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Special Collaboration

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Leading authors and co-authorship networks over 60 years of the journal Pesquisa Agropecuária Brasileira

Abstract – The journal Pesquisa Agropecuária Brasileira (PAB) plays a significant role in disseminating advancements in agricultural research in Brazil and abroad. As part of its 60th anniversary celebrations, the objective of this work was to identify the leading authors and co-authorship networks over these years through bibliometric and scientometric approaches. From the 9,213 articles published from 1966 to 2025, data were collected using web scraping techniques and processed to standardize author names and construct a co-authorship network comprising 18,288 authors and 60,047 co-authorship relations. Metrics including publication count, degree, betweenness centrality, and PageRank were calculated, and the Louvain method was used to identify major co-authorship communities. Among the 50 most prolific authors, the top contributors were Cosme Damião Cruz and Magno Antonio Patto Ramalho, along with the eight largest co-authorship communities. Prominent authors play crucial roles in bridging across research groups and fostering collaboration. By presenting the structural dynamics of agricultural research in Brazil during PAB's 60 years, this analysis underscores the importance of collaborative networks in enhancing scientific output and impact.

Index terms: agricultural research, bibliometrics, research collaboration, scientometrics.

Autores de destaque e redes de coautoria ao longo de 60 anos da revista Pesquisa Agropecuária Brasileira

Resumo – A revista Pesquisa Agropecuária Brasileira (PAB) desempenha papel significativo na disseminação dos avanços da pesquisa agropecuária no Brasil e no exterior. Como parte das comemorações de seu 60º aniversário, o objetivo deste trabalho foi identificar autores de destaque e suas redes de colaboração ao longo destes anos, por meio de abordagens bibliométricas e cientométricas. Dos 9.213 artigos publicados de 1966 a 2025, os dados foram coletados por meio de técnicas de web scraping e processados para padronizar os nomes dos autores e construir uma rede de coautoria composta por 18.288 autores e 60.047 relações de coautoria. Métricas como contagem de publicações, grau, centralidade de intermediação (*betweenness centrality*) e PageRank foram calculadas, e o método Louvain foi utilizado para identificar as principais comunidades de coautoria. Entre os 50 autores mais prolíficos, os principais colaboradores são Cosme Damião Cruz e Magno Antonio Patto Ramalho, juntamente com as oito maiores comunidades de coautoria. Autores proeminentes desempenham papéis cruciais na integração de grupos de pesquisa e no fomento à colaboração. Ao apresentar a dinâmica estrutural da

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pesquisa agropecuária no Brasil durante os 60 anos da PAB, esta análise ressalta a importância das redes colaborativas no aumento da produção científica e de seu impacto.

Termos para indexação: pesquisa agrícola, bibliometria, colaboração em pesquisa, cientometria.

Introduction

The journal Pesquisa Agropecuária Brasileira (PAB) was founded in 1966 in the municipality of Rio de Janeiro, in the state of Rio de Janeiro, Brazil, initially as a platform for disseminating technical-scientific articles produced by the former Brazilian Department of Agricultural Research and Experimentation of the Ministry of Agriculture (Silva, 1966). In 1973, the journal was assumed by Empresa Brasileira de Pesquisa Agropecuária (Embrapa) while still in Rio de Janeiro. Four years later, it was relocated to the company's headquarters in the country's capital, Brasília, where it remains based.

Over six decades of existence, PAB has chronicled the history of Brazilian research in the field of agriculture-related themes, playing a significant role in disseminating previously unpublished scientific knowledge generated by both national and foreign institutions. Since PAB is an open access journal, this information can be reached online freely and unrestrictedly by any audience (Pesquisa Agropecuária Brasileira, 2026).

In 2025, the journal celebrated its 60th anniversary, a milestone that inspired a series of commemorative activities. One of them includes an overview of the journal's trajectory over these years using data collected from the published articles to pinpoint leading authors and co-authorship networks, reflecting the collaborative nature of research.

Analyzing such networks, increasingly prevalent in numerous publications, provides meaningful insights into the relationships among individual authors (Popp et al., 2018). For this reason, the identification of co-authorship networks has become a common pathway to study scientific collaborations, research dynamics, and interdisciplinary partnerships (Aguirre-Guerrero & Bernal-Jaquez, 2023), which are particularly important when addressing increasingly complex modern issues, such as climate change and food and nutrition security (Cravens et al., 2022). In recent decades, such cooperation has become a fundamental activity for the progress of science, contributing to an improved communication among research groups, the exchange of experiences and expertise, and the production and dissemination of new scientific knowledge (Camargo & Camargo, 2018; Cravens et al., 2022; Camargo, 2025). Another core advantage is facilitating the application of technological innovations in a specific area (Cyrus et al., 2020; Santen et al., 2022).

In the literature, Maghsoudi et al. (2023), for example, used the social network analysis to evaluate a co-authorship network, aiming to encourage collaborative research and determine main authors, cooperation among national and international scientific institutions, and research categories through keyword verification. To assess the social network of smallholder livestock farming communities in the United Kingdom, Munaf et al. (2024) combined network analysis, influential-user analysis, and community detection.

As part of its 60th anniversary celebrations, the objective of this work was to identify the leading authors and co-authorship networks over these years through bibliometric and scientometric approaches.

Materials and Methods

The data were extracted from the articles available at PAB's website (Pesquisa Agropecuária Brasileira, 2026), covering the journal's 60-year history from 1966 to 2025. For the analysis, quantitative (bibliometric and scientometric) and qualitative (descriptive) approaches were used. The social network analysis was applied because it allows investigating social structures through networks and the graph theory, indicating links between actors and the patterns of these relationships (Wasserman & Faust, 1994), represented here by main authors and co-authorship collaborations. The workflow included data collection, processing, visualization, and analysis, in addition to interpretation under Results and Discussion (Zupic & Ĉater, 2015).

