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# EXAMINING THE RESEARCH PRODUCTIVITY OF ICAR'S TOP-RANKED INSTITUTIONS FROM 2012-2021: A SCIENTOMETRIC ANALYSIS

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**ABSTRACT**

*The current paper intends to assess the Indian Council of Agricultural Research's top five agricultural institutions' research output as per the ranking of agricultural universities 2020. This assessment takes into account research papers published between 2012 and 2021. For the data analysis, the bibliographical information was gathered from the Scopus citation database, which contains 22,219 publications during the study period. To conclude the expansion and significance of research outputs from selected data, essential metric-based indicators are evaluated. This study also includes annual growth of publications, a ranking of authors on the basis of their publication count and citation received, most productive institutions from the sample, highly cited articles, citation profile of papers, and most favoured research communication sources by authors from these agricultural institutions. The major findings show that the Indian Agricultural Research Institute (IARI) has a higher proportion of research papers published, as well as citations and cited articles. All of these institutes' primary research areas were agricultural and biological sciences.*

***Keywords**: Scientometric ana lysis; ICAR; Research productivity; Agricultural institutions*

## 1. PENDAHULUAN

The process of two or more researchers sharing their resources and ideas to develop work is known as scientific cooperation. Co-authorship is a scientific collaboration in which numerous partners (researchers, academics, etc.) work together to develop a product. Solo research, which was common in the ancient and mediaeval periods, is now nearly extinct. This collaborative research trend is essential since different forms of collaborations bear varying weights in the ranking of organisations and the accreditation process. As a result, each institution encourages its research community to collaborate in undertaking research investigations. This needs the institution to map what type of cooperation is occurring within the organisation. (Deepthi & Tadasad, 2019).

Agriculture dominates the economics of most developing countries since it provides a large amount of their population's livelihood. It also substantially contributes to the Gross Domestic Product (GDP). In 2020-21 agriculture sector contributed 20.2 per cent of Gross Value Added (GVA).

The Indian Council of Agricultural Research (ICAR) is a self-governing body within the Agriculture and Farmers Welfare Ministry's Department of Agricultural Research and Education (DARE). This is the national coordinating, leading, and controlling agency for agricultural research and education, encompassing animal sciences, horticulture, and fisheries, with its headquarters in New Delhi. It encompasses sixty-four ICAR institutions and over seventy agricultural universities. ICAR promotes teaching, research, and extension operations in agricultural and associated sciences. In agricultural university ranking status for 2020-21, ICAR included 67 agricultural organisations based on their

ranks. The top-ranked five institutions are the National Dairy Research Institute, Indian Veterinary Research Institute; Indian Agricultural Research Institute; GB Pant University of Agriculture and Technology; and Punjab Agricultural University.

Examining the publication's knowledge output produced by these all institutions operating under the auspices of ICAR gives insight into agricultural science research and development. There have been very few papers published on agriculture and associated science. As a result, an effort is made in this study to determine the pattern of collaboration in a university setting in order to contribute value to the scientometric literature and give publication trends.

## OBJECTIVES

The primary goal of the present research is to examine the growth and impact of the ICAR's top five agricultural institutions from 2012 to 2021 based on their research yield as indexed in Scopus. These are the objectives:

- to investigate the document growth among the top-ranked ICAR institutions;
- to determine the citation profile and most cited papers;
- to find the most prolific authors of every institution;
- to know the key disciplines in which articles were published; and
- to learn the most preferred sources chosen for publication.

## LITERATURE REVIEW

Garg et al. (2006) conducted a scientometric analysis of 16,891 publications by Indian agricultural researchers between 1993 to 2002 using the Web of Science and discovered that publication trends in the agricultural sciences decreased between 1998 and 2002. Sagar et al. (2014) examined Indian agricultural articles from 1993 to 2012 using the Web of Science and determined that the maximum publications (8.48 per cent), and citations (8.81 per cent), were published in 2008. Khanna et al. (2017) conducted a quantitative study of Guru Nanak Dev University's research output in physics between 2006-2015 and discovered that GNDU ranked twenty-third among Indian universities in literature with an h-index of 29, 16th in average cites per item, and 18th in the portion of most cited papers. Parmar and Siwach (2018) examined the top five Indian agricultural universities' research amount produced as indexed in the Indian Citation Index during 2006-15. They found that the Indian Agricultural Research Institute, New Delhi, have a larger percentage of the number of articles published.

