



Dissemination of scientific information on natural rubber by the Rubber Research Institute of India

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Abstract

There are many ways and means by which scientific information on natural rubber (NR) generated at the Rubber Research Institute of India (RRII) is disseminated among its clientele. These include research papers in international and national periodicals, scientific presentations in conferences and seminars, publications of books and other monographs, patents of novel innovations and compilation of scientific secondary services like bibliographies and directories. A quantitative evaluation of the mechanism for the generation and dissemination of information at the RRII is attempted. Over the past 50 years, scientists of RRII have contributed over 2300 research papers covering various disciplines of NR research of which 1171 are periodical articles, 784 are presentations in scientific seminars and 97 are theses/dissertations. A phenomenal increase in the number of publications can be observed during the last 10 years. The institute has published 20 books along with 39 monographs and compiled 10 bibliographies. In addition to a series of training programmes, RRII organized 18 conferences of which eight were international. The websites of Rubber Board also helps in the speedy dissemination of NR information.

Key words : Bibliographies, Conferences, Information dissemination, Natural rubber, Periodicals, RRII, Scientific books, Technology transfer

Introduction

Proper documentation and effective dissemination of the information generated is an important aspect of any R&D programme. The Rubber Research Institute of India (RRII) ever since its inception in 1955 has been active in disseminating information to its target clientele.

A quantitative evaluation of the ways and means by which the innovations of the RRII was channeled to the potential users is highly pertinent for critically assessing the growth that RRII has acquired. Bibliometric studies of RRII and Rubber Board publications up to 1994 (Jose and Korah, 1997b) and world NR literature (Korah and Jose, 1999) are earlier attempts in this direction. A comprehensive appraisal of the dissemination of research contributions of RRII is particularly relevant as the institute has completed fifty years of activity during 2005-2006. This paper attempts to evaluate the channels of

information dissemination and provides a panoramic view of the patterns evolved.

Materials and Methods

Publications from the Rubber Board and RRII like articles in scientific periodicals, papers presented in conferences and workshops, books, monographs, articles contributed for lecture notes and souvenirs from 1955 to 2005 constitute the core database of this study. For the bibliographic details of RRII publications, the compilation by Korah and Jose (2005) has been consulted. Details of a few books, monographs and lecture notes which were not covered in the bibliography were also included in the database so as to make it comprehensive. Full details of conferences, seminars and workshops organized by the Institute and the website of the Rubber Board were also codified. Details of a few publications, conferences and training programmes

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conducted during 2006 were also added to the database as their contents were derived through the research during the 50 years of RRII.

Publications of RRII were categorized as scientific primary and secondary as suggested by Thomas (2000; 2002) with modifications. The information on NR disseminated through these means were quantified and analyzed to evolve a holistic profile of the information dissemination system utilized by the RRII during the past 50 years.

Results and Discussion

Means of information dissemination

Over the past 50 years, scientists of RRII and other officers of Rubber Board have contributed 2385 publications in various disciplines. During the first decade (1950s), the scientists of RRII mostly used Rubber Board Bulletin, the semi technical popular periodical, as an outlet for their scientific contributions. Research articles from RRII started appearing in national and international scientific periodicals since the late 1960s. Since 1988, the Indian Journal of Natural Rubber Research (IJNRR) became the regular and expeditious avenue for the research communications for the scientists of RRII. This journal also published several research papers on NR from all over the world. Since 2004 it is published under the new title, Natural Rubber Research (NRR) and new format. The Annual Report of RRII presents detailed account of its major accomplishments.

The RRII also organized 18 conferences as well as a few training programmes and workshops. The website of Rubber Board also contributes to speedy dissemination of information generated at RRII.

Publications of RRII

The publication productivity of RRII is given in Table 1. Out of the 2385 publications, 1171 are periodical articles, 784 are presentations in scientific seminars and 97 are theses/dissertations. In addition, RRII published 20 books, 39 monographs, 179 chapters in various books and lecture notes and 36 articles in souvenirs. RRII has compiled 10 bibliographies and a few directories for better bibliographic control of published literature on NR. The Institute has registered 42 genotypes with GeneBank of National Centre for Biotechnology Information (NCBI), USA and the Institute holds the US patent for deproteinization of NR latex.

