R & D COMMUNICATION STRATEGY VIS-A-VIS LIBRARIANSHIP

Present study encourages the periodicals and serials librarians to enter into the niche of 'pre-publication role' in R&D institutions by actively providing information inputs in the knowledge generating system, and by accelerating knowledge disseminating system.

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ABSTRACT

Channels of communications used by researchers at Sugarcane Breeding Institute, Coimbatore, during 1912-1987, to disseminate R&D information, were analysed as a case study of an Research and Development organisation. Concentration of publications in few core channels have indicated a definite strategy followed to reach various target groups. Research organisation is considered as an information generating system. The study can guide sugarcane information seekers, about where to find information pertaining to particular domain. Information dissemination behaviour of scientists must synapse with information seeking behaviour of target groups for effective and efficient communication to occur. Present study encourages the periodicals and serials librarians to enter into the niche of 'pre-publication role' in R&D institutions by actively providing information inputs in the knowledge generating system, and by accelerating knowledge disseminating system, through evolving professional management, reference services, etc. and catalyse the process of bringing together authors and their target readers for their mutual benefit without expecting extrinsic motivation.

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0 INTRODUCTION

The essence of the scientific method is communication. Without communication there is no science. Only when theory or discovery is either validated or invalidated by the scientific community has science taken place, and that is a process of communication. This communication takes many forms, both formal and informal, and has evolved over the centuries. One of the earliest forms was letters, which contained considerable detail concerning a scientist's latest investigations and thoughts. Personal correspondence was the predominant means of scientific communication until the middle of the 17th century. It's defects were:

- much time and efforts were needed to write letters;
- letters were personal in tone, and were not sent to those who would disagree with or debate their contents;
- unsound theories were not objectively criticized and rejected;
- questions of priority could not be resolved satisfactorily;
- some writers invented ciphers or systems of shorthand to maintain secrecy; and
- many people who were interested in science did not receive letters.

Gradually groups of people with similar interests began to form scientific societies. Sir Robert Moray, President of the Royal Society mooted the idea of Scientific journal publishing in 1661. The first weekly issue of the *Journal des Scavans* was published on January 5, 1665 in France. The *Philosophical Transactions* journal was published from England on March 6, 1665. *Asiatick Researches* was the first journal from India published during 1788 by Sir William Jones the founder of the Asiatic Society of Bengal which was founded in 1784. Scientific journals have remained one of the most important R&D publications outlet channels for the communication of scientific and technical information.

Important functions of scientific journals are:

- it serves as an archival record of scientific scholarship, scrutinized and validated by scientists, and constitutes the basic source material for consolidation and compaction into textbooks, reviews, handbooks, encyclopaedias, and similar other secondary packages;
- it is a medium for disseminating current, historical, social, political, commercial, and pedagogical information of interest to scientists;
- primary journal is a social institution that confers prestige and rewards on authors, editors, referees, subscribers, and publishers;
- published papers are considered as a tangible measure of scientists contribution to the advancement of scientific knowledge, and as a basis for an evaluation of their work by their peers and employers; and
- publication of the results of research and development in journals facilitates the establishment of priority and ownership of ideas and discoveries.

Other methods of scientific communications include, but are not limited to, books, conferences, the invisible colleges, patents, and popular press. Other means of interaction among scientists are:

- organisation of information exchange groups for public distribution or preprints;
- on-demand distribution of author-prepared summaries and/or full papers;
- repackaging of primary journals into "user journals" or "super journals" for particular user groups;
- establishment of separate radio stations and/or television stations for broadcasting science reports;
- distribution of research reports on tape recordings;
- substitution of the primary journal by the individual paper (or "separate") as the primary unit of distribution;

- computer-aided desk-top publishing;
- miniprint publication;
- microform publication;
- "letters" journals publication;
- "synopsis" journals publication;
- "electronic" journals;
- electronic mail;
- facsimile;
- videotext;
- bulletin boards; and
- teleconferencing.

