agriculture, Faisalabad	Pakistan	10	746	74.60
Monneveux, P	International Potato Center, Lima	Peru	10	245	24.50
Piepho, HP	University of Hohenheim, Stuttgart	Germany	10	467	46.70
Cao, W	Nanjing Agricultural University, Nanjing	China	9	303	33.66
Dai, T	Nanjing Agricultural University, Nanjing	China	9	303	33.66

Hoffmann, CM	Institute of Sugar Beet Research, Gottingen	Germany	9	312	34.66
Hussain, M	Bahauddin Zakariya University, Multan	Pakistan	9	480	53.66
Wahid, A	University of Agriculture Faisalabad, Faisalabad	Pakistan	9	507	56.33
Ashraf, M	University of Agriculture, Faisalabad	Pakistan	8	384	48.00
Bilalis, D	Agricultural University of Athens, Athens	Greece	8	208	26.00

The below Figure 1 depicts that the authors with at least five papers were included in the co-authorship network. The co-authorship network comprised of 8 clusters with at least 5 authors in each cluster. Top ten core authors in the co-authorship clusters were Farooq, Jacobsen, Liu, Smith, Jiang, Basra, Monneveux, Piepho, Cao, and Dai. The cluster, related to Farooq made an inter-link among other clusters. Jacobsen leading with 9 links and total link strength of 17 had the highest weight in the *Journal of Agronomy and Crop Science* co-author network followed by the second rank belonged to Jiang, Liu and li with 8 links each and total link strength of 34, 30 and 24.



**Figure-1: The co-authorship network**

### ***Top ten cited articles***

The table 6 shows that the top ten most frequently cited the *Journal of Agronomy and Crop Science* articles from 2000 to 2019. Dhanda et al. "Indices of drought tolerance in wheat genotypes at early stages of plant growth" (2004) is the most cited article with 226 citations, averaging about 13.29 citations per year. This article is followed by Piepho et al. "A Hitchhiker's guide to mixed models for randomized experiments" (2003) with 194 citations. All ten of the most highly cited articles have at least 130 citations. An attempt is made to check the citations for articles listed in the table from Google Scholar, John Wiley and Sons, Scopus, Web of

Science are compared and it is revealed that the articles have received much better citations compared to the Web of Science database. The one obvious reason for this could be that Web of Science indexes covered only high impact factor journals leaving the low impact factor journals.