Table 1. RRII publications (1955-2005)

Type of publication	Number	Percentage
Primary		
Articles in scientific journals	1171	49.10
Papers presented in conferences	784	32.87
Dissertations	97	04.07
Genebank registration	42	01.76
Patent	1	00.04
Secondary scientific		
Books	20	00.84
Monographs other than books	39	01.64
Chapters in books and lecture notes	179	07.50
Articles in souvenirs	36	01.51
Secondary bibliographic		
Bibliographies & Directories	16	00.67
Total	2385	100.00

Subject domains of publications

The subject-wise distribution of information disseminated as on 31st December 2005 and the corresponding figures as on 31st March 1994 are given in Table 2. Crop processing and product development leads the list with 519 publications followed by crop improvement with 459 publications and economics, management and extension with 409 publications.

Table 2. RRII publications (1955-2005)

Subject	Number of publications	
	March 1994*	December 2005
Crop improvement	194(18.71)	460(19.27)
Crop management	120(11.57)	359(15.09)
Crop protection	171(16.49)	256(10.73)
Crop physiology and exploitation	121(11.67)	310(13.00)
Crop processing and product development	238(22.95)	519(21.76)
Economics, extension, etc	193(18.61)	409(17.15)
Environmental impact etc	**	55(02.31)
Natural rubber (Comprehensive)	**	17(00.71)
Total	1037(100.00)	2385(100.00)

* Source: Jose and Korah, 1997

** Not calculated

Figures in parenthesis indicate percentage of the total

The relative share of major disciplines shows almost the same trend during 1994 and 2005. The RRII had to its credit only 1037 publications till March 1994 (Jose and Korah, 1997b). By 2005, the number almost doubled and 1339 publications were added during 1994-2005. It is worth mentioning that this phenomenal increase in the number of publications during the last decade happened without any increase in the total number of scientists. The introduction of annual review of research contributions of RRII since 2000 appears to have positively contributed towards motivating the scientists

towards consolidation of observations and speedy dissemination of information they had generated during the preceding year.

Information dissemination through primary sources

Primary publications on NR, which report the original research or observations include articles in periodicals, papers presented in conferences, theses and dissertations, patents and standards.

Through articles in scientific journals

The scientists of RRII and officers of Rubber Board have contributed over 1171 scientific papers in leading national and international journals and their subject domains are presented in Table 3. There are 238 articles on crop processing, followed by crop improvement with 216 scientific articles. A total of 940 articles were published in Indian scientific periodicals and 226 in overseas journals. Crop processing had the highest share in overseas publications.

Table 3. Subject domains of articles published in scientific journals

Subject	Indian	Overseas	Total
Crop improvement	179	36	216
Crop management	182	7	191
Crop protection	143	9	152
Crop physiology	109	27	136
Crop processing	103	135	238
Economics, Management and Extension	198	2	209
Environment, Effluent treatment	26	10	29
Total	940	226	1171

The IJNRR and NRR published over 430 research papers during the past 18 years of which 330 (75%) are contributed by the scientists of RRII, 71 by overseas scientists and the remaining by scientists from other Indian institution. The subject domains of articles by RRII scientists show that more than 50% of contributions are from crop improvement and crop management (Table 4).

Table 4. Subject domains of information generated at RRII disseminated through own scientific journal

Subject	Number	% of total
Crop improvement	84	25.45
Crop management	97	29.39
Crop protection	40	12.12
Crop physiology, harvesting etc	58	17.58
Crop processing and product development	38	11.52
Economics, etc	13	3.94
Total	330	100.00

Through papers presented in conferences

The Institute has been very effectively utilizing conferences and scientific seminars as an ideal platform

for scientists and other stakeholders for exchange of scientific ideas and technological innovations (Thomas et al, 2006). About 784 publications are presentations in scientific seminars. The subject domains of scientific presentations from RRII include crop processing and product development (186 publications), crop improvement (147), crop physiology and harvesting (138), crop management (123), economics, policy papers etc (92), crop protection (76) and environmental impact and effluent treatment (22). About 47 per cent of the total scientific contributions in plant physiology and exploitation studies were disseminated through conferences. The share of scientific presentations were 19%, 24% and 57% in seminars organized by overseas agencies, Rubber Board as well as RRII and Indian universities as well as other professional and commercial organizations respectively

In their study of publications up to March 1994, Jose and Korah (1997b) reported that 28% of the total contributions of RRII are disseminated as presentations in scientific seminars. Presentations in scientific seminars constitute 36 per cent of the total publications up to December 2005, thus showing an increasing trend. The growing importance for this communication medium is due to the realization that participation and presentation of scientific innovations in seminars will help for better opportunity for interaction.

Through thesis, dissertations, patents etc

Thesis and dissertation are other forms for the dissemination of NR information and there are 97 publications in this category. RRII has registered 42 genotypes with the GenBank database of National Centre for Biotechnology Information (NCBI), USA which is designed to provide and encourage better access to the most up-to-date and comprehensive DNA sequence information (NCBI, 2006).