Individual scientists select a research problem because they know its solution would be of considerable interest to them and, possibly, to other scientists and the general public. The practice of science is defined as the conduct of research, which includes theory, experimental design, observation, measurement, and interpretation and communication of results. The analytical thrust of contemporary science leads to gathering of more and more data with the answers to questions leading to more questions. One feels the periodic need to review the state-of-the art, confirm assumptions or discard others, reset oneself and then proceed a new.

Agricultural development [1] basically depends on the 'Knowledge Generating System' (KGS), the 'Knowledge Disseminating System' (KDS) or the 'Transfer Of Technology System' (TOT), the 'Input Supply Agencies' (ISA), and the 'Knowledge Consuming System' (KCS). Sources of agricultural literature were identified [2] by the types of sources; and subject matter of sources. Types of sources indicate the format of source in which information is available, for example: books, journals, reports, conference proceedings, theses, patents, etc. The subject matter of sources indicate the thought content in the sources.

The knowledge generating process through research and its communication is the foundation of scientific, technological and social progress of any nation. It is not the creation or innovation alone that is important but the dissemination or transfer of such innovation from the point of production to the point of utilisation also plays a major role. In the process of modernizing agriculture four distinct systems are involved, viz. the 'Research system' that creates new knowledge and innovations; the 'Documentation system' that classifies information and stores for quick and correct retrieval; the 'Client system' consisting of potential users of new knowledge; and the 'Extension system' comprising extension personnel performing the task of communication link. These four systems are equally important and their roles are complementary and supplementary to each other.

The traditional avenues for the dissemination of research results have been scholarly publications, such as journal articles and conference presentations, training and seminars, technical reports, and articles intended to be published in Farmer's publications. Present study is in order to know where sugarcane researchers publish their research findings.

1 CASE STUDY

Sugarcane Breeding Institute, Coimbatore (SBI) has specialised as an important single crop based R&D institution with definite strategy in generating and disseminating information in the domains of Botany, Genetic Resources, Plant Breeding, Genetics & Cytogenetics, Mutation, Tissue Culture, Physiology & Biochemistry, Agricultural Chemistry, Agronomy & Soil Science, Plant Pathology, Agricultural Entomology, Nematology, Agricultural Statistics, and Agricultural Extension & Technology Transfer.

SBI is one of the oldest R&D institutions in India [3] specialising in sugarcane crop research. Hence considered for present case study. The productivity of research [4]

was highlighted for 75 years since the inception of SBI. The present study attempts to find out:

a) core channels of communications,

b) Indian journals used by SBI researchers and being included in Indexing and Abstracting Services and their Impact Factors,

c) empirical values for papers published/presented and the journals/channels of communications used for the purpose by various disciplines/domains,

d) bradford multipliers for each discipline, and

e) periodicals subscribed.

2 METHODOLOGY

All publications originated from SBI during 1912-1987 were documented on cards and sorting was done as per requirement to extract various data. Normal count procedure was used.

3 RESULTS AND DISCUSSION

Core channels of communications are included in the Table 1. 'Current Science' tops the list with 84 papers, followed by 'Proceedings of International Society of Sugarcane Technologists' (68), 'Indian Sugar' (44), 'Indian Journal of Agricultural Science' (43), 'Proceedings of the Biennial Conference of Sugarcane Research and Development Workers' (38), 'Proceedings of the Indian Science Congress' (31), and others. Twenty three journals included about 62 percent of the total publications.

In the classical model of scientific communication, the interaction, or peer review begins when preliminary research is first presented at seminars, then in forums such as symposia or conference. The scientists attending these forums not only learn what research is being done by other scientists, they provide the objective feed back

pointing out the potential questions and/or modifications that are needed to advance the research to the point of publishing an article in refereed journals. Conference literature forms a vital communication link in many fields of science and engineering. Quite often the first public disclosure of important science and technology development or discoveries occurs at conferences, symposia or meetings having similar designations. Conference materials constitute a significant portion of the scientific literature, and frequently contain information not available elsewhere, or early results presented ahead of more formal scientific publications. Peer review thus begins in the early stages of the research, and continues through and beyond the process of publication. The refereed article or forum offers implicit guarantees to scientists receiving the information. The referees act somewhat like a screening committee. Articles are reviewed for importance and methodology. Therefore, in theory, to read an article in a peer reviewed journal is to learn of research which has been reviewed by scientists assuring that a certain level of methodology and design has been conducted, and that this research is a significant contribution to the literature and to the science.