**Table-6: Top ten cited articles**

Rank	Top ten articles bibliographic information	WOS	WOS Average per Year	John Wiley & Sons	Google Scholar	SCOPUS
1	Dhanda, S. S., Sethi, G. S., & Behl, R. K. (2004). Indices of Drought Tolerance in Wheat Genotypes at Early Stages of Plant Growth. <i>Journal of Agronomy and Crop Science</i> , 190(1), 6–12.	226	13.29	154	495	241
2	Piepho, H. P., Buchse, A., & Emrich, K. (2003). A Hitchhiker's Guide to Mixed Models for Randomized Experiments. <i>Journal of Agronomy and Crop Science</i> , 189(5), 310–322.	194	10.78	186	280	211
3	Essa, T. A. (2002). Effect of Salinity Stress on Growth and Nutrient Composition of Three Soybean ( <i>Glycine max</i> L. Merrill) Cultivars. <i>Journal of Agronomy and Crop Science</i> , 188(2), 86–93.	169	8.89	130	340	160
4	Sairam, R. K., & Saxena, D. C. (2000). Oxidative Stress and Antioxidants in Wheat Genotypes: Possible Mechanism of Water Stress Tolerance. <i>Journal of Agronomy and Crop Science</i> , 184(1), 55–61.	168	8	115	356	167
5	Wollenweber, B., Porter, J. R., & Schellberg, J. (2003). Lack of Interaction between Extreme High-Temperature Events at Vegetative and Reproductive Growth Stages in Wheat. <i>Journal of Agronomy and Crop Science</i> , 189(3), 142–150.	164	9.11	144	272	161
6	Khanh, T. D., Chung, M. I., Xuan, T. D., & Tawata, S. (2005). The Exploitation of Crop Allelopathy in Sustainable Agricultural Production: Crop Allelopathy in Agriculture. <i>Journal of Agronomy and Crop Science</i> , 191(3), 172–184.	159	9.94	124	312	164
7	Prasad, P. V. V., Pisipati, S. R., Momčilović, I., & Ristic, Z. (2011). Independent and Combined Effects of High Temperature and Drought Stress During Grain Filling on Plant Yield and Chloroplast EF-Tu Expression in Spring Wheat: Effects of Temperature and Drought on Wheat Plants. <i>Journal of Agronomy and Crop Science</i> , 197(6), 430–441.	156	15.6	150	215	155
8	Anjum, S. A., Wang, L. C., Farooq, M., Hussain, M., Xue, L. L., & Zou, C. M. (2011). Brassinolide Application Improves the Drought Tolerance in Maize Through Modulation of Enzymatic Antioxidants and Leaf Gas Exchange: Brassinolide Improves Drought Tolerance in Maize. <i>Journal of Agronomy and Crop Science</i> , 197(3), 177–185.	138	13.8	127	274	149
9	Sairam, R. K., & Srivastava, G. C. (2001). Water Stress Tolerance of Wheat ( <i>Triticum aestivum</i> L.): Variations in Hydrogen Peroxide Accumulation and Antioxidant Activity in Tolerant and Susceptible Genotypes. <i>Journal of Agronomy and Crop Science</i> , 186(1), 63–70.	134	6.7	96	245	135

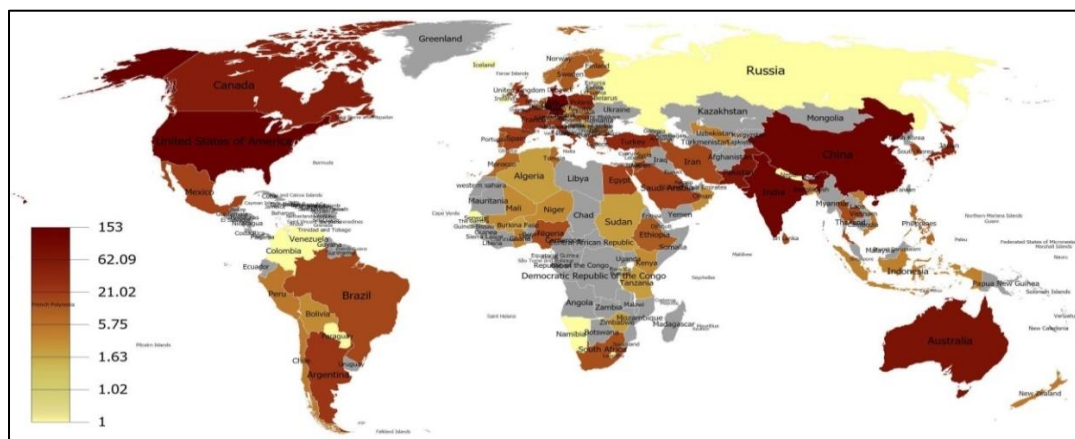
Murillo-Amador, B., Lopez-Aguilar, R., Kaya, C., Larrinaga-Mayoral, J., & Flores-Hernandez, A. (2002). Comparative Effects of NaCl and Polyethylene Glycol on Germination, Emergence and Seedling Growth of Cowpea. *Journal of Agronomy and Crop Science*, 188(4), 235–247.

### ***Geographical distribution of Contributions***

The geographical distribution of contributions reveals that authors from 87 countries have contributed to the *Journal of Agronomy and Crop Science* during the study period are presented in table 7. Germany has emerged as a major contributor with 142 papers and 2530 citations and closely followed by the United States contributing 141 papers with 3216 citations and China 123 papers with 2715.

