

Part A. PERSONAL INFORMATION

Part A. PERSONAL INFORMATION		CV date	11/09/2025
First name	José Manuel		
Family name	Colmenero Flores		
Gender (*)	Male	Birth date	15/11/1966
DNI	27300197W		
e-mail	chemacf@irnase.csic.es	https://www.irnas.csic.es/en/regulacion-ionica-e-hidrica-en-plantas-rih/	
Open Researcher and Contributor ID (ORCID)		0000-0001-9475-1187	

A.1. Current position (> 15 years of active service as a senior scientist at the CSIC)

Position	Investigador Científico (Scientific Researcher) of the CSIC		
Initial date	Started as CSIC Tenured Scientist on 15/08/2008		
Institution	Spanish National Research Council (CSIC)		
Department/Center	Plant Biotechnology	Institute of Natural Resources and Agrobiology	
Country	Spain	Teleph. Num.	+34-954624711 (208181)
Key words	Ion Homeostasis, Ion Transport, Chloride, Nitrate, Plant Nutrition, Water Balance, Abiotic Stress, Water Deficit, Salinity, Root		

A.2. Previous positions, Mobility and Internationalization

(> 7 years in pre- and post-doctoral international stays)

Period	Position/Institution/Country/Interruption cause
28/10/1997 - 01/01/1999	Associate Researcher from the Biotechnology Institute. National Autonomous University of Mexico (Mexico), and Commissioned at the Max Planck Institute for Plant Breeding Research, Koln, (Germany),
01/01/1999 - 30/06/2002	Head of the R&D Dept. / Plant Tissue Culture Lab. Private Sector (Spain)
01/07/2002 - 31/06/2007	Research Contract “Ramón y Cajal” Valencian Institute of Agricultural Research, IVIA (Spain) 3-month stay in the group of Dr. Anna Amtmann, Institute of Biomedical & Life Science, University of Glasgow (UK)
03/07/2007 - 14/08/2008	Deputy Scientific Collaborator. Unidad Mixta IVIA / Fundación Agroalimed. Consellería de Agricultura, Comunidad Valenciana (Spain)

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Licensed in Biological Sciences	University of Seville, Spain	1990
MsC in Biotechnology	Biotechnology Institute, National Autonomous University of Mexico, UNAM (Mexico)	1993
PhD in Biotechnology	Biotechnology Institute, UNAM (Mexico). 3-month stay in the group of Dr. P Zambriski, University of California, Berkeley (USA)	1997

Part B. CV SUMMARY

My research has focused on the interaction of plants with the environment in aspects such as water deficit, salt stress and mineral nutrition, using physiological, molecular and genomic approaches.

Leadership and Independence: As Senior Scientist at IRNAS (CSIC), **I created the “Plant Ion and Water Regulation-RIH” Group** (CSIC-891717), which currently includes a staff technician, 3 PhD students and a post-doc. To respond to numerous R+D+i demands from private companies and administrations, **I created** in 2015 **the Platform “Plant Crop Biotechnology Unit-UBCV”** (CSIC-824750), which currently includes a staff technician and a higher degree graduate. In 2019 together with Dr. Antonio Díaz Espejo (IRNAS, CSIC), **we created the “Interdepartmental Laboratory of Plant Molecular Ecophysiology-LEM”** to address research lines that require synergies between Physiological and Molecular approaches. **Since 2018, I am deputy director of IRNAS (CSIC).**

I have Managed a **budget of €4.0 million as Principal Investigator**, including: • 12 competitive national projects (≥ 3 years) • 26 R&D contracts with companies, totaling about €700 thousand • 29

contracts for research personnel from competitive public calls and projects, amounting > €1million • around 400 R&D services for Spanish companies and public administrations (CCAAAs, courts, Environmental Agencies, State security force-Seprona) with an approximate value of €450,000.00.

