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2005 ha sido un año de una actividad extraordinaria en el CSIC. A nivel de los Institutos, la principal repercusión ha sido la realización de los Planes Estratégicos de los institutos para el quinquenio 2005-2009. Por primera vez, estos planes se han preparado de un modo sistematizado para todo el Organismo, y han pasado por una evaluación externa por paneles internacionales. En la EEAD podemos estar satisfechos de la evaluación recibida, lo que es un premio al esfuerzo colectivo que ha supuesto la redacción de nuestro Plan. Estoy convencido de que la EEAD ha salido reforzada de este proceso, y es nuestra responsabilidad continuar por este buen camino. En este sentido, debemos tomar buena nota del “diagnóstico” que nos han hecho, en el cual nos indican los retos que debemos acometer a corto y medio plazo:

- mayor visibilidad y actividad internacional;
- incremento de transferencia de tecnología al sector privado;
- profundización en la investigación en genómica, proteómica, metabolómica y bioinformática y
- aumento de impacto de las publicaciones

En este sentido, podemos ya anunciar los primeros logros en respuesta a estos retos, como el incremento en la participación en proyectos europeos (tres en vigor en 2005, por sólo dos durante todo en el quinquenio anterior) y la firma de contratos sustanciales con empresas privadas para el desarrollo de tecnologías (especialmente en el área de riegos y de obtención y licencia de materiales vegetales). También es destacable la adquisición de equipamiento singular en las áreas de proteómica y metabolómica, continuando actuaciones de años anteriores y que seguirán durante 2006, que colocarán al Instituto en situación competitiva en un área de investigación candente. Por todo ello, se puede afirmar que la EEAD está en el buen camino para consolidarse como uno de los centros destacados de investigación en Ciencias Agrarias en España.

El otro gran hito para la EEAD durante 2005 ha sido la participación activa en la solicitud para la creación de un Parque Científico Tecnológico en el campus de Aula Dei, que fue finalmente aprobada. Esta iniciativa, liderada por el Centro de Investigación y Tecnología Agroalimentaria de la DGA, involucra a todos los centros de investigación del campus, y puede convertirse en su mayor apuesta de futuro. Su actividad se centrará en los campos de agroalimentación y medio ambiente, y pretende canalizar la investigación que se realiza en los centros actuales hacia desarrollos interesantes para el sector privado, así como responder a las demandas de nueva tecnología que haya desde las empresas. Se trata de una iniciativa de largo recorrido, a la que posiblemente cueste dar los primeros pasos, pero es a la vez una iniciativa valiente y necesaria, en la que merece la pena invertir nuestro esfuerzo, con el objetivo evidente de repercutir en la sociedad la inversión que realiza en la I+D pública.

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DEPARTAMENTO DE EDAFOLOGÍA

Su objetivo principal se centra en el estudio del suelo y del agua en el suelo, desde el punto de vista del manejo, conservación y uso racional para una mayor sostenibilidad de los diferentes agrosistemas. Los objetivos generales de los grupos de investigación son los siguientes:

- **Grupo de Física del Suelo y Laboreo de Conservación** (responsable: José Luis Arrúe Ugarte; Mª. Victoria López Sánchez)

  Desarrollo de prácticas agronómicas orientadas a la mejora de la calidad del suelo y al control de procesos de degradación. Para la consecución de este objetivo, la investigación actual del Grupo se centra en la evaluación de sistemas de laboreo de conservación (laboreo reducido y no-laboreo).

- **Grupo de Erosión y Evaluación de Suelo y Agua** (responsable: Ana Navas Izquierdo; Javier Machín Gayarre)

  Estudio de la degradación de suelos y sedimentos (erosión y contaminación) en distintos contextos fisiográficos dentro de la diversidad de ambientes mediterráneos y en otros de gran fragilidad (Antártida, desierto), con una perspectiva de sostenibilidad y de conservación medioambiental. Evaluación del suelo y del agua y de sus propiedades, con objeto de racionalizar su uso y minimizar los impactos medioambientales adversos.

DEPARTAMENTO DE GENÉTICA Y PRODUCCIÓN VEGETAL

Centra sus trabajos en la obtención y desarrollo de materiales vegetales adaptados a nuestras condiciones de cultivo y en el desarrollo de técnicas de producción acordes con las buenas prácticas medioambientales.

La obtención de materiales vegetales con buena adaptación al medio y calidad del producto final se inicia con el mantenimiento y explotación de la amplia variabilidad genética autóctona y foránea; continúa con la generación de nueva variabilidad con sistemas que van desde los tradicionales, hasta los de más reciente desarrollo, basados en la mutación, el ADN recombine, los cultivos celulares o de tejidos y las técnicas de transformación; y finaliza en la identificación, selección y fijación de los genotipos superiores.

La agricultura actual y de futuro exige la implementación de sistemas agrarios sostenibles, tanto en los aspectos económicos como medioambientales. Con este fin, centramos nuestros esfuerzos en la mejora de la gestión del agua para el regadío, que tiene graves carencias en España, creando soportes tecnológicos mejorados para optimizar el uso de este bien tan preciado; y en el desarrollo de tecnologías para los principales cultivos de regadío de nuestro entorno. Los objetivos generales de los grupos de investigación de este departamento son:

- **Grupo de Aplicación de Cultivos Celulares y Desarrollo de Técnicas de Biotecnología para Mejora Vegetal** (responsable: Luis Cistué Solá; Ana Mª. Castillo Alonso; Mª. Pilar Vallés Brau)
Optimización de las técnicas para facilitar las aplicaciones biotecnológicas de los cereales: cultivo de anteras y microsporas de cebada, trigo blando, trigo duro y arroz para la producción de doble haploides, incluyendo la mejora de las técnicas y el estudio del control genético; transformación genética y mutagénesis.

- Grupo de Genética y Desarrollo de Materiales Vegetales (responsable: José Manuel Lasa Dolhagaray; Ángel Álvarez Rodríguez; Ana Mª. Casas Cendoya; Mª. Pilar Gracia Gimeno; Ernesto Igartua Arregui; Antonio Galán Lasierra)

Obtención de variedades y germoplasma mejorado de cereales adaptados a nuestras condiciones de cultivo.

- Grupo de Riegos, Agronomía y Medio Ambiente (responsable: Enrique Playán Jubillar; José Cavero Campo; Antonio Martínez-Cob)

Desarrollo de conocimientos y tecnologías que mejoren el uso del agua en el regadío y minimicen el impacto negativo del mismo.

**DEPARTAMENTO DE NUTRICIÓN VEGETAL**

Los trabajos realizados en este Departamento se encaminan a profundizar en el conocimiento de los procesos fisiológicos que limitan el rendimiento de los sistemas agrícolas, para conseguir producciones de calidad con el menor impacto ambiental. Para la consecución de este objetivo es preciso conocer desde aspectos básicos como los mecanismos moleculares de adquisición y utilización de los nutrientes, hasta otros prácticos como las formas óptimas de aplicación de fertilizantes. De esta forma se podrán desarrollar sistemas que permitan incrementar la eficiencia de los cultivos y minimizar la incidencia de los factores de estrés abiótico y el impacto ambiental de las prácticas agronómicas de fertilización. Los objetivos generales de los grupos de investigación de este departamento son:

- Grupo de Fisiología de Estrés Abiótico en Plantas (responsable: Javier Abadía Bayona; Mª. Anunciación Abadía Bayona; Fermín Morales Iribas; Ana Mª. Álvarez Fernández; Victoria Fernández Fernández; Ana Flor López Millán)

Avanzar en el conocimiento de los estreses abióticos en plantas, con un énfasis particular en la homeostasis de metales (adquisición, transporte y almacenamiento), estudiando a la vez sus implicaciones prácticas (diagnóstico, fertilización de precisión, biofortificación, fitorremediación), y utilizando técnicas avanzadas “–ómicas” (metabolómica, xenómica y proteómica) y sensores a distancia.