Siwach and Parmar (2018) studied the publishing patterns at Haryana Agriculture University between 2001 and 2015. They found that almost 47 per cent of the university's research was distributed in ten journals, and the university partnered with several institutions at the domestic and worldwide levels in its research publishing. Amin and Parekh (2020) published a paper on agricultural science's research growth and productivity in Gujarat's agricultural institutions. Their study takes into account papers published between 2010 and 2019. For the analysis, the necessary data was retrieved from Scopus to

conclude the growth and status of chosen research outputs. Savitha and Bagalkoti (2020) compared the research output of Indian agricultural literature to the other producing nations using factors such as overall contribution, growth trend, citation impact, and international collaboration through retrieving a decade's data by searching the terms 'Agriculture Research' in the combined fields of the Web of Science database. According to the report, Indian agriculture research production is relatively low globally, as seen by its publishing output.

## 2. METODE

The current study is restricted to only five agricultural institutions rated in the top positions in the ICAR's Universities Ranking, 2020. The selected top five institutions are listed in Table 1.

**Table 1. ICAR top ranked agricultural institutions**

| Rank | University's Name |
|---|---|
| 1 | National Dairy Research Institute, Haryana (NDRI) |
| 2 | Indian Veterinary Research Institute, Uttar Pradesh (IVRI) |
| 3 | Indian Agricultural Research Institute, New Delhi (IARI) |
| 4 | Govind Ballabh Pant University of Agriculture and Technology (GBPU) |
| 5 | Punjab Agricultural University (PAU) |

Data for this study were collected from the Scopus abstract and citation database with a vast collection of peer-reviewed literature. A separate query was entered in the Scopus affiliation search tag for each institute. The data was extracted in CSV format and analysed to obtain relevant findings.

## 3. HASIL DAN PEMBAHASAN

### 3.1 Annual distribution of publications

Table 2 displays the total quantity of publications produced by the top five agriculture institutions between 2012 and 2021. According to the table, IARI provided the most publications (34.28 per cent), followed by PAU (21.01 per cent) and IVRI (18.50 per cent). GBPU and NDRI produced nearly equal numbers of articles, 13.21% and 13%, respectively. It is also clear that the bulk of papers was published in 2021. (3235 articles). The table shows the annual contribution of each affiliation. Two institutes, particularly IARI and PAU, produced more articles in 2021 than the other three. Figure 1 depicts the yearly research growth graph.

**Table 2. Annual distribution of publications**

| Year | NDRI | IVRI | IARI | GBPU | PAU | Total |
|---|---|---|---|---|---|---|
| 2012 | 220 | 377 | 526 | 262 | 264 | 1649 |
| 2013 | 209 | 394 | 608 | 284 | 289 | 1784 |
| 2014 | 270 | 499 | 660 | 257 | 375 | 2061 |
| 2015 | 335 | 455 | 731 | 263 | 425 | 2209 |
| 2016 | 315 | 367 | 782 | 305 | 443 | 2212 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2017 | 348 | 406 | 837 | 336 | 430 | 2357 |
| 2018 | 309 | 346 | 746 | 307 | 425 | 2133 |
| 2019 | 249 | 324 | 836 | 257 | 438 | 2104 |
| 2020 | 273 | 420 | 859 | 276 | 647 | 2475 |
| 2021 | 361 | 522 | 1032 | 388 | 932 | 3235 |
| **Total (%)** | **2889 (13%)** | **4110 (18.50%)** | **7617 (34.28%)** | **2935 (13.21%)** | **4668 (21.01%)** | **22,219 (100%)** |

