The three-authored pattern came second with a contribution of 16.59% (3541), followed by the four-author style with a 17% share, and the five-authored pattern with 12.20%. Therefore, collaborative multi-authorship was more popular among Seed technology researchers than single-authorship.

E. Highly Cited Authors

TABLE VI TOP 10 HIGHLY CITED AUTHORS IN SEED TECHNOLOGY

Sl. No.	Impacted Authors	Total Publications	Total Citations	% of 350561	Country	Institution	Rank
1	Shewry PR	37	3495	1.0	England	Rothamsted Research, Harpenden	1
2	Takaiwa F	42	2441	0.7	Japan	National Agriculture and Food Research Organization	2
3	Ashman TL	25	2274	0.65	USA	University of Pittsburgh	3
4	Lamont BB	50	2225	0.63	Australia	Curtin University, Perth, Western Australia	4
5	Tatham AS	22	1900	0.54	England	University of Bristol, IACR Long Ashton Research station	5
6	Eckert CG	22	1866	0.53	England	Queens University	6
7	Hara-Nishimura I	40	1781	0.51	Japan	Konan University	7
8	Shimada T	41	1750	0.5	Japan	Tohoku Research Center Forestry and Forest Products Research Institute	8
9	Nishimura M	35	1719	0.49	Japan	National Institute for Basic Biology	9
10	Agren J	31	1673	0.48	Sweden	Uppsala University, Department of Ecology and Genetics	10

According to the data, Shewry, PR affiliated with Rothamsted Research in Harpenden, England, has the highest number of citations with a total of 350561. Out of those citations, 37 publications by Shewry have garnered 3495 citations, which is 0.1%. In the second position is Takaiwa F from the National Agriculture and Food Research Organization in Japan, with a total of 42 publications and 2441 citations (0.7%). In third place is Ashman TL from the University of Pittsburgh in the USA, with 25 publications and 2274 citations (0.65%).

VII. DISCUSSION OF FINDINGS

This study analyzed the research output in the Web of Science multidisciplinary database from 1990 to 2019. The researchers aimed to identify general metrics, growth in literature, authorship patterns, and citations received by published papers. Over this period, the number of Seed technology publications showed a consistent rise, averaging 553.77 publications yearly. This growth aligns with a linear model, signifying a steady expansion. Notably, 2019 witnessed the highest publications at 952, indicating a promising upward trajectory. The citation patterns revealed dynamic trends, with variations in Annual Growth Rate (AGR) and Compound Annual Growth Rate (CAGR). The Relative Growth Rate (RGR) spiked from 1.28 in 1991 to 2.92 in 2019, showcasing a substantial surge in Seed technology literature. Doubling Time (DT) decreased, suggesting an accelerated pace of growth. The analysis forecasts a significant increase in Seed technology publications, reaching 1628 by 2050. Authorship patterns showcased a dominance of collaborative multi-authorship, notably double-authored papers at 21.37%. Top three highly cited authors were Shewry PR (England), Takaiwa F (Japan), and Ashman TL (USA), with Shewry PR amassing the highest total citations at 350,561.

VIII. CONCLUSION AND SUGGESTIONS

This comprehensive analysis of seed technology publications from 1990 to 2019, utilizing the Web of Science multidisciplinary database, sheds light on several key findings. The study's findings are helpful for policymakers and administrators to identify research strengths and weaknesses and understand the knowledge dissemination pattern of seed technology research. This information can assist them in developing seed policies at national and international levels. The economic growth and per capita income of any country are heavily dependent on the agriculture sector. This sector plays a vital role in ensuring the overall development of a country. Therefore, significant investment is required from the government to promote research and development activities in seed technology and increase research output. To achieve this, Indian scientists should be encouraged to collaborate with global seed technology research authors or institutions. Additionally, the most cited papers in seed technology research should be made available in open access mode for Indian scientists to access. It is important to encourage researchers to publish their research results in open access journals, as this can enhance the visibility of their research.