- Grupo de Fijación de Nitrógeno y Estrés Oxidativo en Leguminosas (responsable: Manuel Becana Ausejo; Manuel Ángel Matamoros Galindo; Mª. Carmen Rubio Luna)

Investigación multidisciplinar en leguminosas modelo y cultivadas, con especial referencia al papel de los antioxidantes en la tolerancia a estrés abiótico y oxidativo, y a la interacción beneficiosa de las plantas con las bacterias fijadoras de nitrógeno.
– **Grupo de Fotosíntesis: Genómica y Proteómica del Cloroplasto y su Respuesta al Estrés Abiótico** (responsable: Rafael Picorel Castaño; Miguel Alfonso Lozano; Mª. Inmaculada Yruela Guerrero)

Estudio multidisciplinar del cloroplasto de plantas (fundamentalmente soja y Arabidopsis) en el que se combinan aspectos de estructura y función del aparato fotosintético, y el análisis de la respuesta del cloroplasto a determinados estreses abióticos. Todo ello apoyado con técnicas de biología molecular, genómica y proteómica.

**DEPARTAMENTO DE POMOLOGÍA**

El Departamento de Pomología centra su actividad en el estudio y selección de material vegetal en frutales de hueso y pepita. La obtención de nuevos patrones y variedades frutales bien adaptados a condiciones del área mediterránea se apoya a su vez en la conservación, identificación y evaluación de recursos fitogenéticos para las especies implicadas. Para ello, se dispone de Bancos de Germoplasma y colecciones varietales en ciruelo, manzano, melocotonero y patrones Prunus, entre otras. La aplicación de técnicas de cultivo de tejidos para la mejora de frutales y el desarrollo de sistemas de producción de plantas mediante cultivo in vitro complementan los trabajos tradicionales de mejora y selección de patrones frutales. También se estudia la fisiología de la producción de especies frutales, prestando particular atención a los procesos de cuajado y fructificación, así como a las relaciones de competencia entre órganos por nutrientes, con énfasis en la calidad del fruto. Los objetivos generales de los grupos de investigación de este departamento son:

– **Grupo de Nutrición de Cultivos Frutales** (responsable: Álvaro Blanco Braña; Emilio Monge Pacheco; Jesús Val Falcón)

 Mejora de la calidad del fruto: diagnóstico y prevención de fisiopatías. Este grupo reúne a investigadores de los departamentos de Pomología y Nutrición Vegetal.

– **Grupo de Biología del Desarrollo y Material Vegetal en Frutales** (responsable: María Herrero Romero; Aránzazu Arbeloa Matute; Juan Antonio Marín Velázquez; Mª. Pilar Andréu Puyal)

 Conocimiento de las estrategias que utiliza la planta y que tienen una repercusión en agricultura y estudio del material vegetal en frutales.

– **Grupo de Mejora, Selección y Caracterización de Especies Leñosas** (responsable: Mª Ángeles Moreno Sánchez; Mª. Yolanda Gogorcena Aoiz)

 Obtención de patrones Prunus y variedades de melocotonero adaptados a condiciones del área mediterránea. Mantenimiento de la biodiversidad en especies leñosas, estudios de caracterización y análisis genético.
actividad científica
1. PUBLICACIONES

1.1. Publicaciones en revistas incluidas en SCI


Abstract: Soil application of synthetic Fe(III)-chelates, mainly those derived from ethylenediamine di(o-hydroxyphenylacetic) acid (EDDHA) and ethylenediamine di(2-hydroxy-4-methylphenylacetic) acid (EDDHMA), is the most effective, but the most expensive practice used to correct iron deficiency in plants growing on calcareous soils. Previous studies that compared the effectiveness of EDDHA/Fe³⁺ and EDDHMA/Fe³⁺ always used commercial products and their results are contradictory. In this study, the effectiveness of commercial EDDHA/Fe³⁺ and EDDHMA/Fe³⁺ fertilizers to correct iron chlorosis in three different crops (sunflower, peach and pear) was compared using doses calculated with the actual content of chelated iron determined by HPLC. The effectiveness of the Fe(III)-chelate derived from the ethylenediamine di(2-hydroxy-5sulfophenylacetic) acid (EDDHSA), that recently has been marketed as iron fertilizer, was also tested in the sunflower and pear experiments. For the three experiments, several parameters related to the plant iron nutritional status, such as leaf growth, yield, SPAD index (chlorophyll concentration), iron content, Fe/Mn ratio and 50(10P + K)/Fe index were determined. Leaf weight, iron concentration per leaf area, leaf iron content, and K/Ca and 50(10P + K)/Fe ratios were well correlated with the degree of chlorosis, suggesting that these parameters could be used for the diagnosis of the plant iron nutritional status when only iron limited the plant growth. One application of the synthetic Fe(III)-chelates (EDDHA/Fe³⁺, EDDHMA/Fe³⁺ and EDDHSA/Fe³⁺) was enough to cause a visible full recovery from iron-deficiency of the three crops. The EDDHSA/Fe³⁺ was as effective as the EDDHA/(Fe³⁺) and EDDHMA/Fe³⁺ to correct iron chlorosis in the three different crops, growing either in a soil-less system or in field conditions. However, the doses of EDDHA/Fe³⁺ and EDDHMA/Fe³⁺ were respectively 1.4- and 1.7-times higher than the EDDHSA/Fe³⁺. Although these results pointed out the EDDHSA/Fe³⁺ as a promising iron fertilizer, further research is needed to know technical details related to the application such as doses, timing and frequencies as well as its mobility, distribution and persistence in the environment. Soil-less experiments could be a good and quick tool to test the effectiveness of these iron fertilizers, since there were no differences in the order of effectiveness found for the Fe(III)-chelates between soil (field experiments) and soil-less experiments. (C) 2004 Elsevier B.V. All rights reserved.

Author Keywords: EDDHA; EDDHMA; EDDHSA; fertilizers; iron chelates; iron chlorosis


Abstract: The establishment of new in vitro cultures from mature woody plants is often a difficult task due to the little growth of initial explants. Since the explant origin plays an important role, in this work the effect of the origin of the explants (micropropagated or conventionally propagated plants) on both establishment and multiplication of the in vitro cultures has been studied using dif-
ferent culture media. Best results during establishment were obtained with explants taken from micropropagated plants. The multiplication rate of new cultures was strongly affected by the type of propagation of the mother plants. Thus, while the cumulative number of shoots increased sharply in cultures originated from micropropagated plants, cultures originated from cutting-derived plants showed only a moderate increase. Culture medium composition influenced the multiplication rate. After nine subcultures, a significantly lower number of shoots was found on QL medium than on MS or on WP. The positive effect of micropropagation of donor plants on the establishment and multiplication of new in vitro cultures is discussed in terms of a possible reinvigoration during in vitro culture. (c) 2005 Elsevier B.V. All rights reserved.

Author Keywords: apparent rejuvenation; reinvigoration; micropropagation; cuttings; culture medium composition


Abstract: The STS marker MWG699/TaqI is closely linked to the vrs1 locus and has been proposed as a marker of domestication in barley. This study included 257 cultivated barleys of both two- and six-rowed varieties, mainly from the western Mediterranean region. These included many landraces from the Spanish barley core collection, Moroccan landraces, and a set of accessions from other European countries. Restriction analysis of amplified DNA revealed three alleles, as previously described. Most of the two-rowed entries had the same allele, type K. Six-rowed entries showed both types A and D. Indeed, type D was widespread among Spanish landraces and commercial varieties from central Europe. It was also found in some two-rowed landraces originating from Spain and Morocco. Barleys with the D haplotype were predominantly winter types, whereas the A haplotype was evenly distributed among spring and winter types. These results support the existence of two different genetic sources among six-rowed Spanish landraces.

