

Advanced Course
INTEGRATED NUTRIENT MANAGEMENT: PRESENT CHALLENGES AND FUTURE OPPORTUNITIES. Zaragoza (Spain), 15-20 February 2027

Time	Monday 15	Tuesday 16	Wednesday 17	Thursday 18	Friday 19
9:15 - 10:15	1. Official opening Raúl Compés	3.1. Soil health implications in the Mediterranean region linked to INM Laura Martínez	4.1. Nutrient pathways from soil to plant Sawsen Ayadi	5.1. Coupling between irrigation, soil water status, nutrient mobility and crop uptake (rainfed and irrigated systems) Jorge Álvaro-Fuentes, Sawsen Ayadi	6.3. Methods and tools in INM research: long-term trials, tracers and isotopes, omics, modelling and decision-support tools Sergio Esposito
10:15 - 11:15	2.1 Definitions and scope of INM in relation to soil fertility management, plant nutrition and sustainable agriculture Sergio Atares	3.2. Physical, chemical and biological properties of Mediterranean soils: determination and relevance to nutrient dynamics (texture, density, CEC, pH, salinity, carbonates) Ruben Sakrabani, Laura Martínez	4.2. Transport, assimilation and remobilisation of nutrients within the plant; primary and secondary metabolic pathways Sawsen Ayadi, Sergio Esposito		
11:15 - 11:45	Coffee break				
11:45 - 12:45	2.2 Nutrient cycles (N, P, K and micronutrients) at plot, farm and territory scales. Nutrient balances Ruben Sakrabani	3.2. Physical, chemical and biological properties of Mediterranean soils: determination and relevance to nutrient dynamics (texture, density, CEC, pH, salinity, carbonates) Ruben Sakrabani, Laura Martínez	4.3. Relationships between mineral nutrition, enzyme activity, carbon and nitrogen allocation under Mediterranean stress Sawsen Ayadi, Sergio Esposito	5.2. Leaching, volatilisation, denitrification and runoff under variable rainfall, fire and extreme events Héctor Moreno	6.4. Final debate: Mediterranean case studies, final synthesis, political perspective (future and challenges), evaluation and closing session José Antonio Mayoral, Sawsen Ayadi, Sergio Atares, Ruben Sakrabani
12:45 - 14:00	Lunch				
14:00 - 15:00	2.2 Nutrient cycles (N, P, K and micronutrients) at plot, farm and territory scales. Nutrient balances Ruben Sakrabani	3.3. Role of organic matter in retention, buffering, aggregation and water holding capacity Jorge Álvaro-Fuentes	4.4. Plant-microbe interactions: rhizosphere, root exudates, beneficial symbioses and metabolic plasticity Alia Dellagi, Sergio Atares	5.3. Fertigation, deficit irrigation and precision water-nutrient tools and management; climate change impacts and implications for INM Alberto San Bautista	Lunch
15:00 - 16:00	2.3 Performance indicators: NUE, PUE, KUE, partial factor productivity and surplus indicators Sawsen Ayadi	3.4. Microbial communities as drivers of mineralisation, solubilisation, immobilisation and stabilisation; functional groups Alia Dellagi		5.4. Guided debate and case study: water-nutrient management strategies under Mediterranean conditions Jorge Álvaro-Fuentes, Sawsen Ayadi, Héctor Moreno, Alberto San Bautista	
16:00-16:15	Coffee break				
16:15 - 17:15	2.4. Guided debate & case study: Are indicators operational in Mediterranean systems? Sergio Atares, Ruben Sakrabani, Sawsen Ayadi	3.4. Microbial communities as drivers of mineralisation, solubilisation, immobilisation and stabilisation; functional groups Alia Dellagi	4.5. Guided debate: biostimulants, stress tolerance and efficiency gains through biotic interactions Sawsen Ayadi, Sergio Esposito, Sergio Atares	6.1. Organic resources: types, quality and nutrient content (manure, compost, green manures, biosolids, digestate). Contributions to soil Ruben Sakrabani	
17:15 - 18:15		3.5. Guided debate and group work: Biology or chemistry as the limiting factor in each context? Jorge Álvaro-Fuentes, Ruben Sakrabani, Laura Martínez, Alia Dellagi		6.2. Circular nutrient management: logistics, variability, contaminants, sanitary risks and territorial strategies. Energy and circularity José Antonio Mayoral	

Saturday 20th: Technical Visit (Fertinagro, Utrillas – TBC)