



Organic agriculture exploratory analysis of the research field in Iberoamerica

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Abstract

The research on the techniques, production and distribution on organic agriculture has acquired special relevance in the last decades. The preservation of the soil, human health, the increasing demand for these kinds of products along to the revenues that they generate are some of the main causes of this rapid scientific evolution of the field. The objective of the present study is to analyze the production of the area of organic agriculture in Iberoamerica from 1980 to 2018. The data is retrieved from the Web of Science scientific database and results are presented in categories of authors, volume of articles, countries, institutions and research areas.

Keywords: Organic agriculture, Bibliometry, Iberoamerica

JEL Codes: Q1, Q15, Y1

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Análisis bibliométrico del campo de investigación de la agricultura orgánica en Iberoamérica

Resumen

La investigación en técnicas, producción y distribución en la ciencia de la agricultura orgánica ha tomado relevancia en las últimas décadas. La preservación de los suelos, la salud del ser humano, la creciente demanda mundial de este tipo de productos y las ganancias que de esta actividad se derivan son algunas de las principales causas de la rápida evolución de publicaciones en el área. El objetivo del presente artículo es realizar un análisis bibliométrico de la difusión científica de temas relacionados a la agricultura orgánica en Iberoamérica durante el período de 1980 – 2018. El estudio obtiene información de la base de datos Web of Science y presenta resultados de las revistas, artículos, autores, países, instituciones y áreas de investigación.

Palabras clave: Agricultura orgánica, Bibliometría, Iberoamérica.

Código JEL: Q1, Q15, Y1

1. INTRODUCTION

The conventional farming system consumes fossil fuel, water, and topsoil at unsustainable rates contributing to numerous forms of environmental degradation, including air and water pollution, soil depletion, declining biodiversity, and fish extinction (Horrigan, Lawrance & Walker, 2002). For its part, organic agriculture is a holistic production management system that promotes and improves the health of agroecosystems, biodiversity, biological cycles, and soil biological activity. Emphasizes the use of management practices rather than the use of non-agricultural inputs; begins to consider the possible environmental and social impacts by eliminating the use of chemical and synthetic inputs, and instead, they are replaced by practices that maintain and increase soil fertility in the long term (FAO, 2019).

Therefore, this production system supports the health of soils, ecosystems, and people (IFOAM, 2019a). Unlike conventional agriculture, whose use of chemical inputs generates adverse effects on soils and human health, organic agriculture is based on ecological processes, biodiversity, and adapted cycles, taking into account that regional conditions require adapted systems locally (FAO, 2019).

The term organic agriculture is used for the first time in the United States by the British writer Lord Northbourne in 1940, defining agriculture as an organic, living, and dynamic whole (Duram, 2005). It covers food safety, human health and it cares for the environment by avoiding the use of fertilizers, pesticides, hormones, and antibiotics; guaranteeing soil fertility, prohibiting genetic modifications in plants, crop rotation, and waste recycling (Aceleanu, 2016).

Organic agriculture offers many synergistic benefits to address biophysical and socioeconomic challenges: it reduces hunger, poverty, and rural inequality and conserves the cultural diversity of natural resources (Organic Research Centers Alliances, 2009), in addition to greater biodiversity, better quality of soil and water per unit area, higher profitability and higher nutritional value (Seufert & Ramankutty, 2017). Although it still represents a small proportion of the total agricultural sector, organic agriculture is becoming increasingly important in several countries, given the increasing global demand from consumers, offering new national and international market opportunities for farmers and farming companies (FAO, Committee on agriculture, 1999; Gomiero, 2018). In 2017, 2.9 million organic producers were registered worldwide, obtaining a growth of 5% more than in 2016. India is the country with the highest number of registered producers with 835,200, in second place is Uganda with 210,352 and in third place Mexico with 210,000 producers. Regarding the area of organic agriculture, Austria is the country with the largest number of hectares with 35.6 million hectares, followed by Argentina with 3.4 million hectares and China with 3 million hectares. The Ecovia Intelligence report (2019) on the global organic food and beverage market, indicates that sales exceeded 100 billion dollars in 2018. Currently, the countries with the highest consumption of organic products are Switzerland, Denmark, Sweden, and Austria (IFOAM, 2019b).

Thus, the growing worldwide development of this production system has created a gap for research and generation of knowledge in various disciplines and

contributions to the scientific literature. It is from the last five years that there has been a greater growth in the publication of articles on organic agriculture: from research focused on the study of its evolution from ancient civilizations (Guesmi, Serra, Radwan & Gil, 2018) to its performance in the 21st century (Reganold & Wachter, 2016), considering from various approaches and objectives, such as the analysis of research that analyzes its trend, development maps and specific statistical analyzes (Paull & Hennig, 2016; Willer & Lernoud, 2017) , as well as its relationship with various factors such as fair trade (Parvathi & Waibel, 2016), the differences in performance between organic and conventional production methods (Crowder & Reganold, 2015; Kniss, Savage & Jabbour 2016; Seufert & Ramankutty, 2017), the study and analysis of the demand for organic products (Mercati, 2016), the evaluation of the quality of conventional versus organic products (Hidalgo-Baz, Martos- Partal & González- Benito, 2017; Ponder & Hallmann, 2019), the competitiveness of organic agriculture (Mile, 2017), the development of strategies of ecological commercialization (Aceleanu, 2016), the study of the determinants for the decision-making of the adoption of organic products (Jambor, Toth & Koroshegyi, 2018), the impact of a conversion from conventional agriculture to organic agriculture (Smith et al., 2018) and even in the energy impact it generates (Smith, Williams & Pearce 2015).

In the same way, various international organizations, such as the International Federation of Organic Agriculture Movements (IFOAM), Food and Agricultural Organization (FAO), Organic Trade Association (OTA), among others, have contributed to the promotion, promotion,

and research of the organic agriculture. Thus, there is a large amount of multidisciplinary literature whose object of study is organic agriculture.

Currently, important databases are analyzed in the scientific community using bibliometric tools (Alfaro-García et al., 2020; Blanco-Mesa, Merigó & Gil-Lafuente, 2017; Buter & Van Raan, 2013; Cancino, Merigo, Torres & Diaz 2018; Merigo, Blanco-Mesa, Gil-Lafuente & Yager, 2017; Yılmaz, Dincol & Yalcin, 2019; Zhang, Zhong & Geng, 2019). Through bibliometrics, we can identify and analyze from different aspects the various scientific publications that have focused on the study of organic agriculture.

