

PERSONAL DATA

Name and Surname	Carlos Garcia Izquierdo		NIF: 22442536X
Researcher identification number	Researcher ID	F-9452-2011	
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Current Professional Activity

Institution	Spanish National Research Council (CSIC).		
Dept./Centre	Centro de Edafología y Biología Aplicada del Segura (CEBAS) (Dept. of Soil and Water Conservation and Organic Waste Management)		
Address	Campus Universitario, Apdo. 164, 30100-Espinardo (Murcia)		
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Professional Category	Professor of Research of CSIC	Start date	2003
UNESCO spec. ref.	Soil Science: 251104; Soil Fertility: 310313.		
Keywords	<i>Organic wastes; waste recycling; composting; organic waste valorisation; organic amendment; semiarid soils; soil organic matter; soil degradation; soil quality and protection; soil enzymology; bioremediation of degraded soils; soil functionality</i>		

NUMBER INDICATORS FOR C Garcia (SCIENTIFIC QUALITY AND PRODUCTION).

- Spanish Ministry evaluations of research productivity:** “Sexenios” (Six-year periods of productivity): 5; “Quinquenios” (five-year periods): 6; (date of the last six-year period evaluated: 2011).
- H Index: 55** (ISIWeb) (C Garcia; address: CEBAS OR SEGURA); **h Index = 73** in Google Scholar.
- Total citations: 8900** in ISIWeb, and 18490 in Google Scholar.
- Total indexed scientific publications: 212** (142 in the first quartile).
- In more than 75% of his scientific publications**, C Garcia is the 1st or last author, indicating his significant level of contribution to the papers.
- Search systems worldwide:** ISI Web of Science for C Garcia: for Organic Wastes = 8st of 47949 records; for Organic Amendments = 1rd of 8801 records; for Soil Organic Matter = 11th of 57888 records.
- Responsible researcher** in National and Regional projects (Group of Excellence leader of the Seneca Foundation) and several Special Actions. Dr. Garcia has also been the Spanish researcher leader (leader of WP interest) in 14 European projects (Framework Programs VI and VII, LIFE Programs).

FUNDING OBTAINED IN THE LAST FIVE YEARS:

- The research group** of CEBAS-CSIC lead by Dr. Garcia has obtained about **3.5 million euros** in funding in the last 5 years.
- 80% of the funding** was directly managed by Dr. Garcia.
- Diversification** of the funds obtained: over **600,000 euros** were obtained from company contracts, and **1.5 million euros** from various European programs, particularly LIFE Projects.

RESEARCH LINES. Dr. Garcia has carried out basic and applied research focussed on the **ORGANIC WASTE—SOIL binomial** with the aim of generating new soil organic matter using organic amendments from high quality organic waste. His research lines include the following components:

- i) The valorisation of quality organic waste (after treatment) (From Waste to Resource).
- ii) Soil protection, conservation and sustainability: the goal here is to improve our understanding of the mechanisms governing the processes of soil degradation and recovery in semiarid conditions.
- iii) Strategies to combat land degradation in arid environments through the use of organic amendments from quality organic wastes; this involves both the aerobic and anaerobic stabilisation of organic waste.
- iv) New tools (e.g., proteomics) for Soil Science.
- v) Agriculture and the environment, for sustainable production.

Significance of the research: The use of organic fertilizers based on organic waste (after treatment and when the quality of the organic waste is acceptable) is necessary to improve the fertility and productivity

of soils and thus prevent degradation. This research is highly regarded by regional, national and European administrations, as well as by society in general.

A REFERENCE IN SCIENCE

1) A reference in studies on organic waste and its valorisation: "THE CONVERSION OF WASTES TO RESOURCES". 2) A reference in studies on the problematics of highly degraded semiarid soils and the recovery of such soils by adding exogenous organic matter to avoid degradation. 3) A reference in research on quality indices and the enzymology of soils in semiarid environments and in the proteomics of semiarid soils, key for the future.