Author Keywords: barley; origin; SBCC; Spanish barley core collection; haplotype


Abstract: The eddy covariance technique for measuring surface fluxes is often not affordable outside experimental research institutes. Therefore knowledge of the performance of alternative methods for determining surface fluxes is valuable. The performance of surface renewal (SR) analysis and the flux variance (FV) method for estimating sensible heat flux has been evaluated in an experiment carried out over a heterogeneous canopy (olive orchard, 50% ground cover) at a semiarid climate in a windy area. Measurements were made at a single level close to the canopy top. SR analysis was accurate under both stable and unstable conditions. The FV method also showed a good performance under unstable conditions, but it was uncertain near neutral conditions and was not applicable under stable conditions.


Abstract: Four barley doubled haploid populations were produced by anther culture from the reciprocal crosses between two six-row barley cultivars, ‘Plaisant’ and ‘Orria’; the doubled haploid lines (DHLs) derived from each cross were subsequently assigned to weak or vigorous populations according to the weak or vigorous nature of the originating embryos. Well-formed embryos at day 25 on the induction medium were considered vigorous, whereas embryos maturing later were considered weak. The classification of vigorous and weak was closely associated with the ratio of green to albino plantlets regenerated. A random set of 25 DHLs from each of the four populations were selected for field testing in a replicated trial. Furthermore, a second set consisting of a total of 454 unreplicated DHLs from the four populations were also field assessed for grain yield. Distortion during in vitro culture may impede regeneration of a random array of microspores from a given cross, and may bias genetic estimates of specific trait/marker association in genetic studies. However, no significant differences were detected in this study among the four populations for days to heading, height, grain yield and thousand-kernel-weight when measured on the replicated trial of 100 DHLs, nor for grain yield in the second collection of 454 entries. This suggests that the likelihood of producing improved agronomic pure lines is independent of the direction of crossing and, more importantly, independent of the time when embryos matured in the induction media, at least for these particular six-row cultivars and for the anther culture method used.

Author Keywords: *Hordeum vulgare*; anther culture; doubled haploid lines; gametic selection

Abstract: Quercus ilex L. subsp. ballota (Desf.) Samp., a Mediterranean evergreen species growing in a continental Mediterranean climate, did not experience water stress and showed greater sensitivity to winter stress than to summer stress over a 12-month period. Net CO2 assimilation rates and photosystem II (PSII) efficiency decreased markedly during the cold months and recovered completely in spring. Lutein, neoxanthin and (β-carotene to chlorophyll (Chl) molar ratios all showed the same trend throughout the year, increasing from September to March. This increase was a result of increases in carotenoid concentrations, because Chl concentration per unit leaf area remained stable, and was higher at the end than at the beginning of the first growing season. Lutein-epoxide was a minor component of the total lutein pool. Thermal energy dissipation and non-photochemical quenching (NPQ) were associated with the de-epoxidated forms of the xanthophyll cycle pigments in the warm months. Photosynthetic rates decreased slightly at midday in summer. These changes were accompanied by decreases in maximum potential PSII efficiency (which recovered during the night), actual and intrinsic PSII efficiencies, photochemical quenching and increases in NPQ. Overall, our data indicate down-regulation of photosynthesis during the summer. The diurnal de-epoxidation of violaxanthin to antheraxanthin and zeaxanthin occurred throughout the year, except in January. Antioxidant enzymatic activity increased in the winter months, especially during the coldest months, highlighting its key role in photoprotection against photo-oxidation. Structural and functional modifications protected PSII from permanent damage and allowed 1-year-old leaves to photosynthesize at high rates when temperatures increased in spring.

Author Keywords: antioxidant enzymatic activity; chlorophyll fluorescence; photosynthetic pigments; summer stress; winter stress


Abstract: We investigated the response of the photosynthetic apparatus during an episode of extreme low winter temperature in Quercus ilex subsp. ballota (Desf.) Samp., a typical Mediterranean evergreen species in the Iberian peninsula. Both plants in a woodland located at high altitude (1,177 m. a.s.l.) and potted plants obtained from acorns of the same populations grown at low altitude (225 m. a.s.l.) were analyzed. Net CO2 assimilation rate was negative and there was a marked decrease in photosystem II (PSII) efficiency during winter in leaves of the woodland population (high altitude individuals). These processes were accompanied by increases in non-photochemical quenching (NPQ) and in the de-epoxidated carotenoids within the xanthophyll cycle, mechanisms aimed to dissipate excess energy. In addition, these de-epoxidated carotenoids were largely preserved during the night. There was no chlorophyll bleaching during the winter, which suggests that leaves were not experiencing photoinhibitory damage. In fact, the net photosynthetic rate and the PSII efficiency recovered in spring. These changes were not observed, or were much more reduced, in individuals located at lower altitude after a few frosts. When the response to rapid temperature changes (from 20 degreesC to -5 degreesC and from -5 degreesC to 20 degreesC) was studied, it was found that the maximum potential PSII efficiency was fairly stable, ranging from 0.70 to 0.75. The rest of the photosynthetic parameters measured, actual and intrinsic PSII efficiency, photochemical and NPQ, responded immediately to the changes in temperature and, also, the recovery after cold events was practically immediate.

Author Keywords: chlorophyll fluorescence; holm oak; photochemical and non-photochemical quenching; photoprotection; photosystem II efficiency


Abstract: Application of foliar iron (Fe) sprays is a common means of correcting Fe deficiency of agricultural crops. However, variable plant responses to iron sprays, ranging from no effect to defoliation, have often been described in the Fe-fertilization literature. Knowledge is still limited concerning the mechanisms of penetration of a leaf-applied, Fe-containing solution and the role of Fe in the leaf. The complex and multi-disciplinary character of the factors determining the effects of Fe sprays hinder the development of suitable foliar fertilization strategies, applicable under variable local con-
ditions and for different plant types. This review describes some key factors involved in the process of penetration of a leaf-applied, Fe-containing solution before briefly analyzing the available foliar Fe-fertilization literature. Iron chemistry, leaf penetration, and plant-nutrition principles will be merged with the aim of clarifying the constraints, opportunities, and future perspectives of foliar Fe sprays to cure plant Fe deficiency.

Author Keywords: iron sprays; iron deficiency; foliar application; iron chelates; iron salts


Abstract: Effects of 10 μM cadmium (supplied as Cd nitrate) on the utilization and allocation of iron (Fe) were investigated in poplar (Populus alba L.) plants grown in nutrient solution with Fe(III)-EDTA or Fe(III)-citrate as the Fe source. The effects of Cd were also compared with those of Fe deprivation. The accumulation of Fe in roots was 10-fold higher in plants grown with Fe-citrate than with Fe-EDTA. Cadmium decreased leaf chlorophyll concentrations and photosynthetic rates, and these decreases were more marked in plants grown with Fe-citrate than with Fe-EDTA. In both Fe treatments, addition of Cd caused large increases in root and shoot apoplastic and non-apoplastic Cd contents and increases in root Fe content; however, Cd decreased shoot Fe content, especially in plants grown with Fe-citrate. New leaves of plants grown with Fe-citrate had small cellular (non-apoplastic) Fe pools, whereas these pools were large in new leaves of plants grown with Fe-EDTA. Non-apoplastic Cd pools in new leaves were smaller in plants grown with Fe-citrate than with Fe-EDTA, indicating that inactivation of non-apoplastic Cd pools is facilitated more by Fe-EDTA than by Fe-citrate. In the presence of Cd, Fe-EDTA was also superior to Fe-citrate in maintaining an adequate Fe supply to poplar shoots. Differences in plant responses to Fe-EDTA and Fe-citrate may reflect differences in long-distance transport of Fe rather than in acquisition of Fe by roots.

