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BIBLIOMETRIC ANALYSIS OF THE SCIENTIFIC PRODUCTION OF THE *CUBAN JOURNAL OF AGRICULTURAL SCIENCE* AND THE MAPPING OF CO-OCCURRENCE NETWORKS BETWEEN KEY WORDS

ANÁLISIS BIBLIOMÉTRICO DE LA PRODUCCIÓN CIENTÍFICA DE LA *CUBAN JOURNAL OF AGRICULTURAL SCIENCE* Y EL MAPEO DE REDES DE CO-OCURRENCIA ENTRE PALABRAS CLAVE

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A bibliometric study was carried out to describe the performance of the publications from the *Cuban Journal of Agricultural Science* in the period 1967-2024 and to know the most published topics in recent years. The bibliometric indicators used were: scientific production and key words analysis. To analyze the journal's scientific production, Price's law was used, and the number of articles was compared by period and by the journal's main sections. The relation between the key words in the publications for each section was obtained from the co-occurrence matrices in a .net file generated with the Bibexcel program, and the VOSviewer program made possible their subsequent visualization. The journal's scientific output grew exponentially until 2016, with a marked reduction in the number of annual publications starting in 2018. The largest number of articles was obtained between 1991 and 2018. Key word analysis showed that the most important topics were related to the following terms: mathematical modeling, milk production, multivariate analysis, impact indices, animal feeding, prebiotics, probiotics, *in vitro* gas production, chemical composition, food quality, biomass, and yield. Bibliometric analyses proved to be useful in evaluating scientific activity and will help guide researchers in their future studies, as well as the editorial team in designing guidelines and strategies for publishing scientific results and improving the journal's current positioning.

Key words: *bibliometrics, cartography, indicators, Price's law*

Se realizó un estudio bibliométrico para describir el comportamiento de las publicaciones de la *Cuban Journal of Agricultural Science* en el período 1967-2024 y conocer las temáticas más publicadas en los últimos años. Se utilizaron los indicadores bibliométricos: producción científica y análisis de palabras clave. Para analizar la producción científica de la revista se empleó la ley de Price, y se comparó la cantidad de artículos por períodos y por las secciones principales de la revista. La relación entre las palabras clave de las publicaciones por cada sección se obtuvo a partir de las matrices de coocurrencia en un fichero.net, generado con el programa Bibexcel, y el programa VOSviewer posibilitó su posterior visualización. Se demostró el crecimiento exponencial de la producción científica de la revista hasta el 2016, con una marcada reducción en la cantidad de publicaciones anuales a partir del 2018. La mayor cantidad de artículos se obtuvo entre 1991 a 2018. El análisis de las palabras clave evidenció que las temáticas más importantes se relacionan con los términos: modelación matemática, producción de leche, análisis multivariado, índices de impacto, alimentación animal, prebióticos, probióticos, producción de gas *in vitro*, composición química, calidad de los alimentos, biomasa y rendimiento. Los análisis bibliométricos resultaron ser útiles para evaluar la actividad científica, y posibilitarán orientar a investigadores en sus trabajos futuros y al grupo editorial a diseñar pautas y estrategias para la publicación de los resultados de la ciencia y mejorar el posicionamiento actual de la revista.

Palabras clave: *bibliometría, cartografía, indicadores, ley de Price*

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Introduction

Since the last century, there is an exponential growth in the information sources and, at the same time, in the ways in which they are accessed, making it a challenge to identify what is relevant for decision-making (Rivas *et al.* 2023). Authors such as Arriojas and Marín (2021) state that the production of scientific knowledge is essential for the development of countries, and its continuous increase is an essential task for research institutes and universities around the world. It is important to highlight that the development and dissemination of science go hand in hand with the economic and social development of nations; therefore, knowledge must be made available to the international scientific community for consultation and use (Povedano *et al.* 2020).

In the field of science, researchers are published through specialized electronic journals and indexed for access in bibliographic databases (Vitón *et al.* 2019). Scientific journals have played a crucial role in research management and development processes, becoming the primary means of communicating scientific results (Armengol 2017).

