



Impact assessment of Consortium for e-Resources in Agriculture (CeRA) on research productivity of agricultural universities in India

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ABSTRACT

This study aims to assess the extent of usage of Consortium for e-Resources in Agriculture (CeRA) and its impact on overall research productivity of Indian Agricultural Universities (AUs). The data was retrieved from CeRA and SCOPUS. The study is limited to 61 AUs during the period 2015–2021, and excludes ICAR research institutions. The results revealed that the top 10 universities accounted for 50.02% of the total downloads from CeRA. The top nine universities in terms of publication output contributed 50.71% of total number of publications produced by all AUs combined. Furthermore, 73% of the top 10 highly cited papers of each of the top 20 AUs, were published after the implementation of CeRA. Universities and institutions that have high CeRA download activity, but relatively low research output, need to be sensitized about this gap, encouraging them to optimally utilise CeRA resources more effectively to enhance research productivity.

Keywords: Agricultural research, Consortium for e-resources in agriculture, Impact assessment, Research productivity

There are 76 Agricultural Universities under the aegis of Indian Council of Agricultural Research (ICAR), located across various regions of India. The ICAR is an apex body responsible for monitoring activities of all these universities, and maintaining a communication network across these, providing access to quality national and international journals (<https://icar.gov.in>).

In 2007, the National Agricultural Innovation Project (NAIP) funded the establishment of Consortium for e-Resources in Agriculture (CeRA) at the Indian Agricultural Research Institute, New Delhi. All universities under NARES now rely primarily on CeRA for scholarly information published in national and international journals and reports, supporting their efforts in teaching, research and extension (Sudhier 2011, Chandrasekharan *et al.* 2012, Veeranjaneeyulu and Ramaiah 2013, Veeranjaneeyulu 2015, Kumar and Veeranjaneeyulu 2018).

At present, CeRA provides access to over 2,670 journals including 600 open-access titles (<http://www.cera.jccc.in>). Since its inception, CeRA has significantly contributed

India to ascend from 11th (2006) to the 4th rank (2020) in the SCImago Journal and Country ranking. The total publication output in agriculture and biological sciences has increased substantially, from 2,845 publications in 1997 to 14,072 in 2020. Although, a few studies have been conducted on the usage of CeRA by AUs (Francis 2011, Motebennur 2012, Singh and Kumar 2012, Rathod 2020, Sharma 2022, Hadimani *et al.* 2023), there has been no known systematic attempt to measure the impact of CeRA on research productivity within these institutions in India.

Hence, study aimed to analyse the pattern and growth of CeRA publication downloads across all AUs; to examine the publication trends of AUs and its growth as indexed in SCOPUS; to explore the relation between the number of CeRA downloads by respective institutions and their publication output indexed in SCOPUS; to evaluate the impact of compound annual growth in the number of downloads on the publication performance of AUs.

MATERIALS AND METHODS

The data were obtained from two primary sources, the CeRA portal and SCOPUS database (<https://www.scopus.com>). Key indicators, including number of document downloads, average and compound annual growth rates (CAGR), and number of downloads per paper were calculated.

The CAGR representing the mean annual growth rate of a variable over a specified period, between given years

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X and Z, where $Z - X = N$ is calculated as follows:

For example, the CAGR for 2015 to 2021 is calculated as:

$$(X = 2015, Z = 2021, N = 6) = [(value\ in\ 2021 / value\ in\ 2015)^{1/6} - 1]$$

$$CAGR = \left(\frac{\text{Ending Value}}{\text{Beginning Value}} \right)^{\frac{1}{N}} - 1$$

N = time in years

The study is limited to 61 SAUs and covers the period from 2015 to 2021, and excludes ICAR research institutions.

RESULTS AND DISCUSSION

Full-text downloads from CeRA by AUs and respective publication output: The data pertaining to full-text downloads for each AU was collected for the period 2015–21. Similarly, data about research output of AUs was retrieved from SCOPUS. The CAGR for both the aforementioned variables was also calculated (Table 1).

The distribution of document downloads from CeRA reveals that University of Agricultural Sciences, Bengaluru (UASB) recorded the highest number of downloads, followed by Indira Gandhi Krishi Vishwavidyalaya, Raipur and Acharya N G Ranga Agricultural University, Andhra Pradesh (ANGRAU). However, the year-wise analysis revealed fluctuating and inconsistent trends in download activity for University of Agricultural Sciences, Bengaluru and Indira Gandhi Krishi Vishwavidyalaya, Raipur.

