

## **Contributions To Crop Science Research: Measuring Authorship Pattern**

<sup>1</sup>S. Thilakar , and <sup>2</sup>Dr. R. Ponnudurai

<sup>1</sup>Tamil Nadu Agricultural University, ADAC & RI, Tiruchirappalli-620 009.  
<sup>2</sup>Professor, Department of Library & Information Science, Annamalai University,  
Annamalai Nagar- 608 002

---

**ABSTRACT:** The article examine the measurement of research productivity of scientists contributing to Crop Science research for the periods of 1981 to 2010 based on the data available in the Web of Knowledge (SCI, SCHI and ACHI) database. The scholar measured the publications of genetics the following tools, Collaboration Coefficient (CC), , Modified Collaboration Coefficient (MCC) and Collaboration Index (CI), prolific authors and their Dominance Factor (DF).

---

### **I. INTRODUCTION**

Generally the recent researches are shows that the research output has highly with joint venture compared than the individual contribution. So here the researcher has taken the tool of Collaborative coefficient (CC) is for measure of collaboration in research that reflects both the mean number of authors per paper as well as the proportion of multi-authored papers. Collaboration is a passionate form of interaction that allows for effective communication as well as the sharing of competence and other resources (Melin and Persson 1996). A simple alteration of CC, which we call modified collaboration coefficient (MCC), which improves its performance in this respect. However, the complex nature of human interaction that takes place between collaborators and the magnitude of their collaboration are not easily captured by quantitative tools.

### **II. METHOD AND DATA SOURCES**

The present study has been analysed the contributions made by global scientists to the Crop Science research. The study covers the contributions made by Indian scientists on genetics research available in the Web of Science (SCI, SSCI and ACHI). The data for the study has been taken from the 30 years during the period 1981 to 2010, 10795 records were downloaded and data extracted from the histCite software under different fields and analyzed for the study. Statistical analysis has also been carried out.

### **III. MEASURING TOOLS**

To compare the extent of collaboration in two fields (or subfields) or to show the trend towards multiple authorships in a discipline, many studies have used either the mean number of authors per paper, termed the Collaborative index (CI) by Lawani (1980) and/or the proportion of multiple-authored papers, called Degree of collaboration (DC) by Subramanyam K (1983) as a measure of the strength of collaboration in a discipline. These two measures are shown inadequate by Ajiferuke et al. (1988) and they derived a single measure that incorporates some of the merits of both of the above. Collaboration coefficient (CC) as defined by Ajiferuke et al. lies between 0 and 1, with 0 corresponding to single authored papers. However it is not 1 for the case where all papers are maximally authored, i.e. every publication in the collection has all authors in the collection as co-authors. Let the collection K be the research papers published in a discipline or in a journal during a certain period of interest.

In the following, we write

In this study, scientific collaboration has been measured as follows:

(i) Collaborative Coefficient (CC) has been suggested by Ajiferuke et.al, and is based on fractional productivity defined by Price and Beaver and is given by the formula

$$CC = 1 - \left\{ \sum_{j=1}^n (1/j) F_j / N \right\}$$

Here,

$f_j$  = the number of papers having  $j$  authors in collection  $K$ ;  
 $N$  = the total number of papers in  $K$ .  $N = \sum_j f_j$ ; and  
 $A$  = the total number of authors in collection  $K$ .

**Dominance Factor**

Dominance factor formula in bibliometrics has been developed by Sudhir Kumar (2008). Dominance Factor (DF) is proportion of number of joint-authored papers of an author as first author ( $N_{mf}$ ) to total number of joint-authored papers of the author ( $N_{mt}$ ) [17]. Mathematically it is represented as

$$DF = N_{mf} / N_{mt}$$

**Collaboration Index**

Collaboration index is the mean number of authors per joint authored publications. The mathematical presentation of collaboration index (C.I.) is given by:

$$CI = \frac{\sum_{j=1}^A jf_j}{N}$$

Here,  $\sum_j jf_j$  is number of authors of total joint publications and  $N$  is total joint publications

It is a measure of mean number of authors. Although it is easily computable, it is not easily interpretable as a degree, for it has no upper limit. Moreover, it gives a non-zero weight to single-authored papers, which involve no collaboration.