The word bibliometrics is defined in 1969 by Alain Pritchard as the application of statistical and mathematical models for the definition of written communication processes and the development of different scientific disciplines (Martino & Alfonso, 2014). Bibliometry is the field of science that deals with the development and application of quantitative measures and indicators for science and technology, based on bibliographic information, whose information is the representation of codified knowledge and can be found in a great diversity of scientific publications, such as books, book chapters, articles, conference proceedings (Van, 2004).

Only two bibliometric studies on organic agriculture have been detected: “Mapping research at the intersection of organic farming and bioenergy - A scientometric review” (Siegmeier & Möller, 2013) and “Mapping the scientific research in organic farming: a bibliometric review” (Aleixandre, Aleixandre- Tudo, Bolaños- Pizarro & Aleixandre- Benavent, 2015). The first

analyzes organic agriculture and bioenergy issues, while the second focuses on scientific productivity, collaboration, and the impact of organic agriculture research globally during the period 1954 to 2013.

According to the Web of Science database, during the period 1980-2018, no studies were identified that methodically analyze the evolution of publications on organic agriculture, specifically for Latin American countries. For this reason, and given the emerging importance and growth of research on organic agriculture, this research seeks to contribute to this field of study by proposing an analysis of the evolution and growth of articles published on organic agriculture, as well as the scientific relevance and the number of international authors specialized in this field. The structure of the present investigation is as follows, the methods section details how the bibliometric search was carried out to obtain results. The third section presents the results obtained, then the discussion section is proposed, and finally the conclusions.

2. METHODOLOGY

To perform the bibliometric analysis of organic agriculture in Latin America, the Web of Science (WoS) platform owned by the "Thomson Reuters Institute for Scientific Information" (ISI) created by Eugene Garfield in the 1960s was used. The platform is an of the main bases of worldwide data from bibliographic references and periodical citations (Aghaei et al., 2013).

The search methodology applied in this article follows the process proposed in the article “Mapping the scientific research in organic farming: a bibliometric review” (Aleixandre, Aleixandre- Tudo, Bolaños-

Pizarro & Aleixandre- Benavent, 2015), in which, a bibliometric analysis is carried out at a global level in the area of organic agriculture. The advantages of following the proposed consultative process are to find patterns and trends in common, as well as to increase the possibility of generating collaborations and synergies from the results obtained. The search parameters used are detailed below. The keywords entered in the search engine are "Ecolog * agriculture" "OR" "organic agriculture" "OR" "organic farm *". The type of search is carried out by "Title" and the period time, from 1980 to 2018, thus closing with information from entire years and facilitating the replication of the search. Overall, 3,721 results were obtained. Two additional refinements are proposed, the first by type of document: "article", "review", "letter" and "note". This refinement yields 3,225 results. The second refinement is by country, selecting those considered within the Latin American region (SEGIB, 2020). According to the Ibero-American General Secretariat, the countries that make up the region are Andorra, Argentina, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Chile, Dominican Republic, Ecuador, Spain, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Portugal, Uruguay, and Venezuela. However, only records of publications from Spain, Brazil, Mexico, Portugal, Argentina, Chile, Venezuela, Costa Rica, Ecuador, Peru, Uruguay, Bolivia, Colombia, and Cuba. Once the search has been carried out with the parameters and refinements indicated, the WoS platform returns a total of 322 articles.

The categories that are analyzed in this study are general citation, journals, articles, authors, countries, institutions, and most influential research areas in organic

agriculture. The data obtained were processed using Office Excel software and the VOSviewer bibliometric network generator (Van Eck & Waltman, 2010).

3. RESULTS

In September 2019, a search was carried out in the WoS database, narrowing down the type of search described in the previous section. The results obtained are the following:

In 1980, eight investigations focused on the study of organic agriculture were published globally; For its part, in Latin America, the first publication was registered until 1994.

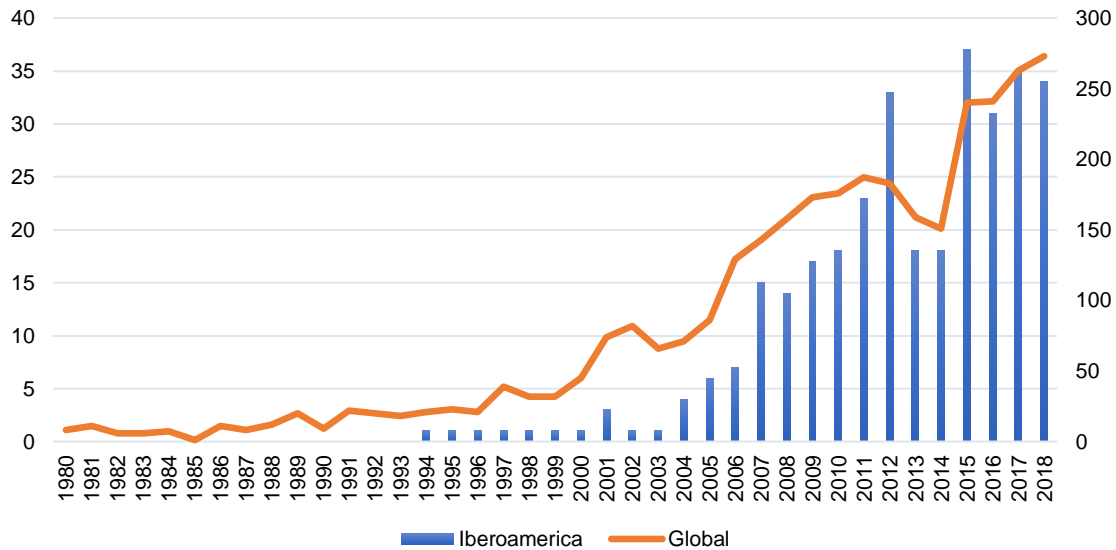
The 1990s were characterized by two distinguishable discourses on organic agriculture: an agroecological orientation and the other to agribusiness. The agroecology-oriented discourse is championed by organic pioneers, social and environmental non-governmental organizations (NGOs). Organic farming was seen as an alternative to conventional farming, whose farming methods were unsustainable. Choosing an organic production is seen as a positive choice because organic is synonymous with better quality and more value (De Cock, Dessein & De Krom, 2016).

Graph 1 shows the evolution of publications focused on organic agriculture from 1980 to 2018 both globally and in Latin America, whose similar trend shows an increase, except for the years 2013 and 2014 that both cases are observed a notable reduction. The first publication in Ibero-America was registered in 1994, whose global contribution represented 5%; for 2018, these types of publications increased by 12%, which implied an increase during these years

of 7%. It is in 2015 in the year that Ibero-America registered the highest number of publications with a total of 37, while globally

the highest number of publications was obtained (273) in 2018.

