

## COLLABORATION TRENDS IN SUGARCANE RESEARCH - A CASE STUDY

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*In order to find out the collaboration trends in Sugarcane Research, a case study has been undertaken with the help of publications from Sugarcane Breeding Institute, Coimbatore during 1948 to 1987. Disciplinewise Collaboration Coefficient (CC) and Average Authorship per Paper (AAP), were calculated. It was noticed that both CC and AAP increased steadily over a period of time. The relationship between these two factors indicates positive direction but with varied magnitudes among the disciplines.*

### INTRODUCTION

Measuring Science has become a major aim and concern for a variety of reasons. All those who are studying the evolution of science epistemologically, or interested in the history or sociology of the scientific community, or dealing with decision making for the management of science, need a frame work in which various aspects of science can be assessed in as quantitative manner as possible [1]. The openly published scientific paper or its functional equivalent may be regarded as the end product of scientific research [2]. It is well known that the number of authors per paper in natural sciences has risen in the last decade and it can be considered as an indicator of cooperation among authors driven by the challenge to do big science or due to the interdisciplinary character of research in some fields of science [3]. In order to verify whether agricultural sciences also follow the rising trends in collaboration activity or not, a case study of the publications of one of the primary institution, i.e. the Sugarcane Breeding Institute, Coimbatore (SBI) was undertaken. Cornell University, USA had conducted a survey of the cost benefit ratio in the

agricultural institutions all over the world and the SBI was found ranking at the highest level with the lowest budget and the maximum benefit to the community [4].

### METHODOLOGY

Publication from Sugarcane Breeding Institute, Coimbatore, in well established disciplines, viz. botany, genetic resources, breeding, genetics & cytogenetics, physiology & biochemistry, agricultural chemistry, agronomy & soil sciences, pathology and entomology during 1948-87, were considered. Number of authors, year of publication and content of publications were noted. One score was given for each author by observing its occurrence [5]. The degree of collaboration in a discipline was defined as the ratio of the number of collaborative research papers to the total number of research papers published in a discipline during a certain period of time (6). It is expressed as:

$$CC = \frac{Nm}{Nm + Ns} \dots\dots(1)$$

where,

CC is the Collaboration Coefficient, i.e. degree of collaboration in the discipline,

Nm is the Number of multi-authored research papers in the discipline published during a year, Ns is the Number of single-authored research papers in the discipline published during the same year. The average authorship per paper (AAP) was calculated using the following formula:

$$(AAP) = \frac{\sum W_i P_i}{\sum P_i} \dots\dots\dots(2)$$

Where  $W_i$  is the number of authors contributing to the  $i$ th Category ( $i = 1,2,3,4$ ),  $P_i$  is the total number of papers in the  $i$ th Category. In order to study the association, a linear relationship has been assumed between CC and AAP, with CC as dependent and AAP as independent variable. The relationship is shown mathematically as:

$$(CC) = a + b(AAP) \dots\dots\dots(3)$$

Where  $a$  and  $b$  are the constants to be estimated from the observed data.

The Coefficient of Determination ( $r^2$  %) between (CC) and (AAP) for each discipline has been calculated using the following formula.

$$r^2(\%) = \frac{[\sum (CC)_i (AAP)_i]^2}{\sum (CC)_i^2 \sum (AAP)_i^2} \times 100 \dots\dots\dots(4)$$

**RESULTS AND DISCUSSION**

The Collaboration Coefficient (CC) and the Average Authorship per Paper (AAP) in a decade for each discipline were worked-out and are given in Table 1. It was found that among various disciplines, agricultural chemistry had the highest average Collaboration Coefficient followed by agronomy & soil sciences. Entomology had the lowest average Collaboration Coefficient. It was also observed that in most of the disciplines CC increased steadily over decades. This was a healthy and positive sign noticed in sugarcane research programme. Similar trend was seen in Average Authorship per Paper, where the average number of collaborators was found around two for all the disciplines. Based on the classification of the disciplines, viz. sugarcane improvement, sugarcane production and sugarcane protection, a good collaborative research was noticed in sugarcane production followed by sugarcane improvement. On the other hand less collaborative tendency was seen in entomology during 1948-67. An analysis was also undertaken to know the relationship between CC and AAP. A linear relationship has been tried with the help of the equation 3 given above based on the dec-

ade-wise data (1948-87). The values of the coefficient of determination ( $r^2$  %) for each discipline using the formula (4) are given in Table 1 (Appendix 1). It was seen that the value of  $r^2$  varied considerably from 0.02 to 76.84 among the disciplines. In other words, the relationship between number of authorship per paper and the Collaboration Coefficient was not of uniform order among the disciplines. CC had good linear relationship with AAP in genetics & cytogenetics, physiology & biochemistry and also to some extent in entomology, pathology and breeding. It was interesting to note that the relationship was in positive direction of collaboration for all the disciplines though varied considerably in magnitudes.

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Table 1.  
*Discipline-wise Collaboration Coefficient (CC) and Average Authorships  
 Per Paper (AAP) Over Four Decades*

Period Disciplines	1948-1957		1958-1967		1968-1977		1978-1987		Average		(r <sup>2</sup> %)
	CC	AAP	CC	AAP	CC	AAP	CC	AAP	CC	AAP	
<b>Sugarcane Improvement</b>											
Botany	0.60	1.7	0.61	2.05	0.86	2.29	--	--	0.69	2.17	3.17
Genetic Resources			0.83	1.75	0.50	2.00	0.79	2.54	0.71	2.09	0.02
Breeding	0.66	1.85	0.71	2.08	0.64	2.13	0.74	2.31	0.69	2.09	38.51
Genetics & Cytogenetics	0.39	1.39	0.52	1.77	0.52	1.77	0.78	1.93	0.55	1.72	76.84
<b>Sugarcane Production</b>											
Physiology & Biochemistry	0.55	1.82	0.50	1.60	0.45	1.67	0.87	2.12	0.59	1.80	50.75
Agricultural Chemistry	1.00	2.00	1.00	2.18	0.77	2.31	0.85	2.33	0.91	2.12	20.25
Agronomy & Soil Science	1.00	0.50	1.00	3.00	0.80	2.46	0.62	2.04	0.86	2.00	28.66
<b>Sugarcane Protection</b>											
Pathology	0.57	1.50	0.50	1.56	0.51	1.62	0.73	2.33	0.58	2.01	30.05
Entomology	0.19	1.15	0.34	1.38	0.70	1.87	0.77	2.36	0.50	1.69	47.56