**Collaboration Coefficient**

Collaboration coefficient (CC) was designed to remove the above shortcomings pertaining to CI and DC. It is given by:

$$CC = 1 - \frac{\sum_{j=1}^A (1/j)f_j}{N}$$

It vanishes for a collection of single-authored papers, and distinguishes between single authored, two-authored, etc., papers. However, CC fails to yield 1 for maximal collaboration, except when number of authors is infinite. We note that DC also equals to 1 for maximal collaboration.

**Planned measure of MCC**

The derivation of the new measure is almost the same as that of CC, as given in Ajiferuke et al. Imagine that each paper carries with it a single ‘‘credit’’, this credit being shared among the authors. Thus if a paper has a single author, the author receives one credit; with 2 authors, each receives 1/2 credits and, in general, if we have  $X$  authors, each receives  $1/X$  credits (this is the same as the idea of fractional productivity defined by de Solla Price and Beaver as the score of an author when he is assigned  $1/n$  of a unit for one item for which  $n$  authors have been credited.)

Hence, the average credit awarded to each author of a random paper is  $E[1/X]$ , a value that lies between 0 and 1. Since we wish 0 to correspond to single authorship, we define the modified collaborative coefficient (MCC),  $k$ , as:

$$k = \frac{A}{A - 1} \left\{ 1 - \frac{\sum_{j=1}^A (1/j)f_j}{N} \right\}$$

Where,  $A$  is a normalization constant to be determined. Setting  $A = 1$  yields the measure CC. The requirement that  $j = 0$  for single authorship does not restrict. The above equation is not defined for the trivial case when  $A = 1$ , which is not a problem since collaboration is meaningless unless at least two authors are available. CC approaches MCC only when  $A \rightarrow \infty$ , but is otherwise strictly less than MCC by the factor  $1-1/A$ .

#### IV. RESULTS AND DISCUSSION

##### PROLIFIC AUTHORS

In this analytical study period of 1981 to 2010, 26,306 scientists have produced 10795 articles contributions scattered over 2,988 journals. Here the fourth hypothesis is subsequently proved. In accordance to this the researcher has ranked according to their highest publications in the field of Crop Science research till the 12<sup>th</sup> rank for the top 100 published authors. The first 100 authors are identified as the most productive contributors to Crop Science research. Table 4.26 reveals the first 100 (0.38 %) prolific authors of Crop Science research belongs to their highest productivity. It shows the total local citation scores and its t-value; total global citation scores and its t-value; total citation ranks; first author's contribution and single author contribution among these seventy five authors. In the present study, the authors are ranked on the basis of their maximum number of papers published. Among the 26306 authors, Anonymous has published 64 articles and it is the highest publications. The author of "LAL R" has published the highest number of articles have been 33 (0.13 %); 209 TLCS with 10.54 t value; 1257 TGCS with 71.01 t value and the 95 TLCS measured. It occupies the first rank in Crop Science research output. The author "KATERJI N" has published 25 articles (0.10 %); 85 TLCS with 8.28 t value; 333 TGCS with 51.07 t value and the 85 TLCS measured. It occupies the second rank in Crop Science research output. The author "ANONYMOUS" has published 21 articles (0.08 %); 90 TLCS with 5.1 t value; 579 TGCS with 35.76 t value and the 74 TLCS measured and the author stood in third position to the productivity of Crop Science. The author "KROPFF MJ" has published 16 articles (0.06 %); 21 TLCS with 2.22 t value; 199 TGCS with 23.71 t value and the 28 TLCS measured and the author stood in fourth position to the productivity of Crop Science.

Table 1 Showing Prolific Authors according to highest research productivity (26306 authors)

S. No	Author Name	R. O/P	Rank	% of 26306	TLCS	TLCS/t	TGCS	TGCS/t	TLCR
1	[Anonymous]	64	-	0.24	0	0	0	0	0
2	Lal R	33	1	0.13	209	10.54	1257	71.01	95
3	Katerji N	25	2	0.10	85	8.28	333	51.07	85
4	Anonymous	21	3	0.08	90	5.1	579	35.76	74
5	Kropff MJ	16	4	0.06	21	2.22	199	23.71	28
6	Mastrorilli M	14	5	0.05	46	5.04	91	10.27	118
7	Struik PC	14	5	0.05	21	2.45	195	25.01	26
8	Hoogenboom G	14	5	0.05	10	1.26	97	16.84	10
9	Keating BA	13	6	0.05	46	5.04	91	10.27	110
10	Meinke H	13	6	0.05	13	2.14	21	3.27	27
11	Wopereis MCS	12	7	0.05	9	1.01	124	19.39	16
12	Goudriaan J	12	7	0.05	14	1.01	664	46.37	7
13	Singh S	12	7	0.05	28	7.5	130	32.08	27
14	Jones JW	12	7	0.05	28	7.28	215	38.14	23
15	Olesen JE	12	7	0.05	0	0	0	0	0