GRAPH 1. NUMBER OF PUBLICATIONS ON ORGANIC AGRICULTURE AT THE GLOBAL LEVEL AND IBEROAMERICA, 1980-2018.



Source: Own creation based on WoS.

In general, the highest publication productivity in Ibero-America has been recorded in the last 11 years, the trend of which shows growth with some ups and downs. Such is the case, for example, of the 114% increase between 2006 and 2007, as well as a considerable 45% decrease between 2012 and 2013. 2014 remained constant, however, the subsequent year registered an increase of 105%. In 2016, a reduction of 16% was observed again, in 2017 an increase of

13%, and finally in 2018 a decrease of 3%. That is, even when the trend shows an increase, there has been some variation in publications from one year to another. The article with the highest number of citations at the date of the review is “Organic farming and the sustainability of agricultural systems” (Rigby & Cáceres, 2001), with a total of 252 citations. Most of the published articles (76.09%) register less than 20 citations (see Table 1).

TABLE 1. NUMBER OF ARTICLES PUBLISHED AND CITED IN WOS

Number of citations	Number of articles	% Articles
≥200	1	0.31%
≥100	2	0.62%
≥80	3	0.93%
≥60	8	2.48%
≥40	19	5.90%
≥20	44	13.66%
≤20	245	76.09%

Source: Own creation based on WoS.

3.1. Analysis by journals

Table 2 was constructed considering the total publications on organic agriculture; the journal with the highest number of publications is the Spanish Journal of

Agricultural Research (SJAR), which accepts research articles, reviews, and short communications of content related to agriculture. The SJAR is ranked 28 (Q2), has an Impact Factor (IF) of 1,035, and an Impact Factor 5 (IF5) of 1,189 (SJAR, 2019).

TABLE 2. MOST INFLUENTIAL JOURNALS ON ORGANIC AGRICULTURE RESEARCH IN IBEROAMERICA

R	JOU	TPOA	HOA	%	TP	H	TC	CA	IF	IF5
1	SPAR	12	5	18.52	1,374	27	8,363	7,715	1.035	1.189
2	AEE	7	6	3.77	6,628	159	206,055	120,868	3.954	4.655
3	HB	6	2	11.76	1,185	17	4,550	3,028	0.585	0.702
4	ASD	6	4	5.33	870	75	23,793	19,093	4.263	6.154
5	ASFS	6	4	21.05	391	19	1,888	1,438	1.381	1.977
6	PO	5	4	1.49	208,241	268	1,839,599	-	2.776	3.337
7	AS	5	4	4.21	2,950	95	61,618	38,014	4.131	4.155
8	EJA	5	5	5.15	1,872	97	58,405	37,711	3.384	4.161
9	GEO	5	5	29.41	1,185	17	4,550	3,028	0.585	0.70
10	STE	4	3	1.46	27,033	205	673,261	433,739	5.589	5.727
11	FC	4	4	1.81	23,636	221	757,930	418,664	5.399	5.488
12	JCP	4	4	2.67	13,238	150	280,014	138,729	6.395	7.051
13	EP	4	3	1.55	12,099	194	401,062	237,812	5.714	6.152
14	SBB	4	4	1.94	9,316	206	418,156	143,872	5.290	6.065
15	SCA	4	2	10.00	3,053	20	6,402	5,085	0.37	0.501
16	LDD	4	3	4.41	1,739	68	31,479	18,317	4.275	4.866
17	RAFS	4	3	7.32	580	41	7,771	5,916	1.771	2.251
18	ESPR	3	2	2.44	14,037	82	138,053	103,862	2.914	3.208
19	JAE	3	3	1.75	4,589	171	223,399	137,108	5.782	6.533
20	BAH	3	2	6.06	781	33	7,838	6,300	1.239	1.517

Source: Own creation based on WoS data. Abbreviations: JOU, journal; TPOA, Total Publications of Organic Agriculture; HOA, H Index of Organic Agriculture; %, HOA / H; TP, Total Publications; H, H Index; TA, Total Citations; CA, Articles in which it is cited; IF, Impact factor; IF5, 5-year impact factor; SJAR, Spanish Journal of Agricultural Research; AEE, Agriculture Ecosystems & Environment; HB, Horticultura Brasileira; ASD, Agronomy for Sustainable Development; ASFS, Agroecology and Sustainable Food Systems; PO, Plos One; AS, Agricultural Systems; EJA, European Journal of Agronomy; GEO, Geoderma; STE, Science of the Total Environment; FC, Food Chemistry; JCP, Journal of Cleaner Production; EP, Environment Pollution; SBB, Soil Biology & Biochemistry; SCA, Semina- Ciencias Agrarias; LDD, Land Degradation and Development; RAFS, Renewable Agriculture and Food Systems; ESPR, Environmental Science and Pollution Research; JAE, Journal of Applied Ecology; BAH, Biological Agriculture & Horticulture.

The H index, as well as other related bibliometric indices, have received much attention from the scientific community in recent years due to the ease of their calculation and the balance between the number of publications and their impact (Alonso, Cabrerizo, Herrera-Viedma & Herrera, 2009). The H index can be conceptualized as a particularly simple and useful way of defining the scientific output of a researcher or a publication (Hirsch, 2005). The journal with the highest H index in organic agriculture is Agriculture, ecosystems and environment (AEE). It publishes

scientific articles that deal with the interface between agroecosystems and the natural environment, specifically analyzing the impact of agriculture and its influence on the environment, as well as changes in the environment and its impact on agroecosystems (AEE, 2019). For its part, the magazine with the highest total H index rate compared to the H index for organic agriculture is Geoderma.

The journal with the highest number of publications, H-index, total citations, and articles in which it is cited is the Plos One

journal, while the journal with the highest Impact Factor (IF) is the Journal of Cleaner Production.

During 1980 - 2018, the total number of citations of publications on organic agriculture is 4703. The first journal published in Latin America is Landscape and Urban Planning with the article "Development of Mediterranean Agriculture- an Ecological Approach" (Perez, 1990). While the most productive in 2018 are Agricultural Ecosystems & Environment, Agroecology, and Sustainable Food Systems, Open Agriculture and Science of the Total Environment, with two publications each. 2015 is the most productive year, registering more publications in Latin America; the most productive magazines are Land Degradation & Development and Plos One with two publications each.

