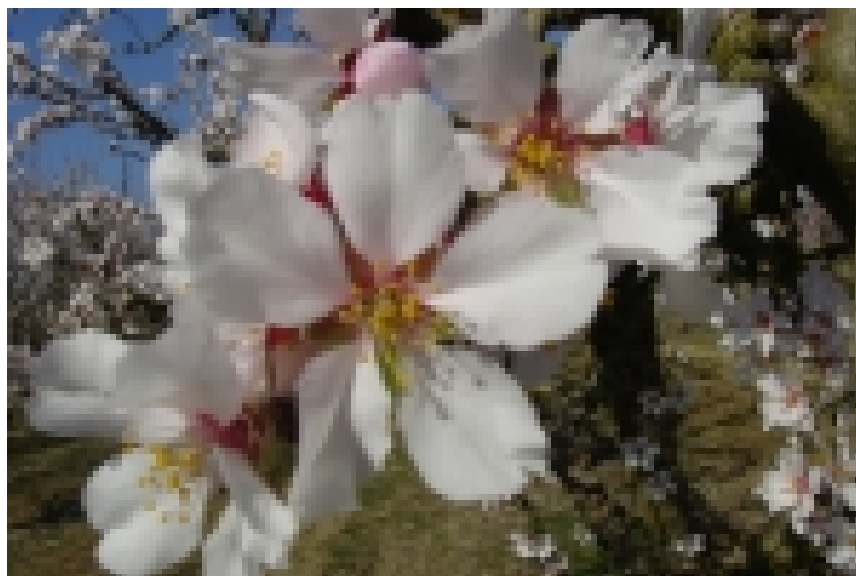


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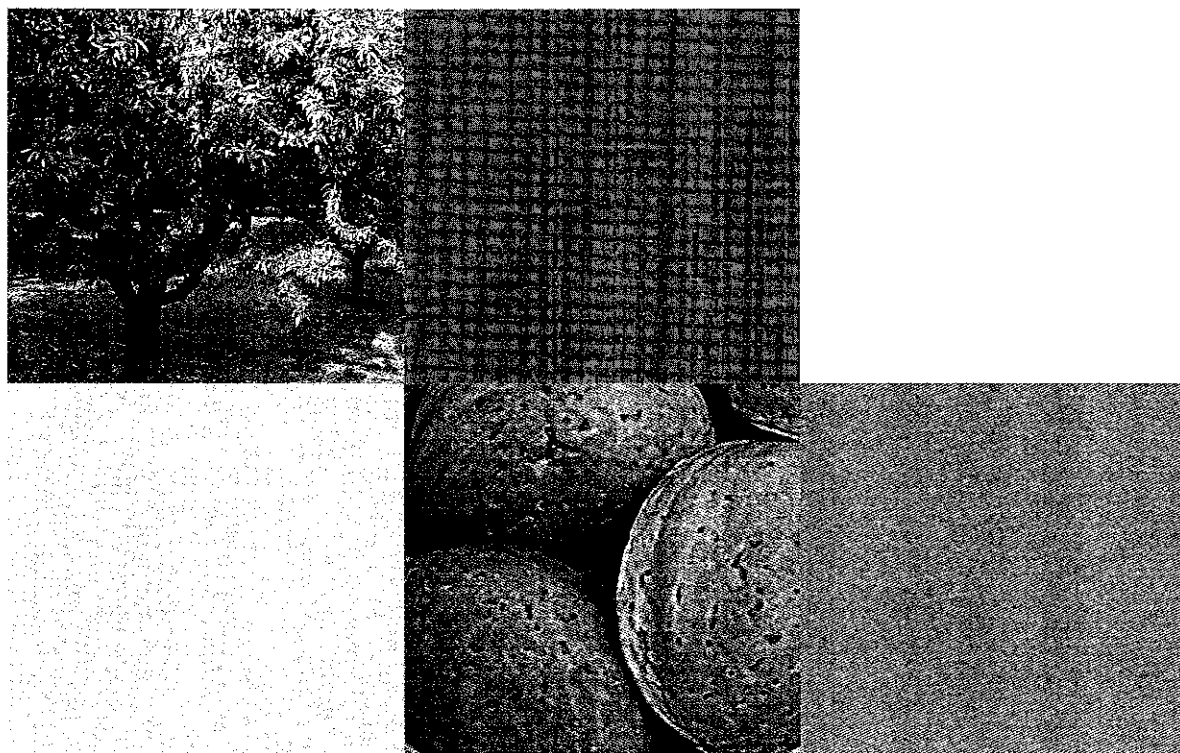
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# Investigación agroalimentaria de vanguardia