Information on the coverage of Indian periodicals in international indexing and abstracting services and their impact factors [5] during 1975-1988 are provided in Table 2A and 2B. Impact factors (IF) for journals are calculated and published in the 'Journal Citation Reports' brought out by the Institute for Scientific Information, Philadelphia, (USA) as a companion volume of 'Science Citation Index'. It adopts a two-year period as the basis of its calculations. For example if a journal publishes 100 papers in 1991 and 1992, and these papers are cited 90 times in 1993, the IF would be 90/100, or 0.90. IF indicates quality and standing of the journal which indirectly implies the quality of the article published. Among Indian Journals, highest impact factor was 0.588 for Journal of Genetics in 1988, where only one paper was published by SBI. It is a matter of concern that no Indian journal finds place in the list of journals with impact factor above 1.474. There have been

disturbing reports from developed countries about fast erosion in the credibility of Indian journals among librarians and scientists there. It is clear from Tables 2A and 2B that SBI researchers have not cared to publish their papers in high impact factor journals. Their target groups namely sugarcane farmers and sugar industries do use SBI generated information but do not enter into citation activity. Citation counting ignores the very substantial amount of non-citation directed browsing and other reading done by scientists. Agriculture is a local enterprise and hence needs different approach of data collection to quantify information utilisation. However, SBI should publish their high quality contributions in high impact factor journals.

Publication frequencies for the discipline of Sugarcane Improvement is given in Table 3. It deserves mention that Genetics and Cytogenetics papers were preferentially published in 'Current Science', probably because it publishes papers quickly as its frequency is fortnightly and in 'Indian Journal of Agricultural Sciences', which is published monthly. Plant Breeders have shown high preference for 'Proceedings of International Society of Sugarcane Technologists', and 'Indian Sugar'.

Publication frequencies for the discipline of Sugarcane Production are provided in Table 4. Physiologists and Biochemists have shown high preference for 'Proceedings of Indian Science Congress'. Agricultural Chemists have preferred 'Proceedings of Annual Convention of Sugar Technologists Association of India'. Agronomy and Soil Science publications were predominantly communicated through 'Indian Sugar'.

Publication frequencies for Sugarcane Protection discipline are furnished in Table 5. Plant Pathologists have preferred 'Current Science', and 'Proceedings of International Society of Sugarcane Technologists' to disseminate their research results. Entomologists also consider 'Current Science' to be the best channel followed by 'Indian Sugar', 'Proceedings of Annual Convention of

Deccan Sugar Technologists Association', and 'Proceedings of Annual Convention of Sugar Technologists Association of India'.

Nematology, and Agricultural Statistics are young domains as such there are only 14 and 7 papers respectively on the subject. Sugarcane Extension accounts for 44 papers and there is no significant preference to any journal/channel.

The Table 6 provides information on Bradford distribution (four zones). Average Bradford multiplier (b) for sugarcane improvement was 3.10, for sugarcane production it was 2.16, and for sugarcane protection it was 2.69. The Bradford's theoretical law has practical consequences for any reader: one should try to find out - using ones own experience, consultation with colleagues or librarians, checking abstracting journals indexes, and references - what are the 'core journals' in ones field of interest. One should pay a great deal of attention to those. One should probably read, or at least scan, those cover-to-cover in a library or one should subscribe those. The citations and review columns will lead to other sources outside the 'core' group. Another larger, group of journals, on average, fewer but still a reasonable number of relevant articles (roughly - the second level according to the Bradford's law), is equally worth scanning.

As per 1982 list of current periodicals, SBI was subscribing to 218 periodicals. Subject-wise distribution of periodicals can indicate the interest of the researchers at SBI. Subject-wise number of periodicals subscribed were: Agronomy (18), Biology/Biosciences (5), Botany (12), Chemistry (16), Entomology(18), General (60), Genetics & Cytogenetics (16), Library Science (3), Physiology (12), Plant Pathology (21), Plant Breeding (5), Soil Science (7), Statistics (1), and Sugar/Sugarcane (24).