3.2. *Analysis by articles*

During the study period, the article with the highest number of citations was "Organic farming and the sustainability of agricultural systems" (Rigby & Cáceres, 2001) with a total of 252 citations (see Table 3), whose objective is to analyze to what extent the concept of sustainable agriculture has some operational meaning. The article belongs to the journal Agricultural Systems which deal with studying the interactions between agricultural systems and their natural, social, and economic environments. Among the 15 main articles, the most current is published in 2015, it is titled "Impact of conservation tillage and organic farming on the diversity of arbuscular mycorrhizal fungi" (Såle et al., 2015), its objective is to investigate the impact of Soil cultivation in organically managed clay soils from a long-term field experiment.

3.3. *Analysis by authors*

According to Table 4, the author with the highest number of publications is Lopez-Alonso, M., affiliated with the University of Santiago de Compostela in the Department of Animal Pathology, in Spain. His lines of research are organic milk production, organic farming, organic dairy systems, toxic elements in organic and conventional milk, organic and conventional meat farm systems. The most cited article on organic agriculture by Lopez-Alonso, M. is "Evaluation of organic, conventional and intensive beef farm systems: health, management, and animal production" (Blanco-Penedo et al., 2012) with a total of 7 citations. The author with the highest H index is Mateus, N. from the University of Porto, Department of Chemistry and Biochemistry, in Portugal. His lines of research are organic agriculture, pest management in organic agriculture and the study of residues with pesticides. The most cited article on organic agriculture by Mateus, N. is "Organochlorine Pesticide Residues in Strawberries from Integrated Pest Management and Organic Farming" (Fernandes, Domingues, Mateus & Delerue, 2011) with a total of 39 citations.

The articles "Organochlorine Pesticide Residues in Strawberries from Integrated Pest Management and Organic Farming" (Fernandes, Domingues, Mateus & Delerue, 2011) and "Mycotoxins in maize grains grown in organic and conventional agriculture" (Ruiz et al., 2015) are the most cited authors according to Table 3. Although the article with the most citations is "Chemical and biochemical properties of a clay soil under dryland agriculture system as affected by organic fertilization" (Melero, Madejón, Ruiz & Herencia, 2007), with 77 citations.

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TABLE 3. MAIN ARTICLES IN THE FIELD OF RESEARCH ON ORGANIC AGRICULTURE IN IBEROAMERICA

R	Title	Authors	Jou	Year	TC
1	Organic farming and the sustainability of agricultural systems	Rigby, D; Caceres, D.	AGR	2001	252
2	Effects of fish farming on seagrass (<i>Posidonia oceanica</i>) in a Mediterranean bay: seagrass decline after organic loading cessation	Delgado, O; Ruiz, J; Perez, M; Romero, J; Ballesteros, E	OCE	1999	134
3	Changes in soil organic carbon stocks under agriculture in Brazil	Zinn, YL; Lal, R; Resck, DVS	SOI	2005	106
4	Anaerobic codigestion of municipal, farm, and industrial organic wastes: A survey of recent literature	Alatrisme-Mondragon, F.; Samar, P.; Cox, H.; Ahring, B.; Iranpour, R.	WAT	2006	97
5	Sedimentation of organic matter from fish farms in oligotrophic Mediterranean assessed through bulk and stable isotope ($\delta C-13$ and $\delta N-15$) analyses	Holmer, M.; Marba, N.; Diaz-Almela, E.; Duarte, C. M.; Tsapakis, M.; Danovaro, R.	AQU	2007	85
6	Hepatitis E virus infection dynamics and organic distribution in naturally infected pigs in a farrow-to-finish farm	De Deus, N.; Casas, M.; Peralta, B.; Nofrarias, M.; Pina, S.; Martin, M.; Segales, J.	VET	2008	81
7	Chemical and biochemical properties of a clay soil under dryland agriculture system as affected by organic fertilization	Melero, Sebastiana; Madejon, Engracia; Carlos Ruiz, Juan; Francisco Herencia, Juan	EUR	2007	77
8	Effects of Fair Trade and organic certifications on small-scale coffee farmer households in Central America and Mexico	Mendez, V. ; Bacon, C.; Olson, M.; Petchers, S.; Herrador, D.; Carranza, C.; Trujillo, L.; Guadarrama-Zugasti, C.; Cordon, A.; Mendoza, A.	REN	2010	70
9	Biodiversity and multiple ecosystem functions in an organic farmscape	Smukler, S. ; Sanchez-Moreno, S.; Fonte, S.; Ferris, H.; Klonsky, K.; O'Geen, A. ; Scow, K.; Steenwerth, K.; Jackson, L.	ECO	2010	68
10	Responses of soil microbial biomass and activity for practices of organic and conventional farming systems in Piauí state, Brazil	Araujo, A. ; Santos, V. ; Monteiro, R.	EJS	2008	66
11	Impact of conservation tillage and organic farming on the diversity of arbuscular mycorrhizal fungi	Saele, V.; Aguilera, P.; Laczko, E.; Maeder, P.; Berner, A.; Zihlmann, U.; Van der Heijden, M.; Oehl, F.	SBB	2015	65
12	Formulation of lavandin essential oil with biopolymers by PGSS for application as biocide in ecological agriculture	Varona, S.; Kareth, S.; Martin, A.; Jose Cocero, M.	JOU	2010	62
13	Organic carbon pools in a Luvisol under agroforestry and conventional farming systems in the semi-arid region of Ceara, Brazil	Ferreira M., Stoecio M.; Xavier, F.; Oliveira, T.; Mendonca, E.; Araujo Filho, J.	SYS	2007	62
14	Soil enzymes, nematode community and selected physico-chemical properties as soil quality indicators in organic and conventional olive oil farming: Influence of seasonality and site features	Garcia-Ruiz, R.; Ochoa, V.; Vinegla, B.; Hinojosa, M.; Pena-Santiago, R.; Liebanas, G.; Linares, J. C.; Carreira, J.	APP	2009	60
15	Occurrence of <i>Fusarium</i> mycotoxins in Italian cereal and cereal products from organic farming	Juan, C.; Ritieni, A.; Manes, J.	FOO	2013	58

Source: Own creation based on WoS data. Abbreviations: Jou, journal; TC, Total Citations; AGR, Agricultural Systems; OCE, Oceanologica Acta; SOI, Soil & Tillage Research; WAT, Water Environment Research; AQU, Aquaculture, VET, Veterinary Microbiology, EUR, European Journal of Agronomy; REN, Renewable Agriculture and Food Systems; ECO, Agriculture Ecosystems & Environment; EJS, European Journal of Soil Biology; SBB, Soil Biology & Biochemistry; JOU, Journal of Supercritical Fluids; SYS, Agroforestry Systems; APP, Applied Soil Ecology; FOO, Food Chemistry.

