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Scientometrics of cereal crop science research in India as seen through SCOPUS database during 1965-2010

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The paper analyses publication output of India on cereal crops as reflected by its coverage in Scopus international database during 1965-2010 in gaps of five years. Analysis indicates that highest number of papers (40%) was published on rice, followed by wheat (29%). Agricultural universities and institutions under the aegis of Indian Council of Agricultural Research (ICAR) were most productive. A significant number of papers were published in journals originating from the advanced countries with low impact factor. The highest number of papers was published in *Indian Journal of Agricultural Sciences,* followed by *Indian Journal of Agronomy.* Indian Agricultural Research Institute, New Delhi topped the list among the prolific institutions followed by Punjab Agricultural University, Ludhiana. The major research was focused on 'genetics and plant breeding' followed by 'agronomic aspects'. The authorship pattern reveals that co-authored papers accounted for 94% of total output. Citation analysis of the study reveals that 22% of the papers remained uncited. Most of the prolific authors were affiliated to Indian Agricultural Research Institute, New Delhi.

Keywords: Agriculture; Cereal Crops; Scientometrics; Bibliometrics; India

Introduction

In an earlier study undertaken by Tripathi, Sharma and Garg[1] on cereal crop research in India using Indian Science Abstracts (ISA) and CAB abstracts during 1965-2010, authors found that highest number of papers (43.80%) was published on rice, followed by wheat (24.28%). State Agriculture Universities (SAUs) followed by institutions under the aegis of the Indian Council of Agricultural Research (ICAR) were most productive. Most of the papers were published in Indian journals with low impact factor. The highest number of papers was published in *Indian Journal of Agricultural Sciences,* followed by *Indian Journal of Agronomy.* Indian Agricultural Research Institute, New Delhi, Tamil Nadu Agricultural University, Coimbatore and Punjab Agricultural University, Ludhiana contributed about 7% of papers each. The major research focused on 'genetics and plant breeding' followed by 'agronomic aspects' and pest diseases and pest control. Co-authored papers accounted for 90% of total output. Citation analysis of the papers published found that more than half (57%) remained uncited and 36.8% papers received citations ranging from 1 to 10. Highest number of citations was received by papers published in *Indian Journal of Agronomy* (1446), followed by *Indian Journal of Agricultural Science* (1211), *Euphytica* (1109) and *Theoretical and Applied Genetics* (1000). The present study like the above quoted study makes an assessment of the crop science research in India during 1965-2010 in gaps of five years using SCOPUS international database and to compare how the findings of the present study differ with the above quoted study. Following are the objectives of the study.

Objectives of the study

- To examine the output of different crops during 1965-2010 in gaps of five years;

- To identify the most prolific institutions in the field of cereal crops;
- To study the communication behavior of Indian agriculture scientists as reflected by the country of publication of journals in which the papers were published and their impact factor;
- To identify most prolific authors in the field of crop sciences;
- To identify the sub-disciplines where the crop science output is concentrated; and
- To identify highly cited papers in the field of crops sciences.

Methodology

The data for the study was downloaded from the SCOPUS database for the period 1965 to 2010 in gaps of five years using Hindi names, common names and botanical names of the six cereal crops. Following key words were used for downloading the records.

1. Wheat or G*ahu* or *Triticumaestivum* and India, and not buckwheat, and not buck wheat,
2. Barley or *Jau* or *Hordeumvulgare* and India,
3. Maize or *Zeamays* or M*akka* or Corn and India, not *Valerinellalocusta*
4. Rice or C*hawal* or D*han* or Paddy or *Oryza sativa* and India, but not rice bean
5. Sorghum or J*owar* or J*waarie* or J*ondhahlaas* or M*utthaari* or K*ora* or Sudan grass or Millet bloom, and India
6. Millet or *Bajra* or R*agi* or Pennisetum, and India, or *Eleusinecoracana*, or *Setariaitalica*; or *Echinochloaesculenta*, or *Panicummiliaceum*

Data elements downloaded were name of the authors with their affiliation, title of the paper to identify the subject, name of the journals in which papers were published, year of publication and citations received by each article. A database of the downloaded data was created into MS Excel for analysis to meet the objectives mentioned above. The analysis of the study is based on complete counting of authors and institutions, which has resulted in inflation of the total publication output.