SBI, is recognised for post graduate and doctoral research by various universities like, Madras, Bombay, Bharathiar, Calicut, Agra, Patna, Bihar, Tamil Nadu Agricultural University, and Indian Agricultural Research

Institute. Till 1987 researchers at SBI have submitted 128 theses to these universities and copies of the theses are maintained in SBI library.

On the diffusion dimension [6] quality is positively influenced by the intension to publish scientific articles, to present results in congresses, and in training programmes. The author and reader have different objectives. One is telling what he knows and the other is looking for help. The journal packages together items that wouldn't be economically viable if published separately. The publisher acts as a translator between the two by applying a value judgment to the information. This judgment may act to clarify the author's presentation or it may combine many people's work into one - commonly called textbooks, reference books, tutorials, etc. In any case it functions to improve the transfer of information. The libraries have been looked to as "funding" agencies to further extend the market-place, technically as a mechanism for multiple use. The librarians must actively participate in the organized efforts to disseminate relevant scientific and technical information to the intended readers. Librarians need not be afraid to change. The world is changing, and demand on efficient role of librarianship will be very high in future. Librarians may have to undertake research on behaviour of both authors as well readers and assist both to reach their respective goals.

The commercial publisher actively seeks out authors that will have a high probability of "value-added" manuscripts. Publishers who supply a high level of value-added products will keep corresponding high level of readership and will continue to sell packages of information to readers. Functionally they will represent information that has been distilled, clarified, and translated into reader terms. Whereas not-for-profit publishers (societies, institutions and universities) tend to keep wide open doors for authors and apply a quality control (peer review) to the author's work, but they do not necessarily seek out authors to fill specific readers' needs. [7] An offsetting factor for professional societies is that they have

further, must not be passively attentive, but must actively participate in the organized efforts to disseminate relevant scientific and technical information to the general public.

A library or information department which does not disseminate information [10] effectively for the benefit of its organisation could be viewed as an expendable overhead. Consequently, information professionals need to identify, evaluate and disseminate efficiently information derived from both internal and external sources which is necessary to their organisation's decision making processes.

Librarians must become active partners [11] in the scholarly process and in discussions pertaining to the generation, production and access of information...; Librarians must be increasingly involved with those responsible for the development of information technology for the university and the information industry; Librarians must influence information policy as it affects information use and technology by collaborating with other stakeholders, especially in the political arena, at various governmental levels and in scholarly associations. Scientists and politicians will fight for library funding if educated in proper perspective. Here is the strategy for librarians who really want to gain control of their collections: be analysts of the literature beyond mere processing and pricing studies.

Librarians have been invisible members of the science community for too long. Science librarians should begin to understand that their economic value is not to publishers so much as it is to the community of interests that we call research and development, national defense, industry, higher education, and national economy. Establish higher visibility and closer relationships with the important library users who get the grants and who have a voice in how grant income and other funds are actually spent. Librarians have met the challenge of reduced funding by seeking "cost-effective" methods of collection management analysis: new ways to decide which

independent means of communicating with a wide group of readers via membership in the society.

The function of science publishing [8] today is to get information about new findings in science to at least three different communities:

- Group A, the specialists working in the same field as that in which the findings were made (numbering anywhere from 10 to 1,000 scientists);
- Group B, the general community of scientists and engineers who, although not in that field, are nevertheless interested in major advances in scientific areas other than their own-advances that may, indirectly or in the long term, be significant to them (probably between 1,000 and 10,000);
- Group C, the general, attentive public and the policy-makers who want or need to know of scientific developments that could have economic or social consequences (10,000 - 100,000).

The classic media for science publishing - journals put out by societies and other discipline - oriented organizations - were designed only for Group A, while the media serving Group B are the short news articles in society house organs, and in multi-disciplinary publications.

Group C is served by the general media - including newspapers and magazines, which tend to overamplify and inappropriately dramatize the "breakthroughs" they consider newsworthy.