Author Keywords: cadmium toxicity; chelating agents; heavy metals; iron deficiency; nutrient solution


Abstract: Pollen competition and selection have significant evolutionary consequences, but very little is known about how they can be modulated. We have examined in cherry (Prunus avium L.) how pollen performance is affected by the genotype of the pollen and by the environmental conditions under which it grows, namely the pistilar tissue and temperature. The different pollen donor genotypes tested in this work differed in their behaviour both in vitro and in vivo and this behaviour was modulated depending on the female recipient they grew on. Furthermore, there was a significant temperature-genotype interaction that affected the pollen tube population census that succeeded in reaching the base of the style. The combination of these three factors, while enabling a capacity of response to variations in environmental pressures, could maintain variability in pollen performance avoiding the fixation of the genes that control pollen tube growth rate.

Author Keywords: pollen performance; pollen tube growth; *Prunus avium*; Rosaceae; success ratio; temperature stress


Abstract: Temperature is a major climatic factor that limits geographical distribution of plant species, and the reproductive phase has proven to be one of the most temperature-vulnerable stages. Here, we have used peach to evaluate the effect of temperature on some processes of the progamic phase, from pollination to the arrival of pollen tubes in the ovary. Within the range of temperatures studied, 20 degrees C in the laboratory and, on average, 5.7 degrees C in the field, the results show an accelerating effect of increasing temperature on pollen germination and pollen tube growth kinetics, as well as an increase in the number of pollen tubes that reach the style base. For the last two parameters, although the range of temperature registered in the field was much lower, the results obtained in the laboratory paralleled those obtained in the field. Increasing temperatures drastically reduced stigmatic receptivity. Reduction was sequential, with stigmas first losing the capacity to sustain pollen tube penetration to the transmitting tissue, then their capacity to offer support for pollen germination and, finally, their capacity to support pollen grain adhesion. Within a species-specific range of temperature, this apparent opposite effect of temperature on the male and female pollen functions points to a complex interaction between the two phases.
female side could provide plants with the plasticity to withstand changing environmental effects, ensuring a good level of fertilization.

Author Keywords: pollen germination; pollen tube growth; Prunus persica; stigmatic receptivity; temperature stress


Abstract: The surface Irrigated District V of the Bardenas Canal (Zaragoza, Spain) was evaluated, and alternatives were assessed to improve on-farm irrigation performance. Field work consisted of a soil survey and a campaign of irrigation evaluation. The results of the irrigation evaluations were extrapolated to the whole district using a hydrodynamic surface irrigation model. An average irrigation discharge of 152 L s\(^{-1}\) results in a relatively low irrigation time (2.8 h ha\(^{-1}\)). Shallow soils, a limited conveyance network, and poor irrigation management practices determine that the application efficiency in the district is low, with an average of 49%. The district wide irrigation efficiency only reaches reasonable values when the system operates under water scarcity (49% in 2000 versus 66% in 2001). The simulation of surface irrigation indicated that the optimum irrigation time in the current situation is 1.7 h ha\(^{-1}\). The optimization of the irrigation time would lead to an average application efficiency of 76%. Improved irrigation management can therefore result in substantial water conservation in the district. (c) 2004 Elsevier B.V. All rights reserved.

Author Keywords: Bardenas Canal; on-farm irrigation; efficiency; evaluation; modelling


Abstract: Most of the benefits from conservation tillage are attained by maintaining crop residues on the soil surface. However, the effectiveness of crop residues depends on their persistence in time and maintenance of sufficient residue cover can become difficult, especially when a long-fallow period is involved. In this study, we evaluate the effects of conventional tillage (CT) and two conservation tillage systems (reduced tillage, RT, and no-tillage, NT), under both continuous cropping (CC) and cereal-fallow rotation (CF), on the dynamics of surface barley residues during four fallow periods in a dryland field of semiarid Aragon. The CC system involves a summer fallow period of 5-6 months and the CF rotation a long-fallow of 17-18 months. Results indicate that the lack of residue-disturbing operations in NT makes this practice the best strategy for fallow management. With this tillage system, the soil surface still conserved a residue cover of 10-15% after long-fallowing and percentages of standing residues ranging from 20 to 40% of the total mass after the first 11-12 months. In both CT and RT, primary tillage operations had the major influence on residue incorporation, with percentages of cover reduction of 90-100% after mouldboard ploughing (CT) and 50-70% after chiselling (RT). Two decomposition models were tested, the Douglas-Rickman and the Steiner models. Our data indicate that the Steiner model described more accurately the decline of surface residue mass over the long-fallow period in the NT plots. Measured and predicted data indicate that, under NT, 80-90% of the initial residue mass is lost at the end of fallow and that 60-75% of this loss occurs during the first 9-10 months. Finally, the mass-to-cover relationship established in this study for barley residues could be used to predict soil cover from flat residue mass through the fallow period by using a single A(m) coefficient (0.00208 ha kg\(^{-1}\)). (C) 2004 Elsevier B.V. All rights reserved.

Author Keywords: barley residues; conservation tillage; fallowing; residue cover; standing residues; decomposition models


Abstract: The novel raz (requires additional zinc) mutant of Medicago truncatula can accumulate high Zn concentrations in all tissues when compared to wild type plants, yet still develops Zn deficiency symptoms, suggesting that total Zn in tissues may not be physiologically available. The objectives of this study were first to determine whether there are differences in the biochemical Zn availability between wild type and raz mutant plants based on the activity of carbonic anhydrase and superoxide dismutase and second to assess the suitability of using the activities of these two Zn-requiring enzymes as indicators of utilizable Zn in a wide range of Zn tissue concentrations. In leaf extracts, CA and total SOD activities as well as the distribution of the tSOD activity among the different
isoforms were similar in both genotypes. In roots, there were no significant differences observed in total SOD activities between genotypes; however, CuZnSOD activities were lower in raz than in wild type plants when grown at high Zn concentrations. Based on these results, availability of Zn in raz leaves does not seem to be altered; however, in roots of the raz mutant, Zn availability is restricted or limited in comparison to the wild type plants, especially when raz roots accumulate high levels of Zn. With increasing total Zn tissue concentrations, CA activity increased linearly and then reached a plateau in both leaves and roots, whereas CuZnSOD also increased linearly in leaves but no significant correlation was found in roots, suggesting that CA is a better indicator of tissue Zn status. (c) 2004 Elsevier Ireland Ltd. All rights reserved.

Author Keywords: superoxide dismutase; carbonic anhydrase; zinc; manganese; Medicago truncatula; raz mutant


Abstract: Heterotic patterns among European maize (Zea mays L.) populations are strongly affected by genotype X environment (GE) interactions and no single heterotic pattern has been identified so far that is not influenced by GE interaction. The objectives of this work were to study (i) the mean performance and stability of the heterotic patterns 'Humid Spain X Southern France' and 'Dry Spain X Humid Spain' and (ii) the influence of some environmental and genotypic covariates on G and E main effects and their interaction. We studied the GE interaction for grain yield in eight environments using Sites Regression (SREG) and factorial regression models. The biplot obtained from the SREG model allowed visual cultivar evaluation. The factorial regression model incorporated genotypic and environmental covariates that enhanced biological interpretation of GE interaction. The heterotic patterns Humid Spain X Southern France and Dry Spain X Humid Spain had similar mean performance across environments, but the former, represented by the cross Lazcano X Millette du Lauragais, was more stable. Effects of G, E, and GE for grain yield were mainly due to earliness, vigor effects, and/or environmental factors related to cold stress. An adequately long vegetative cycle along with early vigor had a great influence on the mean grain yield performance of Lazcano X Millette du Lauragais. Additionally, its intermediate number of days to silking and tolerance to temperature stresses could be related to its stability. Breeding for tolerance to temperature stresses could render more stable maize genotypes.