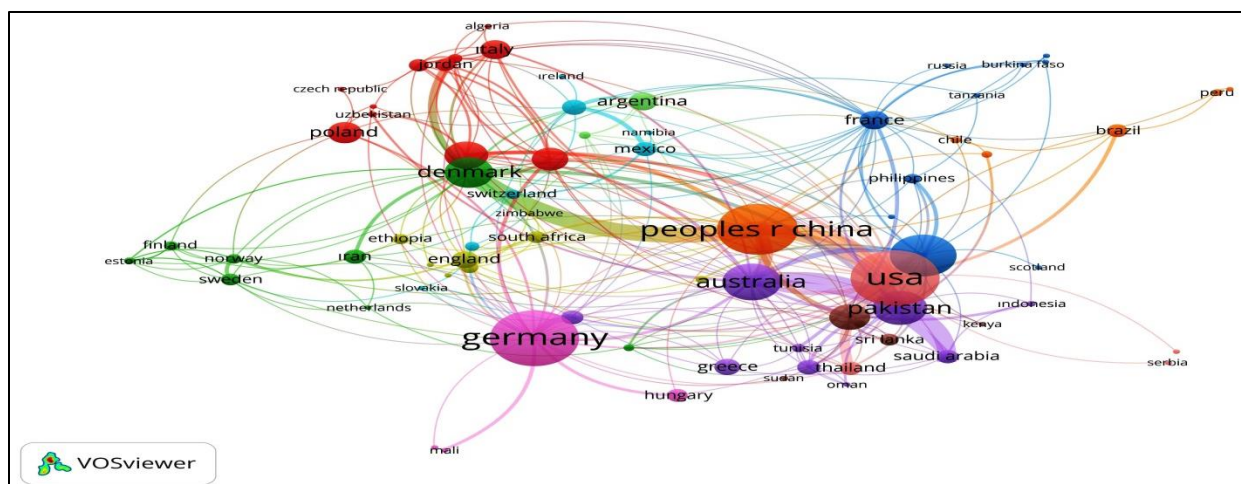
**Table-7: Top Ten collaborative Countries**

Country	Documents	Citations	Total link strength
China	122	2715	72
Australia	74	1115	66
United States	141	2151	64
Pakistan	64	2384	61
Denmark	55	1195	50
Germany	142	2530	40
India	90	2362	28
Saudi Arabia	15	481	28
Turkey	34	936	22
France	25	594	22



**Figure-2: Geographical distribution of contributions**





**Figure-3: VOSviewer Bibliometric Network Pattern among Countries**

A diagram of the top-ranked countries is presented in Figure 2 and 3. The size of the circle indicated the number of research papers published during the study period. As shown in the figure, China, Australia, the United States, Pakistan, Denmark, Germany, Saudi Arabia, India, France and Turkey were the world's top countries in publishing research papers in the *Journal of Agronomy and Crop Science*. Lines connecting the countries indicated co-authorship. When the two countries connected by one line, they collaborated on the publication of the paper. Therefore, the thickness of the line represented a high level of co-operation between one or more countries. As per the figure, there was scientific co-operation between the countries with China (Cluster-6 have links 237 and total link strength 72) followed by China (Cluster-6 have links 24 and total link strength 66) and the United States (Cluster-5 have links 28 and total link strength 64).

### ***Productive Institutions/Organizations***

The researchers/scientists from the different institutions like government organizations, research and development institutions and universities etc. have published their papers in the "*Journal of Agronomy and Crop Science*" are presented in Table 8. The highest numbers of publications, i.e. (50, 2090 citation) have come from the University of Agriculture Faisalabad followed by University of Copenhagen has contributed (41, 797 citations) publications and the University of Western Australia has (21, 440 citations) publications to its credit. It is evident from the data that the top-ranked ten institutions have contributed about (220, 5907 citations) of the total contributions during the study period. Among the top-ranked ten Institutions, two institutions were from China, Denmark and Pakistan. Majority of contributors were affiliated to the

universities and research institutions from developed countries. Active participation of institutions across the geographical margins implies the recognition and reputation of this Journal across the globe in the field of Agronomy and Crop Sciences.