REFERENCES

[1] Balamurugan, T., & Thanuskodi, S. (2019). Use of social networking sites among the college students in Tamil Nadu, India. *Library Philosophy and Practice.*

[2] Balu, M., Supreeti, D., & Sabitri, M. (2011). Research Productivity of Agricultural Scientists of Central Rice Research Institute (CRRI),

Cuttack: A Study. *Indian Journal of Information Sources and Services, 1*(1), 60-66.

[3] Chattopadhyay, T., & Ash, M. (2019). A Bibliometric Study of 'IASLIC Bulletin': 1996–2016. *Quest-The Journal of UGC-HRDC Nainital, 13*(3), 143. https://doi.org/10.5958/2249-0035.2019.00021.4

[4] Fu, H. Z., & Ho, Y. S. (2015). Highly Cited Canada Articles in Science Citation Index Expanded: A Bibliometric Analysis. *Canadian Social Science, 11*(3), 50-62.

[5] Garg, M., & Priya. (2019). Accountability in Research: A Bibliometric Analysis. *Library Herald, 57*(3), 327. https://doi.org/10.5958/0976-2469.2019.00019.8.

[6] Kane, D. A., Rogé, P., & Snapp, S. S. (2016). A systematic review of perennial staple crops literature using topic modeling and bibliometric analysis. *PLoS ONE, 11*(5), 1–18. https://doi.org/10.1371/journal.pone.0155788.

[7] Liu, B., Zhang, L., & Wang, X. (2017). Scientometric profile of global rice research during 1985-2014. *Current Science, 112*(5), 1003–1011. https://doi.org/10.18520/cs/v112/i05/1003-1011.

[8] Mumtaj Begum, H. (2022). Scientometric Analysis of the Research Paper Output on Artificial Intelligence: A Study. *Indian Journal of Information Sources and Services, 12*(1), 52–58. https://doi.org/10.51983/ijiss-2022.12.1.3160.

[9] Nove E. Variant Anna. (2018). Library and Information (LIS) Research Topics in Indonesia from 2006 to 2017, *Library Philosophy and Practice (e-journal)*. http://digitalcommons.unl.edu/libphilprac/1773.

[10] Patel, V. (2018). Scientometrics Analysis of Contributions to Journal of Artificial Intelligence Research during 2010-2016. *Indian Journal of Information Sources and Services, 8*(1), 58-63.

[11] Poornima, A., Surulinathi, M., Amsaveni, N., & Vijayaragavan, M. (2011). Mapping the Indian research productivity of food science and technology: A scientometric analysis. *Food Biology, 1*(1), 36-41.

[12] Prakash, M., & Jayaprakash, M. (2019). Mapping of Deforestation Research across the Globe: A Scientometric Assessment on Web of Science Database. *Indian Journal of Information Sources and Services, 9*(2), 38–43. https://doi.org/10.51983/ijiss.2019.9.2.627

[13] Pratheepan, T. (2019). Global Publication Productivity in Materials Science Research: A Scientometric Analysis. *Indian Journal of Information Sources and Services, 9*(1), 111-116. https://doi.org/10.51983/ijiss.2019.9.1.583.

[14] Rajendran, L. (2019). Banana Study Publications: A Scientometric Evaluation on Cab Direct for the Period 1978-2018. *AJIST, 9*(3), 44-47.

[15] Ramakrishnan, J., Ravi Sankar, G., & Thavamani, K. (2022). A Scientometric Study on Neuroanatomy Literature. *Indian Journal of Information Sources and Services, 12*(1), 34-46. https://doi.org/10.51983/ijiss-2022.12.1.3102.

[16] Sagar, A., Kademani, B. S., & Bhanumurthy, K. (2014). Agriculture research in India: A scientometric mapping of publications. *DESIDOC Journal of Library and Information Technology, 34*(3), 206–222. https://doi.org/10.14429/djlit.34.5022.

[17] Sankar, M., & Srinivasaragavan, S. (2012). A Scientometric Study of Authorship Collaboration in Agricultural Research from 1970 – 2012. *AJIST, 2*(2).