In Cuba, within the Agricultural Sciences, the *Cuban Journal of Agricultural Science* (CJAS) stands out, which publishes original and high-quality articles on topics related to the agricultural field: zootechnics (physiology, nutrition and management of ruminants and non-ruminants, microbiology and biotechnology), grasses, forages and other plants used in livestock, animal genetics, mathematics, economics, rural development, environment, sustainable agricultural systems, knowledge management, technology transfer, technological innovation and extension processes. The journal also has a (peer review) system and is indexed in regional and international databases (https://www.cjascience.com/index.php/CJAS). This availability to the international community gives relevance, credibility, and visibility to the journal's scientific output and to the authors who publish in it.

The journal's periodic production creates information flows across the various disciplines and thematic areas that inform researchers about the progress in their fields of study. Therefore, they become an important and tangible result that makes possible to measure and quantify aspects of scientific interest (López *et al.* 2021). In this sense, Bibliometrics emerges as the discipline that allows characterizing the scientific production of the journal, through the use of mathematical and statistical methods (Povedano *et al.* 2020).

Bibliometric analyses of scientific production are necessary to assess the current state of research, as well as the contributions of researchers and countries in the fields of knowledge, which will allow future lines of research to be directed towards specific areas (Hurtado *et al.* 2022). It should be noted that bibliometric analysis provides objective results of interest to both scientific journal editors and authors, given that it has become a reliable source of information on individual or joint production. Currently, other tools that are introduced in this type of analysis are bibliometric maps, which are very useful for visualizing the results (Franco *et al.* 2016).

Taking into account the above, the study aimed to carry out a bibliometric study to describe the performance of the publications from the *Cuban Journal of Agricultural Science* in the period 1967-2024 and to know the most published topics in recent years.

Materials and Methods

Scientific production: A descriptive and retrospective bibliometric study was conducted on the scientific production of the *Cuban Journal of Agricultural Science.* To do this, the number of articles published per year between 1967 and 2024 was compiled for a total of 2,899. In the analysis, Price's law of exponential growth or first law of Bibliometrics was applied, which reflects an essential fact of scientific production, which is its exponential growth (Price 1963). To determine whether the data fit the exponential model, equation (1) was used for processing; Statgraphics version 5.1 plus (Anon 1995) and the statistical package Infostat (Di Rienzo *et al.* 2012) were used.

$$y_{(t)} = \alpha * e^{\beta * t} + \varepsilon \quad (1)$$

where:

$y_{(t)}$: dependent variable (number of publications) as a function of time

α; β: exponential model parameters

t: independent variable (time measured in years)

Ɛ: random error with zero mean and constant variance

In addition, two independent analyses were conducted. The first compared the journal's production by four-year period to determine which period(s) produced the largest number of publications. In the second analysis, production was compared by each of the journal's main sections (Biomathematics, Animal Science, and Grasses Science). In both procedures, a Chi-square proportion comparison analysis was performed for $P<0.05$ and the Fisher-Yates test (1958) was applied.

Key words analysis and bibliometric mapping: To study the most recent research topics, publications from the last 10 years (429 scientific articles) were compiled by the main sections: Biomathematics, Animal Science and Grasses Science. A database was created in the bibliographic manager EndNote version X7 (Clarivate Analytics 2014) and the necessary metadata related to the key words were extracted from each article and the database was converted into a text file for subsequent bibliometric analysis.

The relation between the key words of the publications for each section of the journal was obtained from the co-occurrence matrices in a net file generated with the Bibexcel program version 1.6.4 (Persson *et al.* 2009).

For the final visualization of these co-occurrence networks, bibliometric cartography or the mapping methodology proposed by Franco *et al.* (2016) was used. In the bibliometric maps, each term was identified by a circle and the diameter length (label size) is related to the frequency of appearance of each term and its weight. In addition, as the distance between two circles is smaller, the co-occurrence of the terms will be greater. The different colors formed the different clusters with the most discussed topics in the publications. Each central cluster was identified by the main research topic for each journal section (Dextre *et al.* 2023). To view the maps the VOSviewer program version 1.6.5 was used (van Eck and Waltman 2010).