Results and discussion

Pattern of output during 1965-2010

During 1965-2010, Scopus indexed 2,232 papers published from India after removing the duplicate records that dealt with multi-cereal crops. Figure 1 indicates that in the initial years the output is low, but it started increasing after 1990 and reached a peak in

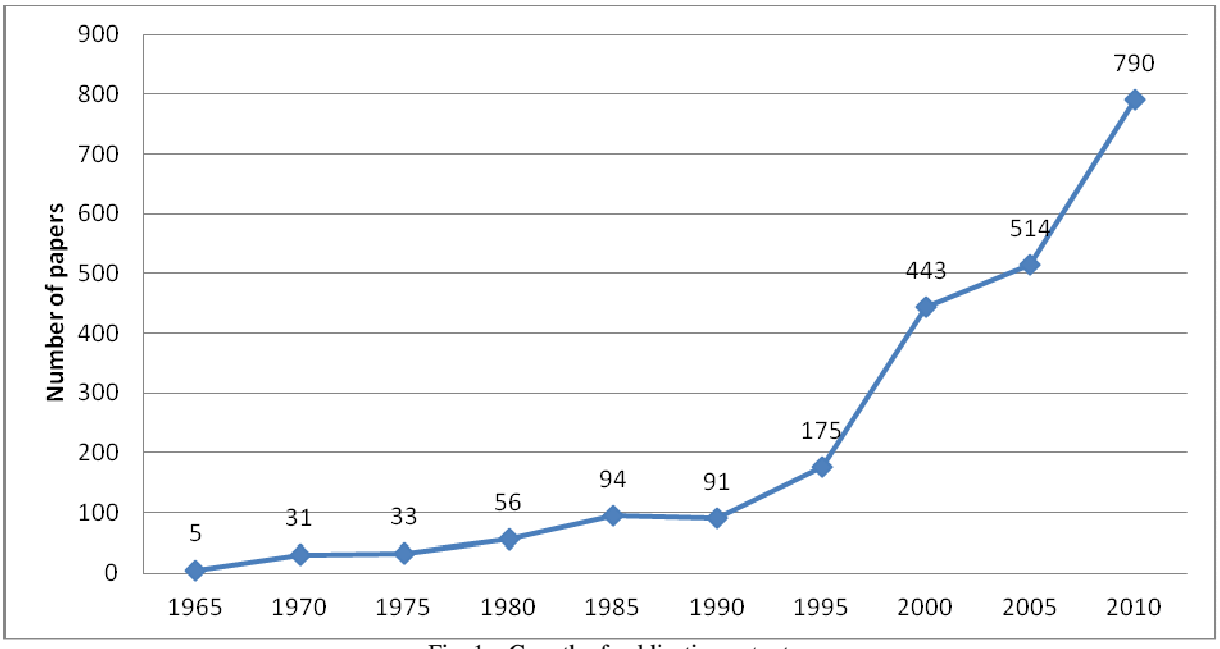


Fig. 1—Growth of publication output

2010. One possible reason for low output in the initial years may be that Scopus database started publishing only in 2004 and before that period it might be having a lower coverage of journals published from India, which might have increased in later years. This finding is quite different from our earlier study (reference 1) in which a sharp decline was observed in 1970 and1990 and a marginal dip in 2010.

Publication output in different cereal crops

Table 1 gives the output in different cereal crops during 1970-2010 in gaps of five years. Data presented in Table 1 indicates that the highest number of papers was published in the rice crop followed by wheat. Lowest number of papers was published on barley. The output on rice and wheat constituted about two-third (67.74%) of the total output. Remaining 32.26% papers were scattered over millets (11.42%), maize (11%), sorghum (7.12%) and barley (2%) respectively. Pattern of output on different crops during the period 1965-2010 indicates that the lowest number of papers on each cereal crop was produced in the initial years and steadily increased in the later period. In the first block 1965-1985 the output constituted about 10% of the total output and in the second block it was 90%. Thus in second block the output has increased significantly for all crops. The pattern of output in different crops is almost similar to the output reported by Tripathi, Sharma and Garg (reference 1).