On the other end of the spectrum, West Bengal University of Animal and Fishery Sciences (WBUAFS) recorded only 19,966 downloads (0.10%), followed by Kamdhenu University with 19,356 downloads (0.10%), and Narendra Deva University of Agriculture and Technology (NDUAT) with 23,526 downloads (0.12%), indicating minimal utilization of CeRA resources. Overall, 10 universities accounted for 50.02% of the total downloads from CeRA.

Narendra Deva University of Agriculture and Technology recorded the highest CAGR at 6.77, followed by Acharya N G Ranga Agricultural University (ANGRAU) at 0.9 and Nanaji Deshmukh Veterinary Science University at 0.43. Based on the calculated CAGR, 19 out of 61 AUs reflect a positive growth rate. The overall growth rate of all the universities together depict a negative trend with a -0.05 CAGR. These findings underscore the need for concerted efforts to promote and enhance utilization of CeRA amongst SAUs.

The SCOPUS indexed productivity analysis revealed that the ICAR-Indian Agricultural Research Institute (ICAR-IARI) consistently published the highest number of research papers annually as well as cumulatively (5,701) during the study period. Punjab Agricultural University (PAU) ranked second with a total of 3,576 (7.70%) publications, followed by ICAR-Indian Veterinary Research Institute (ICAR-IVRI) with 2,828 (6.09%) publications. Dr. Panjabrao Deshmukh Krishi Vidyapeeth was the least productive with only one

Table 1 CeRA full text downloads by AUs and respective publications, along with CAGR

S.no.	Institute/University name	CeRA full text downloads										Publications of AUs as per SCOPUS									
		2015	2016	2017	2018	2019	2020	2021	Total	Average	CAGR	2015	2016	2017	2018	2019	2020	2021	Total	Average	CAGR
1	Acharya N G Ranga Agricultural University	5480	61008	81662	91595	102673	143588	485110	971116	138730.86	0.90	77	70	65	71	50	74	97	504	72.00	0.03
2	Anand Agricultural University	61340	75014	43925	35359	48016	18561	36237	318452	45493.14	-0.07	284	264	215	180	120	133	152	1348	192.57	-0.09
3	Assam Agricultural University	26376	37322	29001	20711	13345	7132	5761	139648	19949.71	-0.20	134	154	126	122	112	132	166	946	135.14	0.03
4	Bidhan Chandra Krishi Viswavidyalaya	81164	82477	67679	40688	19241	33975	31960	357184	51026.29	-0.12	134	164	174	177	128	144	177	1098	156.86	0.04
5	Bihar Agricultural University	16593	21092	23635	9966	9145	8137	12400	100968	14424.00	-0.04	90	78	123	68	51	72	61	543	77.57	-0.05
6	Birsra Agricultural University	3409	16817	9821	6593	4764	3862	5138	50404	7200.57	0.06	27	24	14	14	25	36	27	167	23.86	0.00
7	Central Agricultural University	30474	34180	23974	13088	7267	4026	6722	119731	17104.43	-0.19	71	65	72	67	82	112	180	649	92.71	0.14
8	Chandra Shekar Azad University of Agriculture & Technology	1985	1471	1664	1496	1681	14748	8245	31290	4470.00	0.23	30	36	27	16	22	27	20	178	25.43	-0.06
9	Chaudhary Charan Singh Haryana Agricultural University	156058	130269	104200	49425	29428	17343	13196	499919	71417.00	-0.30	175	182	262	190	189	259	287	1544	220.57	0.07

Contd.

Table 1 (Continued)