Data collection

The web scraping technique to extract data from websites was used (Aydin, 2018). A scraper was implemented to systematically download all editions published on PAB's webpage, running for about 10 min on September 11, 2026, at 4:00 p.m. At this

time, a snapshot of the website was captured. The retrieved data spanned 60 years of the journal, from volume 1 of 1966 to volume 60 of 2025, totaling 9,213 published articles. The main page of each issue was also downloaded – for volume 60, for example, it was https://seer.sct.embrapa.br/index.php/pab/issue/view/677 (Pesquisa Agropecuária Brasileira, 2025). The following metadata were retrieved from the published papers: titles, years, authors, institutions, countries, and index terms.

The downloaded data were preprocessed to extract author names from each article, identifying 36,177 authors. Then, the Levenshtein algorithm was applied to calculate string distances, revealing several cases in which author names had been written in different formats. The name of the author "Magno Antonio Patto Ramalho", for instance, also appeared in these variants: "Magno Antonio Pato Ramalho", "MAGNO. Antonio Patto Ramalho", "Magno A. Patto Ramalho", "Magno Antonio P. Ramalho", "Magno A. P. Ramalho", and "M. A. P. Ramalho".

After the different forms entered for an author name were identified, the number of individual authors was reduced from 36,177 to 18,288. A plain text file was generated, listing the names of the authors of each article, separated by commas, in each line.

Data processing

The plain text file was divided into two additional files: one containing the sequential identification number of each author and their respective name; and the other, in each line, the sequential identification number for collaborations (co-authorship networks) and the identification numbers of the 2 authors who participated in them. In articles with more than 2 authors, one line was created for each pairwise combination of co-authors. A total of 60,047 co-authorship relationships were identified. This protocol was previously employed by Afolabi et al. (2021) and Camargo (2025) to study other databases.

Data visualization

The author and collaboration files were imported into the Gephi tool to generate a collaboration network graph and calculate author metrics. This form of data visualization was chosen because it is widely used to illustrate relationship data in the social network analysis (Wasserman & Faust, 1994). Graphs are adaptable frameworks for studying complex real-world problems, where nodes and edges represent a set of actors and their connections/relationships, each carrying empirical or conceptual significance (Gross et al., 2023). In this case, the actors are the authors, and the relationships are co-authorship interactions.

The main graph concepts used in the analysis were: nodes, representing each author who published in the journal; edges, indicating co-authorship relationships; edge weight, depicting the number of co-authorship relationships between two authors; and graph, illustrating the interaction structure among all authors and co-authorships throughout 60 years of the journal. It is important to note that the graph was undirected, as the order of authorship was not considered.

Based on the graph theory (Gross et al., 2023), the following metrics were calculated for each author:

Number of publications: Represents the absolute quantity of publications in which this author participated, regardless of their ordinal position in relation to other coauthors. This metric varies in the $[1, \infty)$ range.

Degree: Indicates how many different authors collaborated in co-authoring works with another author. This metric varies in the $[0, \infty)$ range.

Betweenness centrality: Portrays an author's importance as a connecting element between different research groups (Umadevi, 2013). This metric varies in the [0, 1] range.

PageRank: Shows authors who play a leadership role in the network (Wang et al., 2013). This metric varies in the [0, 1] range.

Community: Classifies co-authorship communities using the Louvain method (Blondel et al., 2008). The position of a community in the ranking of the largest ones is indicated by a number, i.e., Community 1 is the largest, Community 2 is the second, and so forth.

The author's institution was identified based on the information provided in their most recently published article.

Data analysis – programming language and tools

To identify leading authors, metrics such as publication count, degree, betweenness centrality, and PageRank were evaluated. Due to space constraints, the detailed analysis for each metric was restricted to the highest values. Additionally, the Louvain algorithm

was applied to detect the primary co-authorship communities among the most productive authors, defined as those with more than 10 publications.

The scraper and other scripts were implemented using the R language software, version 4.5.2 (R Core Team, 2026). The Integrated Development Environment RStudio, version 2026.09.0 Build 174 (Posit Team, 2026), was also employed. The used packages were: Stringr, version 1.4.0, and Stringi, version 1.7.6, for string manipulation; and Dplyr, version 1.0.8, for data manipulation. The Gephi tool, version 0.11.2, was applied for network visualization and author metrics calculation (Bastian et al., 2009).

Results and Discussion

Among the 18,288 identified authors, the top 50 who published a minimum of 24 articles over the 60 years of the journal PAB were ranked in descending order based on number of publications, degree, betweenness centrality, and PageRank (Table 1). Information about co-authorship communities and author affiliations were also presented.

The cumulative publications of the top 50 authors amounted to 1,839 articles, representing 0.27% of the total author pool. Outside of the ranking, 33, 94, 244, 942, and 16,924 authors published 20 or more articles, 15 to 19 articles, 10 to 14 articles, 5 to 9 articles, and 4 or fewer articles, respectively. The other 12,753 authors (69.5%) only published one article. Therefore, the majority of the authors published a single paper, while the top 50 accounted for more than 20% of all 9,213 publications up to volume 60.

The Louvain method identified the largest co-authorship communities (a total of eight) with over 420 members each, indicated by different colors in Figure 1. The 4,118 authors grouped represented 22.51% of the total. The analysis of the communities was based on their most productive authors, i.e., as those with more than 10 publications.

Considering affiliation institutions and publication number, the 5 following authors stood out among the top 50 (Table 1): Cosme Damião Cruz from Universidade Federal de Viçosa (UFV), with 84 publications; Magno Antonio Patto Ramalho from Universidade Federal de Lavras (UFLA), with 66 publications; and Moacir Pasqual from UFLA, Paulo de Souza Gonçalves from Instituto Agronômico (IAC), Jöhanna Dobereiner from Embrapa Agrobiologia, and Henrique Pereira dos Santos from Embrapa Trigo, each with 58 publications. These authors were responsible for 382 articles, representing over 4.1% of the journal's publications up to 2025.

Regarding degree, the following authors were highlighted (Table 1): Cosme Damião Cruz (ranked first among the top 50), collaborating with 187 co-authors; Nilton Curi (ranked seventh) from UFLA, with 108 co-authors; Magno Antonio Patto Ramalho (ranked second), with 107 co-authors, and Nereu Augusto Streck (ranked tenth) from Universidade Federal de Santa Maria (UFSM), with 104 co-authors.