Abstract: Prohexadione-Ca (ProCa) has been evaluated as a growth inhibitor in the vigorous red apple cultivars 'Fuji' and 'Royal Gala'. Greatest inhibition of shoot growth was obtained when ProCa was first sprayed at about 200 mg 1(-1) from full bloom (FB) up to 12 d after full bloom (DAFB). Shoot regrowth often occurred later in the growing season, and a second application of ProCa was then needed to maintain growth inhibition. Inhibition of shoot growth was due mainly to a reduction in internode length. No effects on yield have been found, except for cv. 'Royal Gala', where an increase in crop-load and a decrease in fruit size were recorded. Fruit quality parameters were not affected; but, in cv. 'Fuji', the red colouration of fruit was promoted by ProCa, particularly when repeated sprays of the chemical (at 125 or 250 mg 1(-1)) were made. Changes in hue, chroma and lightness were recorded on both the blushed and shaded sides of fruit. No effects on fruit colour were seen in ProCa-treated cv. 'Royal Gala' trees.


Abstract: Synchrotron radiation and the time-correlated single-photon counting technique were used to investigate the spectral and time-resolved characteristics of blue-green fluorescence (BGF) of artichoke leaves. Leaves emitted BGF under ultraviolet (UV) excitation; the abaxial side was much more fluorescent than the abaxial side, and in both cases, the youngest leaves were much more fluorescent than the oldest ones. The BGF of artichoke leaves was dominated by the presence of hydroxycinnamic acids. A decrease in the percentage of BGF attributable to the very short kinetic component (from 42 to 20%), in the shape of the BGF excitation spectra, and chlorogenic acid concentrations indicate that there is a loss of hydroxycinnamic acid with leaf age. Studies on excita-
tion, emission, and synchronized fluorescence spectra of leaves and trichomes and chlorogenic acid contents indicate that chlorogenic acid is one of the main blue-green fluorophores in artichoke leaves. Results of the present study indicate that 20-42% (i.e., the very short kinetic component) of the overall BGF is emitted by chlorogenic acid. Time-resolved BGF measurements could be a means to extract information on chlorogenic acid fluorescence from the overall leaf BGF.

Author Keywords: artichoke; blue-green fluorescence; chlorogenic acid; Cynara cardunculus var. Scolymus; decay-associated spectra; synchronous fluorescence spectrometry; time-resolved fluorescence


Abstract: Superoxide dismutases (SODs) are a family of metalloenzymes that catalyze the dismutation of superoxide anion radicals into molecular oxygen and hydrogen peroxide. Iron superoxide dismutases (FeSODs) are only expressed in some prokaryotes and plants. A new and highly active FeSOD with an unusual subcellular localization has recently been isolated from the plant Vigna unguiculata (cowpea). This protein functions as a homodimer and, in contrast to the other members of the SOD family, is localized to the cytosol. The crystal structure of the recombinant enzyme has been solved and the model refined to 1.97 A resolution. The superoxide anion binding site is located in a cleft close to the dimer interface. The coordination geometry of the Fe site is a distorted trigonal bipyramidal arrangement, whose axial ligands are His43 and a solvent molecule, and whose in-plane ligands are His95, Asp195, and His 199. A comparison of the structural features of cowpea FeSOD with those of homologous SODs reveals subtle differences in regard to the metal-protein interactions, and confirms the existence of two regions that may control the traffic of substrate and product: one located near the Fe binding site, and another in the dimer interface. The evolutionary conservation of reciprocal interactions of both monomers in neighboring active sites suggests possible subunit cooperation during catalysis.

Author Keywords: antioxidants; iron superoxide dismutase; manganese superoxide dismutase; X-ray crystallography; protein-protein interaction


Abstract: The bioavailability of heavy metals, and thus their possible harmful impact on ecosystems and humans, depends on metal partitioning. This study describes the chemical partitioning of iron, manganese, zinc and chromium, because the potential affect of soil contamination is better assessed through the knowledge of the forms in which a given metal is present rather than the use of its total concentration. In four soil types representative of mountain soils in the Iberian and Pyrenean ranges in Aragon, a total of 16 selected sites have been sampled and five subsamples were taken in each site to create a composite sample. The 4 heavy metals have been extracted by the sequential extraction procedure of Tessier et al. (1979) and analyzed by emission atomic spectrometry of solid state (ICP OES).

Little Fe, Mn and Zn (&LT; 1, 2.4-35.9, &LT; 1-24.5 mg/kg, respectively) were retrieved from the exchangeable phase, a readily available phase for biogeochemistry cycles in the ecosystems. Chromium was not detected in the potentially bioavailable forms. The largest contents of Fe, Zn and Cr were retrieved from the residual phase with mean values of 21100, 72 and 60 mg/kg, and maximum values of 35 700, 279 and 271 mg/kg, respectively. Mn was mainly bound to oxide phases with mean and maximum values of 236 and 887 mg/kg, respectively. For all metals, the highest contents are found in Leptosols on igneous rocks due to the rich and diverse mineral composition of their parent materials. The knowledge of the chemical partitioning of Fe, Mn, Zn and Cr provides information to identify the soils in which their mobile forms may be transferred to the soil-water-plant system. This information is of interest for the management of fragile mountain soils to avoid the environmental risk of cycling these metals in the environment.

Author Keywords: Fe, Mn, Zn, Cr; geochemical phases; heavy metals; Iberian and Pyrenean ranges; mountain soils; NE Spain; sequential extraction

Abstract: The soil and vegetation in some areas of the central Pyrenean middle mountains are in poor condition. The main cause of degradation has been identified as soil erosion due to intensive use, including deforestation, overgrazing and extensive agriculture since the Middle Ages, followed by land abandonment starting at the beginning of the 20th century and intensifying during the early 1950s. In this work, a raster geographical information system (GIS) combined with an expert evaluation system and fallout (CS)-C-137 were used to assess soil erosion in the Arnas catchment in the southern Pyrenees, where changes in land use were quite rapid at the beginning of the last century. A soil survey was carried out in the Arnas catchment to identify the soil types and to determine physico-chemical properties related to soil erodibility. A grid pattern was established across the study area and 77 sites were sampled. The GIS was used to integrate the information derived from an automated land evaluation system that, in turn, identified the erosion risk of areas by combining data on various soil properties and physiographic and bioclimatic factors. According to the map of erosion risks generated for the catchment, there were three distinct areas with different soil erosion features where fallout (CS)-C-137 was used to assess the soil redistribution pattern. The depth distributions of (CS)-C-137 were measured along three transects that represented the three main areas. The (CS)-C-137 content in the soils on the shrub slope transect was smallest and significantly different from the deeper and better developed soils on the forest slope, indicating different patterns of soil mobilization. The relationship of some basic soil properties was also examined, such as organic matter and texture, in terms of the patterns of radioisotope distribution and soil erosion. In the catchment, soil redistribution was affected by physiographic and landscape features such as soil properties, slope gradient as well as orientation and vegetation cover. Soil loss was highest along the shrub transect where the rate of soil erosion was much higher than soil formation. Conversely, the soils on the forest transect were mainly stable although some sediment was also deposited. Both aggradation and erosion were found in the valley bottom. The automated evaluation system and GIS used to identify areas vulnerable to erosion combined with the 137CS technique have proven to be a suitable approach to assess soil erosion aimed to design effective strategies for soil conservation in Mediterranean mountain environments. (C) 2004 Elsevier B.V. All rights reserved.