S.no.	Institute/University name	CeRA full text downloads																Publications of AUs as per SCOPUS																							
		NA	2678	4247	6376	7214	4323	4286	29124	4854.00	0.08	9	8	9	7	7	6	14	60	8.57	0.07	NA	70547	49861	34283	62897	84583	31127	15592	348890	49841.43	-0.19	88	101	66	68	39	49	52	463	66.14
10	Chhattisgarh Kamdhenu Vishwavidyalaya	64383	64052	26970	33396	27860	6599	7296	230556	32936.57	-0.27	90	111	107	94	88	113	137	740	105.71	0.06	64383	64052	26970	33396	27860	6599	7296	230556	32936.57	-0.27	90	111	107	94	88	113	137	740	105.71	0.06
11	College of Agriculture, Junagadh Agricultural University	19554	24473	21084	26222	14112	11036	7354	123835	17690.71	-0.13	11	18	10	7	2	4	2	54	7.71	-0.22	19554	24473	21084	26222	14112	11036	7354	123835	17690.71	-0.13	11	18	10	7	2	4	2	54	7.71	-0.22
12	CSK Himachal Pradesh Krishi Vishwavidyalaya	79367	81736	84300	70650	85033	55393	102889	559368	79909.71	0.04	86	133	128	110	91	100	146	794	113.43	0.08	79367	81736	84300	70650	85033	55393	102889	559368	79909.71	0.04	86	133	128	110	91	100	146	794	113.43	0.08
13	Dr. Rajendra Prasad Central Agricultural University	18359	35697	33136	38556	29310	11719	24045	190822	27260.29	0.04	5	31	11	8	12	11	18	96	13.71	0.20	18359	35697	33136	38556	29310	11719	24045	190822	27260.29	0.04	5	31	11	8	12	11	18	96	13.71	0.20
14	Dr. Yashwant Singh Parmar University of Horticulture and Forestry	41261	41879	40228	44434	50751	53482	165618	437653	62521.86	0.22	0	0	1	0	0	0	1	0.14	0.00	0.00	41261	41879	40228	44434	50751	53482	165618	437653	62521.86	0.22	0	0	1	0	0	0	1	0.14	0.00	0.00
15	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth	389	27483	19864	15810	15694	12482	9995	101717	14531.00	0.59	20	33	17	10	13	18	10	121	17.29	-0.09	389	27483	19864	15810	15694	12482	9995	101717	14531.00	0.59	20	33	17	10	13	18	10	121	17.29	-0.09
16	Dr.Panjabrao Deshmukh Krishi Vidyapeeth	114069	112075	75731	37237	19042	14153	21210	393517	56216.71	-0.21	260	305	335	307	257	277	351	2092	298.86	0.04	114069	112075	75731	37237	19042	14153	21210	393517	56216.71	-0.21	260	305	335	307	257	277	351	2092	298.86	0.04
17	Dr.Y.S.R.Horticultural University	61714	56266	41159	23185	21983	13591	14318	232216	33173.71	-0.19	218	200	187	190	170	163	195	1323	189.00	-0.02	61714	56266	41159	23185	21983	13591	14318	232216	33173.71	-0.19	218	200	187	190	170	163	195	1323	189.00	-0.02
18	Govind Ballabh Pant University of Agriculture and Technology	137131	62449	15675	15462	36155	16833	20190	303895	43413.57	-0.24	91	97	124	128	119	132	180	871	124.43	0.10	137131	62449	15675	15462	36155	16833	20190	303895	43413.57	-0.24	91	97	124	128	119	132	180	871	124.43	0.10
19	Guru Angad Dev Veterinary and Animal Sciences University	103817	85127	50519	32387	21745	19866	15697	329158	47022.57	-0.24	731	782	837	746	836	862	907	5701	814.43	0.03	103817	85127	50519	32387	21745	19866	15697	329158	47022.57	-0.24	731	782	837	746	836	862	907	5701	814.43	0.03
20	ICAR-Central Institute of Fisheries Education	41894	41684	27268	16443	21383	10907	16213	175792	25113.14	-0.13	455	367	406	346	328	422	504	2828	404.00	0.01	41894	41684	27268	16443	21383	10907	16213	175792	25113.14	-0.13	455	367	406	346	328	422	504	2828	404.00	0.01
21	ICAR-Indian Agricultural Research Institute	53555	56398	52521	43732	35200	30853	15137	287396	41056.57	-0.17	335	315	348	309	251	272	348	2178	311.14	0.01	53555	56398	52521	43732	35200	30853	15137	287396	41056.57	-0.17	335	315	348	309	251	272	348	2178	311.14	0.01
22	ICAR-Indian Veterinary Research Institute	71946	110812	89091	82074	180956	81157	372266	988302	141186.00	0.26	50	25	42	17	27	22	46	229	32.71	-0.01	71946	110812	89091	82074	180956	81157	372266	988302	141186.00	0.26	50	25	42	17	27	22	46	229	32.71	-0.01
23	Indira Gandhi Krishi Vishwavidyalaya	56528	45689	33116	75065	94192	35125	18863	358578	51225.43	-0.15	51	58	54	28	27	30	48	296	42.29	-0.01	56528	45689	33116	75065	94192	35125	18863	358578	51225.43	-0.15	51	58	54	28	27	30	48	296	42.29	-0.01
24	Jawaharlal Nehru Krishi Vishwavidyalaya	NA	1549	5629	3560	6770	880	968	19356	3226.00	-0.08	1	4	4	3	0	1	8	21	3.00	0.35	NA	1549	5629	3560	6770	880	968	19356	3226.00	-0.08	1	4	4	3	0	1	8	21	3.00	0.35
25	Kamdhenu University	37636	74704	50664	28785	33263	28590	15326	268968	38424.00	-0.12	91	100	89	66	66	50	77	542	77.43	-0.02	37636	74704	50664	28785	33263	28590	15326	268968	38424.00	-0.12	91	100	89	66	66	50	77	542	77.43	-0.02
26	Karnataka Veterinary, Animal and Fisheries Sciences University	118043	134498	159352	111793	132686	82052	68366	806790	115255.71	-0.08	79	78	94	111	111	120	188	781	111.57	0.13	118043	134498	159352	111793	132686	82052	68366	806790	115255.71	-0.08	79	78	94	111	111	120	188	781	111.57	0.13
27	Kerala Agricultural University																																								