TABLE 4. MOST PRODUCTIVE AUTHORS IN ORGANIC AGRICULTURE IN IBEROAMERICA

R	Authors	TPOA	PT	TP	H	TC	AC	Cou	Inst	Organic Agriculture Article	TCOAA
1	López-Alonso, M.	7	2.17	325	24	2,175	1,619	Esp	USC	Evaluation of organic, conventional and intensive beef farm systems: health, management and animal production	7
2	Sans, FX.	6	1.86	58	19	1,080	873	Esp	UB	Long-term feasibility of reduced tillage in organic farming	26
3	Miranda, M.	6	1.86	25	7	126	118	Esp	USC	Evaluation of organic, conventional and intensive beef farm systems: health, management and animal production	7
4	Bautista, PF.	6	1.86	12	2	2	4	Mex	UG	The experiences of the courses - farmer workshops for the organic agriculture	0
5	Rey-Crespo, F.	5	1.55	10	3	70	62	Esp	USC	Identifying sources of metal exposure in organic and conventional dairy farming	3
6	Mateus, N.	4	1.24	265	48	6,891	4,164	Por	UDP	Organochlorine Pesticide Residues in Strawberries from Integrated Pest Management and Organic Farming	39
7	Perea, J.	4	1.24	356	42	7,016	5,897	Esp	UC	Technical efficiency and viability of organic dairy sheep farming systems in a traditional area for sheep production in Spain	26
8	Landa, A.	4	1.24	256	42	5,676	4,368	Esp	UPB	Mycotoxins in maize grains grown in organic and conventional agriculture	10
9	Delerue-Matos, C.	4	1.24	301	37	6,251	5,076	Por	ISEDP	Organochlorine Pesticide Residues in Strawberries from Integrated Pest Management and Organic Farming	39
10	Ordas, A.	4	1.24	166	27	2,750	1,701	Esp	CSIC	Mycotoxins in maize grains grown in organic and conventional agriculture	10
11	Malvar, RA.	4	1.24	150	24	2,060	976	Esp	MBG	Mycotoxins in maize grains grown in organic and conventional agriculture	10
12	Revilla, P.	4	1.24	159	23	1,962	1,167	Esp	CSIC	Mycotoxins in maize grains grown in organic and conventional agriculture	10
13	Melero, S.	4	1.24	35	17	1,048	932	Esp	IIFAP	Chemical and biochemical properties of a clay soil under dryland agriculture system as affected by organic fertilization	77
14	Domingues, VF.	4	1.24	42	15	701	602	Por	ISEDP	Organochlorine Pesticide Residues in Strawberries from Integrated Pest Management and Organic Farming	39
15	Fernandes, VC.	4	1.24	52	15	666	554	Bra	URP	Organochlorine Pesticide Residues in Strawberries from Integrated Pest Management and Organic Farming	39

Source: Own creation based on WoS data. Abbreviations: TPOA, Total Publications of Organic Agriculture; PT, percentage based on the total of 322 articles; TP, Total Publications; H, H Index; TC, Total Appointments; AC, Articles in which it is cited; Inst, Institution; TCOAA, Total Citation of Organic Farming Articles; USC, Universidad de Santiago de Compostela; UB, Universidad de Barcelona; UG, Universidad de Guadalajara; UDP, Universidade de Porto ; UC, Universidad de Cordoba; UPB, Universidad del País Vasco; ISEDP, Instituto Superior de Engenharia Do Porto; CSIC, Consejo Superior de Investigaciones Científicas; MBG, Misión de Biológica de Galicia; IIFAP, Instituto de Investigación y Formación Agraria y Pesquera; URP, Universidade de Ribeirao Preto.

3.4. Country analysis

According to Table 5, Spain is the Latin American nation with the highest H index and with the highest number of publications on organic agriculture. In second and third place are Brazil and Mexico respectively.

TABLE 5. TOP 10 OF THE MOST INFLUENTIAL COUNTRIES IN THE RESEARCH OF ORGANIC AGRICULTURE IN IBEROAMERICA.

R	Countries	TPOA	PT	HOA	TCOA	ACOA
1	España	142	44.10	29	2,412	2,222
2	Brasil	97	30.12	19	1,092	1,047
3	México	45	13.98	13	569	527
4	Portugal	15	4.66	9	261	252
5	Costa Rica	7	2.17	6	114	110
6	Venezuela	8	2.48	6	105	98
7	Argentina	8	2.48	5	313	309
8	Chile	8	2.48	3	127	127
9	Ecuador	5	1.55	2	29	29
10	Perú	3	0.932	2	19	19

Source: Own creation based on WoS data. Abbreviations: TPOA, Total Publications of Organic Agriculture; PT, percentage based on the total of 322 articles; HOA, H Index of Organic Agriculture; TCOA, Total Citations of Organic Agriculture; ACOA, Articles in which Organic Agriculture is Cited.

3.5. Analysis by institutions

Table 6 reveals that the Higher Council for Scientific Research by its acronym CSIC, has the highest number of publications on organic agriculture with a total of 26, an H index of 14 and a total of 654 citations. While the second institution is the Brazilian Agricultural Research Corporation (CBIA) with a total of 20 publications, an H index of 11, and a total of 451 citations in organic agriculture.

TABLE 6. MOST INFLUENTIAL INSTITUTIONS IN ORGANIC AGRICULTURE RESEARCH IN IBEROAMERICA

R	Institutions	TPOA	PT	H	TCOA	ACOA
1	CSIC	26	8.08	14	654	615
2	CBIA	20	6.21	11	451	448
3	UB	15	4.66	9	345	337
4	USC	14	4.35	4	99	96
5	UC	11	3.42	8	206	179