The highest betweenness centrality values were (Table 1): 0.07003 for Cosme Damião Cruz (ranked first among top 50 authors), 0.02493 for Magno Antonio Patto Ramalho (ranked second), 0.02107 for Paulo Roberto Cecon (ranked sixty-eighth) from UFV, 0.02090 for Nilton Curi (ranked seventh), and 0.01843 for Roland Vencovsky (ranked eightieth) from Escola Superior de Agricultura Luiz de Queiroz (ESALQ). This metric pinpoints the authors who played a significantly relevant role in facilitating communication between different research communities (Umadevi, 2013), contributing to their integration within PAB.

The highest PageRank values were (Table 1): 0.00135 for Cosme Damião Cruz (ranked first among the top 50 authors), 0.00090 for Nilton Curi (ranked seventh), 0.00090 for Magno Antonio Patto Ramalho (ranked second), 0.00089 for Paulo de Souza Gonçalves (ranked fourth), and 0.00085 for Moacir Pasqual (ranked third). The higher this metric, the greater the prominence of the author within the co-authorship network (Wang et al., 2013).

The first largest community, with 729 members, was led by the author Cosme Damião Cruz (ranked first among the top 50), followed by Marcos Deon Vilela de Resende (ranked thirty-eighth) from Embrapa Café, and Carlos Sigueyuki Sediyama (ranked forty-fifth) and Maurilio Alves Moreira (ranked forty-ninth), both from UFV (Figure 2 A).

The second largest community had 692 members and was led by the author Johanna Döbereiner (ranked fifth), succeeded by Sebastião Manhães Souto (ranked twenty-fifth), Dejair Lopes de Almeida (ranked twenty-ninth), Avílio Antônio Franco (ranked thirtieth), and Segundo Sacramento Urquiaga

Table 1. Ranking of the top 50 authors over the 60-year history of the journal Pesquisa Agropecuária Brasileira, along with the evaluated metrics and affiliation institution.

Rank position	Author	Metric[1]					Institution[2]
		Pub	Degree	BC	PR	Com	
1	Cosme Damião Cruz	84	187	0.07003	0.00135	1	UFV
2	Magno Antonio Patto Ramalho	66	107	0.02493	0.00090	23	UFLA
3	Moacir Pasqual	58	100	0.01888	0.00085	22	UFLA
4	Paulo de Souza Gonçalves	58	85	0.00844	0.00089	12	IAC
5	Johanna Döbereiner	58	70	0.00871	0.00070	2	Embrapa Agrobiologia
6	Henrique Pereira dos Santos	58	40	0.00478	0.00055	26	Embrapa Trigo
7	Nilton Curi	51	108	0.02090	0.00090	8	UFLA
8	Fernando Irajá Félix de Carvalho	48	103	0.00875	0.00079	7	UFPEL
9	José Oswaldo Siqueira	44	62	0.00622	0.00062	8	UFLA
10	Nereu Augusto Streck	43	104	0.00608	0.00074	13	UFSM
11	Alberto Cargnelutti Filho	43	98	0.01176	0.00069	13	UFSM
12	Ciro Antonio Rosolem	42	69	0.00727	0.00066	6	UNESP
13	Luis Fernando Stone	42	43	0.00490	0.00041	4	Embrapa Arroz e Feijão
14	Paulo Regis Ferreira da Silva	41	64	0.00600	0.00057	21	UFRGS
15	Napoleão Esberard de Macêdo Beltrão	41	44	0.00652	0.00049	23	Embrapa Algodão
16	Nand Kumar Fageria	41	32	0.00733	0.00029	4	Embrapa Arroz e Feijão
17	Francisco José Pfeilsticker Zimmermann	40	64	0.00696	0.00050	4	Embrapa Arroz e Feijão
18	Jurgen Döbereiner	40	36	0.00292	0.00052	43	Embrapa
19	Anne Sitarama Prabhu	38	48	0.00201	0.00044	4	Embrapa Arroz e Feijão
20	Carlos Alexandre Costa Crusciol	37	72	0.00760	0.00061	6	UNESP
21	José Roberto Postali Parra	36	42	0.00781	0.00050	11	USP
22	Carlos Hubinger Tokarnia	35	25	0.00236	0.00042	43	UFF
23	Luiz Carlos Federizzi	34	56	0.00166	0.00047	7	UFRGS
24	Vania Dea de Carvalho	34	46	0.00419	0.00050	6	UFLA
25	Sebastião Manhães Souto	34	43	0.00340	0.00043	2	Embrapa Agrobiologia
26	Marcelo Coutinho Picanço	33	68	0.00662	0.00062	18	UFV
27	Wilson Roberto Maluf	32	70	0.00685	0.00061	33	UFLA
28	Homero Bergamaschi	32	54	0.00465	0.00050	28	UFRGS
29	Dejair Lopes de Almeida	31	56	0.00438	0.00050	2	Embrapa Agrobiologia
30	Avílio Antônio Franco	31	53	0.00439	0.00047	2	Embrapa Agrobiologia
31	Segundo Sacramento Urquiaga Caballero	30	94	0.01679	0.00067	2	Embrapa Agrobiologia
32	Hélio Wilson Lemos de Carvalho	30	51	0.00947	0.00047	5	Embrapa Tabuleiros Costeiros
33	Ivan Cruz	30	49	0.01130	0.00046	11	Embrapa Milho e Sorgo
34	Elias Tadeu Fialho	28	40	0.00348	0.00047	20	UFLA
35	Adonis Moreira	28	36	0.00399	0.00037	6	Embrapa Soja
36	Nilson Gilberto Fleck	28	22	0.00094	0.00028	21	UFRGS
37	Demóstenes Marcos Pedrosa de Azevedo	28	16	0.00063	0.00029	23	Embrapa Algodão
38	Marcos Deon Vilela de Resende	27	75	0.01760	0.00045	1	Embrapa Café
39	Pedro Marques da Silveira	27	50	0.00567	0.00037	4	Embrapa Arroz e Feijão
40	Antonio Carlos de Oliveira	26	64	0.01462	0.00045	5	Embrapa Milho e Sorgo
41	Rogério Peres Soratto	26	48	0.00389	0.00048	6	UNESP
42	Lindolfo Storck	26	47	0.01043	0.00035	13	UTFPR
43	Elto Eugênio Gomes e Gama	26	46	0.00553	0.00043	5	Embrapa Milho e Sorgo
44	Erlei Melo Reis	26	16	0.00071	0.00023	26	UPF
45	Carlos Sigueyuki Sediyama	25	54	0.01092	0.00037	1	UFV
46	Cláudio Bellaver	25	41	0.00361	0.00041	20	Embrapa Suínos e Aves
47	Manoel Xavier dos Santos	25	31	0.00335	0.00037	5	Embrapa Milho e Sorgo
48	Laudemiro Baldoino da Nóbrega	25	13	0.00020	0.00027	23	Embrapa Algodão
49	Maurílio Alves Moreira	24	59	0.00170	0.00048	1	UFV
50	Luis Sangoi	24	44	0.00284	0.00034	21	UDESC