Productivity by performing sectors and highly productive institutions

The analysis of data on the distribution of output by different performing sectors indicates that State Agriculture Universities (SAUs) including agricultural colleges, universities and colleges produced 2,660 (37.5%) papers. The share of institutions under the aegis of ICAR was 2,228 (31.4%) papers. Thus, these two performing sectors published more than two-third (69%) of the total output in crop science research. Remaining 31% of the output came from other institutions under the aegis of other central/state government agencies as well as private institutions and international institutions located in India. The total output came from 427 institutions located in different parts of India. Of these 25 prolific institutions listed in Table 2 produced about (60%) of the output and the rest 402 institutions produced 40% of the output. Among the prolific institutions, state agriculture universities are the major producers. IARI, New Delhi, the premier research institute under the aegis of ICAR produced about 12% of total output. The top three highly productive institutes are IARI, New Delhi, followed by PAU, Ludhiana and CCSHAU, Hisar. The share of these prolific institutions in the total output is about one-fourth (24%) of the total output. Several institutions, which were present in the earlier study, could not make to the list of prolific institutions in the present study. These institutions were University of

Table 1—Research output in different cereal crops during 1965-2010

Year	Rice	Wheat	Millets	Maize	Sorghum	Barley	Total
1965	0	0	0	1	2	2	5
1970	6	4	5	8	6	2	31
1975	11	7	4	5	3	3	33
1980	18	17	5	8	2	6	56
1985	28	27	19	12	4	4	94
1965-1985	63	55	33	34	17	17	219
1990	26	15	21	11	15	3	91
1995	60	48	29	21	16	1	175
2000	182	142	41	42	29	7	443
2005	209	160	56	47	31	11	514
2010	329	223	75	90	51	22	790
1990-2010	806	588	222	211	142	44	2013
Grand Total	869	643	255	245	159	61	2232
%	38.93	28.81	11.42	10.98	7.12	2.73	100

Table 2—Highly productive institutions

Sl. No.	Institutes	TNP	TNC	CPP	RCI
1	IARI, New Delhi	844	1355	1.61	0.39
2	PAU, Ludhiana	469	1207	2.57	0.62
3	CCSHAU, Hisar	395	755	1.91	0.46
4	GBPUAT, Pantnagar	258	497	1.93	0.47
5	ICRISAT, Hyderabad	207	654	3.16	0.77
6	TNAU, Coimbatore	201	284	1.41	0.34
7	UOH, Hyderabad	194	109	0.56	0.14
8	CRRI, Cuttack	158	430	2.72	0.66
9	CFTRI, Mysore	147	302	2.05	0.50
10	CSKHPAU, Palampur	131	292	2.23	0.54
11	BHU, Varanasi	129	378	2.93	0.71
12	DRR, Hyderabad	116	251	2.16	0.52
13	UAS, Dharwad	113	59	0.52	0.13
14	UOD, Delhi	102	422	4.14	1.00
15	UOM, Mysore	102	128	1.25	0.30
16	DWR, Karnal	89	114	1.28	0.31
17	BCKVV, Mohanpur	85	160	1.88	0.46
18	NDUAT, Faizabad	73	93	1.27	0.31
19	IGKVV, Raipur	71	117	1.65	0.40
20	*ICAR RCNEH, Umiam	70	111	1.59	0.38
21	BAU, Ranchi	66	63	0.95	0.23
22	NCL, Pune	65	204	3.14	0.76
23	IIT, Kharagpur	65	351	5.4	1.31
24	PD-FSR, Modipuram	65	385	5.92	1.44
25	VPKAS, Almora	62	68	1.1	0.27
	Total	4277	8789	2.05	0.50
	Remaining 402 Institutes	2819	17433	3.51	1.50
	Total 427 Institutes	7096	29255	2.9	1.00