Results and Discussion

Scientific production: Figure 1 shows the curve of the scientific production of the journal. By applying Price's law of exponential growth, the model only fit up to 2016 and managed to explain 70.17 % (R^2) of the variability. According to López *et al.* (2021), when the model fit is greater than 65 %, the statements of the law are fulfilled, which is why an exponential growth in the scientific production of the journal was evident over the years.

After 1970, scientific production systematically increased, not only in the journal itself but also in Cuba, influenced by several important aspects of science. A research on Cuban science performed by García (2011) describes that in the 1970s there was an increase in research in multiple spheres, due to the role of the National Commission of the Cuban Academy of Sciences (founded in February 1962), which is recognized as the first multidisciplinary institution established after the triumph of the Revolution to carry out scientific researchers and provide services with high scientific-technical content.

By the 1990s, a paradigm change took place in Cuba, with a substantial increase in the way science was transmitted. During this period, scientific centers were created with the aim of promoting the development of biotechnology, the medical-pharmaceutical industry, and advanced technologies, to study, evaluate, and develop solutions in the fields of health and nutrition. In June 1994, the Ministry of Science, Technology and Environment (CITMA) was created, with the mission of directing, executing and controlling all State and Government policy in the areas of science, technology and the environment. By 1996, the Cuban Academy of Sciences was established as an official institution of the Cuban State, national, independent, and consultative with respect to science, representing the national scientific community. Another aspect to highlight within this systemic evolution of Cuban science was the organization of the network of Higher Education Centers in Cuba and the reorganization of the Science, Technology and Innovation Entities (ECTI) supervised by CITMA (Rivas *et al.* 2023).

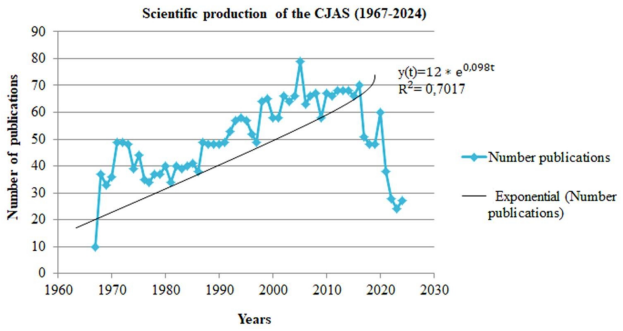

Figure 1. Scientific production of the CJAS (1967-2024)

Also, as part of the update of the country's economic and social development model, the Cuban State approved several policies between 2015 and 2020 to improve science, technology, and innovation activities. These new provisions make possible the introduction of institutional and individual incentives, linked to the scientific production of researchers and the impact of their results, and the creation of new economic figures in Cuba, such as Science and Technology Parks (STPs), interface enterprises between universities, ECTIs and the productive and service sector, and high-tech enterprises (HTEs) (Rodríguez and Núñez 2021). Díaz-Canel and Núñez (2020) and other authors confirm that the advancement of science and continuous advice for decision-making in the different spheres of the country have contributed over the years to greater recognition of the importance of science as a component of technological sovereignty and national security in Cuba.

A bibliometric analysis carried out by López *et al.* (2021) on the international scientific literature of the Cuban Academy of Sciences on the science website, from the 1960s to the 1990s, showed the performance of the scientific production of several research centers. The Institute of Animal Science stood out as the most productive institution with over 400 papers during analyzed period, and CJAS was identified as the core journal with the highest participation rate (PaR = 56.34). In addition it was shown that the most productive authors in the analyzed period were: PhD. Arabel Elías, who contributed 8.26 % of the total documents, followed by PhD. Rafael S. Herrera with 4.13 %, and PhD Manuel Valdivié with 3.44 %, all three belonging to the Instituto de Ciencia Animal.

However, figure 1 shows a marked decrease in the number of annual CJAS publications starting in 2018. Specifically, in 2019, when the development of scientific researchers was affected by the COVID-19 pandemic and Cuba focused scientific studies on the search for medical products to mitigate the disease. Other factors that may have influenced on this performance were the high costs of raw materials on the international market and the lack of economic and financial resources that affected the country, particularly in activities related to food production.