[1]Pub, publications; BC, betweenness centrality; PR, PageRank; and Com, community. [2]UFV, Universidade Federal de Viçosa; UFLA, Universidade Federal de Lavras; IAC, Instituto Agronômico; UFPEL, Universidade Federal de Pelotas; UFSM, Universidade Federal de Santa Maria; UNESP, Universidade Estadual Paulista; UFRGS, Universidade Federal do Rio Grande do Sul; USP, Universidade de São Paulo; UFF, Universidade Federal Fluminense; UTFPR, Universidade Tecnológica Federal do Paraná; UPF, Universidade de Passo Fundo; and UDESC, Universidade do Estado de Santa Catarina.

Caballero (ranked thirty-first), all from Embrapa Agrobiologia (Figure 2 B).

The third largest community had 480 members, typically affiliated with Embrapa Gado de Leite. However, since none of them was part of the top 50 authors, no analysis was carried out in this case (Figure 3 A). The fourth community had 461 members, headed by Luis Fernando Stone (ranked thirteenth) (Figure 3 B). Other highly ranked authors included Nand Kumar Fageria (ranked sixteenth), Francisco José Pfeilsticker Zimmermann (ranked seventeenth), and Anne Sitarama Prabhu (ranked nineteenth), all affiliated with Embrapa Arroz e Feijão.

The fifth largest community had 458 members (Figure 4 A). The authors who stood out were: Hélio Wilson Lemos de Carvalho (ranked thirty-second)

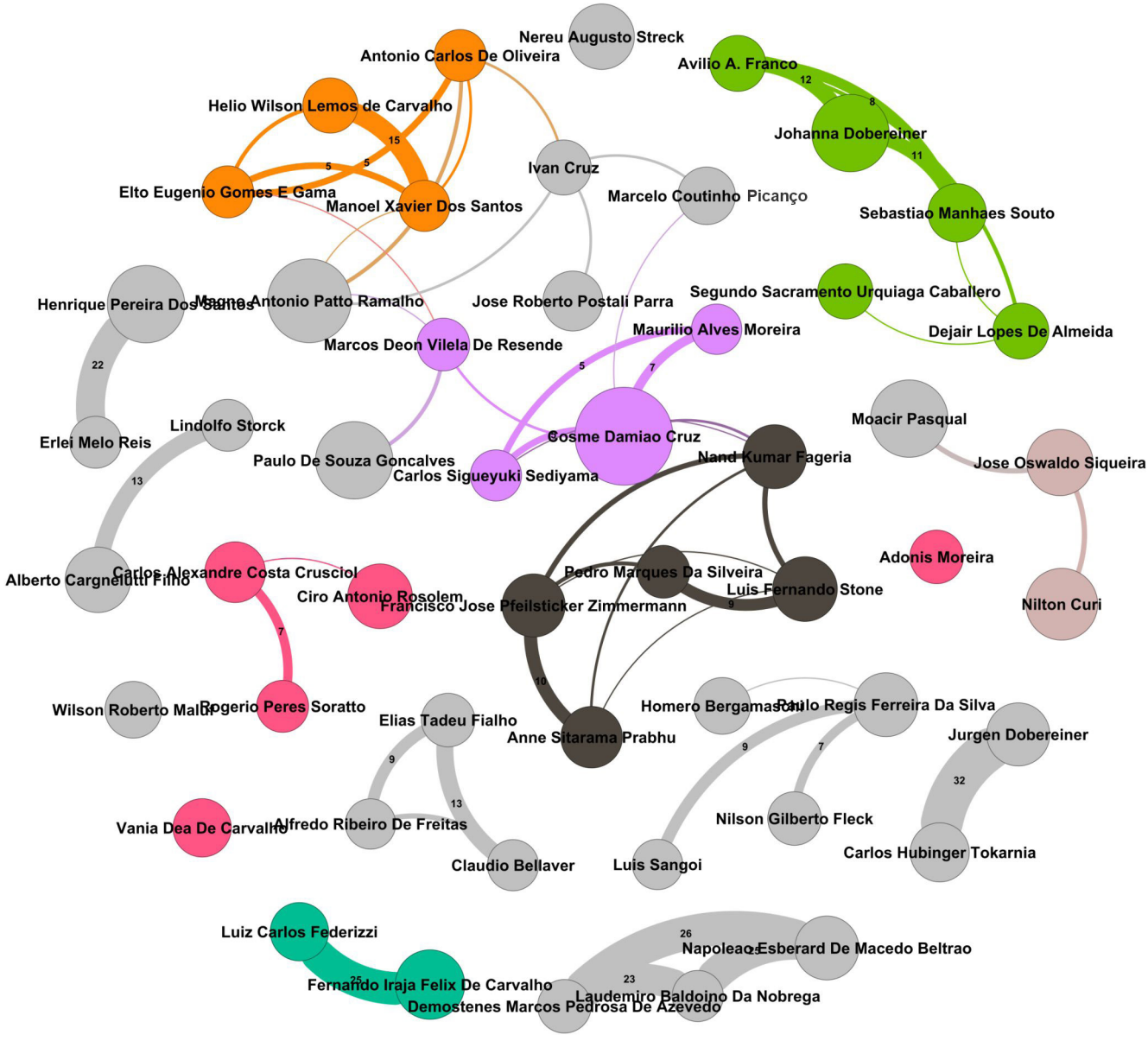

Figure 1. Network formed by the top 50 ranking authors and respective co-authorship collaborations over the 60 years of the journal Pesquisa Agropecuária Brasileira. Nodes represent authors with 24 or more published articles, with size proportional to total publication count. Edges indicate co-authorship collaborations, with thickness proportional to the number of collaborations between the connected authors.