The library profession [9] should share the concern of educators, public servants, and scientists regarding the science literacy crisis. To date, there has been relatively little written in the literature of librarianship about science literacy. If the profession is to play its potentially significant role in the promotion of science literacy, librarians themselves must be among the attentive public, and,

subscriptions to cancel. Such methods are faulty and will eventually put researchers at a great disadvantage [12] compared to those using libraries that have adequate funding. Library resources are essential to progress. Librarians are encouraged to advocate better funding based on libraries' importance to research and development and their place in the economy. Library is the hub of our R & D environment. We may see our scientists making fewer visits to the library, yet demanding more information and services from and through the library, i.e., literature searches, multimedia productions, and requirements for the latest technology for scientific presentations. Our libraries must assist agricultural administrators in being at the forefront in new discoveries. Both basic and applied research are essential to societal progress. Libraries with their information system are critical in this process. To the most-informed goes the competitive edge.

Language-wise analysis revealed that 99 percent articles from SBI were published in English language. Articles published in Hindi language were, 0.46 percent for sugarcane improvement, 0.92 percent for sugarcane production, and 0.75 percent for sugarcane protection.

English clearly is the dominant language of science and technology world-wide, and will likely remain one in the foreseeable future is a reasonable conclusion to draw from its role in information access and retrieval, as well as from its role in science and technology research [13].

There are a few crucial features of English, however, that do contribute to its success as a world language. First, English has by far the largest vocabulary of any language, and 80% of these words have been borrowed from a rich variety of other languages, plus English has an easy ability to coin new words. The Oxford English Dictionary lists 500,000 words, with an additional 500,000 technical terms. English nouns have no gender, and English grammar is both simple and flexible [14]. Although it is highly unlikely that English will become the only language of the planet, it will continue to dominate in

science, technology, and a host of other areas. This clearly implies that R & D librarians must be well conversant in English language, must be interested in science, willing to learn necessary skills, and not afraid to handle difficult reference questions.

Information producers and users need to know (if they do not already understand it), that information is power. But ..... information is nothing unless it can be transmitted and used. Users need to understand that they must make clear what kind of information is wanted and also to realize that there is a system's loop involved. Information must be put into the system before it can be made available for retrieval, analysis and continuing use by others.

Sugarcane Breeders from all over the country migrate to SBI during sugarcane flowering season (October to December) and perform selective sugarcane crosses at the 'National Hybridisation Garden' early in the morning every day. They were found to spend their maximum time in the SBI library. This was the only period every year when SBI library readership was found to be maximum. Here is an opportunity for the librarians to satisfy their information needs.

In order for agricultural librarians to function effectively in the provision of information to the user populations, agricultural information personnel need to possess skills in agricultural information handling [15]. Several agricultural information experts have expressed concern over the lack of qualified agricultural information personnel in the developing countries. The consensus of experts is that information training institutions in the developing countries should organise formal training programmes for agricultural information personnel. Such courses could lead to the awarding of recognised diplomas and degrees in agricultural information. Ideally, such training should be geared towards graduates in agriculturally related disciplines. However, in the developing countries it would be difficult to attract enough agricultural graduates to such programmes. An alternative plan would be to enroll

persons without specialised background in agriculture, and to ensure that such courses have a substantial agricultural discipline content. Since agricultural information personnel will also be needed at the intermediate level, diploma and certificate holders in agriculture who already serve as extension officers will be able to combine effectively their training in an agricultural extension setting with information handling capability after undergoing training in agricultural information at the intermediate level. It is hoped that a formal training programme in agricultural information will include basic agriculture, rural sociology, communications, agricultural information sources and systems, information retrieval systems, information technology and management components.

If agricultural information personnel are well trained, they will be in a position to meet the information needs of research scientists, policy makers, planners, extension officers, students, and farmers by packaging appropriate information. The flow of such information is dependent upon interactions among special agricultural libraries, local public libraries, and selected gate-keepers in the farmer population.

The human view of a networked organization [16] is one in which people are connected to one another in diverse forums to exchange ideas and other resources. In this view the networked organization is defined by its people, forums and resources. Technical components of the networked organization provide necessary technical infrastructure to connect people but by themselves do not create the human networked organization.