Author Keywords: erosion; mountain catchment; GIS; MicroLEIS; automated land evaluation; Cs-137; central Pyrenees; Aragon; Spain


Abstract: As a part of a broader study of the surface formations in maritime Antarctica, a preliminary survey on the content of radionuclides has been carried out in soils of Byers Peninsula, located in the western end of Livingston Island, South Shetland Islands. Data on natural and artificial radionuclides are very scarce in Antarctica and the studied soil samples can be representative of the maritime Antarctic environment. Byers Peninsula has an extensive presence of permafrost and an active layer, the studied soils being Criosols and Cryle Leptosols. A series of soil cores between 13 and 40 cm depth have been collected in different lithological and altitudinal contexts. In the southwestern sector of the peninsula, soils have been sampled in seven different sites along a transect on different geomorphological units from an upper marine platform (88 m above sea level) to a Holocene raised beach at an altitude of 24 m a.s.l. The parent materials are mainly Upper Jurassic-Lower Cretaceous marine sandstones and conglomerates and Lower Cretaceous volcanoclastic materials. Individual samples have been obtained from the cores according to textural and colour criteria and analysed for U-238, Ra-226, Th-232 K-40 and Cs-137 by gamma spectrometry. Radionuclides show variations in the depth profile as well as in the different morphoedaphic environments studied. Variability in some radionuclides seems to be related to mineralogy derived from parent materials as well as with cryogenic and soil processes affecting the depth distribution of the granulometric fractions and the organic matter. (c) 2005 Elsevier Ltd. All rights reserved.

Author Keywords: radionuclides; depth distribution; soils; permafrost; cryogenic processes; Livingston Island; Antarctica


Abstract: Natural gamma-emitting radionuclides (238U, 226Ra, 232Th, 210Pb) and selected major and trace elements (Ca, K, Mg, Na, Fe, Al, Mn, Pb, Ba, Zn, Sr, Li, Co, Ni, Cu, Cr, Cd) were determined in a soil toposequence along a mountain slope of the Tertiary Flysch landscapes in the Central Spanish Pyrenees. A variety of basic properties were also measured from the soil profiles. Mean radioiso-
tope activities (Bq kg⁻¹) range from 22 to 33 for 238U; 25 to 32 for 226Ra; 23 to 33 for 210Pb, and 37 to 46 for 232Th. The radionuclides showed different patterns in their depth distribution, thus 238U and 210Pb had largest differences in concentrations down the soil profiles, whereas 226Ra and 232Th exhibited uniform depth distributions. 238U was depleted in all upper soil layers and enriched in deeper layers. 210Pb exhibits very different depth profiles along the soil toposequence and accumulated at upper layers in three sites. 238U/226Ra activity ratios indicate disequilibrium in the 238U decay chain and reflect the leaching of 238U in contrast with the lack of mobility of 226Ra. The values of 232Th/226Ra indicate that the initial proportionality in the 238U and 232Th decay chains has not been maintained in this toposequence. The relationships between soil properties and gamma-emitting radionuclides suggested the association of 226Ra and 232Th with Fe and Mn oxides. Al, Ca, Fe, and K were the most abundant elements, followed by Mn, Ba, Pb, Sr, Li, and Zn, whereas Co, Cu, Ni, and Cr are as trace elements and Cd was not detected. Correlations between elements suggest association with carbonates (Ca, Sr), silicates and clay minerals (Al, K, Na) and with Fe and Mn oxides (Cr, Cu, Ni, Co, Zn). Along the soil toposequence, Ca, Sr, Mg and Na, K, Al increase at the bottom slope positions, due to highest carbonate contents and abundance of finer soil fractions (clay and silt), respectively. Fe and Mn decrease at the bottom slope because highest contents of Fe and Mn oxides are at upper slope positions. This research is of interest to describe the geochemical cycling of elements in the environment and to assess the processes that affect their mobility in the ecosystems.


Abstract: Regeneration of adult plant material is one of the main limitations for successful Prunus rootstock transformation. Results herein show that a liquid pulse (90 min) of 2,4-dichlorophenoxyacetic acid (2,4-D) (1.7 μM), applied to leaf explants, greatly improved shoot regeneration in Marianna 2624 (Prunus cerasifera x munsoniana) and Myrobalan 605 AD (P. cerasifera); and induced roots in Adafuel (Prunus x amigdalo-persica) when placed in regeneration medium. Whole leaves and basal leaf explants of Marianna 2624 regenerated shoots in a higher proportion of explants after the pulse (up to 58.9% in whole leaves) than medium or tip leaf segments, whereas the leaf tip was the explant that showed less regeneration. In the regeneration medium, in the presence of BAP, NAA was more effective than 2,4-D. The application of an auxin pulse is a simple method that could enhance adult plant regeneration in commercial rootstocks. (c) 2005 Elsevier B.V. All rights reserved.

Author Keywords: leaf explant type; induction treatment; genotype effect; adventitious organ differentiation; auxin pulse


Abstract: We studied the effects of Fe deficiency on physiological parameters of citrus rootstocks grown in nutrient solution. Three 4-week old rootstocks (‘Troyer’ citrange - Citrus sinensis (L.) Osb. x Poncirus trifoliata (L.) Raf., Citrus taiwanica Tan. and Shim., and ‘Swingle’ citrusumelo - Poncirus trifoliata (L.) Raf. x Citrus paradisi Macf.) were grown in nutrient solutions with 0, 5, 10, 15 and 20 mumol Fe dm⁻³. Calcium carbonate (1 g dm⁻³) was added to all solutions to mimic the natural conditions in calcareous soils. For each rootstock, shoot length, number of leaves, and root and shoot dry weights were measured at the end of experiment. Chlorophyll concentration was estimated using a portable SPAD-502 meter calibrated for each rootstock. The amount of nutrients (P, K, Mg, Ca, Fe, Zn, Mn, and Cu) was determined in shoots. Chlorophyll fluorescence parameters (F₀: basal fluorescence; Fₘ: maximum fluorescence; Fᵥ = Fₘ - F₀: variable fluorescence) were measured with a portable fluorimeter. ‘Troyer’ citrange rootstock was the most tolerant to Fe deficiency. These plants grew more and accumulated more chlorophyll and nutrients than the others in the presence of low levels of Fe (10 mumol Fe dm⁻³). ‘Swingle’ citrusumelo plants needed 20 mumol Fe dm⁻³ in the nutrient solution to secure adequate growth. ‘Taiwanica’ orange rootstock had an intermediate behaviour, but could be distinguished from ‘Troyer’ citrange based on fluorescence parameters, since there was a variation in the basal fluorescence in the former, whereas in ‘Troyer’ citrange the basal fluorescence was not affected by the supply of Fe. (C) 2004 Elsevier B.V. All rights reserved.

Author Keywords: citrus sp.; biomass allocation; chlorophyll fluorescence; lime-induced chlorosis; mineral composition; rootstocks; SPAD

Abstract: Wind drift and evaporation losses (WDEL) represent a relevant water sink in sprinkler irrigation, particularly in areas with strong winds and high evaporative demand. The objectives of this paper include: (1) characterize WDEL under day and night operation conditions for solid-set and moving lateral configurations; (2) propose adequate predictive equations; and (3) prospect the effect of sprinkler irrigation on the meteorological variables and on the estimates of reference evapotranspiration. A total of 89 catch can irrigation evaluations were performed in both irrigation systems and under day and night conditions. Different predictive equations of WDEL were proposed for combinations of the two irrigation systems and the two operation times. The equations were selected based on their capability to explain and predict WDEL. Most equations use wind speed alone as an independent variable, although some use relative humidity or combinations of both variables plus air temperature. In the semi-arid meteorological conditions of Zaragoza (Spain), the average WDEL for the solid-set were 15.4 and 8.5% during day and night irrigations, respectively. For the experimental moving lateral, losses amounted to 9.8% during the day and 5.0% during the night. The effect of sprinkler irrigation on the meteorological variables was moderate, with small increases in relative humidity (3.9%) and decreases in air temperature (0.5 degrees C) during the irrigation event and a few minutes afterwards. Consequently, reference evapotranspiration, estimated by the Penman-Monteith method, decreased during the irrigation event by 0.023 mm h(-1) on the average. This decrease represents 2.1% of WDEL, suggesting that the WDEL do not significantly contribute to satisfy crop water requirements, and therefore constitute a consumptive water loss. (c) 2005 Elsevier B.V All rights reserved.