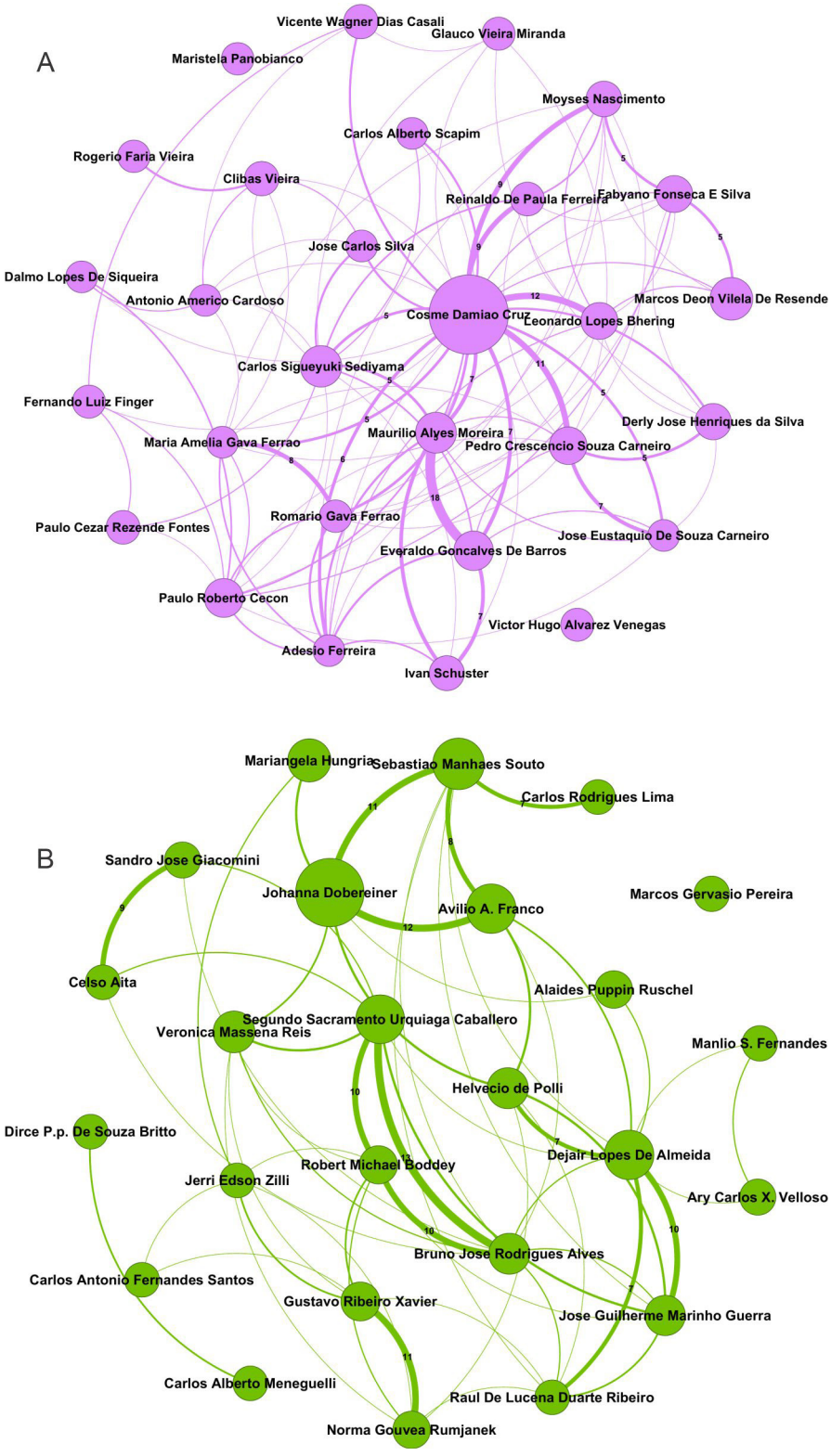

Figure 2. Authors, with ten or more publications over 60 years of the journal Pesquisa Agropecuária Brasileira, grouped in the first (A) and second (B) largest co-authorship communities and predominantly affiliated with Universidade Federal de Viçosa and Embrapa Café (purple color) and with Embrapa Agrobiologia (lemon color), respectively. Edge thickness is proportional to the number of collaborations between the connected authors.