When analyzing the number of articles published by the journal every four years, significant differences were observed (P=0.001) (table 1) The period between 1991 and 2018 highlight as the one with the highest production, with more than 200 articles published by the CJAS in each four-year period, surpassing the rest. In the years 1990-1994 (special period), publications were not affected, and the journal performed excellently and was on the rise. From 1998, the journal began publishing four times a year, rather than three times as previously, which contributed to the increase in the number of annual publications during that period. From 2023 onward, the journal published one issue annually, thus differing from the other analyzed periods.

When analyzing the number of published articles, there were significant differences between the main sections (P=0.001) (table 2). The Animal Science section stands out, with a total of 1,833 articles, representing 63.23 % of those published by the journal. This performance is explained because this section contributes the largest number of publications, based on the main researchers carried out by the institution and other centers, and the researchers who contribute the most to this section. Other notable sections include Grass Science, with 733 articles (25.28 %), and Biomathematics, with 118 (4.07 %). On the other hand, 215 papers were retrieved (7.42 %), which are related to studies on genetics or with economic aspects, among other topics.

Table 1. Number of articles published per four-year period

Four- years period		Published articles		SE (±) Signif.
		No.	%	
1967-1970	1	116	4.00^{f}	0.46 p=0.001
1971-1974	2	185	6.38^{cde}	
1975-1978	3	150	5.17^{ef}	
1979-1982	4	151	5.21^{ef}	
1983-1986	5	158	5.451^{de}	
1987-1990	6	193	6.66^{cd}	
1991-1994	7	217	7.48^{b}	
1995-1998	8	222	7.66^{b}	
1999-2002	9	247	8.526^{ab}	
2003-2006	10	272	9.386^{a}	
2007-2010	11	258	8.90^{ab}	
2011-2014	12	270	9.31^{a}	
2015-2018	13	235	8.11^{ab}	
2019-2022	14	174	6.00^{de}	
2023-2024	15	51	1.76^{g}	
Total		2899	100	

Table 2. Number of articles in the CJAS journal by section

Sections	Published articles		SE (±) Signif.
	No.	%	
Animal Science	1833	63.23^{a}	0.80 p=0.001
Grass Science	733	25.28^{b}	
Biomathematics	118	4.07^{d}	
Other topics	215	7.42^{c}	
Total	2899	100	

Key word analysis and bibliometric mapping: In the Biomathematics section, the analysis of the frequencies of the terms and their relations managed to identify 173 terms defined by the authors as key words (figure 2). The most frequent key words in the articles of the last 10 years were seven: milk production (5), principal components (4), impact index (4), mathematical modeling (3), multivariate analysis (3), information criteria (3) and Statistical Model of Impact Measurement (SMIM) (3). The main cluster was related to milk production, variable modeling, impact measurement, as well as some of the multivariate analysis tools.

Table 3 shows the five clusters that relate to the 19 most frequently used pairs of co-occurrence of terms in the titles and abstracts of the publications.

In the Animal Science section, a total of 1289 terms were identified as key words (figure 3) and 18 clusters were formed, related to 609 pairs of co-occurrence of the most used terms in the titles and abstracts of the publications (table 4).

Table 3. Clusters formed according to the relation with the co-occurrence pairs of the terms

Cluster	Co-occurring terms
1	Rabbits, random effect, fermentation, mathematical modeling, programs
2	Impact indices, milk production, technologies
3	Multivariate analysis, main components, efficiency
4	Information criteria, model, covariance structure
5	Impact, SMIM

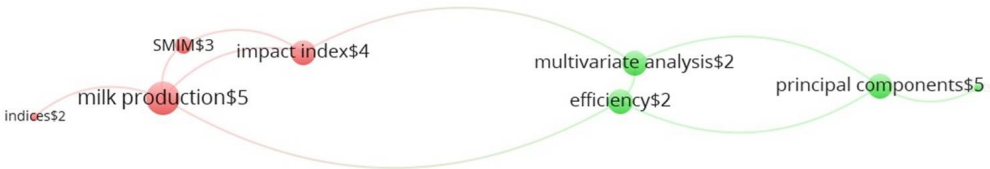

Figure 2. Co-occurrence networks between terms according to the key words of the articles in the Biomathematics section