Training of research personnel: Supervised: • **6 PhD Theses + 1 in progress • 17 MsC Theses • 5 Bachelor's Theses/Undergraduate Final Projects.**

Collaborations with internationally renowned research groups: • **Drs. R Hedrich and D Geiger Group** (Plant Molecular Physiology and Biophysics, Würzburg University, Germany), participating in Project AGL2015-71386-R with a high-impact publication (Current Biology 2016, 26:2213–20) • **Drs. C Maurel and P Macry Group**, Biochemistry and Plant Molecular Physiology Unit, CNRS/INRA/SupAgro/UM (Montpellier, France), participating in Project RTI2018-094460-B-100 and 2 publications in preparation • **Dr. M Gilliam's Group** at the Waite Research Institute, University of Adelaide (Australia), participating in Project PID2021-125157OB-I00, including a 5-month stay in the "Plant Transport and Signalling Lab" in 2024.

Impact of Research lines (10 years): As a Senior Scientist at IRNAS (CSIC), our research group has led the way in understanding the biological functions of Chloride (Cl^-) in higher plants. These functions contribute to **increased plant efficiency in the use of water, nitrogen, and carbon**, essential components of plant nutrition (**1,2,3,4,6,9,12,13,14,17**). Contrary to established beliefs, we have demonstrated that Cl^- does not antagonize nitrate (NO_3^-) uptake in plants but rather reduces leaf NO_3^- content by enhancing its assimilation efficiency. Therefore, Cl^- holds significant agronomic potential yet to be fully explored, enabling: i) enhanced plant drought resistance; ii) reduced use of NO_3^- in agriculture and associated environmental damage (e.g., pollution of the Mar-Menor Sea in Murcia); iii) decreased NO_3^- content in plant tissues, mitigating serious health risks associated with excessive consumption, such as methemoglobinemia in infants and cancer in adults. This knowledge has expanded the definition of Cl^- to that of a **beneficial macronutrient** for higher plants, published as a chapter in the international reference book on plant nutrition (**3**). We are currently investigating the molecular regulation of Cl^- homeostasis. To achieve this, we have characterized different Cl^- transporters such as CCC1 (published in 2007), SLAH1, SLAH3 (**15**), and we are currently exploring the roles of SLAH4 and AtALMT10, as well as the **regulatory components involved in the control of net Cl^- uptake and NO_3^- vs Cl^- preference**, including NPF6.3, NAR2, LPT7, CIPK23, etc. These and other regulatory components determine the level of Cl^- accumulation in aerial organs, and this knowledge may be applied to develop salt-resistant crops in species sensitive to excessive Cl^- accumulation, such as citrus and grapevines (**10,13,16,19**).

In a different research line, we have surveyed and characterized a germplasm collection of wild olive trees with significant potential for **olive orchard breeding** (**5,7,8,11,15**).

Part C. RELEVANT MERITS (last 10 years) sorted by typology

C.1. Publications (last 10 years. **D1**, within 10% greatest impact, **Q1**, 25% greatest impact)

1. Peinado-Torrubia P, Franco-Navarro JD.... Álvarez R, **Colmenero-Flores JM** (2025). Plants maximise chloride uptake during early vegetative development to stimulate cell expansion, maturation of the photosynthetic apparatus, and growth. **Plant J**, 123(5), e70378 **D1**, **0 citations**
2. Lucas M, Diaz-Espejo A, Romero-Jimenez D, Peinado-Torrubia P, Delgado-Vaquero A, Álvarez R, Colmenero-Flores JM & Rosales MA (2024) Chloride reduces plant nitrate requirement and alleviates low nitrogen stress symptoms. **Plant Physiol Biochem** 212: 108717. **Impact Factor-2024 6,63** (9,1% in Plant Science) **D1**, **5 citations**
3. Peinado-Torrubia P, Álvarez R, Lucas M, Franco-Navarro JD, Durán-Gutiérrez FJ, **Colmenero-Flores JM** & Rosales MA (2023) Nitrogen assimilation and photorespiration become more efficient under chloride nutrition as a beneficial macronutrient **Front Plant Sci**, 13:1058774. **Impact Factor-2023 6,10** (8,3% in Plant Science) **D1**, **15 citations**
4. Cakmak I, Brown PH, **Colmenero-Flores JM**, Husted S, ... and Zhao FJ (2023). Micronutrients *In: Marschner's Mineral Nutrition of Plants* 4th Ed, Chapter 7. Rengel Z, Cakmak L and White P (Ed). Academic Press. **Text book, international benchmark in plant nutrition**, **57 citations**
5. Díaz-Rueda P, Peinado-Torrubia P, Durán-Gutiérrez FJ, Alcántara-Romano P, Aguado A, Capote N, & **Colmenero-Flores JM** (2022). Avoidant/resistant rather than tolerant olive rootstocks are more effective in controlling Verticillium wilt. **Frontiers in Plant Science** 13:1032489. **Impact Factor-2021: 7,1** (8,3% Plant Science) **D1 4 citations**
6. Franco-Navarro JD, Díaz-Rueda P, Rivero-Núñez CM, Brumós J, Rubio-Casal AE, de Cires A, **Colmenero-Flores JM** & Rosales MA (2021) Chloride nutrition improves drought resistance by