*ICAR Research Complex for NE Hill Region

Agricultural Sciences (Bangalore), Acharya NG Ranga Agricultural University (Hyderabad), Rajendra Agricultural University (Samastipur), Orissa University of Agriculture and Technology (Bhubaneswar), Dr Panjabrao Deshmukh Krishi Vishvavidalaya (Akola), Chandra Shekhar Azad University of Agriculture and Technology (Kanpur), Assam Agricultural University (Jorhat), Vasantrao Naik Marathwada Krishi Vishvavidalaya (Parbhani), Maharana Pratap Krishi Vishvavidalaya (Udaipur), Jawahar Lal Nehru Krishi Vishvavidalaya (Jabalpur). The reason for this may be that these institutions might have published more papers in Indian journals, which are less covered in the SCOPUS database as compared to Indian Science Abstracts and CAB International. The ranking of the most prolific institutions also changed. For instance, Tamil Nadu Agriculture University (TNAU), Coimbatore ranked second in the earlier study (reference 1), but in the present study it ranked sixth.

Impact of the research output of prolific institutions

Impact of the research output of most prolific institutions was examined using two bibliometric indicators. These are Citation per Paper (CPP) and Relative Citation Impact (RCI). CPP is a relative indicator computed as the average number of citations per paper. It has been widely used in bibliometric studies to normalize a large disparity in volumes of published output among disciplines, countries and institutions for a meaningful comparison of research impact. Here CPP = (Total number of citations for an institution/total number of papers published by India). RCI is a measure of both the influence and visibility of a nation's research in global perspective. RCI is

defined as "a country's share of world citations in the subspecialty/country's share of world publications in the subspecialty". RCI = 1 denotes a country's citation rate equal to world citation rate; RCI < 1 indicates a country's citation rate less than world citation rate and also implies that the research efforts are higher than its impact; and RCI > 1 indicates a country's higher citation rate than world's citation rate and also imply high impact research in that country. Here CPP and RCI have been calculated for a meaningful comparison of the impact of research output of prolific institutions. The average value of CPP for the entire Indian output is 2.9. Of the 25 prolific institutions listed in Table 2 only six institutions namely ICRISAT (Hyderabad), BHU (Varanasi), University of Delhi (Delhi), NCL (Pune), IIT (Kharagpur) and PD-FSR Modipuram had higher value of CPP than national average. It implies that other prolific institutions have published their papers in journals which are less cited. Only two institutions (PD-FSR Modipuram, IIT Kharagpur) have achieved RCI more than 1. The value of RCI for these two institutes was 1.44 and 1.31 respectively. This implies that the impact of research produced by the remaining 23 institutions listed in Table 2 is not commensurate with their research output.

Communication behavior of Indian crop scientists

This parameter has been examined using two aspects. These are distribution of papers by publishing country of journals and distribution by impact factor of journals.

Distribution of papers by publishing country of journals

Paper published by Indian crop science researchers appeared in 376 journals, which were published from different parts of the globe. Of these 46 journals were published from India and the rest 330 were published from 35 different countries from abroad. Table 3 presents the data on the number of papers published by Indian crop scientists in journals published from different countries. Of the 2,232 papers about one-third (33.6%) were published in Indian journals and the remaining two-third (65.4%) papers appeared in journals published from abroad. Among the journals published from abroad about one-fourth (24%) papers were published in journals published from USA followed by journals published from The Netherlands (23.8%) and UK (16.4%). Thus, about half of the papers appeared in journals published from these three countries. The scattering of papers by publishing country of journals indicate mainstream connectivity of Indian crop science research output contrary to the findings published in an earlier study, where it was observed that major portion of the research results were published in journals originated from India.

Distribution of papers by impact factor

Table 4 shows the distribution of output by impact factor of journals where the research results were published. It indicates that more than half (55.65%) of papers were published in journals having impact factor between 0 and 1. Rest of the papers was published in journals having impact factor more than 1. Only 11% papers were published in journals having impact factor higher than 3. Table 5 lists 13 journals and the number of papers published in each with impact factor more than five.