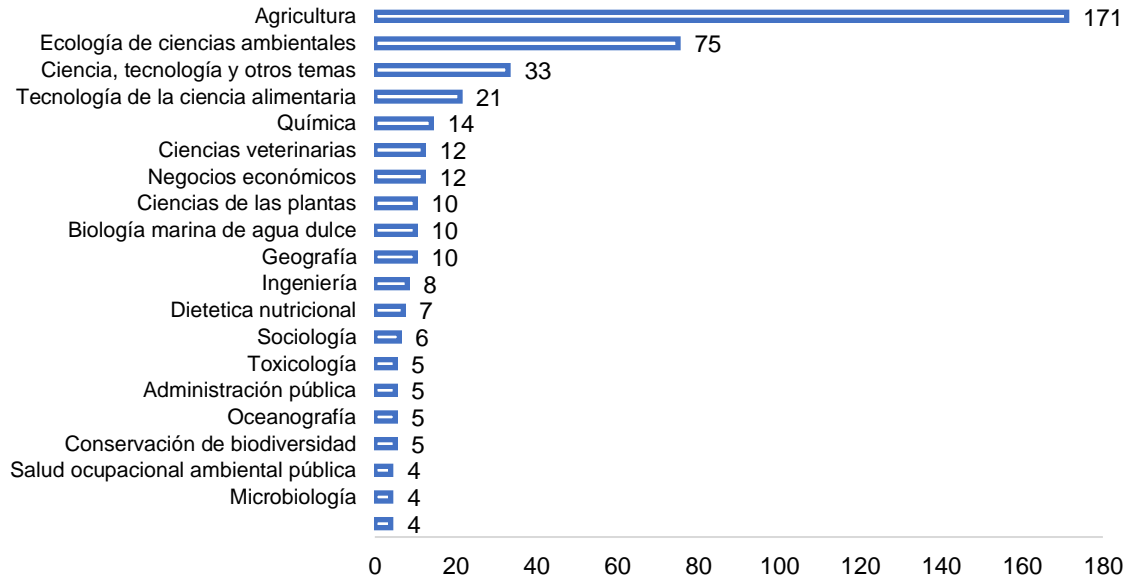
6	IITA	10	3.11	7	218	205
7	USP	10	3.11	5	148	148
8	UEP	9	2.80	4	65	64
9	UFC	8	2.48	5	181	180
10	UNAM	8	2.48	5	144	144
11	UFRGDS	8	2.48	4	50	49
12	UFSC	7	2.17	5	44	41
13	UPO	6	1.86	4	163	157
14	UFV	6	1.86	4	134	133
15	UFDP	6	1.86	4	135	122

Source: Own creation based on WoS data. Abbreviations: TPOA, Total Publications of Organic Agriculture; PT, percentage based on the total of 322 articles; H, H Index; TCOA, Total Citations of Organic Agriculture; ACOA, Articles in which Organic Agriculture is Cited; CSIC, Consejo Superior de Investigaciones Científicas; CBIA, Corporación Brasileña de Investigación Agropecuaria; UB, Universidad de Barcelona; USC, Universidad de Santiago de Compostela; UC, Universidad de Córdoba; IITA, Instituto de Investigación y Tecnología Agroalimentaria; USP, Universidad de Sao Paulo; UEP, Universidad Estadual Paulista; UFC, Universidad Federal de Ceará; UNAM, Universidad Nacional Autónoma de México; UFRGDS, Universidad Federal de Rio Grande Do Sul; UFSC, Universidad Federal de Santa Catarina; UPO, Universidad Pablo de Olavide; UFV, Universidad Federal de Vicosa; UFDP, Universidad Federal Do Piauí.

3.6. Analysis by research areas

Graph 2 shows the main research areas that the methodical search has yielded. The area that occupies the first place is agriculture, with 171 publications on organic agriculture, which represents 53% of the total. This area has an H index of 27 and has been cited 2,424 times in 2,222 articles. The article within the area of agriculture that has the highest average of citations per year is “Organic farming and the sustainability of agricultural systems” (Rigby & Cáceres, 2001) with an average of 13.42. Regarding the economic business area, the total number of publications is 17; its H index is 7, being 235 times cited in 225 articles. The article with the highest average number of citations per year (5.18) is “A Ricardian Analysis of the Distribution of Climate Change Impacts on Agriculture across Agro-Ecological Zones in Africa” (Lippert, Krimly & Aurbacher, 2009).

GRAPH 2. RESEARCH AREAS OF ORGANIC AGRICULTURE IN IBEROAMERICA BY TOTAL PUBLICATIONS



Source: Own creation based on WoS data.

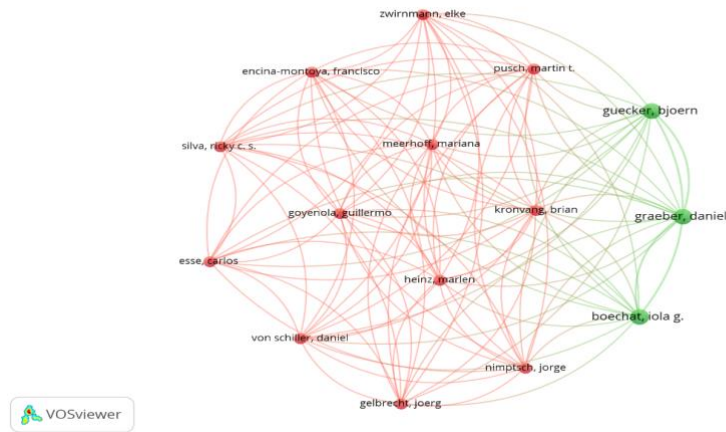
3.7. Bibliometric network analysis

To graphically visualize the information obtained with the present study, the VOSviewer software was used, which is a tool used to build and visualize bibliometric networks. In general, some of the most popular networks are: co-authorship by authors, organizations, and countries; co-occurrence of keywords, keywords by author and keywords plus; citation for documents, resources, authors, organizations and countries; bibliographic coupling by documents, resources, authors, organizations and countries; co-citation by cited references, cited resources and cited authors (Van Eck & Waltman, 2013).

The co-citation by authors shows those authors who cite each other, those spheres that have the largest size are those authors with the highest co-citation. In Figure 1, the selection was refined based on the 322 articles selected with a minimum of 1 article

and at least 20 global citations, the result yielded 378 researchers who meet these conditions. The authors with the highest representation in Latin America are Graeber Daniel from Germany from the UFZ Helmholtz Ctr Environm Res, with an H index of 14, a total of 952 articles cited, and 783 cited articles; Guecker Bjoern from the Universidade Fed Sao Joao del Rei in Brazil with an H index of 15 and 649 for articles cited; Boechat lola G from the Universidade Fed Sao Joao del Rei in Brazil, with an H index of 12 and 425 for articles cited (WOS, 2019). The articles in which the three researchers appear as authors are “Global effects of agriculture on fluvial dissolved organic matter” with 25 citations; and “Urbanization and agriculture increase exports and differentially alter elemental stoichiometry of dissolved organic matter (DOM) from tropical catchments”, with 10 citations.