INTERNATIONAL PROJECTION: a) Specialisation in the "Biochemistry of soil and organic waste" and in soil bioremediation processes in Italy (1990-1991). b) Spanish leader in several research projects within the EU framework programs in the field of the Environment and Agriculture (STREP, CRAFT, LIFE, INCO). c) Collaboration (and scientific publications) with foreign researchers from the following countries: Germany (Drs. Kandeler, Richnow); Austria (Dr. Insam); Italy (Drs. Nannipieri, Senesi, Masciandaro); and Switzerland (Dr. Six). d) Bilateral participation in joint projects with Germany, Italy and others countries. e) Active participation in LIFE Projects: 9 projects since 2008, with 1.5 million euros of funding, LIFE ENVIRON.

TRANSFER:

--The research carried out by Dr. Garcia is of interest to different companies that *are working in the* environment, waste and fertilizer sector.

--Contracts with: REPSOL-OIL, CESPA-FERROVIAL, SOREIN-CECHINI TECNO, EMUASA, FERTINAGRO.

--2 licensed patents: i) *Tricoderma hartzianum* as biopesticide; ii) phosphatase into fertilizers

--1 spin-off generated under the CSIC (Microgaia Biotech) on suppressive compost soil pathogens.

TRAINING CAPACITY:

--Dr Garcia has formed a powerful research group, now together since 1996. He currently has 6 staff researchers, 1 R & D researcher, 7 technicians (5 of them hired), and pre-doctoral personnel.

--Dr. Garcia has directed 16 Doctoral Theses, two of them abroad. He has been a professor at the Master's and Doctoral degree levels and has been the director of several PhD theses.

RESEARCH MANAGEMENT: Director of CEBAS-CSIC from 2005-2009. Member of the Commission of Agricultural Science Area between 2006-2010; Coordinator of all the Institutes of Agricultural Sciences of CSIC between 2010-2012 and 2013-2014. Institutional Coordinator of CSIC in the Region of Murcia since 2007.

SUMMARY CV. Carlos Garcia Izquierdo has been a Professor of Research of the Spanish National Research Council [*Consejo Superior de Investigaciones Científicas* (CSIC)] since 2003. He is currently working in the Centre for Soil Science and Applied Biology of the Segura [*Centro de Edafología y Biología Aplicada del Segura* (CEBAS-CSIC)] of Murcia (Spain). He has belonged to the Department of Soil and Water Conservation and Organic Waste Management since 1989. His scientific work is based on a) the problem of highly degraded semiarid soils and strategies for their protection and rehabilitation; and b) the search for new sources of organic matter (amendments from properly sanitised organic waste). This second component was reinforced during a research fellowship in Italy (1990-1991) focussed on the biochemistry of soil and organic waste and on bioremediation processes. Dr Garcia has directed 16 PhD Theses, including 2 abroad, and has published more than 212 scientific papers in SCI journals of high impact (60% of them within Q1). His h-Index is as follows: 55 (ISI Web) and 73 (Google Scholar). He is also editor of four scientific books and has written numerous book chapters. He has been a leader of national projects funded by the Spanish state as well as of several regional projects. The research group lead by Dr Garcia has been selected as a Research Group of Excellence of the Region of Murcia (Seneca Foundation). Dr. Garcia has been the Spanish leader in 14 European projects (Framework Programs and LIFE projects). He also has extensive scientific management experience, having served as director of

CEBAS-CSIC, Scientific Coordinator of the CSIC Agricultural Science Area, and as a partner in national and regional research programs.

SCIENTIFIC IMPACT: Spain is one of the nations that is most conscious of the problem of land degradation and desertification due to the semiarid conditions in much of the country. For this reason, the scientific publications of Dr Garcia have had a significant scientific impact. In addition, the use of organic waste (when it is of high quality) as the base for organic amendments for improving soil fertility and productivity and thus preventing soil degradation has also had a significant scientific impact and can help regional, national and European administrations. Moreover, the research generated by Dr. Garcia has had a *major direct impact on the international scientific community*, as evidenced by his current indicators:

Some achievements due to this scientific impact: **i)** Regional, national and European funding for a powerful research group, Enzymology and Bioremediation of Soil and Organic Waste, which includes researchers who have been trained within Marie Curie European programs. **ii)** Creation of the Spanish Enzymology Group. **iii)** Participation in major research projects (CONSOLIDER, Regional Excellence Project). **iv)** Internationalisation with a high level of participation in European programs and joint scientific publications with foreign researchers. **v)** High quality scientific publications (**see h-index: 55 ISIWEB and 73 Google Scholar**).