If we believe that a national concerted effort is required, then it may be necessary to plan out the concept of 'National Science Press', which will enable integration of various information dissemination activities and make use of computers and on-line communication a reality, rather than a statement [17]. Such a facility would help in standardisation of the format of scientific periodicals and provide total control on printed information.

4. CONCLUSION

The study has identified core channels of communications used by sugarcane researchers to disseminate their research and development work. This discussion brings out the fact that the use of channels of communications characterizes their importance to author as well readers. Hence acquisition policy for R & D Library must take into consideration this as one of the important criteria besides coverage in indexing and abstracting services, impact factor, readership, cost effectiveness etc. Librarians have to help both authors and readers with empathy for their mutual benefits. Marketing of information has become vital role for librarianship. Librarians can also guide authors to communicate through highly used or cited channels of communications. Hence, Librarians have to enter into the niche of 'pre-publication role' in R & D institutions, which will be effective only if (s)he is alert and research minded and if (s)he can look at many things beyond traditional librarianship. Librarians need to adopt 'intrinsic motivation behaviour', i.e. active performance in the absence of extrinsic rewards, at present evolutionary and transitional stage so as to achieve the goal of professional librarianship status.

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Table 1

Core channels of communications from Sugarcane Breeding Institute, Coimbatore, 1912-1987

Sl. No.	Titles of core channels of communications	No. of papers	Percentage	Cumulative percentage
1	Curr. Sci.	84	8.66	8.66
2	Proc. Int. Soc. Sugarcane Technol.	68	7.01	15.67
3	Indian Sugar	44	4.54	20.21
4	Indian J. Agric. Sci.	43	4.43	24.64
5	Proc. Bien. Conf. Sugarcane Res. & Dev. Workers	38	3.92	28.56
6	Proc. Indian Sci. Congr.	31	3.20	31.76
7	Indian J. Sugarcane Res. Dev.	27	2.78	34.54
8	Proc. All India Conf. Sugarcane Res. Dev. Workers	26	2.68	37.22
9	Proc. Ann. Conv. Sugarcane Technol. Assn. India.	26	2.68	39.90
10	Agric. J. India	22	2.27	42.17
11	Proc. Ann. Conv. Deccan Sugarcane Technol. Assn.	21	2.16	44.33

12	Sugarcane	19	1.96	46.29
13	Diamond Jubil. Symp. Sugarcane Breed. Instt. Coimbatore	19	1.96	48.25
14	Proc. Indian Acad. Sci. (Pl. Sci.)	18	1.86	50.11
15	Maharashtra Sugar (Now Bharatiya Sugar)	17	1.75	51.86
16	Cooperative Sugar	17	1.75	53.61
17	Indian J. Genet.	16	1.65	55.26
18	Sci. Cult.	15	1.55	56.81
19	Sugarcane Breeding Newsletter	11	1.14	57.95
20	SISSTA Sugar Journal	10	1.03	58.98
21	Sugarcane Path. Newsletter	10	1.03	60.01
22	Pestology	10	1.03	60.04
23	Indian Phytopathology	8	0.82	61.86
	Communications in core channels total	600	61.86	
	Communications in other channels total	370	38.14	
	Total	970	100.00	

Table 2A

Coverage of Indian Journals, where SBI scientists published their papers, in indexing and abstracting services

Sl. No.	Title of the Journal	No. of papers published	Journal start year	Journal frequency per year	coverage in I&A	coverage in SCI
1	Curr. Sci.	84	1932	24	27	1975
2	Indian Sugar	44	1970	12	6	—
3	Indian J. Agric.Sci.	43	1931	12	20	1975-77,79
4	Proc. Indian Acad. Sci. (Plant Sci)	18	1980	6	7	1980-82
5	Indian J. Genet.	16	1941	3	10	1975-81
6	Science and Culture	15	1935	12	15	—
7	Indian Phytopath.	8	1948	4	9	—
8	Ind. J. Agric. Res.	2	1967	4	17	—
9	Phytomorphology	1	1951	4	13	1975-79
10	J. Genet.	1	1910	3	11	1975-78
11	Indian J. Pl. Physiology	1	1958	4	9	—