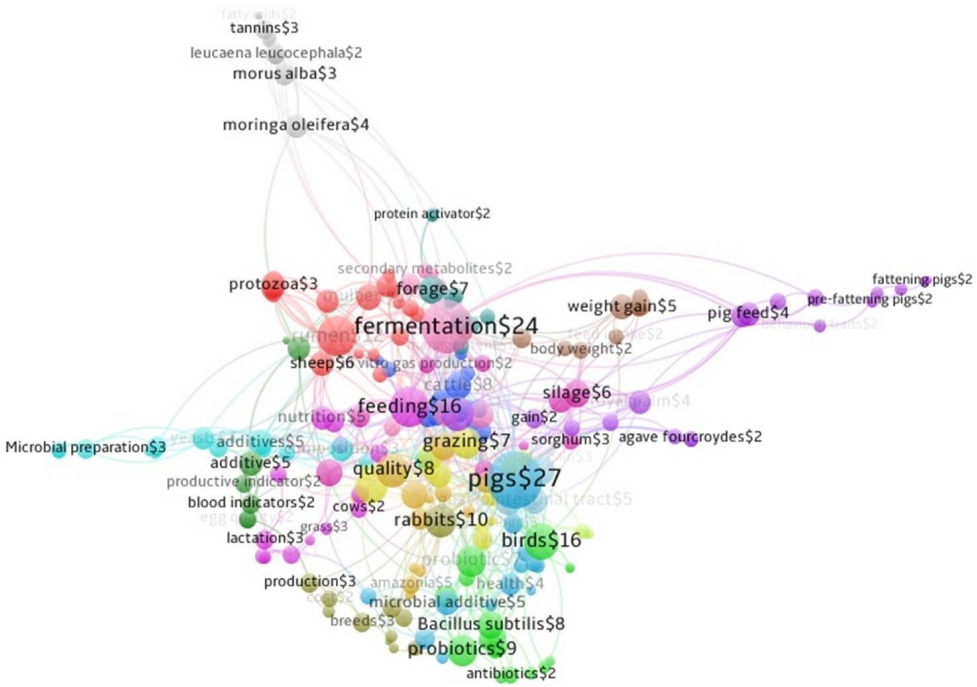

Figure 3. Co-occurrence networks between terms based on key words from articles in the Animal Science section

Table 4. Clusters formed according to the relation with the co-occurrence pairs of the terms