TECHNOLOGICAL IMPACT OF DR. GARCIA'S RESEARCH. **i)** Improved stabilisation processes for organic wastes by aerobic and anaerobic means; sanitisation; **ii)** Implementation of new technology in the rehabilitation and protection of degraded soils in semiarid climates; the ability to recover and protect soils using exogenous organic amendments from quality organic waste (involving a one-time addition of such exogenous organic matter, of sufficient quality to recover soil functionality and fertility); **iii)** The routine use of new tools for measuring enzymatic activities involved in the cycles of elements of interest in the soil (N, P, C), and the significance of such activities in soil protection processes. and for interpreting the stabilisation of organic matter, has been key in understanding new paradigms for interpreting soil fertility. In the same vein, the use of proteomics to explain the functionality of our soils represents a clear technological advance in the field.

SOCIAL AND ECONOMIC IMPACT OF DR. GARCIA'S RESEARCH. Dr. Garcia's research is in high demand in many social sectors involved in organic waste production, soil protection and environmental health. The possibility of constructing new organic matter in soils by adding organic amendments based on organic waste offers a means to "get rid" of such waste in a rational, economical, and environmentally friendly way and is thus highly socially relevant. This fact, coupled with the social consciousness that exists today largely due to environmental groups, makes this research focussed on Soil Protection and systems for "recycling" waste even more pertinent. Another argument for the social relevance of our research lies in its potential application in the field of organic or conservation agriculture, particularly given the current social demand for food produced by this kind of agriculture. It is important to keep in mind that global change will certainly produce new scenarios and climate trends that will change the dynamics of ecosystems such as soil. In this context, Dr. Garcia's line of research is also important and relevant, for his work contributes to fixing C in the soil, thus mitigating the greenhouse effect. Furthermore, the **economic impact** of soil protection (avoiding soil desertification) and of valorising organic waste is highly important and can lead the way towards a circular economy.

OTHER ACTIVITIES: Founder of the Spanish Group of Soil Enzymology and President between 1998 and 2005. Chair of the Soil Biology Section within the Spanish Society of Soil Science since 2010. Professor of Master's and Doctoral courses at the University of Murcia and teacher of summer courses at other universities. Invited speaker at conferences in Spain and abroad. Academician of the Academy of Sciences of the Region of Murcia. Member of the American Society of Soil Science and of the

International Humic Substances Society. Member of the editorial board of the best scientific journals of Soil Science and the Environment.

NOTABLE ACTIVITIES: **i)** CSIC Institutional Scientific management: Director of CEBAS-CSIC for four years (2005-2009). Member of the Commission of the Agricultural Science Area of CSIC since 2006. Coordinator of this Commission for two different periods: 2010-2012 and 2013-2014 (supporting collaboration between agriculture and the environment: neither should live without agriculture nor should agriculture conflict with the environment). Institutional Coordinator of CSIC in the Region of Murcia since 2007. **ii)** State-level Management: Expert for the Ministry of Agriculture and the Environment. Expert collaborator in the management and evaluation of different research programs such as EXPLORE. **iii)** Expert contributor in the implementation of regulations for sludge use in the Region of Murcia. **iv)** Coordinator of Agriculture and Forestry in the National Research Agency from June, 2018.

DISSEMINATION AND OUTREACH: Regular contributor to meetings for farmers and agricultural associations to raise awareness of the importance of protecting the soil and to promote the rational application of organic amendments based on organic waste. Newspaper articles at the dissemination and divulgation level.