Contd.

Table 1 (Continued)

S.no.	Institute/University name	CeRA full text downloads																Publications of AUs as per SCOPUS			
		5644	3111	12557	7581	13255	9585	9144	60877	8696.71	0.07	5	25	28	38	62	110		127	395	56.43
29	Kerala University of Fisheries and Ocean Studies	5644	3111	12557	7581	13255	9585	9144	60877	8696.71	0.07	5	25	28	38	62	110	127	395	56.43	0.59
30	Kerala Veterinary and Animal Sciences University	28493	35174	31162	16601	21913	13471	6873	153687	21955.29	-0.18	51	47	65	56	46	60	63	388	55.43	0.03
31	Maharana Pratap University of Agriculture and Technology	40536	34745	38439	21673	53953	6441	10302	206089	29441.29	-0.18	103	92	125	77	88	84	102	671	95.86	0.00
32	Maharashtra Animal and Fishery Sciences University	39087	32709	35808	81826	42990	41081	60611	334112	47730.29	0.06	52	55	49	55	41	38	42	332	47.43	-0.03
33	Mahatma Phule Krishi Vidyapeeth	102854	135852	80595	52005	43566	27765	28968	471605	67372.14	-0.17	38	40	51	26	20	23	35	233	33.29	-0.01
34	Nanjai Deshmukh Veterinary Science University (Formerly: MPPCVV)	1744	5385	8225	10737	7282	4704	21220	59297	8471.00	0.43	24	28	31	16	11	16	25	151	21.57	0.01
35	Narendra Deva University of Agriculture and Technology	NA	NA	NA	0	25	11780	11721	23526	7842.00	6.77	42	44	57	36	19	24	26	248	35.43	-0.07
36	Navsari Agricultural University	79996	118328	129877	149401	224522	233934	14384	950442	135777.43	-0.22	81	79	70	70	50	46	73	469	67.00	-0.01
37	Orissa University of Agriculture and Technology	153565	168601	120787	129358	111007	32804	28098	744220	106317.14	-0.22	120	157	124	113	108	153	185	960	137.14	0.06
38	Prof. Jayashankar Telangana State Agricultural University	233304	169817	75682	40648	115859	58814	171810	865934	123704.86	-0.04	13	40	46	41	36	52	67	295	42.14	0.26
39	Punjab Agricultural University	181345	142223	111235	118682	121462	159205	68466	902618	128945.43	-0.13	425	443	430	425	438	595	820	3576	510.86	0.10
40	PVNR Telangana Veterinary University	NA	NA	3896	7301	5083	7302	7707	31289	6257.80	0.10	1	3	11	11	6	8	20	60	8.57	0.53
41	Rajasthan University of Veterinary and Animal Science, Bikaner	5287	8869	13305	10118	7585	5708	3774	54646	7806.57	-0.05	74	84	79	82	75	45	41	480	68.57	-0.08
42	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	19276	16602	25299	31222	35905	27793	27577	183674	26239.14	0.05	17	23	24	25	13	12	16	130	18.57	-0.01
43	Sardar Vallabhbhai Patel University of Agriculture and Technology	8051	11897	2904	6138	3430	9674	32256	74350	10621.43	0.22	41	47	46	30	30	40	57	291	41.57	0.05
44	Sardarkrushinagar Dantiwada Agricultural University	20595	35892	14888	35914	12009	5192	4640	129130	18447.14	-0.19	56	56	50	45	34	42	53	336	48.00	-0.01
45	Sher-e-Kashmir Univ of Agricultural Sciences and Technology of Kashmir	29039	23027	15414	11189	13202	3925	16789	112585	16083.57	-0.08	162	202	230	233	180	206	336	1549	221.29	0.11
46	Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu	31684	49997	27633	19163	13460	2879	6921	151737	21676.71	-0.20	98	100	132	85	55	74	116	660	94.29	0.02

Contd.