Cluster	Co-occurring terms
1	Feeding, multivariate analysis, catfish, goats, catfish, correlation, lactation, minerals, nutrition, *Oryctolagus cuniculus*, sheep, grass, postpartum, milk production, products, by-products, tropics, cows, zeolite.
2	Pig feeding, pig food, commercial antibiotic, nutrient use, pig fattening, pre-fattening pigs, chemical composition, silage, antinutritional factors, solid-state fermentation, B molasses, breadfruit, microbial preparation, sorghum, whey, intake.
3	Animal feeding, amino acids, bovine, fattening, productive performance, bromatological composition, body condition, energy, stabling, forage, reproductive indicators, management, MUSS-Lactibiol, metabolic profile, silvopastoralism.
4	Additives, broilers, composition, degradation, digestion, mixed silage, stability, fermentation, yeasts, organic matter, dry matter, *in vitro* gas production, gas production, nutritive value, vinasse.
5	Food, cellulolytic bacteria, biomass, dynamics, ruminal fermentation, fungi, yeast, methane, methanogenesis, methanogens, microorganisms, mulberry, protozoa, rumen.
6	Amazonia, production chain, laying hen, quality, digestibility, productive efficiency, livestock, grasses, milk, legumes, heifers, Piptocoma discolor, by-products, supplementation.
7	Alternative food, pigs, rabbit, digesta, *in vitro* digestibility, environmental effects, fiber, sweet potato foliage, corn, rich molasses, morphometry, pepsin, reproduction, gastrointestinal tract.
8	Nutritional additives, zootechnical additives, unconventional foods, blood biochemistry, endospores, laying hens, productive indicators, *Lactobacillus salivarius*, chickens, probiotics, prebiotics, animal production, calves.
9	Lactic acid bacteria, food intake, feed conversion, feeding cost, silage, weight gain, molasses, replacement level, royal palm nut , potato, body weight, wheat bran.
10	Buffalo, carcass, meat, performance, physiology, average daily gain, legumes, grazing, yield, ruminants, solubility, supplement.
11	Enzymatic activity, antibiotics, birds, *Bacillus subtilis*, sows, enzymes, stress, lipids, milk production, productive response, health, *Tithonia diversifolia*.
12	Fatty acids, microbial additive, diarrhea, diets, rooster, *Leucaena, Moringa oleifera, Morus alba*, productivity, tannins, *Trichanthera gigantea*, VITAFER.
13	Additive, environment, milk quality, egg quality, rumen content, cost, productive indicator, production, breeds.
14	*Agave fourcroydes*, swine, lipid metabolism, royal palm, prebiotic, behavioral traits, zootechny.
15	Suckling, conversion, growth, efficiency, gain, calf, cattle.
16	Alternative food, antioxidant, trees, secondary metabolites, porcine.
17	Protein activator, intake, forage, rumination, protein supplementation.
18	Sugarcane, degradability, cattle, internal organs.

As a general result of the analysis, the key words with frequencies of appearance above five were: pigs (30), fermentation (24), rumen (12), cattle (10), rabbits (10), probiotics (9), feeding (9), laying hens (8), intake (8), quality (8), buffaloes (7), digestibility (7), grazing (7), morera (7), chemical composition (6), gas production (6), sheep (6), prebiotics (6), yeast (6) and nutrition (6). The results showed that recent studies focused on animal feeding, primarily in the pig, cattle, rabbit and laying hens categories, as well as on the use of different prebiotics and probiotics. Other notable researchers included studies on *in vitro* gas production, chemical composition, and the overall quality of these foods. The main cluster was related to researchers on pigs, and in almost all clusters, the word "food" highlighted as one of the most studied.

In the Grasses Science section, a total of 645 terms were identified as key words through analysis of term frequencies and their relations (figure 4). Eleven clusters were formed related to the 253 co-occurrence pairs of the most frequently used terms in the titles and abstracts of the publications (table 5).

In this section, a total of 17 key words were identified with frequencies of appearance above five, among which are digestibility (15), *Tithonia diversifolia* (14), *Pennisetum purpureum* (11), grasses (11), *Cenchrus purpureus* (10), yield (10), forage (10), chemical composition (9), *Moringa oleífera* (8), Bradyrhizobium sp. (8), germination (8), grazing (6), quality (6), soil (6), energy (6), nitrogen (6) and grass (6). These terms allowed *Tithonia diversifolia* to be identified as the most researched forage resource in recent years, and the variables with the greatest study were yield and those related to chemical composition.