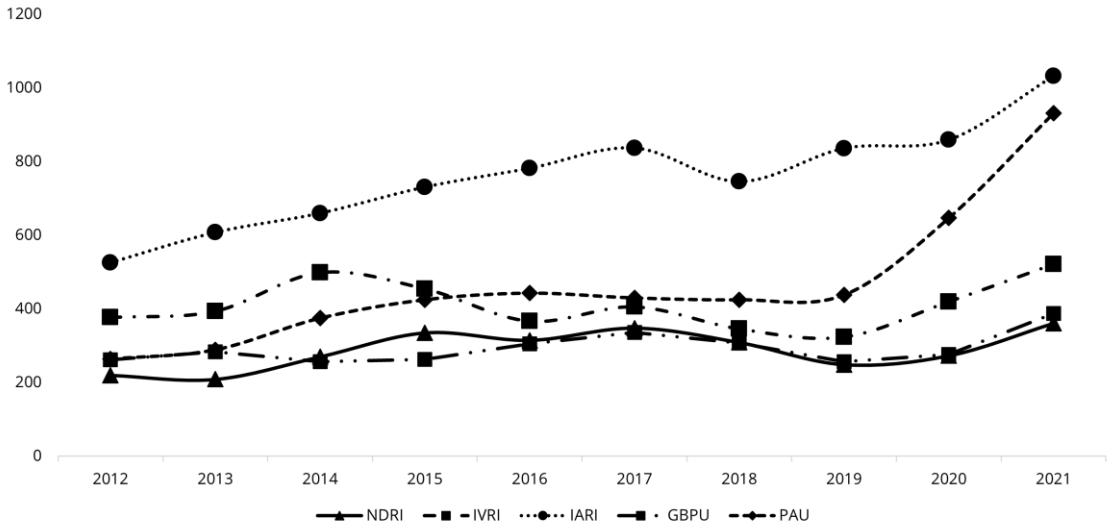


**Figure 1. Annual growth of publications**

### 3.2 Type of documents

Table 3 shows the records distributed by five institutes under study between 2012 to 2021. It was determined that journal articles comprised 85.16 per cent of the documents. The review papers comprised 6.07 per cent, book chapters (4.65%), and proceeding papers (1.79%), respectively. The data also shows that IARI contributed the most, 6497 out of 18,921 research publications, followed by PAU (3944). IARI took the lead by publishing more review papers, while GBPU published more conference papers.

**Table 3. Type of documents**

| Type | NDRI | IVRI | IARI | GBPU | PAU | Total | % |
|---|---|---|---|---|---|---|---|
| Article | 2585 | 3509 | 6497 | 2386 | 3944 | 18,921 | 85.16 |
| Review | 157 | 347 | 419 | 147 | 278 | 1348 | 6.07 |
| Book Chapter | 98 | 117 | 401 | 164 | 253 | 1033 | 4.65 |
| Conference Paper | 26 | 6 | 72 | 193 | 100 | 397 | 1.79 |
| Note | 2 | 21 | 116 | 14 | 41 | 194 | 0.87 |
| Letter | 6 | 53 | 24 | 8 | 8 | 99 | 0.45 |
| Editorial | 2 | 21 | 28 | 7 | 12 | 70 | 0.32 |
| Erratum | 7 | 11 | 32 | 5 | 13 | 68 | 0.31 |
| Book | 2 | 7 | 11 | 10 | 15 | 45 | 0.20 |
| Short Survey | 3 | 14 | 7 | 1 | 1 | 26 | 0.12 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Retracted | 1 | 1 | 5 | - | 1 | 8 | 0.04 |
| Data Paper | - | 1 | 5 | - | 2 | 8 | 0.04 |
| Undefined | - | 2 | - | - | - | 2 | 0.01 |

### 3.3 Discipline-wise publications

Scopus has classified the resources released by the institutes under consideration into numerous subject areas. Though owing to multidisciplinary study, many topic groups overlap, and a publication may fit under more than one subject area. Table 4 displays the various domains in which these five institutes' publications appeared between 2012 and 2021. Agriculture topped the list of all topic areas, with 14,065 papers published by all five institutes. This was followed by biochemistry, genetics and molecular biology, veterinary science, and environmental science, with over two thousand publications published. More than a thousand publications in immunology, microbiology, medicine, and engineering have been published.