**Belona y Soleta:** dos nuevas variedades  
de almendra seleccionadas  
por el Centro de Investigación  
y Tecnología Agroalimentaria de Aragón

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**R. Socias i Company y A.J. Felipe**

**'BELONA' Y 'SOLETA', DOS NUEVOS CULTIVARES DE ALMENDRO**

Separata ITEA

INFORMACIÓN TÉCNICA ECONÓMICA AGRARIA, VOL. **102** N.º 4 (398-408), 2006

# Pollen source effect on pollen tube growth in advanced self-compatible almond selections (*Prunus amygdalus* Batsch)

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*Key words:* breeding, inbreeding, pollination.

**Abstract:** Pollen tube growth after self- and cross-pollination was studied in 35 advanced almond selections to ascertain their self-compatibility as this trait is the main objective of most breeding programmes. The dynamics of pollen tube growth and the number of pollen tubes at the style base showed significant differences between genotypes, independently of the pollen source, pointing to morphological and biochemical differences between them. The number of pollen tubes at the style base was also pollination-type dependent. Some genotypes with a common ancestor showed a lower number of pollen tubes at the style base after self-pollination than after cross-pollination, suggesting a genetic component probably due to inbreeding. As a consequence, the level of self-compatibility expression must be carefully evaluated in almond breeding programmes to avoid problems of low productivity, which may be due to a masked self-compatibility.

## 1. Introduction

Almond, with a few exceptions, shows a pre-zygotic and gametophytic self-incompatibility characterized by a pollen-pistil interaction before fertilization (de Nettancourt, 1977), giving rise to the inhibition of pollen tube growth from the plant's own pollen (Socias i Company *et al.*, 1976). The confirmation of self-compatibility transmission to the offspring (Socias i Company and Felipe, 1977) led to the breeding and selection of new self-compatible almond cultivars in most breeding programmes. Identification of self-compatible genotypes has been assessed by the observation of pollen tube growth after artificial self-pollinations (Socias i Company and Felipe, 1987), by bagging branches at bloom (Grasselly and Olivier, 1984) or by molecular techniques, such as RNases to identify the *S* alleles (Bošković *et al.*, 1997) and by markers linked to self-compatibility after PCR analysis (Ortega and Dicenta, 2003; Alonso, 2004; Sánchez-Pérez *et al.*, 2004).

The release of new self-compatible cultivars, showing also good agronomical and commercial traits, including 'Guara' (Socias i Company and Felipe, 1992), 'Lauranne' (Grasselly *et al.*, 1992), and 'Antoñeta' and 'Marta' (Egea *et al.*, 2000), has allowed the establishment of orchards of a single cultivar to avoid the problems related to a deficient pollination and resulting, as a consequence, in low yields (Socias i Company, 1990;

Dicenta *et al.*, 2002). However, some self-compatible cultivars have shown several fruit setting and production problems (Godini *et al.*, 1994; Torre Grossa *et al.*, 1994).