Author Keywords: sprinkler irrigation; wind drift; evaporation losses


Abstract: To gain further insight into the role played by sporophytic anther tissues in the early stages of the androgenic process, we have compared the cytology and ultrastructure of barley embryogenic pollen grains obtained by anther culture with those obtained by isolated-microspore culture. The microspores behaved similarly in both culture systems but ultrastructural studies detected a significant difference: the presence of electron-dense deposits on the intine of embryogenic pollen grains generated by isolated-microspore culture compared to their absence in grains generated by anther culture. To discover the nature of these deposits, we applied proteinase K and EDTA treatments to ultrathin sections. We also subjected the deposits to X-ray microanalysis and found that they contained iron. Anthers and isolated microspores were cultured in media containing different concentrations of iron so as to evaluate the presence of these deposits on the intine. Deposits were not found in anther cultures at any iron concentration used or in microspore cultures when concentrations were lower than 40 mg/L. The Fe deposits on the intine appear to derive from an excess of Fe in the isolated-microspore culture medium which, if allowed to pass through the cell wall, could well be toxic to the embryogenic development of the microspores. (C) 2004 Elsevier Inc. All rights reserved.

Author Keywords: anthers; barley; culture medium; cell wall; iron; microspore embryogenesis


Abstract: In this experiment we (i) tested the hypothesis that, besides decreasing leaf C fixation, lime induced iron (Fe) deficiency increases root C fixation via PEP carboxylase and (ii) assessed the Fe-induced modifications in the elemental composition of plant tissues. Sugar beet plants were grown in nutrient solutions with Fe (45 mu M Fe-EDTA; +Fe control) or in a similar nutrient solution without Fe (-Fe) and in presence of CaCO3 (1.0 gL(-1)), either labelled with C-13 (20 at. %) or unlabelled. After 7 and 17 days from treatment imposition, plants were harvested and single organs analysed for total O, C, H, macro and micronutrients. C-13 abundance was also assessed in control, unlabelled and labelled -Fe plants. Iron deficiency caused significant growth reductions; chlorophyll and net photosynthesis decreased markedly in Fe-deficient plants when compared to the controls, whereas leaf transpiration rates and stomatal conductance were not affected by Fe deficiency. Iron deficient
plants had leaf biomass with lower C (2 to 4%) and higher O (3 to 5%) concentrations than +Fe plants. The delta(13)C was higher (less negative) in +Fe than in -Fe unlabelled plants. Iron deficient plants grown in the nutrient solution enriched with labelled CaCO3 absorbed a relatively small amount of labelled C, which was mainly recovered in the fine roots and accounted for less than 2% of total C gain in the 10 d treatment period. Evidences suggest that iron deficient sugar beets grown in the presence of CaCO3 do not markedly shift their C fixation from leaf RuBP to root PEPC.

Author Keywords: bicarbonate; elemental composition; Fe deficiency; stable carbon isotope; labelled carbon; sugar beet


Abstract: Vernalization, the requirement of a period of low temperature to induce transition from the vegetative to reproductive state, is an evolutionarily and economically important trait in the Triticeae. The genetic basis of vernalization in cultivated barley (Hordeum vulgare subsp. vulgare) can be defined using the two-locus VRN-H1/VRN-H2 model. We analyzed the allelic characteristics of HvBM5A, the candidate gene for VRN-H1, from ten cultivated barley accessions and one wild progenitor accession (subsp. spontaneum), representing the three barley growth habits - winter, facultative, and spring. We present multiple lines of evidence, including sequence, linkage map location, and expression, that support HvBM5A being VRN-H1. While the predicted polypeptides from different growth habits are identical, spring accessions contain a deletion in the first intron of HvBM5A that may be important for regulation. While spring HvBM5A alleles are typified by the intron-localized deletion, in some cases, the promoter may also determine the allele type. The presence/absence of the tightly linked ZCCT-H gene family members on chromosome 4H perfectly correlates with growth habit and we conclude that one of the three ZCCT-H genes is VRN-H2. The VRN-H2 locus is present in winter genotypes and deleted from the facultative and spring genotypes analyzed in this study, suggesting the facultative growth habit (cold tolerant, vernalization unresponsive) is a result of deletion of the VRN-H2 locus and presence of a winter HvBM5A allele. All reported barley vernalization QTLs can be explained by the two-locus VRN-H1/VRN-H2 model based on the presence/absence of VRN-H2 and a winter vs. spring HvBM5A allele.

Author Keywords: barley; HvBM5A; Triticeae; vernalization; VRN-H1; VRN-H2


Abstract: Flower and foliar nutrient content of 'Queen Giant' and 'Tebana' peach [Prunus persica (L.) Batsch] on six almond x peach hybrids rootstocks (‘Adafuel’, ‘Adarcias’, ‘GF 677’, ‘Cadaman’, ‘Garnem’ and ‘Felinem’) were determined during one season. The mineral elements analysed were: N, P, K, Ca, Mg, Fe, Mn, Zn, Na and Cu. Leaf N concentration in ‘Queen Giant’ was the highest on ‘Cadaman’ and ‘GF 677’ and the lowest on ‘Adarcias’. The P, Fe and Zn concentrations in flowers and leaves were significantly correlated. The leaf chlorophyll concentration at 120 DAFB was positively correlated with Fe floral concentration and with K, Zn and Na leaf concentration, in ‘Queen Giant’, and with K and Mn leaf concentration, in ‘Tebana’. In ‘Queen Giant’, the greatest trunk cross-sectional area was exhibited with ‘Felinem’ and ‘Garnem’ and the lowest with ‘Adarcias’. In contrast, the greater yield efficiency was found on ‘Adarcias’. In ‘Queen Giant’, a negative correlation was found between yield efficiency and Ca in leaves and in flowers. A positive correlation was observed between tree vigour and flower Fe, flower Ca and leaf Ca concentration. Correlation was also found between yield efficiency and Mg in ‘Tebana’ flowers. In ‘Queen Giant’, ‘Felinem’ rootstock showed the weakest balanced nutritional values (Sigma DOP index) compared with other rootstocks. (c) 2005 Elsevier B.V. All rights reserved.

Author Keywords: peach; rootstock; flower mineral analysis; foliar mineral analysis

1.2. Publicaciones en revistas no incluidas en SCI


1.3. Libros y capítulos de libro


1.4. Informes científico-técnicos


2. OBTENCIones VEGETALES Y PATENTES


3. TESIS

3.1. Tesis doctorales


3.2. Tesis de Master

Moussaoui S (2005) Molecular characterization of grapevine cultivars from Aragón (Spain) using sequence-tagged microsatellite markers. CIHEAM, Instituto Agronómico Mediterráneo de Zaragoza. Directores: Gogorcena Y, Núñez R.


3.3. Tesinas o trabajos para DEA


Julian Laguans C (2005) Desarrollo de la yema de flor en albaricoquero (*Prunus armeníaca*). Departamento de Bioquímica y Biología Molecular y Celular, Facultad de Ciencias, Universidad de Zaragoza. Directores: Rodrigo J, Herrero M.


4. PROYECTOS Y CONVENIOS DE INVESTIGACIÓN (EN VIGOR EN 2005)

Iniciados en 2001


Iniciados en 2002


Iniciados en 2003


Iniciados en 2004


Iniciados en 2005


5. CONGRESOS

5.1. Congresos nacionales

5.1.1. Congresos nacionales. Organización

acciones Beneficiosas entre Plantas y Microorganismos”. BIO2004-20504-E. Jaca (Huesca), agosto.


