

# SPANISH JOURNAL OF AGRICULTURAL RESEARCH

Formerly known as "Investigación Agraria" the SJAR merged in 2003 from two series: "Producción y Protección Vegetales" and "Producción y Sanidad Animales" founded in 1985, the predecessor of which was "Anales del Instituto Nacional de Investigaciones Agronómicas", first published in 1952.

## EDITORIAL BOARD

### Chief Scientific Editors

PLANT SCIENCE. **Fernando Ponz Ascaso**. INIA, Madrid. fponz@inia.es  
ANIMAL SCIENCE. **Antonio López Sebastián**. INIA, Madrid. alopezs@inia.es  
AGRICULTURAL ECONOMICS AND ENGINEERING. **Carmen de Blas Beorlegui**. INIA, Madrid. cblas@inia.es

### Managing Editors

**Victoria Baonza Merino**. INIA, Madrid (Spain). baonza@inia.es  
**Carmen de Blas Beorlegui**. INIA, Madrid (Spain). cblas@inia.es

### Technical Editor

**Gemma Pérez Rivera**. INIA, Madrid (Spain). publinia@inia.es

### AGRICULTURAL ECONOMICS

SECTION EDITOR: **Fernando Vidal** (UMH, Orihuela, Alicante, Spain) fvidal@umh.es

ASSOCIATE EDITORS: **Jesús Barreiro** (FAO, Roma, Italy). **Julio Berbel** (UCO, Córdoba, Spain). **Margarita Brugarolas** (UMH, Orihuela, Alicante, Spain). **Carlos Romero** (UPM, Madrid, Spain). **Baldomero Segura** (UPV, Valencia, Spain).

### AGRICULTURAL ENGINEERING

SECTION EDITOR: **Francisco Rovira** (UPV, Valencia, Spain) frovira@dmia.upv.es

ASSOCIATE EDITORS: **Carlos J. Alvarez** (USC, Santiago de Compostela, Spain). **Emilio Gil** (UPC, Castelldefels, Barcelona, Spain). **Julio Mosquera** (Wageningen UR Livestock Research, Wageningen, The Netherlands). **Victor Sanchez-Giron** (UPM, Madrid, Spain).

### AGRICULTURAL ENVIRONMENT AND ECOLOGY

SECTION EDITOR: **Ismael Aranda** (INIA, Madrid, Spain) aranda@inia.es

ASSOCIATE EDITORS: **Alvaro Alonso Fernandez** (UAH, Alcalá de Henares, Spain). **Eustaquio Gil-Pelegrin** (CITA, Zaragoza, Spain).

### ANIMAL BREEDING, GENETICS AND REPRODUCTION

SECTION EDITOR: **Manuel Baselga** (UPV, Valencia, Spain) mbaselga@dca.upv.es

ASSOCIATE EDITORS: **Josep M. Folch** (CRAG, Campus UAB, Barcelona, Spain). **Eva Mocé** (IVIA, Valencia, Spain). **Julián Santiago** (INIA, Madrid, Spain). **Luis Varona** (U Zaragoza, Spain).

### ANIMAL HEALTH AND WELFARE

SECTION EDITOR: **Lorenzo Gonzalez** (AHVLA-Lasswade, Penicuik, Scotland, UK) lorenzo.gonzalez@ahvla.gsi.gov.uk

ASSOCIATE EDITORS: **José M. Blasco** (SIA, Zaragoza, Spain). **Mercedes Gomez** (UCM, Madrid, Spain). **Ramon A. Juste** (Neiker, Derio, Vizcaya, Spain). **Silvia Siso** (VLA, Edinburgh, Scotland, UK).

### ANIMAL PRODUCTION

SECTION EDITOR: **Clemente Lopez-Bote** (UCM, Madrid, Spain) clemente@vet.ucm.es

ASSOCIATE EDITORS: **Agustín Brenes** (CSIC, Madrid, Spain). **Dolores Carro** (U León, León, Spain). **Argimiro Daza** (UPM, Madrid, Spain). **Carlos J. Fernandez** (UPV, Valencia, Spain). **Fuensanta Hernandez** (UM, Murcia, Spain). **María Angeles Latorre** (U Zaragoza, Zaragoza, Spain). **Alfredo Teixeira** (Inst Politécnico Bragança, Portugal).

### PLANT BREEDING, GENETICS AND GENETIC RESOURCES

SECTION EDITOR: **Marcelino Perez de la Vega** (U Leon, Leon, Spain) m.perez.delavega@unileon.es

### Journal Editorial Office

**Emilia Redondo**, Servicio de Publicaciones-INIA. Autopista A-6, km 7.5. E-mail: sjar@inia.es. Phone: +34 91 347 39 15. Fax: +34 91 357 22 93

ASSOCIATE EDITORS: **Jose Maria Carrillo** (UPM, Madrid, Spain). **Maria José Diez** (UPV, Valencia, Spain). **Elisabetta Frascaroli** (U Bologna, Bologna, Italy). **Ernesto Igartua** (CSIC, Zaragoza, Spain). **Nicolas Jouve** (UAH, Alcalá de Henares, Spain). **Luis Navarro** (IVIA, Valencia, Spain). **Eduardo Rosa** (U Trás-os-Montes e Alto Douro, Vila Real, Portugal). **Raul de la Rosa** (IFAPA, Córdoba, Spain). **M. Isabel Vales** (ICRISAT, Patancheru, India).