- enhancing water deficit avoidance and tolerance mechanisms. **J Exp Bot** 72:5246–5261. **Impact Factor-2021 7.38** (6.2% in Plant Sci) **D1 23 citations**
7. Díaz-Rueda P, Aguado A, Romero-Cuadrado L, Capote N, **Colmenero-Flores JM** (2021) Wild Olive Genotypes as a Valuable Source of Resistance to Defoliating *Verticillium dahliae*. **Front Plant Sci** 12(1253). **Impact Factor-2020 5.75** (8.1% in Plant Sci) **D1 11 citations**
 8. Díaz-Rueda P, Cantos-Barragán M, **Colmenero-Flores JM** (2021) Growth Quality and Development of Olive Plants Cultured In Vitro under Different Illumination Regimes. **Plants** 10:2214.). **Impact Factor** (2021) **4,658** 18,1% en Plant Sci año 2021 **Q1 9 citations**
 9. Rosales MA, Franco-Navarro JD, Peinado-Torrubia P, Díaz-Rueda P, Álvarez R, **Colmenero-Flores JM** (2020) Chloride Improves Nitrate Utilization and NUE in Plants. **Front Plant Sci.** 11(442). **Impact Factor-2020 5.75** (8.1% in Plant Sci) **D1 50 citations**
 10. **Colmenero-Flores JM**, Arbona V, Morillon R, Gómez-Cadenas A. (2020). Salinity and Water Deficit. In M. Talon, F. G. Gmitter, & M. Caruso (Eds.), *The Genus Citrus* (1st Ed, pp. 291–309). Woodhead Publishing Limited, Elsevier. **ISBN 9780128121634 20 citations**
 11. Díaz-Rueda P, Franco-Navarro JD, Messoria R, Espartero J, Rivero-Núñez CM, Aleza P, Capote N, Cantos M, García-Fernández, JL, de Cires A, Belaj A, León L, Besnard G, **Colmenero-Flores JM** (2020) SILVOLIVE, a Germplasm Collection of Wild Subspecies with High Genetic Variability as a Source of Rootstocks and Resistance Genes for Olive Breeding. **Front Plant Sci.** 11(629). **Impact Factor-2020 5.75** (8.1% in Plant Sci) **D1 27 citations**
 12. Franco-Navarro JD, Rosales MA, Cubero-Font P, Calvo P, Álvarez R, Diaz-Espejo A, **Colmenero-Flores JM** (2019) Chloride as a macronutrient increases water-use efficiency by anatomically driven reduced stomatal conductance and increased mesophyll diffusion to CO₂. **Plant J.** 99: 815-83. **Impact Factor-2019 6.14** (3.1% in Plant Sci) **D1** (13,0 citations/año) **74 citations**
 13. Nieves-Cordones M, García-Sánchez F, Pérez-Pérez JG, **Colmenero-Flores JM**, Rubio F and Rosales MA (2019) Coping with water shortage: an update on the role of K⁺, Cl⁻ and water transport mechanisms on drought resistance **Frontiers Plant Science** 10: 1619 **Impact Factor-2019 5.75** (8.1% in Plant Sci) **D1** (7,0 citations/year) **42 citations**
 14. **Colmenero-Flores JM**, Franco-Navarro JD, Cubero-Font P, Peinado-Torrubia P, Rosales MA (2019) Chloride as a Beneficial Macronutrient in Higher Plants: New Roles and Regulation **Int J Mol Sci** 20: 4686 **Imp Factor-2019 4.55** (54.5% in Bioch & Mol Biol) **Q2** (15,1 cit/year) **129 citations**
 15. Hernández-Santana V, Díaz-Rueda P, Diaz-Espejo A, Raya-Sereno MD, Gutierrez-Gordillo S, Montero A, Perez-Martin A, **Colmenero-Flores JM**, Rodriguez-Dominguez CM (2019). Hydraulic Traits Emerge as Relevant Determinants of Growth Patterns in Wild Olive Genotypes Under Water Stress. **Frontiers Plant Science** 10: 291 **Impact Factor-2019 5.75** (8.1% in Plant Sci) **D1 13 citat**
 16. Cubero-Font P, Maierhofer T, Jaslan J, Rosales MA, Espartero J, Díaz-Rueda P, Khaled AS, Al-Rasheid, Marten I, Hedrich R, **Colmenero-Flores JM** & Dietmar Geiger (2016) Silent S-Type Anion Channel Subunit SLAH1 Gates SLAH3 Open for Chloride Root-to-Shoot Translocation. **Curr Biol** 26:2213–20. **Impact Factor-2016 6.14** (6,5% en Biochem & Mol Biol 2016) **D1, 123 citations**
 17. Franco-Navarro JD, Brumós J, Rosales MA, Cubero-Font P, Talón M, **Colmenero-Flores JM**, Chloride regulates leaf cell size and water relations in tobacco plants (2016) **J Exp Bot** 67:873-891. **Impact Factor-2016 5.83** (6.6% in Plant Sci) **D1** (14,6 citations/año) **136 citations**
 18. Paneque M, De la Rosa JM, Franco-Navarro JD, **Colmenero-Flores JM**, Knicker H (2016). Effect of biochar amendment on morphology, productivity and water relations of sunflower plants under non-irrigation conditions. **Catena**, 147, 280–287. **Impact Factor-2016 3.19** (9.0% in Water Resources) **D1** (14,7 citations/año) **149 citations**