5.1.2. Congresos nacionales. Ponencias invitadas


5.1.3. Congresos nacionales. Comunicaciones orales


5.1.4. Congresos nacionales. Pósteres


Luján MA, Alfonso M, Yruela I, Picorel R (2005) Sobreexpresión y reconstitución in vivo del citocromo b_{559} de plantas con la subunidad a en E. coli. XXVIII Congreso de la Sociedad Española de Bioquímica y Biología Molecular. Zaragoza, septiembre.


5.2. Congresos y reuniones internacionales

5.2.1. Congresos internacionales. Organización

Moreno MA (2005) Miembro del Comité Científico del Sixth International Peach Symposium, ISHS. Santiago de Chile (Chile), enero.
5.2.2. Congresos internacionales. Ponencias invitadas


5.2.3. Congresos internacionales. Comunicaciones orales


5.2.4. Congresos internacionales. Pósteres


6. DIVULGACIÓN Y DIFUSIÓN

6.1. Artículos periodísticos

Abadía A (06-06-05) Frutas con mejores propiedades. Heraldo de Aragón.


Álvarez-Fernández A (mayo-05) Estudio de los componentes que producen el carácter picante del pimiento. Aragón Investiga (www.aragoninvestiga.org).

Igartua E, Moreno MA (05-01-05) Biodiversidad y mejora genética. Diario de Navarra, Suplemento Diario del Campo.

López-Millán AF (03-01-05) Alimentación más beneficiosa para la salud. Heraldo de Aragón.


Morales F (23-07-05) En un lugar de La Mancha... la ESA trabaja en futuras misiones. El Mundo, Sección Ciencia/Ecología.

6.2. Conferencias y mesas redondas


6.3. Ferias


6.4. Exposiciones

Organización y participación de la EEAD en las jornadas de puertas abiertas. 10-11 de noviembre de 2005.

Organización y participación de la EEAD en la Semana de la Ciencia con exposición en Zaragoza. 9-14 de diciembre de 2005.

Martínez-Giménez JC. Organización de “El Fondo antiguo de la colección de libros de la EEAD (Ejemplares del s. XVIII y s. XIX)”. Exposición bibliográfica del 24 al 31 de mayo de 2005.

7. OTRAS ACTIVIDADES CIENTÍFICAS

7.1. Reuniones científicas en el Instituto


Moreno MA (2005) Organización y participación en la reunión con técnicos del Instituto Nacional de Semillas (INASE) de Uruguay, bajo los auspicios de la Oficina Española de Variedades Vegetales (OEVV) del MAPA. Sistema de certificación de plantas de vivero de frutales y de vid. Septiembre.


7.2. Cursos de doctorado


Monge E (2005) Profesor en el Curso de doctorado: El ecosistema del olivar en Aragón y su contribución al desarrollo (0,4 créditos). Departamento Edafología y Química Agrícola, Universidad de Zaragoza.

Yruela I (2005) Docencia del Curso de Doctorado del Programa con mención de calidad: Estructura y Función de Proteínas (0,8 créditos). Purificación de proteínas de membrana; Estabilidad de complejos proteicos. Proteínas de organismos extremófilos. Departamento de Bioquímica y Biología Molecular y Celular, Universidad de Zaragoza.

7.3. Seminarios impartidos en el Instituto

Alfonso M. Estudio de los mecanismos de regulación de las desaturasas de plantas y su implicación en las respuestas frente a estreses abióticos.

Hisayo Yamane. Extracellular proteins involved in pollen-pistil interaction.

Hormaza I. Perspectivas de la investigación en fruticultura subtropical.

Martínez-Rivas JM. Regulación de la relación oleico/linoleico en los aceites de girasol y oliva.

Martínez-Giménez JC. Introducción a la Biblioteca virtual del CSIC.

Melchiorre M. Sistema antioxidante en protoplastos de trigo que sobreexpresan Mn-superóxido dismutasa.

Rubio MC. Función de las superóxido dismutasas durante el desarrollo del nódulo en Lotus japonicus.

7.4. Cursos y seminarios impartidos por personal de la EEAD

7.4.1. Cursos de formación universitarios y de postgrado


Marín JA (2005) **Master de Alimentación y Dietoterapia en el Niño y en el Adolescente.** Los frutales en Aragón. Universidad de Zaragoza.


Morales F (2005) **Curso de especialización postuniversitaria del Programa Master en Mejora Genética Vegetal.** Estrés abiótico. Instituto Agronómico Mediterráneo de Zaragoza, CIHEAM.


Moreno MA (2005) **Curso de Tecnologías de producción del melocotón:** tendencias a la luz de las exigencias cualitativas y de seguridad alimentaria de los mercados. Comportamiento agronómico de nuevos patrones para melocotonero. Situación de los patrones para melocotonero en España. Escuela Agraria de Cogullada, Zaragoza.

Moreno MA (2005) **Curso de Tendencias actuales de las tecnologías de producción en cerezo:** Situación de los patrones de cerezo en España. Problemática planteada, con especial referencia a la replantación. Selección de nuevos patrones para el cerezo por la Estación Experimental de Aula Dei (CSIC). Tolerancia a la asfixia. Escuela Agraria de Cogullada, Zaragoza.

Playán E (2005) **Course on land and water resources management: irrigated agricultura.** Design, operation, maintenance and performance evaluation of surface and subsurface irrigation. Instituto Agronómico Mediterráneo (CIHEAM), Bari (Italia).


Playán E (2005) **International course on “Sustainable irrigated agriculture in the Mediterranean region: input management and pollution control.** Irrigation systems and irrigation management. Instituto Agronómico Mediterráneo (CIHEAM), Zaragoza.


7.4.2. **Seminarios impartidos en otros centros por personal de la EEAD**

López MV (2005) **Laboreo de conservación para el control de la degradación del suelo.** Estación Experimental Agropecuaria Anguil del Instituto Nacional de Investigaciones Agropecuarias (INTA), Santa Rosa (Argentina), octubre.


Martínez-Cob A (2005) **Variabilidad espacial y temporal de la velocidad del viento.** Centro de Investigación y Tecnología Agroalimentaria (DGA), Zaragoza.

Morales F (2005) **Use and applications of fluorescence in plant stress physiology.** Institut de l’Olivier, Sfax (Túnez), octubre.

Moreno MA (2005) **Mejora genética y selección de portainjertos de frutales de carozo en la Estación Experimental de Aula Dei.** INTA de San Pedro, Buenos Aires (Argentina), enero.

Moreno MA (2005) **Selección de los últimos portainjertos de frutales de carozo, con énfasis en duraznero.** INTA de Salta (Argentina), enero.


7.5. Estancias de científicos de otros Centros (superiores a una semana)

Bai M (2005) Department of Irrigation and Drainage, China Institute of Water Resources and Hydropower Research, Pekín (China). 7-23 noviembre.


7.6. Estancias de personal de la EEAD en otros laboratorios (superiores a una semana)


Bernal M (2005) Centro de Investigaciones Biológicas (CSIC), Madrid, 8 semanas.

Cantín C (2005) Centro del INRA de Burdeos, Unidad de Mejora de las Especies Frutales y de la Viña. 1 semana.


Gogorcena Y (2005) Centro del INRA de Burdeos, Unidad de Mejora de las Especies Frutales y de la Viña. 2 semanas.

Jiménez S (2005) Centro del INRA de Burdeos, Unidad de Mejora de las Especies Frutales y de la Viña. 1 semana.


Solanas M (2005) Laboratoire de Proteomique INRA, Montpellier (Francia). 8 semanas.

7.7. Convenios de actividad formativa


7.8. Otros

Gogorcena Y (2005) Consejo de Dirección de las revistas “Georgica” y “Kalium”.