The authors "MASTRORILLI M", "STRUIK PC" and "HOOGENBOOM G" has published 14 articles (0.05 %) references stands fifth in the research output with 46, 21 and 10 TLCS; 5.04, 2.45 and 1.26 t values; 91, 195 and 97 TGCS; 10.27, 25.01 and 16.84 t-values and 118, 26 and 10 TLRS are scaled. The authors "KEATING BA" and "MEINKE H" has published 13 articles (0.05 %) references stands sixth in the research output with 46 and 13 TLCS; 5.04 and 2.14 t values; 91 and 21 TGCS; 10.27 and 3.27 t-values and 110 and 27 TLRS are scaled. The authors "WOPEREIS MCS", "GOUDRIAAN J", "SINGH S", "JONES JW", "OLESEN JE" and "CARBERRY PS" have published 12 articles (0.05 %) references which stand seventh in the research output with 9, 14, 28, 280 and 112 TLCS; 1.01, 1.01, 7.5, 7.28, 0 and 3.79 t values; 124, 664, 130, 215, 0 and 331 TGCS; 19.39, 46.37, 32.08, 38.14, 0 and 11.28 t-values and 16, 7, 27, 23, 0 and 19 TLRS are scaled.

Table 2 Showing Prolific Authors performance according to their contributions (26306 authors)

S.No	First Authors	Recs.	Single Authors	Recs.	Collaborative Authors	Recs.
1	Katerji N	16	[Anon]	75	Lal R	38
2	Lal R	13	Olesen JE	15	Anonymous	24
3	Goudriaan J	12	Hammer GL	10	Hansen JW	18
4	Anonymous	11	Katerji N	10	Sadras Vo	17
5	Sadras VO	10	Dobermann A	9	Katerji N	16
6	Ogrady P	9	Sperandio JC	9	Kropff MJ	16
7	Meynard Jm	8	Schroth G	8	Kumar S	14
8	Holser RA	8	Gregory PJ	7	Struik PC	14
9	Sinclair TR	8	Van Ittersum MK	7	Hoogenboom G	14
10	Boulard T	8	Schjonning P	7	Keating BA	13
11	Ghersa CM	7	Rapaport WJ	7	Goudriaan J	12
12	Keating BA	7	Ewert F	6	Ogrady P	12
13	Mills G	7	Blandford AE	6	Stockle CO	11
14	Meinke H	7	Dominicy M	6	Van Keulen H	11
15	Amigoni F	6	Forsythe D	6	Zech W	11
16	Bhuiyan SI	6	Jamieson PD	6	Jones JW	11
17	Godwin RJ	6	Lirov Y	6	Fuhrer J	11
18	Kropff MJ	6	Singh P	6	Ong CK	11
19	Hakansson I	6	Angehrn AA	5	Sinclair TR	11
20	Zech W	6	Bartos FJ	5	Rabbinge R	11
21	Arshad MA	6	Campbell JA	5	Carberry PS	11
22	Lavine BK	6	Gilmore JF	5	Bouma J	10
23	Fuhrer J	6	Jamshidi M	5	Carter MR	10
24	Salim MD	6	Kugel P	5	Wopereis MCS	10
25	Sexton RS	6	Lee ET	5	Meynard JM	10

The above table 4.27 has revealed that the dominant authors based on their contributing for publication as first authors, single (non collaborative) author and collaborative authorship pattern. The author of "KATERJI N" has published in the selected area is 16 articles, he acted been as first author product is 16 and as single authored publications is 10. Same like this author of "LAL R" has produced totally 38 articles; he acted as first author 13 articles and the specific author does not produced as single author status. The author of "GOUDRIAAN J" has produced 12 articles all producing being at first author status. The authors of ANONYMOUS has totally produced 24 articles in this Crop Science area, he acted as first author production is 11 articles and 13 articles having a different status. He does not produce a single author's status. The author SADRAS VO has totally 17 articles and were produced in sample area, as first authors produced 10 articles and there is no production on single author status.