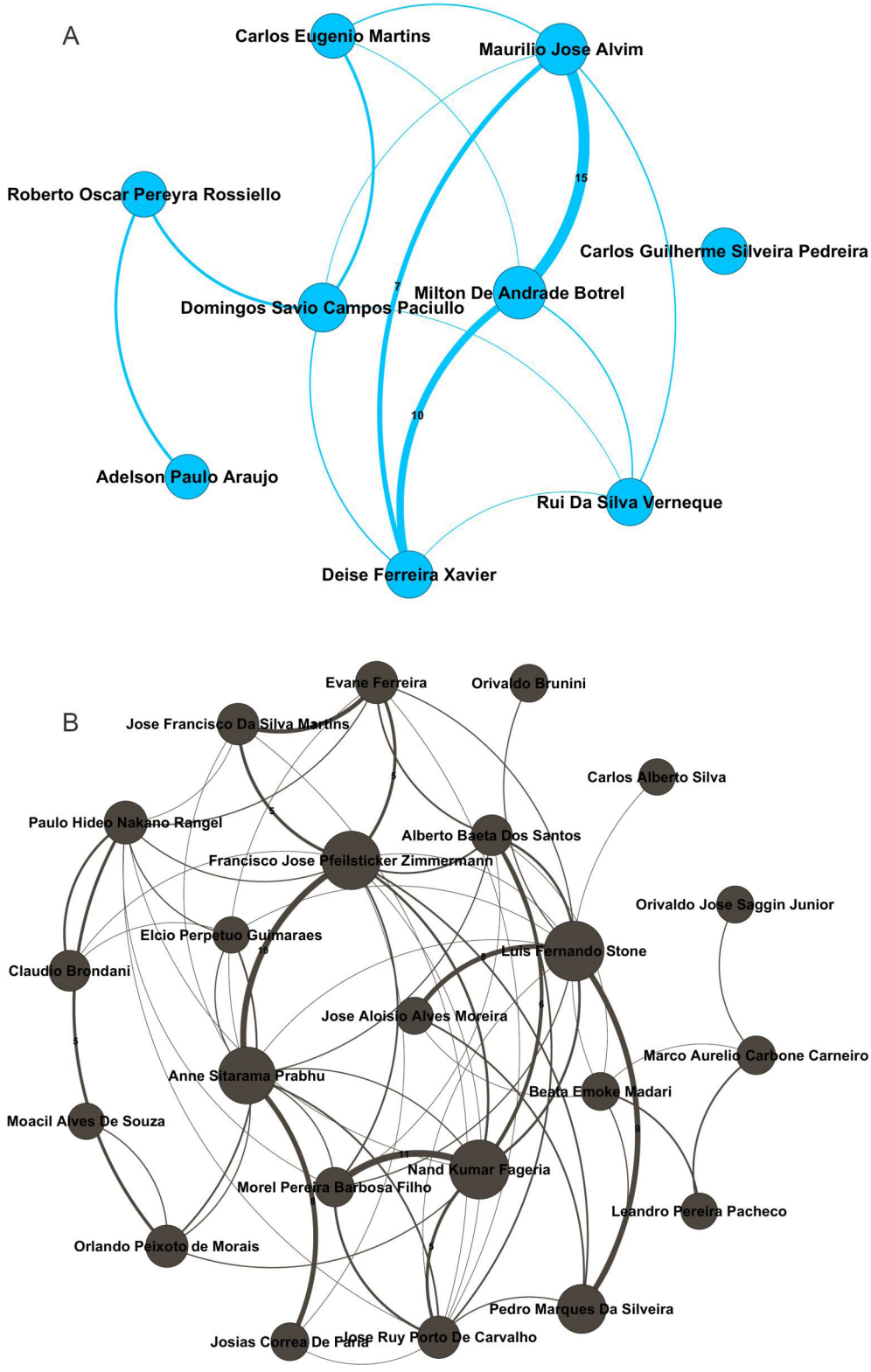

Figure 3. Authors, with ten or more publications over 60 years of the journal Pesquisa Agropecuária Brasileira, grouped in the third (A) and fourth (B) largest co-authorship communities and mostly affiliated with Embrapa Gado de Leite (blue color) and with Embrapa Arroz e Feijão (grey color), respectively. Edge thickness is proportional to the number of collaborations between the connected authors.

from Embrapa Tabuleiros Costeiros, followed by Antonio Carlos de Oliveira (ranked fortieth), Elto Eugenio Gomes e Gama (ranked forty-third), and Manoel Xavier dos Santos (ranked forty-seventh), all from Embrapa Milho e Sorgo.

The sixth largest community included 445 members (Figure 4 B). The leading authors were Ciro Antonio Rosolem (ranked twelfth) and Carlos Alexandre Costa Crusciol (ranked twentieth), both from Universidade Estadual Paulista (UNESP), succeeded by Vania Dea de Carvalho (ranked twenty-fourth) from UFLA, Adonis Moreira (ranked thirty-fifth) from Embrapa Soja, and Rogério Peres Soratto (ranked forty-fourth) from UNESP.

The seventh largest community had 431 members (Figure 5 A), headed by Fernando Irajá Félix de Carvalho (ranked eighth) from Universidade Federal de Pelotas (UFPEL) and Luiz Carlos Federizzi (ranked twenty-third) from Universidade Federal do Rio Grande do Sul (UFRGS). The eighth largest community, with 422 members, was led by Nilton Curi (ranked seventh) and Jose Oswaldo Siqueira (ranked ninth), both from UFLA (Figure 5 B).

These eight communities included 4,118 authors, who accounted for over 22.5% of the total. Of the remaining communities 1, 14, 15, 11, and 934 had over 400 authors, 300 to 399 authors, 200 to 299 authors, 100 to 199 authors, and 99 or fewer authors, respectively.

Co-authorship networks, such as these, are key indicators of how scientific communities cooperate, share knowledge and tools, and evolve worldwide, increasing the relevance of the published researches (Katz & Martin, 1997). For instance, among the authors within PAB's co-authorship networks, Johanna Döbereiner (ranked fifth among top 50) won the UNESCO Science Prize in 1989 for her study on nitrogen-fixing bacteria in tropical agriculture (Embrapa, 2026). Expanding this investigation, Mariangela Hungria (ranked sixty-first) stood out for winning the 2025 World Food Prize, known as "Nobel Prize for Agriculture", attributed to advances in biological nitrogen fixation that transformed soil health sustainability and crop nutrition in the tropics (TWAS, 2025). The presence of researchers such as these, recognized for their overall body of work, highlights the journal's historical role as a platform for the register and diffusion of original studies, contributing to the progress of agricultural sciences.