FIGURE 1. CO-CITATION BY AUTHORS IN IBEROAMERICA

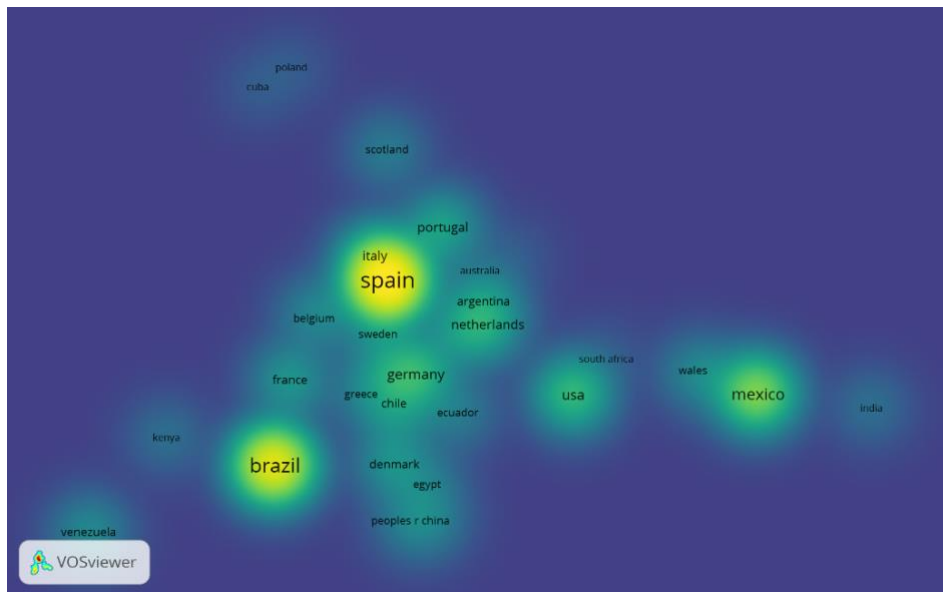


Source: Own creation in VOSviewer, based on WoS data.

In the heat map of co-citation by countries belonging to Ibero-America (Figure 2) a greater concentration is observed in the yellow spheres, identifying Spain, Brazil, and Mexico, the result of which coincides with the analysis of the countries with more research. on organic agriculture. The

countries that tend towards the blue color with less coitus are Chile, Ecuador, Argentina, and Portugal, Cuba and Venezuela also appear, but further away and colored blue, which means they have co-citation but to a lesser degree.

FIGURA 2. CO-CITATION BY COUNTRIES



Source: Own creation in VOSviewer, based on WoS data.

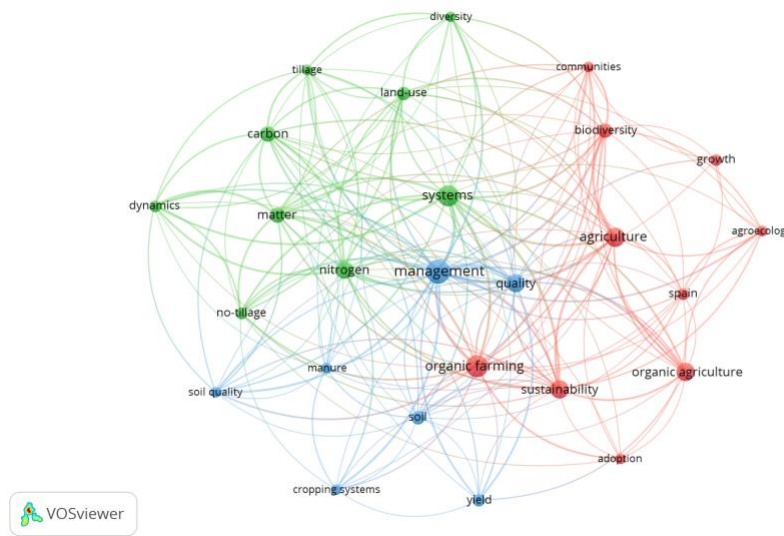
In figure 3 a refinement of 10 occurrences of the keywords is made, resulting in 26

words of which all are included in the analysis. The keyword co-occurrence map

shows the clusters that are formed by color. The green cluster is made up of the words: diversity, tillage, land-use, carbon, dynamics, matter, systems, nitrogen, and no-tillage. Regarding the blue cluster, the keywords that make it up are management, quality, manure, soil quality, soil, cropping systems, and yield. From the red cluster, they are communities, biodiversity, growth, agroecology, agriculture, Spain, organic agriculture, sustainability, organic farming, adoption, and organic agriculture.

agriculture, Spain, organic agriculture, sustainability, organic farming, organic agriculture, and adoption. The most relevant keywords are those whose size is larger, therefore, the most representative word is management; which is followed by the keywords: systems, nitrogen, quality, sustainability, organic farming, agriculture, and organic agriculture.

FIGURE 3. CO-OCCURRENCE OF KEYWORDS

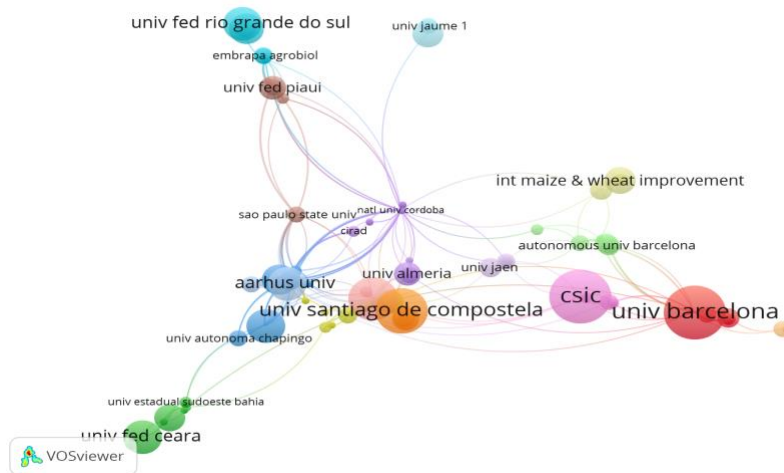


Source: Own creation in VOSviewer, based on WoS data.

Figure 4 presents an analysis of the citation between organizations or institutions. The selection was made by refining the 322 pre-selected articles of those authors who had a minimum of 1 article and at least 10 global citations, the result yielded 42 organizations that meet these conditions. The University of Barcelona is the most representative institution with 88,654 articles, this corroborates the position of Spain within the field of research as the main country in Latin America in research on

organic agriculture. Other institutions that stand out in the study are the CSIC and the University of Santiago de Compostela. In addition to the Fed Ceara University, the Autonomous University of Chapingo, and the Fed Rio Grande Do Soul University. The foregoing reflects that those countries whose economic development is greater generate greater production in the field of organic agriculture, and, therefore, in scientific research.

FIGURE 4. CITATION OF ORGANIZATIONS



Source: Own creation in VOSviewer, based on WoS data.

