

SPANISH JOURNAL OF AGRICULTURAL RESEARCH

Formerly «Investigación Agraria» Series «Producción y Protección Vegetales»
and «Producción y Sanidad Animales» (founded 1985)

EDITORIAL BOARD

Editors-in-Chief

Carmen de Blas Beorlegui (plant section). INIA. Ctra. Coruña, km 7.5. 28040 Madrid (Spain). cblas@inia.es

Antonio López Sebastián (animal section). Dept. Reproducción Animal. INIA. Ctra. Coruña, km 5.9. 28040 Madrid (Spain). alopez@inia.es

Managing Editor

Carmen de Blas Beorlegui. INIA.

Associate Editor-in-Chief for the Sociedad Española de Agroingeniería

Pilar Barreiro Elorza. LPF-TAG. ETSIA-UPM. Avda. Complutense, s/n. 28040 Madrid (Spain). pilar.barreiro@upm.es

Associate Editor-in-Chief for the Sociedad Española de Ciencias Hortícolas

Lorenzo Burgos Ortiz. CEBAS-CSIC. Apartado 164. 30100 Murcia (Spain). burgos@cebas.csic.es

Associate Editors

Manuel Abad (UPV, Valencia, Spain). **Ramón Albajes** (UDL, Lleida, Spain). **Ricardo Alberio** (INTA, Balcarce, Argentina). **Francisco Ayuga** (UPM, Madrid, Spain). **M. Luisa Badenes** (IVIA, Valencia, Spain). **Donald Baird** (U Stirling, UK). **Manuel Baselga** (UPV, Valencia, Spain). **Julio Berbel** (UCO, Córdoba, Spain). **Loys Bodin** (INRA, Castanet-Tolosan, France). **Agustín Brener** (CSIC, Madrid, Spain). **Vicente Caballer** (UPV, Valencia, Spain). **Rodolfo J.C. Cantet** (UBA, Buenos Aires, Argentina). **Angeles Cappa** (INTI, San Martín, Argentina). **Manuel Carrillo** (CSIC, Castellón, Spain). **Jorge Casal** (UBA, Buenos Aires, Argentina). **Pedro Castañera** (CSIC, Madrid, Spain). **Nicolás Castilla** (CIFA, Granada, Spain). **José M. Castro** (UCM, Madrid, Spain). **Paul Chen** (UCDavis, California, USA). **Julio Coll** (INIA, Madrid, Spain). **Dario Colombaro** (UBA, Buenos Aires, Argentina). **David Connor** (CSIC, Córdoba, Spain). **Alberto Escande** (INTA, Buenos Aires, Argentina). **Rafael Espejo** (UPM, Madrid, Spain). **Ricardo Fernández Escobar** (UCO, Córdoba, Spain). **Juan A. Fernández Hernández** (UPCT, Cartagena, Murcia, Spain). **Pilar de Frutos** (CSIC, León, Spain). **Jaime Gallegos** (Colegio Postgrados, Texcoco, Mexico). **Julian Garde** (UCLM, Albacete, Spain). **Lorenzo González** (Moremedum Res Inst, Midlothian, Scotland, UK). **Azucena Gracia** (CITA, Zaragoza, Spain). **George D. Hill** (Lincoln U, Canterbury, New Zealand). **Carmen Jarén** (UPNA, Navarra, Spain). **Nicolás Jouve** (UAH, Alcalá de Henares, Madrid, Spain). **Duane H. Keisler** (UMissouri, USA). **José M. Lasas** (CSIC, Zaragoza, Spain). **José López** (UH, Huelva, Palos de la Frontera, Spain). **Margarita Medina** (INIA, Madrid, Spain). **Paloma Melgarejo** (INIA, Madrid, Spain). **Gary Merkley** (USU, Utah, USA). **Angel Mingo** (UPNA, Navarra, Spain). **Inés Mínguez-Tudela** (UPM, Madrid, Spain). **Jaime Montalegre** (UChile, Santiago, Chile). **Francisco J. Montero** (UCLM, Albacete, Spain). **Mariano Muñiz** (CSIC, Madrid, Spain). **Luis Navarro** (IVIA, Valencia, Spain). **Fernando Nuez** (UPV, Valencia, Spain). **Amando Ordás** (CSIC, Pontevedra, Spain). **Luis Ortega** (UCM, Madrid, Spain). **Jaime Ortiz-Cañavate** (UPM, Madrid, Spain). **Koldo Osoro** (CIATA, Villaviciosa, Asturias, Spain). **Victoria Pablos** (INIA, Madrid, Spain). **Alejandra Palacio** (INTA Balcarce, Argentina). **Vicente Pallás** (UPV-CSIC, Valencia, Spain). **Alfonso Pardo** (CIDA, Logroño, Spain). **Leandro Peña** (IVIA, Valencia, Spain). **Marcelino Pérez de la Vega** (UL, León, Spain). **Enrique Playán** (CSIC, Zaragoza, Spain). **Carlos Quirós** (UCDavis, California, USA). **Carlos Ramos** (IVIA, Valencia, Spain). **Detlef Rath** (Inst Animal Sci, Mariensee, Neustadt, Germany). **Ignacio de los Ríos** (UPM, Madrid, Spain). **Carlos Romero** (UPM, Madrid, Spain). **Raul Rosadio** (CONOPA, Lima, Peru). **Salvador Ruiz** (UM, Murcia, Spain). **Domingo Salazar** (UPV, Valencia, Spain). **Luis F. Salazar** (CIP, Lima, Peru). **Julio Salinas** (CSIC, Madrid, Spain). **Fermín San Primitivo** (UL, León, Spain). **Federico San** (UPM, Madrid, Spain). **Francis Sevilla** (INP Toulouse, Castanet-Tolosan, France). **Vicente Sotés** (UPM, Madrid, Spain). **Manuel Talón** (IVIA, Valencia, Spain). **José V. Tarazona** (INIA, Madrid, Spain). **José M Tarjuelo** (CREA-UCLM, Albacete, Spain). **Alfredo Teixeira** (Inst Politécnico Bragança, Portugal). **José Torrent** (UCO, Córdoba, Spain). **Miguel Angel Valera** (BUAP, Puebla, Mexico). **Fernando Vidal** (UMH, Orihuela, Alicante, Spain). **Carmen Vizcayno** (CSIC, Madrid, Spain). **Lorenzo Zacarias** (CSIC, Burjassot, Valencia, Spain).