C.2. Congress (Total, 10 years: 22 International and 28 National Congress)

Invited Lectures:

1. “Chloride nutrition in plants: much more than a micronutrient” **Waite Campus of the University of Adelaide, Australia**, June 21 2024
2. “Chloride Uptake is Regulated by Nitrate Availability in Plants: Identification of Regulatory Components” **XVIII Spanish-Portuguese Congress Plant Biology**, Braga **Portugal** 9-12 July 2023
3. “Funciones del cloruro en la homeostasis hídrica y la resistencia a sequía en las plantas” Seminario de primavera **INAGEA 2023: New scientific and technological advances applied to agriculture and the environment**. Institut de Reserca Agroambiental i d’Economia de l’Aigua. Universidad de las Islas Baleares. **Spain**. July 17-18, 2023.

4. "The role of Chloride homeostasis on plant drought tolerance" **SEB Annual Main Meeting, Heat and Drought Tolerance - From the Lab to Impact in the Field**. Sevilla, Spain. July 2-5, 2019.
5. SILVOLIVE, a collection of wild olive genotypes as a source of resistance genes and rootstocks for olive grove cultivation. **VI International Conferences on the Olive Tree and Olive Products OLIVE BIOTECH'18**. Seville Spain, October 15-19, 2018.
6. "Chloride as a beneficial macronutrient in plants: biological functions and regulation. **Seminar Program, INRA/CNRS/SupAgro/ UM2 Montpellier, France**, June 23, 2016.

C.3. Competitive Research projects (10 years)