Table 1 (Concluded)

S.no.	Institute/University name	CeRA full text downloads																Publications of AUs as per SCOPUS															
		19176	15526	19519	26850	27162	3862	54659	166754	23822.00	0.16	45	54	35	30	16	30	28	238	34.00	-0.07												
47	Sri Venkateshwara Veterinary University	19176	15526	19519	26850	27162	3862	54659	166754	23822.00	0.16	45	54	35	30	16	30	28	238	34.00	-0.07												
48	Swami Keshwanand Rajasthan Agriculture University	17067	28835	9636	13199	10389	5161	6071	90358	12908.29	-0.14	61	71	69	59	39	53	60	412	58.86	0.00												
49	Tamil Nadu Agricultural University	165811	244842	122517	84579	60593	24706	204520	907568	129652.57	0.03	297	304	322	292	396	437	506	2554	364.86	0.08												
50	Tamil Nadu Dr. J. Jayalalithaa Fisheries University	NA	15823	9424	23121	24043	5590	4177	82178	13696.33	-0.17	23	30	35	20	30	53	58	249	35.57	0.14												
51	Tamil Nadu Veterinary and Animal Sciences University	26976	32751	29509	35303	22943	18150	23242	188874	26982.00	-0.02	222	249	312	238	243	128	141	1533	219.00	-0.06												
52	U.P. Pt. Deen Dayal Upadhaya Pashu Chikitsa Vigyan Vishwa Vidyalaya evam Go Anusandhan Sansthan	8898	12395	8877	6364	5676	2899	1485	46594	6656.29	-0.23	61	56	62	53	46	85	103	466	66.57	0.08												
53	University of Agricultural and Horticultural Sciences, Shivamogga	8614	20539	39702	35878	18560	6100	18135	147528	21075.43	0.11	16	21	9	10	17	18	43	134	19.14	0.15												
54	University of Agricultural Sciences - Bangalore	473154	1429934	123667	59165	54211	37008	61779	2238918	319845.43	-0.25	137	223	163	132	151	172	191	1169	167.00	0.05												
55	University of Agricultural Sciences, Dharwad	233302	130582	74125	53767	62034	30703	18807	603320	86188.57	-0.30	102	114	106	70	50	63	73	578	82.57	-0.05												
56	University of Agricultural Sciences, Raichur	39439	33212	14565	8591	4671	139629	7772	247879	35411.29	-0.21	24	65	51	34	54	58	65	351	50.14	0.15												
57	University of Horticultural Sciences, Bagalkot	57408	58884	66945	26769	21687	16036	10347	258076	36868.00	-0.22	25	32	37	29	49	31	44	247	35.29	0.08												
58	Uttar Banga Krishi Viswavidyalaya	11460	5690	1857	5917	11725	6947	2337	45933	6561.86	-0.20	37	56	54	37	31	55	43	313	44.71	0.02												
59	Uttarakhand-College of ForestryVCSG University of Horticulture and Forestry	2899	2980	3244	16679	5130	2071	989	33992	4856.00	-0.14	18	22	14	9	16	14	29	122	17.43	0.07												
60	Yasantao Naik Marathwada Krishi Vidyapeeth	101699	90487	111043	97777	123699	38338	20756	583799	83399.86	-0.20	27	36	19	17	10	20	22	151	21.57	-0.03												
61	West Bengal University of Animal and Fishery Sciences	6438	3062	2792	3506	2209	1063	896	19966	2852.29	-0.25	74	67	67	63	74	75	111	531	75.86	0.06												
	Overall	3625913	4686531	2635526	2284007	2454732	1771860	2487631	19946200	2849457.14	-0.05	6265	6768	6950	6020	5757	6561	8119	46440	6634.29	0.04												

SCOPUS-indexed publication during 2015-21. Notably, over 50% of the SCOPUS-indexed publications from AUs originated from just nine institutions.

Kerala University of Fisheries and Ocean Studies recorded the highest CAGR of 0.59 with respect to SCOPUS indexed publications, followed by PVNR Telangana Veterinary University (0.53), Kamdhenu University (0.35) and Prof. Jayashankar Telangana State Agricultural University (0.26). In total, CARG of 36 universities was on the positive note.