4. DISCUSSION

The presence of Spain in scientific production on organic agriculture in Latin America is of great relevance, since, in addition to being a pioneer in Latin America on research on this topic; According to the results obtained, by authors, institutions, and countries, it occupies the first places due to its high productivity.

Organic agriculture research is developed by farmers themselves, as researchers from Mediterranean European countries, including Spain, were not interested in organic agriculture until the late 1980s. Before that, some individual initiatives provided some studies on environmental problems caused by conventional farming systems. Organic research in Spain began in the early 1990s, with some isolated projects promoted by individual initiatives carried out by researchers, most of whom were members of the Spanish Society of Ecological Agriculture SEAE. This private association is created with the main objective of providing scientific support to the organic agriculture

sector (Organic Europe, 2008). The above coincides with the year of the first publication in Latin America registered in WOS.

The Spanish Society of Ecological Agriculture (SEAE) was created in 1992 as a private association. It is mainly made up of consultants, educators, researchers, but it also has members as organic operators. SEAE is a not-for-profit, offers national organic training and professional education, and provides scientific and technical support to organic farmers (SEAE, 2019).

Figure 4 shows that the CSIC is one of the most representative organizations that has the Institute for Sustainable Agriculture (IAS). The IAS was established in 1992 as a unique research center within the CSIC's mission in agricultural research. His specific focus is the study of agricultural systems in Andalusia, Spain, such as drylands and irrigated herbaceous crops and olive trees, to harmonize food production with the conservation of natural resources and the protection of the environment. This is the mission statement presented by the IAS and

endorsed by the CSIC at the time of its establishment when research aimed at the economic and social needs of the region was identified as the main objective. It currently has 20 research groups and 177 projects in execution (CSIC, 2019; IAS, 2019).

In addition to being Spain the first country in Latin America with the greatest scientific activity, it is also the number of hectares dedicated to organic agriculture in Europe with 2,082,173 hectares (Eurostat, 2017). In terms of regions, Andalusia has 46.8% of the total area in Spain dedicated to organic farming, while Castilla-La Mancha follows with 18%, and Catalonia with 10% (FWS, 2019).

The influence that Spain has had on other Latin American countries for research on organic agriculture can be confirmed by the number of citations to authors whose origin is Spanish.

5. CONCLUSIONS

According to the results obtained, it is concluded that the objective of the present study, which consisted in carrying out a bibliometric analysis of the scientific dissemination of topics related to organic agriculture in Ibero-America during the period 1980 - 2018, has been achieved through the different analyzes carried out, the conclusions of which are described in the following paragraphs.

The highest productivity of publications in Ibero-America has been registered in the last 11 years, whose trend shows growth with some ups and downs, being 2015 the year in which the largest number of publications were registered with a total of 37; Globally, 2018 is the year that presented the largest number of publications with a record of 273.

The growing evolution of publications focused on organic agriculture research is due to the attention of the scientific community to address safety problems of food and environmental degradation, as well as the growing world demand for this type of food.

The journal with the highest number of publications is the Spanish Journal of Agricultural Research (SJAR) Formerly known as "Investigación Agraria", the SJAR merged in 2003 from two series: "Vegetable Production and Protection" and "Animal Production and Health". founded in 1985. Its predecessor is "Annals of the National Institute of Agronomic Research", published for the first time in 1952 and its editor is the National Institute of Agricultural and Food Research and Technology (INIA) located in Madrid, Spain (SJAR, 2019) The journal that published the first research on organic agriculture in Latin America is Landscape and Urban Planning The most cited article in Latin America, with 252 citations is "Organic farming and the sustainability of agricultural systems" (Rigby & Cáceres, 2001).

The author with the highest number of publications is López-Alonso, M. affiliated with the University of Santiago de Compostela in Spain. The most cited article on organic agriculture by López-Alonso, M. is "Evaluation of organic, conventional and intensive beef farm systems: health, management and animal production" (Blanco-Penedo et al., 2012), for its part, The author with the highest H index is from Mateus, N. from the University of Porto, Department of Chemistry and Biochemistry, in Portugal. The most cited article on organic agriculture by Mateus, N. is "Organochlorine Pesticide Residues in Strawberries from Integrated Pest Management and Organic

Farming” (Fernandes, Domingues, Mateus, & Delerue-Matos, 2011).

Concerning to institutions, the Higher Council for Scientific Research by its acronym CSIC has the largest number of publications on organic agriculture. The CSIC's most cited article is “Pathways Disrupted in Human ALS Motor Neurons Identified through Genetic Correction of Mutant SOD1 ”(Kiskinis et al., 2014) with an average number of citations per year of 29.83 (WoS, 2019). According to the Scimago Institutions Rankings, the CSIC is positioned as the 7th public research institution. Worldwide, it ranks 21st among public and private research institutions around the world, it is the 1st research institution in Spain, the 4th public research institution in Western Europe, and the 6th public or private research institution in Spain Western Europe (SCIMAGO, 2019).

The area that occupies not only the first place it is agriculture. In addition, it is the area that represents 53% of the total publications on organic agriculture with a total of 171 publications. Regarding the area that is in second place is that of Ecology of environmental sciences with 23% of total publications and the area of Science, technology and other topics with 10% of total publications occupying third place.

The authors with the highest co-citation are the German Graeber Daniel from the UFZ Helmholtz Ctr Environm Res, and the Brazilians Guecker Bjoern from the Fed Sao Joao del Rei University, and Boechat lola G from the Fed Sao Joao del Rei University.

The study of organic agriculture is mostly related to keyword management. The translation of the word "management" depends on the context in which it is used, in

the case of the search results for "management agriculture organic" it does not refer to the translation as "management" or "administration" but to action management". The keyword "Spain" is also important, since not only the author with the highest number of Spanish publications but also Spain is the country with the highest number of publications on organic agriculture, as well as the highest H index.

The present study was limited to carrying out a bibliometric analysis on the publications focused on Organic Agriculture, leaving aside the causes of the ups and downs identified during the study period, so it is recommended for future research to analyze their possible reasons.

Likewise, the bibliometric analysis was limited to analyzing Latin America, therefore, for future research; the research could be replicated globally. Additionally, the topics covered by the main journals and articles mentioned, the statistics of the main countries, could be reviewed in greater depth and this analysis could be complemented with other scientific databases.

The implications for the scientific community on the findings obtained in this research focus on glimpsing the growing need to conceive of organic agriculture as a production system of which it is imminent to carry out various investigations from different perspectives, approaches, and disciplines given the problems ecological, environmental, health, market, etc. that can help solve.

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