Regarding institutional affiliations, 23 authors of the top 50 were associated with Embrapa, specifically with nine of the company's specialized research units. Embrapa Arroz e Feijão and Embrapa Agrobiologia stood out with five representatives each, followed by Embrapa Milho e Sorgo and Embrapa Algodão with four and three authors, respectively. Embrapa Trigo, Embrapa Tabuleiros Costeiros, Embrapa Soja, Embrapa Café, and Embrapa Suínos e Aves had one member each (Table 1). Although these authors represented less than half of the top 50, this finding underscores Embrapa's role as a nation-wide driver of agricultural innovation, where commodity- and system-specific research centers serve as long-term hubs for high-density scientific production (Akerman et al., 2025).

Of the top 50 authors, 27 were affiliated with 11 higher education institutions, comprising 7 federal universities, 3 state universities, and 1 community institution (Table 1). Among federal institutions, UFLA lead with 7 authors, succeeded by UFV and UFRGS with 4 authors each, and UFSM with 2. UFPEL, Universidade Federal Fluminense (UFF), and Universidade Tecnológica Federal do Paraná (UTFPR) had one author each. UNESP headed the state institutions, with 3 authors, while Universidade de São Paulo (USP) and Universidade do Estado de Santa Catarina (UDESC) had only 1 author each. The remaining authors were associated with a regional research institute, IAC, and a community institution, Universidade de Passo Fundo (UPF). Therefore, over half of the top 50 authors are linked to institutions other than Embrapa, which indicates low rates of geographic, editorial, and authorship endogamy in the PAB journal, fundamental to meet the criteria of the main indexing databases (SciELO, 2024; DOAJ, 2026).

Having top authors from both traditional agricultural universities (such as UFLA, UFV, UFRGS, and UNESP) and Embrapa units underlines a fundamental structural synergy in Brazilian agronomic science. Historically, these academic institutions have served as primary centers for postgraduate training and foundational research, while Embrapa units drive applied, domain-specific technological advancements (Nascimento et al., 2024). This dual institutional engine not only explains the high concentration of prolific authors within specific geographical and commodity

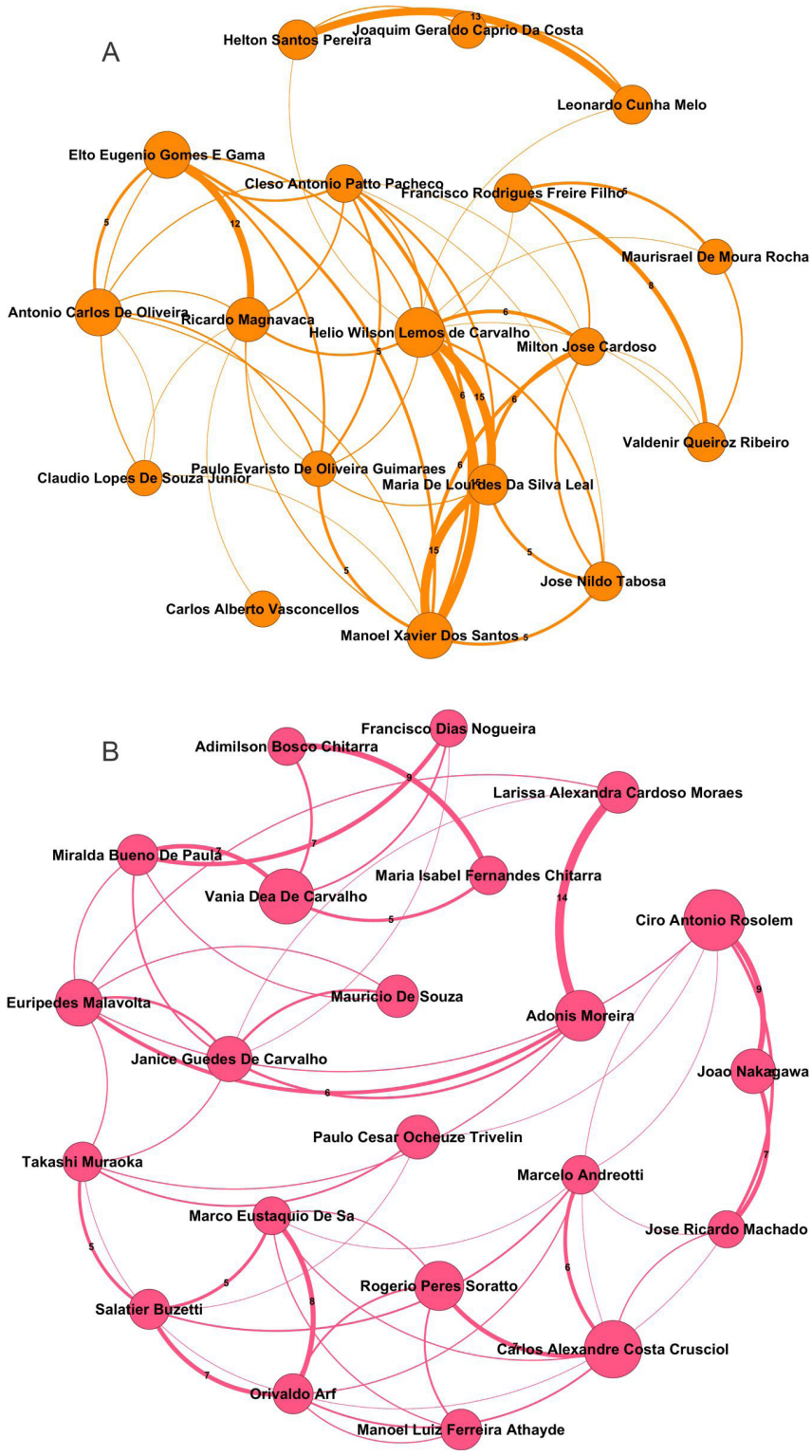

Figure 4. Authors, with ten or more publications over 60 years of the journal Pesquisa Agropecuária Brasileira, grouped in the fifth (A) and sixth (B) largest co-authorship communities and mainly affiliated with Embrapa Milho e Sorgo and Embrapa Tabuleiros Costeiros (orange color) and with Universidade Estadual Paulista (UNESP), Universidade Federal de Lavras (UFLA), and Embrapa Soja (pink color), respectively. Edge thickness is proportional to the number of collaborations between the connected authors.