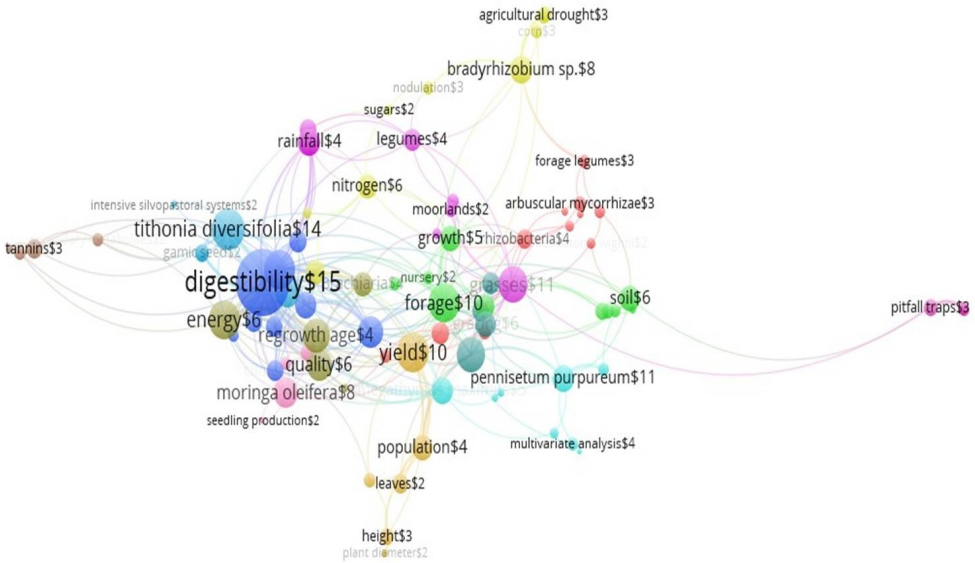

Figure 4. Co-occurrence networks between terms, based on key words from articles in the Grasses Science section

Table 5. Clusters formed according to the relation with the co-occurrence pairs of terms

Cluster	Co-occurring terms
1	Biomass, *Cenchrus purpureus*, establishment, evaluation, organic fertilization, fertilization, forage legumes, arbuscular mycorrhizae, *Neonotonia wighti*, nutrition, grazing, grasses, productivity, forage yield, rhizobacteria, soils, tolerance
2	Agroforestry, trees, biomass bank, growth, forage, livestock, grassland, silvopastoral system, sustainability, soil, nursery
3	Climate, chemical composition, age, legumes, secondary metabolites, biomass production, production, saponins, tannins, *Tithonia diversifolia*
4	Crop, fiber, pigs, germination, *Moringa oleifera,* protein, rhizobia, seeds, nutritional value, vigor
5	Characterization, diversity, antinutritional factors, grasses, legumes, rainfall, moorlands, temperature
6	Sugars, *Bradyrhizobium*, dendrogram, corn, nitrogen, nodulation, agricultural drought, *Trichoderma*
7	Height, plant diameter, grass, leaves, population, yield
8	*Brachiaria,* quality, digestibility, regrowth age, energy
9	Multivariate analysis, agronomic indicators, *Nopalea cochenillifera, Pennisetum purpureum*
10	Trees, creeping legumes, *Megathyrsus maximus*, silvopastoral
11	Monoliths, soil organisms, pitfall traps

Conclusions

Bibliometric analyses proved to be useful in assessing CJAS's scientific activity. Their practical application allowed identifying the period of the journal's greatest scientific output, during which the Animal Science section highlighted. The journal's scientific output grew exponentially until 2016, with a marked reduction in the number of annual publications starting in 2018. Using key words the most frequently discussed topics in recent years could be identified. These analyses will help guide researchers in their future studies and the editorial team in designing guidelines and strategies for publishing scientific results and improving the journal's current positioning.

References

Anon. 1995. Software Statgraphics versión 5.1 plus [Windows].

Armengol, N. 2017. Estudio bibliométrico de la revista Pastos y Forrajes, y su relación con los cambios de paradigma de I+D+i en la EEPF Indio Hatuey. Tesis en opción al grado de Máster en Ciencias en Pastos y Forrajes. Matanzas, Cuba.

Arriojas, D.D.J. & Marín, T.D. 2021. Producción científica en ingeniería: análisis comparativo de países de Suramérica del 2008 al 2018. *Revista Universidad y Sociedad*, 13(3): 84-93, ISSN: 2218-3620. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2218-36202021000300084.

Clarivate Analytics. 2014. EndNote™. reference manager versión X7. Formaly the IP & Science business of Thomson Reuters. Toronto, Canadá.

Dextre, S.A., Febres, R.J. & Mercado, M.R. 2023. Análisis bibliométrico de los 100 artículos más citados en Scopus sobre educación médica y COVID-19. *Revista Cubana de Información en Ciencias de la Salud*, 34(1): 1-28, ISSN: 2307-2113. https://acimed.sld.cu/index.php/acimed/article/view/2196.