### PLANT PHYSIOLOGY

SECTION EDITOR: **Jorge Casal** (UBA, Buenos Aires, Argentina) casal@ifeva.edu.ar

### PLANT PRODUCTION

SECTION EDITOR: **Luis Rallo** (UCO, Córdoba, Spain) agrlrallo@uco.es

ASSOCIATE EDITORS: **Luis Miguel Arregui** (UPNA, Pamplona, Spain). **Juan M. Caballero** (IFAPA, Córdoba, Spain). **Nicolás Castilla** (IFAPA, Granada, Spain). **Victor Galán-Saúco** (ICIA, Tenerife, Spain). **Helena Gómez Macpherson** (Instituto de Agricultura Sostenible, Córdoba, Spain). **Antonio Monteiro** (ISA Lisboa, Portugal). **Alfonso Pardo** (CIDA, La Rioja, Spain). **Maria Jesus Sánchez-Blanco** (CEBAS-CSIC, Murcia, Spain). **Rafael Socias** (CITA, Zaragoza, Spain).

### PLANT PROTECTION

SECTION EDITOR: **Mercedes Campos** (CSIC, Granada, Spain) mercedes.campos@eez.csic.es

ASSOCIATE EDITORS: **Miguel A. Aranda** (CSIC, Murcia, Spain). **Blanca Landa** (CSIC, Córdoba, Spain). **Inmaculada Larena** (INIA, Madrid, Spain). **Vicente Marco-Mancebon** (U La Rioja, Logroño, Spain). **Jose M. Peña-Barragan** (CSIC, Córdoba, Spain). **Enrique Quesada** (UCO, Córdoba, Spain).

### SOIL SCIENCE

SECTION EDITOR: **Rafael Espejo** (UPM, Madrid, Spain) rafael.espejo@upm.es

ASSOCIATE EDITORS: **Teresa Garcia-Gonzalez** (ICA-CSIC, Madrid, Spain). **Pedro Gonzalez-Fernandez** (IFAPA, Córdoba, Spain). **Chiquinquirá Hontoria** (UPM, Madrid, Spain).

### WATER MANAGEMENT

SECTION EDITOR: **Alejandro Perez-Pastor** (UPCT, Cartagena, Murcia, Spain) alex.perez-pastor@upct.es

ASSOCIATE EDITORS: **Diego Intrigliolo** (IVIA, Valencia, Spain). **Victoriano Martínez Álvarez** (UPCT, Cartagena, Murcia, Spain). **Alfonso Moriana-Elvira** (US, Sevilla, Spain). **Amos Naor** (Golan Res Inst, Qazrin, Israel).

## AIM AND SCOPE

The *Spanish Journal of Agricultural Research* (SJAR) accepts research articles, reviews and short communications of content related to agriculture. Research articles and short communications must report original work not previously published in any language and not under consideration for publication elsewhere.

SJAR is an international peer-reviewed journal. The main aim of SJAR is to publish papers that report research findings on the following topics: agricultural economics; agricultural engineering; agricultural environment and ecology; animal breeding, genetics and reproduction; animal health and welfare; animal production; plant breeding, genetics and genetic resources; plant physiology; plant production (field and horticultural crops); plant protection; soil science; and water management.

SJAR is indexed in **Science Citation Index Expanded** and **Scopus**. Additionally, in **Agrícola**, **Agris**, **Biosis**, **CAB Abstracts**, **CABI full text databases**, **Current Contents Connect** (Agriculture/Agronomy), **Dialnet**, **DOAJ** (Directory of Open Access Journals), **FSTA** (Food Science and Technology Abstracts), **Georef**, **Global Health**, **ICyT**, **Pascal**. It is also included in the following automated directories: **Jake**, **Latindex Catalogue**, **Redalyc** (*Red de Revistas Científicas de América Latina y El Caribe, España y Portugal*), **Ulrich's Periodicals Directory**.

SJAR is published quarterly (March, June, September and December) by the *Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria* [Spanish National Institute for Agricultural and Food Research and Technology] (INIA), Autopista A-6, km 7.5, Madrid, Spain.

## ALERT SERVICE

If you wish to receive by e-mail the table of contents with direct links to the respective article abstracts, whenever a new issue of SJAR appears, take advantage of our free Alert Service. To register, simply send an e-mail with the message "Subscribe SJAR" to publinia@inia.es.

## OPEN ACCESS JOURNAL

Full contents available online at [www.inia.es/sjar](http://www.inia.es/sjar)