Moreover, 985 publications were published in chemical engineering, whereas 859 were published in chemistry. Other subject categories included pharmacology, toxicology and pharmaceutics (833). Table 4 also shows the institute-wise contribution in different subjects. IARI contributed more to agricultural, biological, biochemistry, and environmental research than any other institute.

**Table 4. Discipline-wise publications**

| Rank | Discipline | NDRI | IVRI | IARI | GBPU | PAU | Total |
|---|---|---|---|---|---|---|---|
| 1 | Agricultural and Biological Sciences | 1914 | 1724 | 5560 | 1444 | 3423 | 14,065 |
| 2 | Biochemistry, Genetics and Molecular Biology | 725 | 944 | 1885 | 444 | 874 | 4872 |
| 3 | Veterinary | 1134 | 1867 | 27 | 304 | 55 | 3387 |
| 4 | Environmental Science | 105 | 211 | 1227 | 485 | 894 | 2922 |
| 5 | Immunology and Microbiology | 205 | 887 | 578 | 150 | 147 | 1967 |
| 6 | Medicine | 309 | 811 | 329 | 147 | 148 | 1744 |
| 7 | Engineering | 127 | 97 | 391 | 546 | 387 | 1548 |
| 8 | Chemical Engineering | 222 | 180 | 262 | 149 | 172 | 985 |
| 9 | Chemistry | 137 | 68 | 247 | 186 | 221 | 859 |
| 10 | Pharmacology, Toxicology and Pharmaceutics | 62 | 336 | 171 | 92 | 172 | 833 |

### 3.4 Top preferred sources

Table 5 shows the top five sources favoured by each of the five institutes for publishing. More publications were published by NDRI in the *Indian Jour. of Animal Sciences* (355), *Indian Jour. of Animal Research* (224), *Journal of Food Sci. and Tech.* (141), *Veterinary World* (92) and *Tropical Animal Health and Production* (66). These five journals accounted for 30.39 per cent of all NDRI publications.

IVRI preferred the *Indian Jour. of Animal Sciences* (404), *Veterinary World* (194), *Indian Jour. of Animal Research* (123), *Indian Veterinary Jour.* (111), and *Tropical Animal Health and Production* (81) to publish its publications. These five journals published 22.21 per cent of IVRI research.

The *Indian Jour. of Agricultural Sci.* (887), *Indian Jour. of Horticulture* (278), *Indian Jour. of Agronomy* (224), *Indian Jour. of Genet. and Plant Breeding* (223) and *Current Science* (125) were the IARI's favoured publications for publishing. These journals accounted for 22.80% of all IARI documents.

GBPU prefers to have its publications published in the *Indian Jour. of Animal Sci.* (66), *Indian Journal of Agri. Sci.* (58), *Veterinary Practitioner* (51), *Ecol., Environ., and Conser.* (49), and *Indian Veterinary Jour.* (48). Only these five journals contained 9.27 per cent of GBPU's total articles from 2012 to 2021.

PAU's top sources of choice for publishing were the *Agricultural Research Jour.* (176), *Indian Jour. of Ecology* (164), *Indian Jour. of Agri. Sci.* (156), *Jour. of Food Sci. and Tech.* (109) and *Indian Jour. of Horti.* (102). From 2012 to 2021, these five journals accounted for 15.15 per cent of their total articles.

The data also shows that three of the top five ICAR institutes favoured periodicals associated with veterinary sciences.