1. Characterization of Root Ionic Readjustment in Dry soil: a Key Mechanism for Plant Drought Adaptation, OsmoRoot" (PID2024-159116NB-I00). Proyectos de Generación de Conocimiento-2024, MICINN. Period: 01/09/2025 to 01/09/2028. Amount: €274,922. **PI: J. M Colmenero Flores**
2. Plant Nutrition, Ion and Water Homeostasis for Space Habitation. Research Stay at the "Plant Transport and Signalling" del Waite Research Institute, Universidad de Adelaida (Australia). Programa de Estancias de movilidad de investigadores senior en centros de investigación extranjeros, Ref: PRX22/00615. Period: 01/04/2024 to 31/08/2024. € 14.645,00. **PI: José M. Colmenero Flores**
3. Characterization of Chloride Homeostasis in Plants: Interaction with Nitrate, Regulatory Mechanisms and Agronomic Applications, AGRICHLOR (PID2021-125157OB-I00). PEICTI 2021-2023 MICINN. Period: 2022-2025. Amount: €169,400. **PI: José M. Colmenero Flores**
4. Regulation of plant development and crop management through chloride nutrition: a novel tool to improve water and nitrogen-use efficiency "CHLORPLANT" (Ref. 895613) EU Horizon 2020 Type of action: MSCA-IF-EF-CAR. Period 2020-2022. €258,300. **PI: Miguel A Rosales**
5. Chloride homeostasis: New Functions on Early Plant Development, Hydraulic Architecture, and Salinity Tolerance of Crops (RTI2018-094460-B-I00). State Plan for Scientific and Technical Research and Innovation. Period: 2019-2022. €157,300. **PI: José M. Colmenero Flores**
6. SILVOLIVE Operational Group. Wild rootstocks for olive cultivation: regulation of vigor, environmental factors, and emerging diseases (Ref. 20160020006629). FEDER-MAPAMA. Supra-regional Operational Groups Projects. Period 2018-2020. €587,145. **PI: José M. Colmenero Flores**
7. Chloride Homeostasis in Plants: Drought Resistance, Nitrate Interaction, and Molecular Characterization (AGL2015-71386-R). State Plan for Scientific and Technical Research and Innovation. Period: 2016-2018. €86,700. **PI: José M. Colmenero Flores**
8. Generation and identification of new varieties for use as rootstocks in the improvement of intensive olive cultivation (Ref. 20134R089). Recupera-2020 Program. FEDER-MINECO. Period: 2013-2015. €298,000. **PI: José M. Colmenero Flores.**

C.4. Contracts, technological or transfer merits (for all contracts **JM Colmenero is the PI**)

Total (10 years): 24 contracts totaling > €600 thousand. Most recent contracts are displayed below:

- Rescate de Embriones Híbridos de Frutales de Hueso de Maduración Tardía-2025 AGRO-SELECTIONS FRUITS SAS (France). 01/05/2025 - 31/01/2026 (Ref. CSIC-20254309). **€24,500.00**
- Mejoras Bioenológicas y Agronómicas para el uso Farmacéutico y Medicinal de Cannabis sativa. Company: TRICHOME PHARMA. 2024-2025 (Ref. CSIC-20250722). **€35,150.75**
- Assistance in the breeding of Medicinal *Cannabis sativa* Varieties through Biotech Procedures. R&D (Ref. CSIC-20226274). Company: TRICHOME PHARMA. 2022-2024. **€87,594.32**
- Rescue of Hybrid Embryos of Stone Fruit Trees of the Genus *Prunus*, 2021 (Ref CSIC-2020-5752). Company: AGRO-SELECTIONS FRUITS SAS (France). 01/05/2020 - 31/12/2021. **€37,908.00**
- Idem 2019 (Ref CSIC-2019-5634) 02/05/2019 - 02/01/2020. **€66,339.50**
- Idem 2018 (Ref CSIC-2018-4037) 07/05/2018 - 07/12/2018. **€60,979.16**
- Design and Development of a Technical Protocol for the Rescue of Hybrid Embryos of the Genus *Prunus*, 2017 (Ref CSIC-2017-4871) SAT FRUTARIA. 01/04/2017 - 31/12/2017. **€22,264.00**
- Idem 2019 (Ref CSIC-2019-5634) 02/05/2019 - 02/01/2020. **€66,339.50**
- Idem 2016 Campaign (Ref CSIC-2016-3748) **€19,093.80**
- Identification of Diploid Nucellar Lines and In-Vitro Cultivation Methods to Introduce Clonal Micropropagation of New Citrus Rootstocks. **€26,620.00**
- Idem 2016 (Ref CSIC-2016-3748) **€26,620.00**
- Improvement of Elite Stevia Varieties, Creation of a Germplasm Bank, and In-Vitro Clonal Multiplication Procedures (Ref CSIC-2015-2907) Company: AGROALIMENTARIA DEL SUR SA. From: 01/04/2015 to 31/12/2016 **€39,930.00**