Díaz-Canel, M. & Núñez, J. 2020. Gestión gubernamental y ciencia cubana en el enfrentamiento a la COVID19. *Anales de la Academia de Ciencias de Cuba*, 10(2): 1-10, ISSN: 2304-0106. https://revistaccuba.sld.cu/index.php/revacc/article/view/881/886.

Di Rienzo, J.A., Casanoves, F., Balzarini, M.G.,González, L., Tablada, M. & Robledo, C.W. 2012. InfoStat. Versión 2012, [Windows], Universidad Nacional de Córdoba, Argentina: Grupo InfoStat. Available at: http://www.infostat.com.

Fisher, R.A. & Yates, F. 1958. Statistical Tables for Biological. Agricultural and Medical Research. Edinburgo: Oliver and Boyd, Escocia.

Franco, K., Díaz, F.J., Pineda, J.E. & Hidalgo, C.A. 2016. Bibliometric analysis of scientific production of Mexican Journal of Eating Disorders. 2010-2014. *Revista Mexicana de Trastornos Alimentarios*, 7: 9-16, ISSN: 2007-1523. http://dx.doi.org/10.1016/j.rmta.2016.03.001.

García, E. 2011. Revolución y ciencia en Cuba: la Academia de Ciencias de Cuba 1962-1972. *Anales de la Academia de Ciencias de Cuba*, 1(2): 1-32, ISSN: *2304-0106.* https://revistaccuba.sld.cu/index.php/revacc/article/view/23/23

Hurtado, G. Díaz, J., Pérez, F., Araña, Y., Barcos, V. & Herrera, R. 2022. Análisis bibliométrico de publicaciones sobre el Proceso de Atención de Enfermería del período 2015-2020. *Revista Cubana de Enfermería*, 38(1): 1-14, ISSN: 1561-2961. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-03192022000100004.

López, F., Velázquez, L.C., García, E., López, I. & Povedano, F.J. 2021. Análisis bibliométrico y mapeo de redes de la literatura científica internacional de la Academia de Ciencias de Cuba en la Web of Science (1968-1994). *Anales de la Academia de Ciencias de Cuba*, 11(2): 100-117, ISSN: 2304-0106. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2304-01062021000200009.

Persson, O., Danell, R. & Wiborg-Schneider, J. 2009. How to use Bibexcel for various types of bibliometric analysis. In celebrating scholarly communication studies: A Festschrift for Olle Persson at his 60th Birthday. (eds) Åström, F., Danell, R., Larsen, B. & Schneider, J. p. 9-24. Leuven. Belgium: International Society for Scientometrics and Informetrics.

Povedano, F.J., Weinreb, R.N., Raga, I., Romero, A. & López, F. 2020. Detection of neurological and ophthalmological pathologies with Optical Coherence Tomography using retinal thickness measurements: A bibliometric study. *Applied Sciences*, 10(16): 5477-5491, ISSN: 2076-3417. https://doi.org/10.3390/app10165477.

Price, D.J.S. 1963. Little Science. Big Science. New York: Columbia University Press.

Rivas, F., Rosete, A., Cobas, M.J. & Hernández, A. 2023. Un análisis bibliométrico de la producción científica cubana en la web de la ciencia. *Revista Cubana de Transformación Digital*, 4(1): 1-16, ISSN: 2708-3411. https://rctd.uic.cu/rctd/article/view/204.

Rodríguez, A. & Núñez, J.R. 2021. El Sistema de Ciencia, Tecnología e Innovación y la actualización del modelo de desarrollo económico de Cuba. *Revista Universidad y Sociedad*, 13(4): 7-19, ISSN: *2218-3620.* http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2218-36202021000400007

Van Eck, N.J. & Waltman, L. 2010. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84: 523-538, ISSN: 0138-9130. https://doi.org/10.1007/s11192-009-0146-3.

Vitón, A.A., Díaz, R. & Martínez, Y. 2019. Indicadores bibliométricos aplicables a la producción científica individual. *Revista Universidad Médica Pinareña*, 15(2): 273-284, ISSN: 1990-7990. https://revgaleno.sld.cu/index.php/ump/article/view/352/0.