**Table-8: Top Ten Productive Institutions/Organizations**

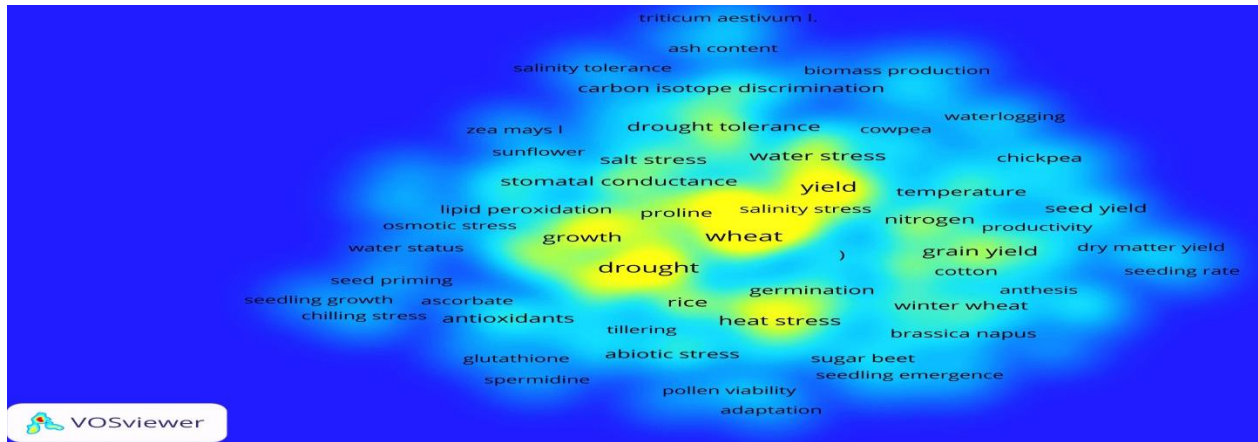
Organization	Country	Documents	Citations	Total link strength
University of Agriculture Faisalabad	Pakistan	50	2090	42
University of Western Australia	Australia	21	440	31
King Saud University	Saudi Arabia	15	481	27
University of Copenhagen	Denmark	41	797	26
Bahauddin Zakariya University	Pakistan	12	379	20
Chinese Academy of Sciences	China	19	296	15
Aarhus University	Denmark	17	406	12
Nanjing Agricultural University	China	19	383	12
International Crops Research Institute for the Semi-Arid Tropics	India	14	229	10
Polish Academy of Sciences	Poland	12	406	9

### ***Author Keywords***

Table 9 shows the top twenty author keywords used in the "*Journal of Agronomy and Crop Science*" during the period of study (2000-2019). The highest frequency keyword has been "*Photosynthesis*" with 141 total link strength, followed by "*Drought*" with 128 total link strength ranked first to second respectively. The author keywords play a vital role in a literature search which will bring up the relevant publications from the vast collection of related documents.

**Table-9: Most used 20 keywords**

Keyword (Total link strength)	
1. Photosynthesis (141)	11. Antioxidant enzymes (50)
2. Drought (128)	12. Proline (47)
3. Yield (123)	13. Nitrogen (46)
4. Drought stress (102)	14. Abscisic acid (44)
5. Wheat (101)	15. Oxidative stress (44)
6. Growth (64)	16. Salicylic acid (44)
7. Stomatal conductance (60)	17. Water relations (44)
8. Antioxidants (58)	18. Water stress (44)
9. Salinity (58)	19. Carbon isotope discrimination (43)
10. Heat stress (56)	20. Grain yield (42)



**Figure-4: Bibliometric Network Pattern among Authors Keywords**

The author keywords terms occurrence in Figure 4 was extracted for the publications published during 2000-2019 and these results are based on the threshold of 2957 terms with 37 clusters, 5530 links (connections) and 6301 total links strength. It can be seen in figure 4 that following keywords represent the mainstream topics in the Journal such as Photosynthesis, Drought, Yield, Drought stress, Wheat, Growth, Stomatal conductance, Antioxidants, Salinity and Heat stress, were the top terms in the title of the research paper. Each density visualization in the map represents a term that occurred at least ten times and the size of the density of a term is proportional to the number of occurrence of that term.