Most common journals used by Indian scientists

Data was analyzed to identify the most common journals used by Indian scientists for publishing their

Table 3—Distribution of research output in domestic and foreign journals

Publishing country of journals	Total	Percent
India	751	33.6
USA	533	23.9
Netherland	365	16.4
UK	236	10.6
Germany	127	5.7
Hungary	36	1.6
Japan	32	1.4
Australia	19	0.9
Poland	19	0.9
Kenya	18	0.8
Other 26 countries	96	4.3
Total	2232	100

Table 4—Distribution of papers by impact factor of journals

Range of IF	No of papers	Percent
0-1	1242	55.65
>1<2	395	17.7
>2<3	351	15.73
>3<4	184	8.24
>4<5	39	1.75
More than 5	24	1.08
Total	2232	100%

Table 5—Journals having impact factor

Sl. no.	Journal	Country	I F	No. of papers
1	*Nature*	UK	38.59	2
2	*Science*	USA	31.03	1
3	*Current Biology*	USA	9.50	1
4	*Plant Journal*	UK	6.58	2
5	*Plant Physiology*	USA	6.56	3
6	*BMC Biology*	UK	6.53	1
7	*American Journal of Clinical Nutrition*	USA	6.50	1
8	*Biotechnology for Bio-fuels*	UK	5.55	1
9	*Plant Molecular Biology Reporter*	Netherlands	5.32	1
10	*Journal of Experimental Botany*	UK	5.24	5
11	*Plant Cell and Environment*	UK	5.14	3
12	*Advances in Agronomy*	USA	5.10	1
13	*Journal of Proteome Research*	USA	5.10	2
	Total			24

research results. The total output was scattered in 376 journals. Of these, 20 most common journals publishing 20 or more papers published about 45% of the total papers (Table 6). Of these top two Indian journals published about 20% of the papers published by Indian crop scientists and the rest were scatted in remaining 16 journals originating from different parts of the globe including India.

Subject distribution of research output

Crop science is the study of scientific approaches used to improve the quality of crops. It is a multidisciplinary research, which deals with areas such as plant breeding and genetics, crop physiology, crop production and management and weed science etc. Using several key words related to crop science research, authors identified six disciplines where the research output was published. Raw analysis of data indicates that highest number (30%) of papers was published in the discipline of genetics and plant breeding followed by agronomic aspects (22%). The share of papers in the sub-discipline of physiological and biochemical aspects as well as soil, climate and environmental aspects was 17% each. Thus, these four sub-disciplines together published about 86% of the total output. Rest 14% output was scattered to pest disease and their control (10%) and harvest and storage agriculture (4%). The number of papers in plant genetics and breeding are more, because, the agricultural scientists are working in the field on rice and wheat crops to increase their yield.

Authorship pattern

A total of 6,678 authors contributed the papers taking into consideration all authors of the each paper, published during the period 1965-2010. Table 7

Table 6—Most common journals used by Indian scientists

Sl. no.	Journal	Country	IF	No. of papers	Percent
1	*Indian Journal of Agricultural Sciences*	India	0.177	247	11.04
2	*Indian Journal of Agronomy*	India	NA	212	9.48
3	*Euphytica*	Netherlands	1.643	60	2.68
4	*Theoretical and Applied Genetics*	Germany	3.658	48	2.15
5	*Journal of Food Science and Technology*	USA	1.123	41	1.83
6	*Plant Biology*	USA	2.906	39	1.74
7	*Plant and Soil*	USA	2.638	36	1.61
8	*Field Crops Research*	Netherlands	2.474	35	1.56
9	*Current Science*	India	0.905	29	1.30
10	*Indian Journal of Genetics and Plant Breeding*	India	0.198	27	1.21
11	*Biologia Plantarum*	USA	1.692	26	1.16
12	*Journal of Plant Biochemistry and Biotechnology*	USA	0.414	26	1.16
13	*Research on Crops*	India	0.103	26	1.16
14	*Food Chemistry*	Netherlands	3.334	25	1.12
15	*Cereal Research Communications*	Hungary	0.549	24	1.08
16	*Journal of Agricultural and Food Chemistry*	USA	2.906	24	1.08
17	*Nutrient Cycling in Agroecosystems*	USA	1.416	22	0.99
18	*Annals of Biology*	India	NA	21	0.94
19	*Molecular Breeding*	USA	3.251	21	0.94
20	*Fertilizer Research*	India	NA	20	0.90
Sub total				1009	45.21
Other 356 journals				1223	54.79
Total	376 journals			2232	100.00