Downloads from CeRA per paper indexed by SCOPUS: To analyse the publication trends of AUs, the overall downloads per paper published were calculated (Table 2).

Table 2 reveals that Indira Gandhi Krishi Vishwavidyalaya recorded the highest number of downloads per publication, followed by Vasant Rao Naik Marathwada Krishi Vidyapeeth. Prof. Jayashankar Telangana State Agricultural University registered 2,935.37 downloads and Dr. Rajendra Prasad Central Agricultural University 2293.24 downloads per

publication. Fig. 1 illustrates the institutions having lowest number of downloads per article.

CAGR of CeRA downloads and SCOPUS-indexed publications: To assess the potential impact of CeRA on research productivity, CAGR of CeRA downloads was subtracted from CAGR of SCOPUS-indexed publications. This arithmetic approach helped in evaluating whether an increase in CeRA downloads corresponds with a growth in research output.

Kerala University of Fisheries and Ocean Studies recorded the highest CAGR at 0.59 followed by PVNR Telangana Veterinary University (0.9) and Kamdhenu University (0.43) (Supplementary Table 1). Dr. Rajendra Prasad Central Agricultural University recorded the lowest CAGR at -0.22 followed by Anand Agricultural University and Dr. YSR Horticultural University with -0.09 each.

Among the 61 AUs included in the analysis, 36 institutions demonstrated positive growth in SCOPUS-indexed publications. The overall growth of SCOPUS

Table 2 AUs having the highest number of downloads per paper indexed in SCOPUS

S.no	Institute/University name	2015	2016	2017	2018	2019	2020	2021	Overall sownloads/ paper
1.	Indira Gandhi Krishi Vishwavidyalaya	1438.92	4432.48	2121.21	4827.88	6702.07	3688.95	8092.74	4315.73
2.	Vasant Rao Naik Marathwada Krishi Vidyapeeth	3766.63	2513.53	5844.37	5751.59	12369.90	1916.90	943.45	3866.22
3.	Prof. Jayashankar Telangana State Agricultural University	17946.46	4245.43	1645.26	991.41	3218.31	1131.04	2564.33	2935.37
4.	Dr. Rajendra Prasad Central Agricultural University	1777.64	1359.61	2108.40	3746.00	7056.00	2759.00	3677.00	2293.24
5.	Navsari Agricultural University	987.60	1497.82	1855.39	2134.30	4490.44	5085.52	197.04	2026.53
6.	Mahatma Phule Krishi Vidyapeeth	2706.68	3396.30	1580.29	2000.19	2178.30	1207.17	827.66	2024.06
7.	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth	3671.80	1151.52	3012.36	4819.50	2442.50	1065.36	1335.83	1987.73
8.	Acharya NG Ranga Agricultural University	71.17	871.54	1256.34	1290.07	2053.46	1940.38	5001.13	1926.82
9.	University of Agricultural Sciences - Bangalore	3453.68	6412.26	758.69	448.22	359.01	215.16	323.45	1915.24
10.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	1133.88	721.83	1054.13	1248.88	2761.92	2316.08	1723.56	1412.88
11.	Jawaharlal Nehru Krishi Viswavidyalaya	1108.39	787.74	613.26	2680.89	3488.59	1170.83	392.98	1211.41
12.	University of Agricultural and Horticultural Sciences, Shivamogga	538.38	978.05	4411.33	3587.80	1091.76	338.89	421.74	1100.96
13.	University of Horticultural Sciences, Bagalkot	2296.32	1840.13	1809.32	923.07	442.59	517.29	235.16	1044.84
14.	University of Agricultural Sciences, Dharwad	2287.27	1145.46	699.29	768.10	1240.68	487.35	257.63	1043.81
15.	Kerala Agricultural University	1494.22	1724.33	1695.23	1007.14	1195.37	683.77	363.65	1033.02