The RRII has filed applications for patents in India and abroad on novel innovations in rubber processing. The institute holds the US patent for deproteinization of natural rubber latex (Varghese, 2000) and has applied for patents for highly transparent latex diaphragm, mechanical cleaning device for upgradation of low quality sheet rubber, mechanical device for fast and efficient drying of sheet rubber and high performance nanocomposites of natural rubber.

Through secondary sources

The scientific secondary sources on NR present synthesis of existing knowledge and provide bibliographic control of published literature (Thomas, 2002), but are not mainly concerned with reporting

original research. Scientific secondary sources were sub-grouped as secondary research (books, monographs, chapters in books and lecture notes, souvenir articles etc) and bibliographic (abstracts, indexes, bibliographies, directories etc).

Through books and monographs

Despite the speed and convenience of research papers, books and monographs have a prominent role in the science communication system and they are grouped as secondary research publications. RRII has published 20 books and 39 other scientific monographs in addition to contributing 187 chapters in various books and lecture notes and 38 articles in souvenirs.

Ever since the publication of the first book in 1977, RRII has released 20 books (Thomas, 2006d) of which six are proceedings of conferences organized or hosted by the Institute. Publication of Handbook of Natural Rubber Production in India (Pillay, 1980) and Natural Rubber: Agromanagement and Crop Processing (George and Jacob, 2000), Natural Rubber: Biology, Cultivation and Technology (Sethuraj and Mathew, 1992) are landmarks in the annals of NR in India. Two books edited by the scientists of RRII were published by M/s. Elseviers, Amsterdam, five by other leading Indian publishers and the remaining 13 books were published by the Institute itself. RRII published 11 books since 2001 of which seven were released in 2005-2006 in commemoration of the Golden Jubilee of the Institute.

During the past 50 years, RRII published 39 monographs (Thomas, 2006b) of which 16 are reports covering various disciplines (Table 5). In addition, two proceedings of conferences, nine manuals, lecture notes, and catalogues of recommended clones, eight working papers and four historical notes were also brought out as monographs. Most of the monographs cover economics and management aspects.

Table 5. Information dissemination through monographs

Subject	Form of publication					Total
	R	LMC	WP	HN	PC	
Comprehensive	-	1	-	-	-	1
Economics, Management etc	12	-	6	4	-	22
Crop improvement	1	4	-	-	1	6
Crop physiology	-	1	2	-	1	4
Crop processing	1	2	-	-	-	3
Crop management	2	-	-	-	-	2
Crop protection	-	1	-	-	-	1
Total	16	9	8	4	2	39

R: Report LMC: Lecture note, manual, catalogue etc WP: Working paper
HN: Historical notes P: Proceedings of conference

Through bibliographic sources

Publications that provide bibliographic control of literature like indexing and abstracting services and bibliographies are included in this category. RRII published 10 bibliographies and a few directories during the period under review (Thomas, 2006a).

The first bibliography published in 1983 provides details of 490 scientific contributions from RRII and Rubber Board since 1955 till August 1983 (Nair, 1983). The 1994 compilation (Jose and Korah, 1994) covered bibliographic details of publications during 1984-94. The book by Korah and Jose (2005) is a comprehensive list of 2368 scientific and technical contributions from the RRII/Rubber Board published from 1955 to 2005.

RRII has compiled annotated bibliographies on rubberized bitumen (Latha *et al.*, 2001), exploitation technology (Latha and Jose, 2003), rubber seed (Sujatha *et al.*, 2003), tapping panel dryness (Latha and Jose, 2005) and rubber based farming systems (Sujatha *et al.*, 2006). The compilation by Karthikakuttyamma and Sathisha (2004) is a collection of abstracts with full bibliographic details of publications in the field of agronomy and soils covering the period from 1956-2004.

Directories and guide to literature published by RRII are also included here. The RRII Library Holdings (Jose and Korah, 1997a; Ajitha *et al.*, 2006) lists bibliographic details of bound volumes of periodicals procured since 1922 and available in the RRII Library. The directory compiled by Jose and Korah (2002) lists full address of 272 organizations/institutes in India and abroad, mainly related to rubber research and industry.