Table 7—Pattern of authorship during 1965-1985 and 1990-2010

Authorship pattern	Block year 1965-1985 (%)	Block year 1990-2010 (%)	Total
Single authored papers	5 (2.3)	116 (5.8)	121
Two authored papers	111 (51.2)	620 (30.8)	731
Multi-authored papers	86 (39.6)	937 (46.5)	1023
Mega authored papers	15 (6.9)	342 (16.9)	357
Total	217 (100)	2015 (100)	2232

presents data about the authorship pattern in crop sciences during two block years i.e. 1965-1985 and 1990-2010. It indicates that the share of papers written by single authors is the lowest. Further analysis of data on the pattern of authorship in two blocks indicate that the share of two authored papers which was highest in the first block of 1965-1985 declined to about 30% in the second block, while the share of multi and mega authored papers increased in second block. Also, more than half (61.8%) of the papers were published as multi-authored (3 and 4 authors) and mega-authored (> 4 authors) papers in both blocks together. This is because the discipline of crop science is multidisciplinary which involves several researchers from different disciplines.

Table 8 lists top 18 authors who have published 10 or more paper during 1965-2010 in journals only. These 18 authors published 227 (10%) of the total papers. Rest 90% papers were contributed by 6,670 authors. These authors published papers ranging from 1 to 9. Seven of these prolific author belonged to Indian Agriculture Research Institute (IARI) New Delhi, four were from agricultural universities, two from institutes under the aegis of the Council of Scientific and Industrial Research (CSIR). Rest five was from other institutions.

Table 8—Highly productive authors

Sl. no.	Authors	Affiliation	No. of papers
1	Prasad, R.	IARI, New Delhi	20
2	Sharma, S.N.	IARI, New Delhi,	19
3	Singh, R.	CCSHAU, Hisar	17
4	Gupta, P.K.	CCSU, Meerut	13
5	Kumar, A.	GBPUAT, Pantnagar	13
6	Ranjekar,P.K.	CSIR-NCL, Pune	13
7	Shetty, H.S.	UOM, Mysore	13
8	Gautam,R.C.	IARI, New Delhi	12
9	Hash, C.T.	ICRISAT, Hyderabad	12
10	Bawa, A.S.	DFRL, Mysore	11
11	Kumar, A.	CCSHAU, Hisar	11
12	Kumar, S.	IARI, New Delhi	11
13	Singh, A.	IARI, New Delhi	11
14	Singh, N.	GNDU, Amritsar	11
15	Gupta, V.S.	CSIR-NCL, Pune	10
16	Pathak, H.	IARI, New Delhi	10
17	Prasanna, BM.	IARI, New Delhi	10
18	Tyagi, A.K.	UOD, New Delhi	10

Table 9—Distribution pattern of citations

Ranging of citation	# of papers (%)	# Citations
Zero	491 (22.0)	0
1	309 (13.8)	309
2	204 (9.1)	408
3	196 (8.8)	588
4	140 (6.3)	560
5	103 (4.6)	515
6-10	337 (15.1)	2559
11 to 20	237 (10.6)	3442
21 to 30	106 (4.7)	2619
31 to 40	28 (1.3)	970
41 to 50	33 (1.5)	1446
More than 50	50 (2.2)	4017
Total	2232	17433

Distribution of citations

Table 9 presents data on the distribution pattern of citations of papers published in the field of crop sciences during 1965-2010. It indicates that about 22% of the papers remained uncited and the rest 88% were cited one or more times. Of these, about 40% were cited between one and five times. Only a minuscule portion of papers were cited more than 50 times. Table 10 list 17 papers which received 75 or more citations.