**Table 5. Most preferred sources**

| University | | Source | NP |
|---|---|---|---|
| **National Dairy Research Institute** | i. | *Indian Journal of Animal Sciences* | 355 |
| | ii. | *Indian Journal of Animal Research* | 224 |
| | iii. | *Journal of Food Science and Technology* | 141 |
| | iv. | *Veterinary World* | 92 |
| | v. | *Tropical Animal Health and Production* | 66 |
| **Indian Veterinary Research Institute** | i. | *Indian Journal of Animal Sciences* | 404 |
| | ii. | *Veterinary World* | 194 |
| | iii. | *Indian Journal of Animal Research* | 123 |
| | iv. | *Indian Veterinary Journal* | 111 |
| | v. | *Tropical Animal Health and Production* | 81 |
| **Indian Agricultural Research Institute** | i. | *Indian Journal of Agricultural Sciences* | 887 |
| | ii. | *Indian Journal of Horticulture* | 278 |
| | iii. | *Indian Journal of Agronomy* | 224 |
| | iv. | *Indian Journal of Genetics and Plant Breeding* | 223 |
| | v. | *Current Science* | 125 |
| **Govind Ballabh Pant University of Agri. and Tech.** | i. | *Indian Journal of Animal Sciences* | 66 |
| | ii. | *Indian Journal of Agricultural Sciences* | 58 |
| | iii. | *Veterinary Practitioner* | 51 |
| | iv. | *Ecology Environment and Conservation* | 49 |
| | v. | *Indian Veterinary Journal* | 48 |
| | i. | *Agricultural Research Journal* | 176 |

| | | | |
|---|---|---|---|
| **Punjab Agricultural University** | ii. | *Indian Journal of Ecology* | 164 |
| | iii. | *Indian Journal of Agricultural Sciences* | 156 |
| | iv. | *Journal of Food Science and Technology* | 109 |
| | v. | *Indian Journal of Horticulture* | 102 |

### 3.5 Research output and Impact

Table 6 demonstrates the total articles produced by ICAR's top-ranked institutions during ten years, as well as the sum of citations obtained, and also validates that more articles were published at IARI in 2021 (*NP*=1032, *h*-index=94).

**Table 6. Research Output and Impact**

| Year | NDRI (*h*=59) | | IVRI (*h*=68) | | IARI (*h*=94) | | GBPU (*h*=60) | | PAU (*h*=77) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ***NP*** | ***TC*** | ***NP*** | ***TC*** | ***NP*** | ***TC*** | ***NP*** | ***TC*** | ***NP*** | ***TC*** |
| 2012 | 220 | 2833 | 377 | 4033 | 526 | 12032 | 262 | 2839 | 264 | 4438 |
| 2013 | 209 | 1952 | 394 | 3883 | 608 | 10231 | 284 | 2728 | 289 | 3988 |
| 2014 | 270 | 4244 | 499 | 5847 | 660 | 10169 | 257 | 2106 | 375 | 6024 |
| 2015 | 335 | 3747 | 455 | 4261 | 731 | 9742 | 263 | 2505 | 425 | 5124 |
| 2016 | 315 | 2934 | 367 | 3471 | 782 | 8293 | 305 | 2790 | 443 | 3796 |
| 2017 | 348 | 2998 | 406 | 3221 | 837 | 8073 | 336 | 2271 | 430 | 3695 |
| 2018 | 309 | 1824 | 346 | 2531 | 746 | 5531 | 307 | 1767 | 425 | 4337 |
| 2019 | 249 | 1058 | 324 | 1356 | 836 | 5053 | 257 | 2107 | 438 | 2128 |
| 2020 | 273 | 811 | 420 | 4592 | 859 | 2752 | 276 | 1844 | 647 | 1910 |
| 2021 | 361 | 226 | 522 | 1101 | 1032 | 925 | 388 | 528 | 932 | 748 |
| **Total** | **2889** | **22,627** | **4110** | **34,296** | **7617** | **72,801** | **2935** | **21,485** | **4668** | **36,188** |

### 3.6 Highly cited papers and citation profile

The research impact is a significant standard for evaluating any research. Furthermore, tracking citations is an important and mutual criterion for measuring research impact. In other words, the sum of citations obtained is directly connected to the published work's credit. Table 7 shows the most cited papers ranked by citation gained, and all of these papers received one hundred or more citations over the last decade (2012-2021). The citation profile of all documents is displayed in Table 8.