***Year-wise Journal Citation Report (JCR)***

Journal Citation Reports produced by Clarivate Analytics gives ranking for journals in the areas of science, technology, and social sciences. Table 10 shows that year-wise Journal Citation Report (JCR) on Journal of Agronomy and Crop Science. The current (2019) journal impact factor is 3.057, 5 Year Impact Factor is 3.332 and it falls under its quartile 1 (Q1) category. The JIF is year to year increased the growth, in 2000 was 0.475 and in 2019 is 3.057 it has enormous changes in growth. The average percentage of articles in citable items is 96 and the range is 93 to 100 percent. The Cited Half-Life is the median age of the articles that were cited in the JCR year and The Citing Half-Life is the median age of the citations produced by a journal during the JCR year. The Cited Half-Life and Citing Half-Life also remarkable increases, in the year 2019 Cited Half-Life is 10.2 and Citing Half-Life is 10.8.

**Table-10: Year-wise Journal Citation Report (JCR)**

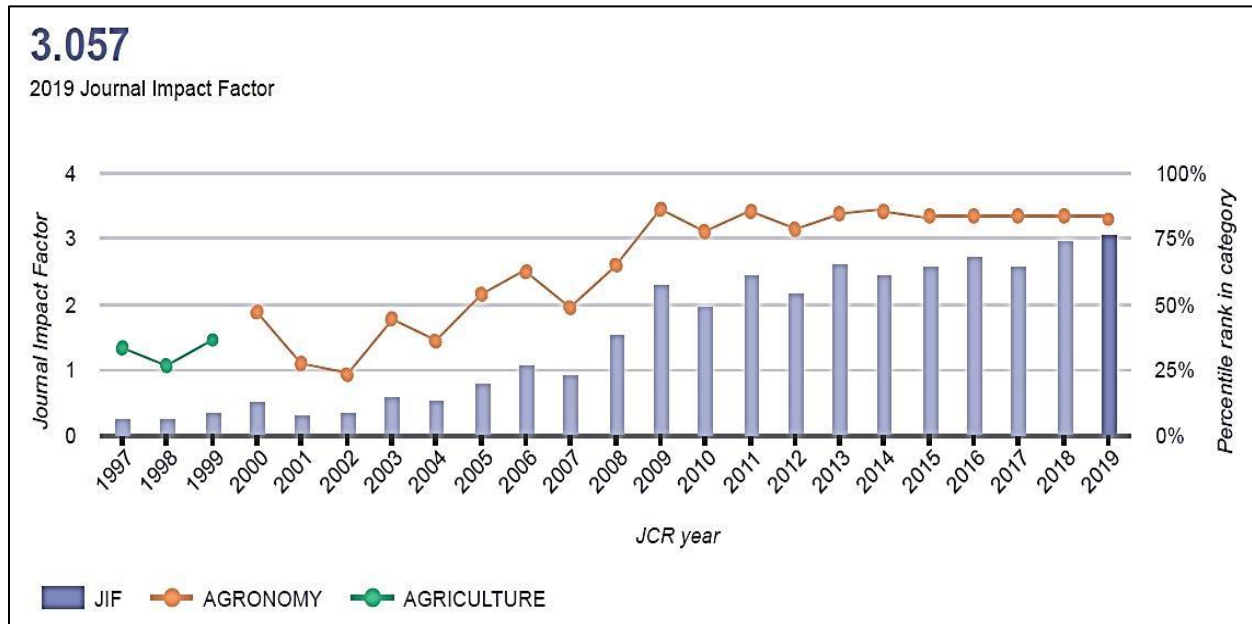
Year	Journal Impact	Impact Factor	5 Year Impact	Immediacy Index	Citable Items	% Articles	Average JIF	Cited Half-	Citing Half-
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	<b>Factor (JIF)</b>	<b>without Journal Self Cites</b>	<b>Factor</b>			<b>in Citable Items</b>	<b>Percentile</b>	<b>Life</b>	<b>Life</b>
2000	0.475	0.369	n/a	0.027	73	100	46.49	5.6	>10.0
2001	0.285	0.181	n/a	0.061	66	98.48	26.36	6.3	>10.0
2002	0.32	0.252	n/a	0.088	57	98.25	22.73	7.5	>10.0
2003	0.565	0.351	n/a	0.089	56	98.21	44.34	6.3	>10.0
2004	0.496	0.327	n/a	0.115	52	100	35	6.6	>10.0
2005	0.759	0.519	n/a	0.089	56	96.43	53.13	6.1	>10.0
2006	1.046	0.843	n/a	0.093	54	100	62.25	6.2	>10.0
2007	0.891	0.755	0.978	0.222	45	100	47.96	7	>10.0
2008	1.515	1.192	1.506	0.481	54	94.44	64.29	6.9	>10.0
2009	2.283	1.505	1.793	0.46	50	98	86.07	7.3	9.8
2010	1.952	1.365	1.834	0.213	47	97.87	78	7.8	9.5
2011	2.433	1.784	2.224	0.587	46	100	85.63	8	9.6
2012	2.151	1.753	2.145	0.395	43	95.35	78.85	8.1	9.3
2013	2.618	2.146	2.583	0.255	47	100	84.18	7.8	9.9
2014	2.444	2.067	2.601	0.6	45	93.33	85.8	8.4	>10.0
2015	2.565	2.38	2.803	0.419	43	97.67	83.74	8.5	>10.0
2016	2.727	2.511	2.897	0.562	48	100	83.74	8.9	>10.0
2017	2.571	2.385	2.743	0.942	52	96.15	83.33	9.1	10.2
2018	2.96	2.76	3.068	0.83	53	96.23	83.71	9.7	12.2
2019	3.057	2.905	3.332	0.649	57	98.25	82.96	10.2	10.8