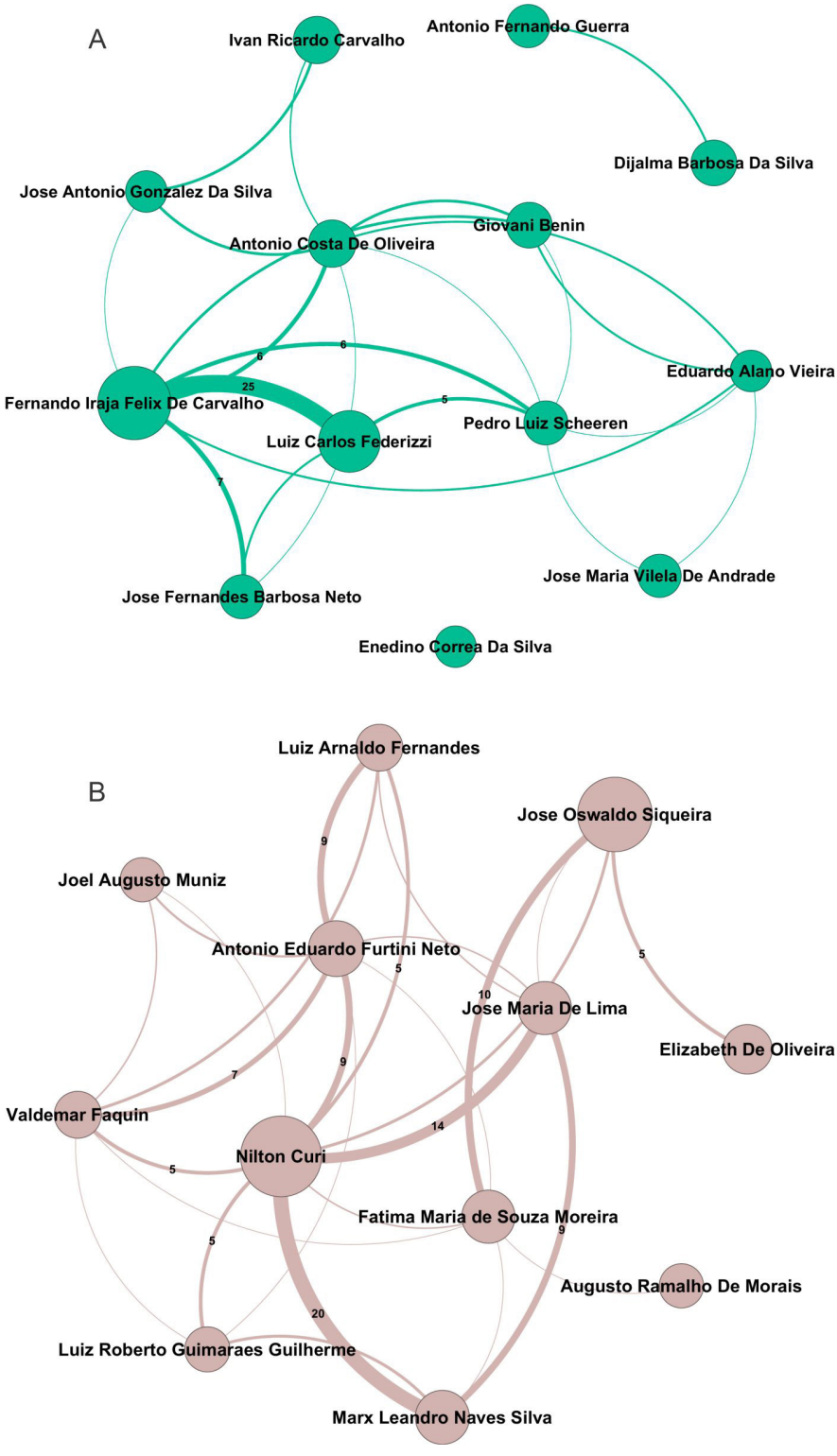

Figure 5. Authors, with ten or more publications over the 60-year history of the journal Pesquisa Agropecuária Brasileira, grouped in the seventh (A) and eighth (B) largest co-authorship communities and primarily affiliated with Universidade Federal de Pelotas (UFPEL) and Universidade Federal do Rio Grande do Sul (UFRGS) (green color) and with Universidade Federal de Lavras (UFLA) (light magenta), respectively. Edge thickness is proportional to the number of collaborations between the connected authors.

nodes, but also shows how long-standing collaborative networks between federal/state universities and state-funded research centers have sustained the scientific output of the journal PAB over its 60-year trajectory.

Conclusions

1. According to the evaluated graph theory metrics, the 10 most relevant contributors (authors) in the history of the Journal Pesquisa Agropecuária Brasileira (PAB) are Cosme Damião Cruz, Magno Antonio Patto Ramalho, Moacir Pasqual, Paulo de Souza Gonçalves, Johanna Döbereiner, Henrique Pereira dos Santos, Nilton Curi, Fernando Irajá Félix de Carvalho, José Oswaldo Siqueira, and Nereu Augusto Streck.

2. Prominent authors play crucial roles in bridging research groups and fostering collaboration, leading to advancements in the agricultural field.

3. PAB's top 50 authors are affiliated to Embrapa units, as well as to federal and state universities, highlighting the journal's low endogamy rates.

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Sandro da Silva Camargo: data curation (equal), formal analysis (equal), investigation (equal), methodology (equal), software (equal), validation (equal), visualization (equal), writing - original draft (equal), writing - review & editing (equal).

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Data availability statement

The data have been deposited in the following GitHub repository: https://github.com/Sandrocamargo/publications/tree/main/pab2025/readme.md

Declaration of use of AI technologies

During the preparation of this work, the author(s) used ChatGPT 4.0 in order to proofreading. After this use, the author(s) reviewed and edited the content as needed and take(s) full responsibility for it.

Conflict of interest statement

The authors declare no conflicts of interest.

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