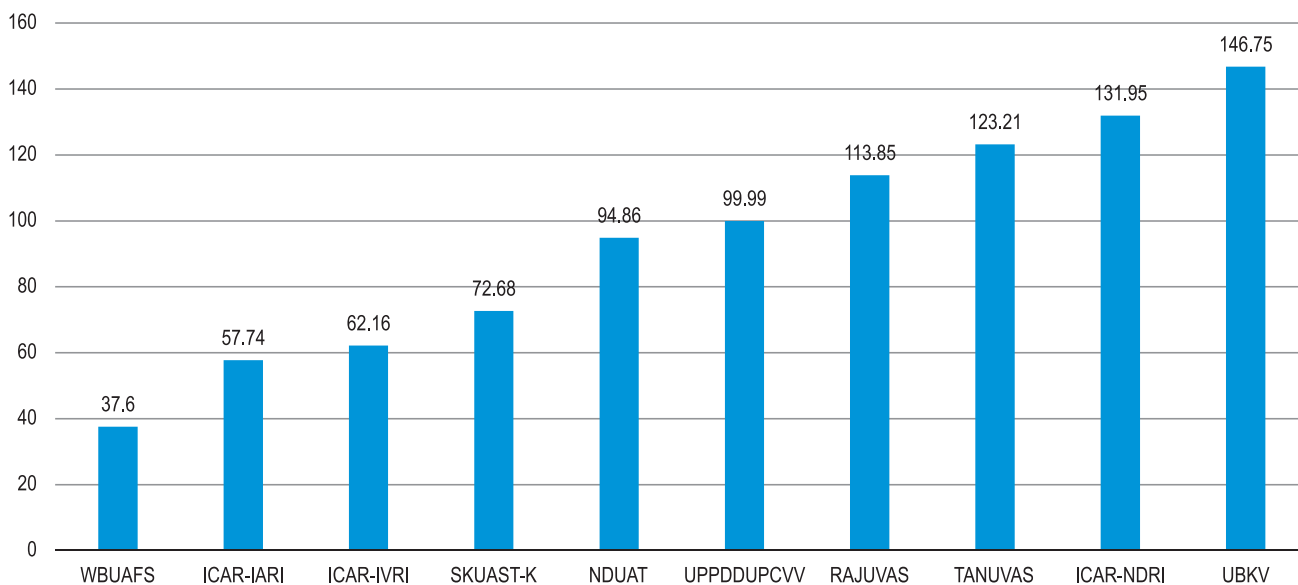


Fig. 1 Top 10 universities having lowest number of downloads per paper.

publications, compared to CeRA downloads across all universities, was found to be positive, with a CAGR of 0.04. This indicates that the growth in SCOPUS publications has outpaced the growth in CeRA downloads. The correlation between the CAGRs of both variables is tested statistically in the following section.

Citations received: The total citations received by publications of AUs as per the SCOPUS database from 2010–19 have also been examined. It was observed that ICAR-IARI leads with 76,599 citations, followed by PAU (39,392 citations), Govind Ballabh Pant University of Agriculture and Technology (GBPUAT) (34,875 citations), ICAR-IVRI (32,439 citations), and CCS HAU (28,964 citations) during the specified period (Supplementary Table 2).

Impact of CeRA on highly cited papers: A careful analysis of data revealed that, among the top 10 publications with the highest number of citations from the selected 20 AUs, 146 papers (73%) were published after the implementation of CeRA in 2007. Notably, all top-cited papers from SKUAST and AAU, Anand were published post-CeRA. Additionally, 90% of the top-cited papers from five universities (BCKV, WBUAFS, MPUAT, ANGRAU and DYSPUHF), were also published after the implementation of CeRA. With the exception of UASB, CCSHAU, and CSKHPKV, all other 17 universities published more than 50% of their highly cited papers after the implementation of CeRA (Fig. 2).

Statistical examination of correlation between downloads from

CeRA and SCOPUS indexed publications, and respective CARG: A Pearson product-moment correlation was run to determine the relationship between number of downloads from CeRA and SCOPUS-indexed publications of AUs (Table 3 and 4).

The number of downloads from CeRA and SCOPUS-indexed publications of AUs do not show a significant linear relationship ($r = 0.229, p > 0.05$). However, a small positive relationship exists between both the variables ($p = 0.076$), indicating that both the number of downloads from CeRA and SCOPUS-indexed publications of AUs tend to increase together, although this relationship is not statistically significant. This suggests that, while CeRA downloads are higher, they do not directly correlate with the publication productivity of AUs in terms of SCOPUS-indexed articles.