Other means

Through conferences organized by RRII

In addition to presenting scientific innovations in conferences in India and abroad, RRII organized 18 conferences (Thomas, 2006c) which served as platforms for interaction among (Table 6). Out of the 18 conferences organized by RRII, eight are international in terms of participation by scientists from overseas countries. A total of 892 research papers from various research institutions were presented in these conferences of which 246 were contributions by scientists of RRII. RRII has organized a series of planters' conferences during 1970-80s. The International Rubber Conference organized in 1980 as part of the Silver Jubilee of RRII was the first comprehensive meeting of the NR plantation industry in the country. The International Natural Rubber Conference organized in 1992 and the International Natural Rubber Conference organized in 2005 to commemorate the Golden Jubilee of RRII are other

important events. Proceedings of seven conferences were published as books, three as monographs, one as preprint and the papers from INRC 92 were published as a special issue of RRII journal.

Table 6. Information dissemination through conferences organized by the RRII

Topic	Nature			No. of research papers		
	National	International	Total	By RRII	Others	Total
NR specific	3	3	6	45	55	100
NR comprehensive	1	4	5	150	256	406
Plantation Crops	5	0	5	45	208	253
Others	1	1	2	6	127	133
Total	10	8	18	246	646	892

Through training programmes

RRII today is an active member of the International Rubber Research and Development Board and India now heads its specialist groups on Physiology as well as Exploitation Technology. Plant Pathology Division of RRII collaborates in the research project on management of *Corynespora* disease funded by the Common Fund for Commodities. Over the years, RRII has rendered advanced training for scientists, students, planters and processors from Bangladesh, China, Cambodia Germany, France, Indonesia, Ivory Coast, Malaysia, Nigeria, Philippines, Sri Lanka, Thailand and Vietnam. RRII maintains extensive tie-ups with well known overseas universities and many research institutions and universities in India. The institute is a recognized centre for advanced studies leading to Ph.D of many universities.

The RRII organized short-term training courses on rubber cultivation, processing and estate management as well as small-scale latex goods manufacturers since 1974. The Workshop organized along with the TREEPHYSINDIA in 1982 was preceded by a specialized methodology course for young scientists. An orientation programme for the young scientist on modern methods of usage of equipments for drought research was organized along with the national symposium in December 1991. A 15 day national training programme on application of molecular markers in plant genetic resource management in plantation crops was organized during November-December 2005 to train the scientists working on the management of PGR. Twelve scientists from 10 different rubber producing countries participated in the International Training on Strategies for the Management of *Corynespora* Leaf Disease funded by the Common Fund for Commodities (CFC), and held during April 2006.

The Institute conducted farmer - scientist interaction programmes at seven different places in the traditional rubber growing region of Kerala and one in the non-traditional regions of North-East India for interaction with innovative growers who have developed useful technologies in areas such as agromanagement practices, crop harvesting, crop processing, pollution control, bee keeping etc. Around 40 progressive farmers, scientists representing various disciplines of RRII and extension officers of the respective regions participated in each programme. RRII also organized an orientation programme during August 2006 for the extension officers of the Rubber Board on the identification of newly recommended RRII 400 series clones.

Through website

Launched in 2001, www.rubberboard.org.in, the interactive portal of Rubber Board (2006) is an enormous databank of all authentic up-to-date information needed for those interested in rubber. Details of various articles published from RRII and a massive repository of data on rubber cultivation are incorporated in the website. Other features of this site include extensive provision for Indian NR statistics since 1955, daily domestic and international rubber prices, list of manufacturers, dealers, processors etc, news relevant to rubber and details on rubber wood. The steady increase in the monthly hits (Table 7) for the official website of Rubber Board is a clear proof to its growing acceptance as an information dissemination mechanism and the most commonly accessed information are given in Table 8.

Table 7. Information dissemination through website (www.rubberboard.org.in)

Year	Total hits	Average per month
2002*	566747	141187
2003	2430172	202514
2004	3690513	307542
2005	6670005	555833
Total	13357437	333936

*since September 2002

Table 8. Most commonly accessed information pages through website (www.rubberboard.org.in) during December 2005

Page	Page views (No)	Percentage of total
/managecultivation.asp	6503	4.36
/earlyrubberprice.asp	5622	3.77
/internationalrubberprice.asp	5559	3.67
/treeview.asp	4830	3.24
/manageaboutus.asp	4297	2.88
/manufacturerdetails.asp	3987	2.67

Conclusion

The RRII has utilized almost all channels for disseminating the fruits of its creative endeavor for the benefits of the clientele. What excites the common man as well as the scientific community are not just statistics of publication but the true scientific and technological achievement with significant impact on man and his environment. Mere counting the number of publications may not be the only assessment of the research contributions of the institute. However, scientometric studies as this attempt to provide an insight into the complex dynamics of information dissemination and enable science policy makers and administrators to take appropriate decisions on transfer of technology. Further, the bibliometric techniques can be effectively utilized to evaluate the productivity of research institution, individual scientist and also for mapping the growth of a research field.

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