**Table 7. Highly cited articles**

| NDRI | | | | |
|---|---|---|---|---|
| **Name** | **Year** | **DOIs** | **TC** | **TCpY** |
| Goyal A | 2014 | 10.1007/s13197-013-1247-9 | 310 | 34.44 |
| Sari TP | 2015 | 10.1016/j.foodhyd.2014.07.011 | 306 | 38.25 |
| Singh BP | 2014 | 10.1016/j.peptides.2014.01.022 | 298 | 33.11 |
| Nagpal R | 2012 | 10.1111/j.1574-6968.2012.02593.x | 261 | 23.73 |

| | | | | |
|---|---|---|---|---|
| Dahiya DK | 2017 | 10.3389/fmicb.2017.00563 | 183 | 30.5 |
| **IVRI** | | | | |
| **Name** | **Year** | **DOIs** | **TC** | **TCpY** |
| Rodriguez-Morales AJ | 2020 | 10.1016/j.tmaid.2020.101623 | 1268 | 422.67 |
| Rahal A | 2014 | 10.1155/2014/761264 | 897 | 99.67 |
| Klionsky DJ | 2021 | 10.1080/15548627.2020.1797280 | 429 | 214.5 |
| Dhama K | 2020 | 10.1128/CMR.00028-20 | 392 | 130.67 |
| Dhama K | 2020 | 10.1080/21645515.2020.1735227 | 298 | 99.33 |
| **IARI** | | | | |
| **Name** | **Year** | **DOIs** | **TC** | **TCpY** |
| Sato S | 2012 | 10.1038/nature11119 | 2033 | 184.82 |
| Lukaszewski AJ | 2014 | 10.1126/science.1251788 | 1114 | 123.78 |
| Asseng S | 2015 | 10.1038/nclimate2470 | 1010 | 126.25 |
| Asseng S | 2013 | 10.1038/nclimate1916 | 818 | 81.8 |
| Wasson AP | 2012 | 10.1093/jxb/ers111 | 470 | 42.73 |
| **GBPU** | | | | |
| **Name** | **Year** | **DOIs** | **TC** | **TCpY** |
| Saini JK | 2015 | 10.1007/s13205-014-0246-5 | 541 | 67.63 |
| Sharma P | 2012 | 10.1007/s12010-012-9759-8 | 299 | 27.18 |
| Javaid M | 2020 | 10.1016/j.dsx.2020.04.032 | 279 | 93 |
| Singh RP | 2020 | 10.1016/j.dsx.2020.04.041 | 264 | 88 |
| Joshi D | 2016 | 10.1016/j.ejor.2015.06.047 | 243 | 34.71 |
| **PAU** | | | | |
| **Name** | **Year** | **DOIs** | **TC** | **TCpY** |
| Appels R | 2018 | 10.1126/science.aar7191 | 1396 | 279.2 |
| Lukaszewski AJ | 2014 | 10.1126/science.1251788 | 1114 | 123.78 |
| Dhall RK | 2013 | 10.1080/10408398.2010.541568 | 420 | 42 |
| Marcussen T | 2014 | 10.1126/science.1250092 | 399 | 44.33 |
| Hirose S | 2017 | 10.1103/PhysRevLett.118.211801 | 376 | 62.67 |