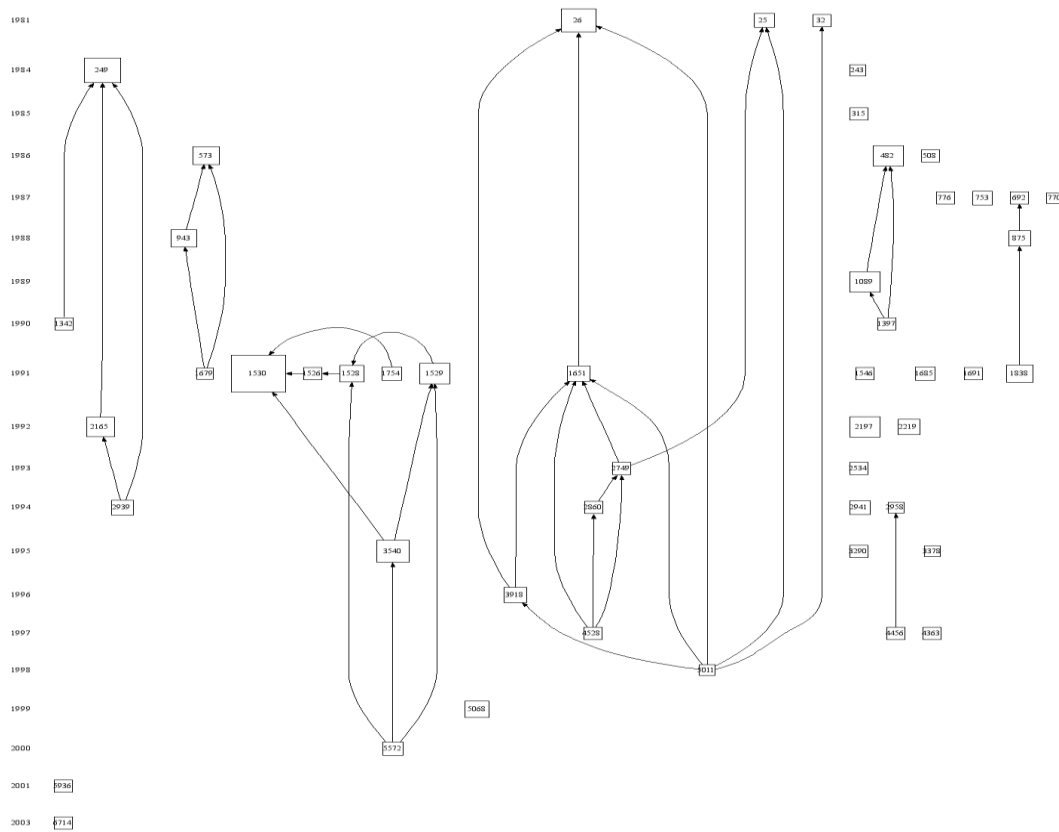


Figure 1: Histrograph maps of for prolific authors LCS Nodes  
 Links: 36 LCS, top 50; Min: 11, Max: 112 (LCS scaled)

From the above analysis, the researcher has concluded that the authors of KATERJI N, LAL R, GOUDRIAAN J, ANONYMOUS and SADRAS VO were producing their articles are highest act as first author status. The authors of OLESEN JE, HAMMER GL, KATERJI N, DOBERMANN A and SPERANDIO JC produced more articles act as single (non collaborative) author status. The authors of LAL R, ANONYMOUS, HANSEN JW, SADRAS VO and KATERJI N were identified as the most productive authors. A specifically identified the active author is KATERJI N.

Table 3 Distributing the most productive authors performance according to their participating times

Participating Times	First Authors	% of 5922	% of 26306	Non Collaborative	% of 3075	% of 26306
One time	4728	79.84	17.97	2366	76.94	8.99
Two times	908	15.33	3.45	552	17.95	2.10
Three times	174	2.94	0.66	75	2.44	0.29
Four times	61	1.03	0.23	45	1.46	0.17
Five times	24	0.41	0.09	17	0.55	0.06
Six times	12	0.20	0.05	8	0.26	0.03
Seven times	4	0.07	0.02	4	0.13	0.02
Eight times	4	0.07	0.02	1	0.03	0.00
Nine times	1	0.02	0.00	3	0.10	0.01
Ten times	1	0.02	0.00	2	0.07	0.01
> ten times	5	0.08	0.02	2	0.07	0.01
Total	5922	100	22.51	3075	100	11.69