12	Indian Farming	1	1940	12	9	—
13	Fertilizer News	1	1956	12	5	—
14	Nucleus	3	1958	3	6	1975-79
15	J. Indian Bot. Soc.	2	1959	4	11	—
16	Madras Agric. J.	5	1912	12	13	—
17	Indian J. Hered.	2	1969	4	6	—
18	Indian J. Agron.	3	1956	4	11	—
19	Entomon	4	1976	4	14	1979-84
20	Indian J. Mycol. Pl. Path.	3	1971	3	9	—
21	Proc. Indian Acad. Sci.(Animal Sciences)	2	1934	12	12	1980-84

I&A-Indexing and Abstracting Services, and SCI-Science Citation Index

Table 2B

Impact factor of the Journals figured in Table 2A

Sl. No.	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0.263	0.334	0.258	0.221	0.268	0.268	0.228	0.189	0.170	0.180	0.160	0.117	0.150	0.164
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	0.027	0.032	—	0.066	0.097	0.024	0.041	0.016	0.024	0.021	0.040	0.015	0.024	0.011
4	—	—	—	—	—	—	0.000	0.008	0.065	0.116	0.155	0.096	0.098	0.036
5	0.198	0.191	0.058	0.027	0.060	0.052	0.061	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	0.000	0.016	0.000	0.000	0.010	—	—	0.023	0.008	0.004	0.000
9	0.212	0.203	0.189	0.165	0.125	—	—	—	—	—	—	—	—	—
10	—	—	0.500	0.214	—	—	—	—	—	—	—	—	—	0.588

12	Sugarcane	-	3	6	1	-	-	10
13	Diamond Jubil. Symp. Sugarcane Breed. Instt.	-	-	4	4	1	-	9
14	SBI internal Publications	-	6	2	-	-	-	8
15	Maharashtra Sugar (now Bharatiya Sugar)	-	1	6	-	-	-	7
16	Cooperative Sugar	-	-	6	-	-	-	6
17	Sugarcane Breed. Newsletter	-	1	3	2	-	-	6
18	Mem. Dep. Agric. India Bot. Ser.	5	-	-	1	-	-	6
19	Cytologia	-	-	-	6	-	-	6
20	Nature	-	1	1	4	-	-	6
21	Sci. Cult.	-	-	1	2	1	-	5
22	Stain Technol.	-	-	-	5	-	-	5
	Sub- papers total	66	24	92	109	11	2	304
	(1-22) channels	10	11	19	19	6	1	66
	Sub- papers total	8	20	55	27	6	16	132
	Others channels	7	17	43	22	4	11	88

papers	74	44	147	136	17	18	436
Total channels	17	28	62	41	10	12	110
Top ranking channels with 50% papers	4	9	14	7	4	4	10

A - Botany, B - Genetic Resources, C - Breeding, D - Genetics & Cytogenetics,
E - Mutation, and F - Tissue culture

Table 4

Channelwise publication frequency of Sugarcane production papers

Sl. No.	Titles of the Channels/Journals	No. of papers			
		G	H	I	Total
1	Proc. Ann. Conv. Sug. Technol. Assn. India	1	7	5	13
2	Proc. Indian Sci. Congress	10	2	1	13
3	Agric. J. India	7	1	3	11
4	Proc. Ann. Conv. Deccan Sug. Technol. Assn.	3	3	5	11
5	Indian Sugar	-	5	6	11
6	Curr. Sci.	5	5	-	10
7	Proc. Int. Soc. Sugarcane Technol.	7	2	1	10
8	Indian J. Agric. Sci.	6	2	-	8
9	Proc. Bien. Conf. Sugarcane Res. Dev. Wkrs.	5	1	2	8
10	Indian J. Sugarcane Res. Dev.	5	1	1	7
11	Cooperative Sugar	3	2	1	6
12	Sugarcane R & D Workers meeting	-	-	5	5