Journal Editorial Office

Servicio de Publicaciones-INIA. Autopista A-6, km 7.5. 28040 Madrid (Spain). E-mail: publinia@inia.es. Phone: +34 91 347 39 16. Fax: +34 91 357 22 93

AIM AND SCOPE

The Spanish Journal of Agricultural Research publishes research articles, reviews and short communications. Research articles and short communications must report original work not previously published in any language, nor under consideration for publication elsewhere.

After peer review and approval by the editorial board, SJAR publishes papers reporting research findings dealing with all aspects on production and health in plants and animals, such as genetics, breeding, organic, biological agriculture and sustainable production systems, apiculture, aquaculture, forages and pastures, plant and animal diseases, pests and weeds, epizootiology, immunology, parasitology, physiology, reproduction, management and food technology, natural and genetic resources, agricultural economics, rural engineering and mechanization, soils, fertilization, irrigation and watering, etc.

SJAR is indexed in **Agrícola**, **Agris**, **Biosis Previews**, **CAB Abstracts**, **CAB Health**, **CABI full text databases**, **Current Contents Connect** (discipline: Agriculture/Agronomy), **FSTA** (Food Science and Technology Abstracts), **Georef**, **Pascal**, **Science Citation Index Expanded**, **Thomson Scientific Web of Science**. It is also included in the following automated directories: **Jake**, **Latindex Catalogue**, **Latindex Directory**, **Ulrich's Periodicals Directory**. Recognised by the Cuban Academy of Sciences.

SJAR is published quarterly (March, June, September and December) by the Spanish National Institute for Agricultural and Food Research and Technology (INIA). Autopista A-6, km 7.5. 28040 Madrid (Spain).

ALERT SERVICE

If you wish to receive via e-mail, whenever a new issue of SJAR appears, the table of contents with direct links to the respective abstracts, 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