Conclusion

The study indicates that the number of papers indexed by Scopus database on crop science research is much less as compared to papers indexed by Indian Science Abstracts or CAB International. Like the earlier study[1], the present study also indicates that highest number of papers was published on rice, followed by wheat crop. Agricultural universities and institutions under aegis of ICAR were found to be the most productive institutions. However, the ranking of

Table 10—Highly cited papers having more than 75 or more citations

Authors	Journal	Citations
Gupta P.K., Varshney R.K.	*Euphytica*, 113 (3) 2000.	352
Prasad M., Varshney R.K., Roy J.K., *et al*	*Theoretical and Applied Genetics*, 100 (3-4) 2000	156
Sreenivasulu N., Grimm B., Wobus U., *et al*	*Physiologia Plantarum*, 109(4), 2000	149
Hittalmani S., Parco A., Mew T.V., *et al*	*Theoretical and Applied Genetics*, 100 (7),2000	136
Bhattramakki D., Dong J., Chhabra A.K., *et al*	*Genome*, 43(6), 2000	122
Sairam R.K., Srivastava G.C., Agarwal S., *et al*	*Biologia Plantarum*, 49 (1), 2005	119
Mohapatra D., Rao P.S.	*Journal of Food Engineering*, 66 (4), 2005	106
Barman S.C., Sahu R.K., Bhargava S.K., *et al*.	*Bulletin of Environmental Contamination and Toxicology*, 64 (4), 2000	101
Sairam R.K., Srivastava G.C., Saxena D.C.	*Biologia Plantarum*, 43(2), 2000	101
Dawe D., Dobermann A., Moya P. *et al*	*Field Crops Research*, 66(2), 2000	100
Yadav R.L., Dwivedi B.S., Pandey P.S.	*Field Crops Research*, 65(1), 2000	88
Sairam R.K., Saxena D.C.	*Journal of Agronomy and Crop Science*, 184(1),2000	80
Pareek A., Singla S.L., Grover A.	*Plant Molecular Biology*, 29(2), 1995	78
Choisne N., Demange N., Orjeda G. *et al*.	*BMC Biology*, 3, 2000	78
Athawale V.D., Lele V.	*Carbohydrate Polymers*, 41(4), 2000	78
Naveena B.J., Altaf Md., Bhadriah K., *et al.*	*Bioresource Technology*, 96(4), 2005	76
Agarwal S., Sairam R.K., Srivastava G.C., *et al.*	*Plant Science*, 169(3), 2005	75

institutions changed considerably from what was reported in the previous study[1]. However, the ranking of IARI, New Delhi remained unchanged. Unlike the earlier study, most of the papers were published in journals originated from the advanced countries with a significant number of papers in journals with impact factor less than 1. Like the previous study, the present study also indicate a focus on 'genetic and plant breeding' research. Citation analysis of the study reveals a different pattern as compared to the earlier study by authors, because of the source of citation data in the two studies.

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Annexure 1

Abbreviations	Full Name
BHU	Banaras Hindu University, Varanasi
BCKVV	Bidhan Chandra KrishiViswavidyalaya, Mohanpur
BAU	Birsa Agricultural University, Ranchi
CCSHAU	CCS Haryana Agricultural University, Hisar
CFTRI	Central Food and Technology Research Institute, Mysore
CRRI	Central Rice Research institute, Cuttack
CCSU	ChaudharyCharan Singh University, Meerut
CSKHPAU	CSK Himachal Pradesh Agricultural University, Palampur
DFRL	Defence Food Research Laboratory, Mysore
DRR	Directorate of Rice Research, Hyderabad
DWR	Directorate of Wheat Research, Karnal
GBPUAT	G.B. Pant University of Agriculture and Technology, Pantnagar
GNDU	Guru Nanak Dev University, Amritsar
IARI	Indian Agricultural Research Institute, New Delhi
ICAR	Indian Council of Agricultural Research
IGKVV	Indira Gandhi KrishiVishwavidyalaya, Raipur
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, Hyderabad
IIT	Indian Institute of Technology, Kharagpur
NDUAT	Narendra.Dev University of Agriculture and Technology, Faizabad
NCL	National Chemical Laboratory, Pune
PD-FSR	Project Directorate of Farming System Research, Modipuram
PAU	Punjab Agricultural University, Ludhiana
TNAU	Tamil Nadu Agricultural University, Coimbatore
UAS	University of Agricultural Sciences, Banglore/Dharwad
UOD, Delhi	University of Delhi, Delhi
UOH, Hyderabad	University of Hyderabad, Hyderabad
UOM, Mysore	University of Mysore, Mysore
VPKAS	Vivekanand ParvatiyaKrishiAnusandhanSansthan, Almora