The results of the Pearson correlation analysis indicated

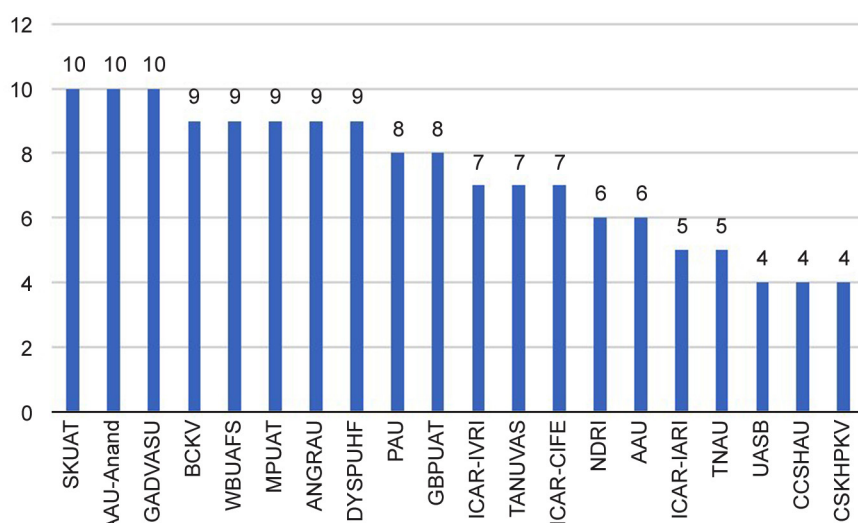


Fig. 2 AUs with highest citations for research outcome published after implementation of CeRA.

Table 3 Descriptive statistics (n=61)

	Downloads from CeRA and SCOPUS publications		CARG of downloads from CeRA and SCOPUS publications		
	Mean	Std. Deviation		Mean	Std. Deviation
Downloads from CeRA	326986.8852	372874.74893	CARG of Downloads from CeRA	.0543	.90086
SCOPUS indexed publications	761.3115	971.04276	CARG of SCOPUS indexed Publications	.0485	.12999

Table 4 Correlations coefficient amongst downloads from CeRA, SCOPUS indexed publications, and respective CARG

		Downloads from CeRA	SCOPUS indexed Publications	CAGR of downloads from CeRA	CARG of Publications
Downloads from CeRA	Pearson Correlation	1	0.229	-0.105	-0.034
	Sig. (2-tailed)		0.076	0.419	0.792
	N	61	61	61	61
SCOPUS indexed publications	Pearson Correlation	0.229	1	-0.129	-0.049
	Sig. (2-tailed)	0.076		0.321	0.709
	N	61	61	61	61
CARG of Downloads from CeRA	Pearson Correlation	-0.034	-0.049	-0.114	1
	Sig. (2-tailed)	0.792	0.709	0.383	
	N	61	61	61	61
CARG of SCOPUS indexed Publications	Pearson Correlation	-0.105	-0.129	1	-0.114
	Sig. (2-tailed)	0.419	0.321		0.383
	N	61	61	61	61

a non-significant, small negative relationship between CARG of downloads from CeRA and CAGR of SCOPUS indexed publications, ($r = -0.114, p=0.383$). Furthermore, no significant correlation was found between the number of downloads from CeRA and respective CAGR, nor between the total number of SCOPUS-indexed publications and their corresponding CAGR.

The study reveals a discernible increase in the number of publications in agriculture and allied subjects by AUs since the inception of CeRA in 2007. However, this increase is not uniform across all 61 AUs. Statistical analysis indicates a small, positive (though non-significant) correlation between research productivity and downloads from CeRA. This lack of significance is attributed to the fact that some AUs, despite recording a high number of downloads, have contributed only a limited number of SCOPUS-indexed publications. Out of a total of 61 AUs, 43 have produced a below-average number of SCOPUS-indexed publications. In contrast, only 16 AUs have contributed almost 50% of the total research publications and maintained a positive CAGR. This discrepancy between a high volume of downloads and a relatively low number of quality publications suggests the need for a critical evaluation of the factors influencing this pattern. Identifying these factors is essential for implementing targeted interventions that promote the judicious use of CeRA resources. Importantly, the study also highlights that nearly three-quarters of the most highly cited papers among the top 10 publications of 20 AUs were published after CeRA's implementation. This

underscores CeRA's strategic role in enhancing access to scholarly content and supporting research endeavours across institutions. Nonetheless, the imbalance between large-scale downloading and comparatively lower publication output raises concerns regarding the optimal utilization of this consortium. Therefore, it is imperative to sensitize Agricultural Universities to the need for more effective and efficient use of CeRA to enhance research productivity and increase the quality of publications in high-impact journals. Additionally, these institutions must be informed about the financial implications of indiscriminate downloading from CeRA. Conversely, institutions that are effectively leveraging CeRA to produce a significant volume of quality research should be acknowledged and incentivized appropriately. Such recognition could serve as a motivational tool and best-practice model for other institutions, thereby fostering a culture of responsible and productive use of research resources across the agricultural research community.

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