### ***Year-wise Growth of Journal Impact Factor on JACS***

As per the Journal Citation Reports (JCR), *The Journal of Agronomy and Crop Science* is categorized under Agronomy subject. The above Figure 5 shows that the year-wise growth of Journal Impact Factor, the 2019 journal impact factor is 3.057 it clearly indicating that the year-

to-year JIF was increased. The year 2009, the JIF was 2.283 and sudden growth and it almost doubles from the previous year.



**Figure-5: Year-wise Growth of Journal Impact Factor on JACS**

## CONCLUSION

This study intends to develop a scientometric analysis of the research trends that have occurred in the journal under review during the period 2000 – 2019. The authors have used the Web of Science database to understand the publication trends of the journal in terms of authors, journal impact, institutions or organizations and leading countries. The investigations of the study reveal that the journal had produced 1077 research papers with 22 volumes and 124 issues during the period chosen for the study. The trend in publication productivity shows the significant growth of the journal.

The highest number of articles (74, 7.03 percent) were published in the year 2001, followed by 2000 with 73 articles (6.93 percent). It is witnessed from the study that the journal had received a total of 22,328 citations from 1077 papers. The journal had 3.057 (2019) journal impact as per the Journal Citation Report (JCR), and it falls under the quartile 1 (Q1) category. It is evident from the study that there were 3044 authors contributed 1077 publications during the period. Farooq M leads the table with 28 research papers followed by Jacobsen SE. with 24 research papers. Four authored contributions have dominated the total contributions with 222 research articles (21.08 percent) closely followed by three authored research papers (215, 21.42 percent). Among the countries who have contributed to the journal, China, Australia, and the United States

were the leading countries followed by Pakistan, Denmark, Germany, Saudi Arabia, India, France and Turkey.