**Table 8. Citation profile**

| Citation Range | Publications | | | | |
|---|---|---|---|---|---|
| | **NDRI** | **IVRI** | **IARI** | **GBPU** | **PAU** |
| **Uncited** | 573 | 867 | 1561 | 845 | 1351 |
| **≥1** | 2316 | 3243 | 6056 | 2090 | 3317 |
| **≥5** | 1262 | 1778 | 3392 | 1112 | 1642 |
| **≥10** | 751 | 1075 | 2114 | 691 | 980 |
| **≥20** | 363 | 481 | 1058 | 333 | 521 |
| **≥50** | 100 | 119 | 315 | 84 | 151 |
| **≥100** | 15 | 32 | 87 | 22 | 52 |

| | | | | | |
|---|---|---|---|---|---|
| **Total** | 2889 | 4110 | 7617 | 2935 | 4668 |

### 3.7 Most prolific authors

Table 9 lists the most prolific authors from each institute, according to their publication count. Dhama K, affiliated with IVRI, ranked first in the list with (*NP*=558; *TC*=12,571), followed by Tiwari R again from IVRI with (*NP*=182; *TC*=7632), Nain L from IARI with (*NP*=167; *TC*=3254), Malik YS from IVRI with 164 publications (*TC*=3600) and so on. From 2012 to 2021, these 25 authors published 3282 out of 22,219 papers.

**Table 9. Most prolific authors**

| **NDRI** | | | | | |
|---|---|---|---|---|---|
| **Name** | **NP** | **TC** | ***h*-index** | ***g*-index** | ***m*-index** |
| Mohanty AK | 128 | 1261 | 20 | 27 | 1.818 |
| Mohanty TK | 127 | 917 | 16 | 23 | 1.455 |
| Kumaresan A | 123 | 1131 | 18 | 26 | 1.636 |
| Chakravarty AK | 107 | 530 | 11 | 19 | 1.000 |
| Arora S | 102 | 1396 | 19 | 31 | 1.727 |
| **IVRI** | | | | | |
| Dhama K | 558 | 12,571 | 53 | 94 | 4.818 |
| Tiwari R | 182 | 7632 | 48 | 81 | 4.364 |
| Malik YS | 164 | 3600 | 29 | 56 | 2.636 |
| Kumar A | 118 | 2761 | 24 | 49 | 2.182 |
| Singh RK | 115 | 2116 | 25 | 40 | 2.273 |
| **IARI** | | | | | |
| Nain L | 167 | 3254 | 33 | 47 | 3.000 |
| Shivay YS | 158 | 1914 | 24 | 39 | 2.182 |
| Prasanna R | 157 | 3683 | 34 | 53 | 3.091 |
| Singh AK | 138 | 2584 | 27 | 43 | 2.455 |
| Singh NK | 127 | 6439 | 31 | 78 | 2.818 |
| **GBPU** | | | | | |
| Kumar A | 113 | 1803 | 24 | 34 | 2.182 |
| Singh SB | 72 | 570 | 13 | 20 | 1.182 |
| Srivastava PC | 60 | 489 | 11 | 19 | 1.000 |
| Prakash O | 50 | 184 | 8 | 11 | 0.727 |
| Kumar M | 49 | 924 | 18 | 28 | 1.800 |
| **PAU** | | | | | |
| Schwanda C | 99 | 1947 | 19 | 43 | 1.900 |
| Aihara H | 94 | 1936 | 19 | 43 | 1.900 |
| Kodyš P | 94 | 1910 | 18 | 42 | 1.800 |
| Mohanty GB | 93 | 2158 | 19 | 45 | 1.900 |
| Singh K | 87 | 4263 | 23 | 65 | 2.091 |

## 4. KESIMPULAN

An organisation's high-quality knowledge output reflects its academic excellence. The published literature of the top five ranked ICAR institutes was assessed in terms of publication growth, key subject areas, document forms, prime researchers, preferred sources for publication and received citations by these publications in the current study.

Among all institutes studied, the Indian Agricultural Research Institute (IARI) has the most published articles in serials and the most citations and referenced articles. 3235 papers were published in 2021 than in the previous ten years (out of 22,219 articles contributed by all institutions). Other publications have cited 17,022 papers from these five agricultural institutes, accounting for 76.62 per cent of the total knowledge production.

## DAFTAR PUSTAKA


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