13 Diamond Jubil. Symp. Sugarcane Breed. Instt.	3	-	2	5
14 SISSTA Sug. J.	-	1	4	5
papers	55	32	36	113
Subtotal (1-14) channels	11	12	12	14
Subtotal papers	43	22	29	104
Others channels	31	17	23	61
papers	98	54	65	217
Total channels	42	29	35	75
Top Ranking Channels with 50% papers	8	7	8	12

G - Physiology & Bio-chemistry, H - Agricultural Chemistry, and
I - Agronomy & Soil Science

Table 5
— Channelwise publication frequency of Sugarcane protection papers

Sl. No.	Titles of the Channels/Journals	No. of papers			
		J	K	L	Total
1	Curr. Sci.	14	19	1	34
2	Proc. Int. Soc. Sugarcane Technol.	11	6	-	17
3	Indian Sugar	7	9	-	16
4	Sug. Path. Newsletter	9	1	-	10
5	Pestology	2	8	-	10
6	Proc. Ann. Conv. Deccan Sug. Technol. Assn.	-	9	-	9
7	Proc. Ann. Conv. Sugar Technol. Assn. India	-	9	-	9
8	Proc. Bien. Conf. Sugarcane Res. Dev. Wkrs.	3	6	-	9
9	Indian Phytopath.	8	-	-	8
10	Proc. All India Conf. Sugarcane Res. Dev. Wkrs.	3	3	1	7
11	Sci. Cult.	5	1	1	7
12	Sugarcane	5	-	-	5
13	Cooperative Sugar	3	2	-	5

Subtotal (1-13)	papers	70	73	3	146
	channels	11	11	3	13
Subtotal Others	papers	54	55	11	120
	channels	42	40	11	76
Total	papers	124	128	14	266
	channels	53	51	14	37
Top Ranking Channels with 50% papers		8	7	7	11

J - Pathology, K - Entomology, and L - Nematology

11	—	—	—	0.132	0.068	0.074	0.021	—	0.019	0.025	0.019	—	—	—	
12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
14	0.157	0.272	0.173	0.193	—	—	—	—	—	—	—	—	—	—	
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
18	—	—	—	0.007	0.000	0.014	0.004	—	0.000	0.000	0.023	0.008	0.004	0.000	
19	—	—	—	—	0.123	0.146	0.155	0.110	0.070	0.077	0.091	0.053	0.021	0.025	
20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
21	—	—	—	—	—	0.052	0.314	0.013	0.046	0.178	0.173	0.028	0.071	0.048	

Table 3

Channelwise publication frequency of Sugarcane Improvement papers

Sl. No.	Titles of the Channels/Journals	No. of papers						
		A	B	C	D	E	F	Total
1	Proc. Int. Soc. Sugarcane Technol.	9	3	13	14	2	-	41
2	Curr. Sci.	17	1	4	16	2	-	40
3	Indian J. Agric. Sci.	5	-	8	16	2	-	31
4	Proc. Bien. Conf. Sugarcane Res. Dev. Wkrs.	11	-	6	3	-	-	20
5	Proc. Indian Sci. Congr.	6	1	2	8	-	-	17
6	Indian J. Sugarcane Res. Dev.	5	3	4	4	-	-	16
7	Indian J. Genet.	-	2	4	8	-	2	16
8	Proc. All Indian Conf. Sugarcane Res. Dev. Wkrs.	4	-	7	4	-	-	15
9	Indian Sugar	-	2	10	1	-	-	13
10	Proc. Indian Acad. Sci. (Plant Sci.)	-	-	3	5	3	-	11
11	Agric. J. India	3	-	2	5	-	-	10

Table 6
Bradford distribution (four zones)

Zone	sugarcane improvement			sugarcane production			sugarcane protection		
	(n)	R(n)	b	(n)	R(n)	b	(n)	R(n)	b
First	3	117	-	5	59	-	3	67	-
Second	7	108	2.33	7	54	1.40	8	69	2.67
Third	19	108	2.71	18	55	2.57	20	66	2.50
Fourth	81	108	4.26	45	49	2.50	58	64	2.90
$\overline{b}$			3.10			2.16			2.69

(n) - Journal titles obtained in each zone, R(n) - Number of articles,
b- Bradford multiplier, and $\overline{b}$- Average Bradford multiplier