Among the 26306 authors, 5922 (22.51 %) of authors were acting as first authors and 3075 (11.69 %) of authors were non collaborative authors were participate of this sample data. 79.84 per cent of authors were participating only one time at first author status and 76.94 per cent of authors were contributing only one time

as non collaborative author status. 15.33 per cent of First authors and 17.95 per cent of single authors were contributing two times of total productivity. 2.94 per cent of first authors and 2.44 per cent of single authors were contributing at three times of total research output. 1.03 per cent of first authors and 1.46 per cent of single authors were contributing at four times. Very less number of first authors and single authors were contributing the more numbers of five, six, seven, eight, nine and ten and more than ten times contributing in this research area. Totally 17.97 per cent of authors were contributing only one time act as first authors. 3.45 per cent of first authors were contributing at two times. 8.99 per cent of single authors were contributing only one time. 2.10 per cent of authors were contributing at two times of total publication in the area of Crop Science research output.

## V. CONCLUSION

Considering the above facts it is concluded that global scientists in agricultural field, the authorship pattern shows majority of joint authorship contributions with 98.35 percents and high collaboration coefficient (0.93) which reveals that team research is predominant. Two, three and four author collaboration is common trend among global scientists. There are 26,306 authors contributing out of which 4728 authors have single contribution. Also very few authors have 10 or more contributions. This is a poor sign in measuring productivity of any country. The value of dominance factor of most of the prolific authors is found low (less than 0.05) which should be a poor sign for collaboration. CC is an interesting measure of collaborative strength in a discipline that has the merit of lying between 0 and 1 (unlike previous measures of collaboration) and tends to 0 as single authored papers dominate. However, unlike CC, which remains strictly less than 1 for finitely many authors, MCC smoothly tends to 1 as the DC becomes maximal. This quantitatively captures our intuitive expectation that any quantification of collaborative strength must become 100 % when the collaboration is maximal. This type of investigation may be useful for understanding the importance of research and development activities, measuring the productivity of countries, performance of scientists. It helps in making research and development policies for improving the productivity of scientists in various fields.

## REFERENCES

- [1] **Ajiferuke, I., Burrell, Q., & Tague, J.** (1988). Collaborative coefficient: A single measure of the degree of collaboration in research. *Scientometrics*, 14, 421–433.
- [2] **Balasubramani R and Murugan C** (2011) Mapping of Tapioca (Sago) Research in India: A Scientometric Analysis, Library Philosophy and Practice <http://www.webpages.uidaho.edu/~mbolin/balasubramani-murugan.pdf>
- [3] **Kalidha A, Balasubramani R, Surulinathi M and N. Amsaveni** (2013) “Indian Contribution to Medicinal Plants Research: A Scientometric Study”, *Journal of Advances in Library and Information Science*, Vol. 1. (2), pp. 65-70
- [4] Ponnudurai R and Thilakar S, (2013) Mapping of Crop Science Research Output: A Scientometric Analysis, *Journal of Advances in Library and Information Science*, Vol.2,(3), pp-134-137.
- [5] **Raja S and Balasubramani R** (2011) Scientometric Study of the Research Publication on Malaria 2003-2007: A Global Perspective, *International Research Journal of Library, Information and Archival Studies* Vol. 1(3), pp. 114-125. <http://www.interestjournals.org/IRJLIAS/pdf/2011/November/Raja%20and%20Balasubramani.pdf>
- [6] **Santosh A Navalur, R.Balasubramani P.Ashok Kumar** (2012) Mapping of Global Research Performance in E-learning: A Scintometrics Analysis, *Journal of Advances in Library and Information Science* Vol. 1. (3), pp. 130-137
- [7] **Surulinathi M, Balasubramani R and Kalidha A** (2013) Continent wise Analysis of Green Computing Research: A Scientometric Study *Journal of Advances in Library and Information Science* Vol. 2. No.1. pp. 39-44 <http://www.jalis.in/pdf/Ppdf2-1/Balasubramani.pdf>
- [8] Thilakar, S. Kalaiselvan, S. Uma Maheswari, Dr.R. Balasubramani and Dr. N. Ningappa (2013) Scientometric Study of Research Publication in India, *Indian Journal of Library & Information Technology*, Vol.3 (1), pp.8-14.