## REFERENCES

- Alemaw, Getinet. 2015. "Scientometric Analysis of the Ethiopian Journal of Agricultural Sciences." *Ethiopian Journal of Agricultural Sciences* 25 (1): 1–10.
- Bagalkoti, V. T. and S. C. Hosamani. 2015. "Scientometric Analysis and Mapping of Scientific Articles on Agriculture Research in India during 1999-2013." *International Journal of Advance Research* 3 (5): 19–25.
- GunnMap. 2020. "GunnMap 2." 2020. <http://lert.co.nz/map/>.
- Hadimani, Manjunath B., Mamdapur, Ghose Modin N. and Mavin, S. S. 2016. "Indian Journal of Agronomy (2009-2013) - A Bibliometric Study." *Indian Journal of Agricultural Library and Information Service* 32 (2): 33–43.
- Mamdapur, Ghose Modin N., Hadimani, Manjunath B., Ali, S. K. and Senel, Engin. 2019. "The Journal of Horticultural Science and Biotechnology (2008-2017): A Scientometric Study." *Indian Journal of Information Sources and Services* 9 (1): 76–84.
- Mamdapur, Ghose Modin N., Hadimani, Manjunath., Kaddipujar, Manjunath and Senel, Engin. 2020. "Scientometric Analysis of Contributions to the Journal of the American Society for Horticultural Science (2010-2019)." *Journal of Library and Information Communication Technology* 9 (1): 1–16. <https://doi.org/10.5958/2456-9399.2020.00001.2>.
- Mnzava, Ester and Mussa Ndambile Chirwa. 2019. "A Bibliometric Analysis of the Tanzania Journal of Agricultural Science (1998-2017)." *Library Philosophy and Practice (e-Journal)*, 1–15.
- Partap, Bhanu. 2018. "Indian Journal of Agricultural Library and Information Services: A Bibliometric Study (2008-2016)." *Library Philosophy and Practice (e-Journal)*, 1–9.
- Ravi, B. and Yeshawant, Veena S. 2016. "Scientometrics Profile of Agronomy Literature." *International Journal of Academic Library and Information Science* 4 (3): 82–86. <https://doi.org/10.14662/IJALIS2016.009>.

- Reddy, K. S. and Shankarappa, T. H. 2015. "Indian Journal of Agricultural Sciences: A Bibliometric Analysis of Scientific Literature (2006-2015)." *Indian Journal of Agricultural Library and Information Service* 31 (3): 18–23.
- Shukla, Ravi., Yadav, Sunil Kumar and Verma, Manoj Kumar. 2018. "Journal of Agricultural Extension (2008-2017): A Bibliometric Study." *Indian Journal of Information Library and Society* 31 (3–4): 261–75.
- Stellenbosch University. 2020. "Welcome to Stellenbosch University: What Is Agronomy?" 2020. <http://www.sun.ac.za/english/faculty/agri/agronomy>.
- Suresh, C., Hema, R. and Sankarasubramaniam, N. 2015. "A Scientometric Analysis of the Indian Journal of Horticulture (2010-2014)." *Asia Pacific Journal of Research* 1 (34): 86–97.
- Thanuskodi, S. 2012. "Bibliometric Analysis of Indian Journal of Agricultural Research." *International Journal of Information Dissemination and Technology* 2 (3): 170–75.
- VOSviewer. 2020. "VOSviewer - Visualizing Scientific Landscapes." VOSviewer. 2020. <http://www.vosviewer.com/>.
- Yoshikane, Fuyuki, Takayuki Nozawa, Susumu Shibui and Takafumi Suzuki. 2009. "An Analysis of the Connection between Researchers' Productivity and Their Co-Authors' Past Attributions, Including the Importance in Collaboration Networks." *Scientometrics* 79 (2): 435–49. <https://doi.org/10.1007/s11192-008-0429-8>.