Self-compatibility evaluation is thus essential in an almond breeding programme to ensure the release of cultivars which resolve the pollination-related problems. Some selections have shown a deficient tube growth of their own pollen during their evaluation (Ben Njima and Socias i Company, 1995; Alonso and Socias i Company 2005 a). This deficient growth has been related to problems of fruit set and productivity shown by some self-compatible selections (Alonso and Socias i Company 2005 b). As a consequence, our objective in the present work was to investigate the effect of self- and cross-pollination in 35 self-compatible genotypes based on the dynamics of pollen tube growth and on the number of pollen tubes reaching the style base.

## 2. Materials and Methods

Eight almond parents and 35 advanced selections obtained from five crosses between them were analysed. Two traditional Spanish cultivars ('Marcona' and 'Desmayo Langueta'), a French cv. ('Ferragnès'), a Spanish local selection ('Bertina'), three releases from the CITA breeding programme ('Felisia', 'Guara' and 'Moncayo'), and one selection from the same programme (A-10-6) were included in the trials. All these selections were grafted onto the peach x almond rootstock (*Prunus per-*

# Consumer Preferences for Walnuts in Spain

Dena M. Camarena  
Ana I. Sanjuán

**ABSTRACT.** Stated consumer preferences for walnuts in Spain are investigated by means of a choice experiment. Conditional heterogeneity is explored, assuming two possible sources: How often walnuts are consumed and how driven by health and nutrition attitudes or convenience the consumer is. In particular, the possibilities for a mostly unknown variety in the Spanish market are investigated. Specific guidelines for the distribution and commercialisation of walnuts are provided. doi:10.1300/J038v12n04\_04 [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2006 by The Haworth Press, Inc. All rights reserved.]

**KEYWORDS.** Logit model, stated preferences, choice experiment, walnuts

## INTRODUCTION

This paper focuses on consumer behaviour and preferences towards walnuts in Spain. Nuts in general, and walnuts in particular, are part of the traditional

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## Guest Editorial: Water Management in Aragon

Understanding water management peculiarities in Aragon requires previous knowledge of some territorial, historical, social, political and legal data specific to the Autonomous Region of Aragon.

Territory-wise, it has to be underlined that this is a fairly extensive territory (almost 50 000 km<sup>2</sup>) with a low population (1 300 000 inhabitants, most of whom are gathered round the city of Zaragoza (Saragossa) and along the River Ebro's 40-km-long corridor running across Aragon). The contrasts are enormous in the water field, since, despite the rich water supply coming from the Pyrenees, there are vast areas with such scarce precipitations that they cause real desert-like aspects (the Monegros area of Aragon, for instance, has a smaller population density than that of the Sahara). Life in such a territory, and the development of the economic activities, has made it necessary to build large regulation and canalization infrastructures yet, even so, there are some municipalities that have to be supplied with water from lorries in crisis situations. Water resources are, obviously, a very important tool towards a well-balanced economical development in Aragon's different areas in the effort to avoid their depopulation.

From a historical point of view, there are ancient traces showing the relevance of water for the lives of Aragon's old inhabitants. For example, the so-called bronzes of Contrebia (describing the over 2000-year-old litigation for water between Zaragoza and Alagón in which the Roman law authority took part) and Agón (containing a set of rules and regulations for irrigation communities). In the same way, regulation and canalization infrastructures dating back to Roman domination in Hispania (Roman Spain) are still visible in the territory nowadays. From that moment on and with better documentation, there are constant signs of human intervention taking advantage of water for irrigation and transport purposes for the cities' supply.

All this has progressively shaped the features of a society concerned with, and aware of, the key role of water with regard to life. The climax was reached when, at the end of the 19th century and beginning of the 20th, Joaquín Costa, the most representative figure among the later so-called regenerationists, carried out intense campaigns advocating active state intervention in building up water infrastructures, and a reaction against the subsidiary role which he had inherited from the prevailing liberal ideology in this respect. All this led to a water crusade that has been going on for the entire 20th century and during which the association of the concepts of water, hydraulic works and irrigation was seen as something natural in agriculture-oriented Spain at that time. Today's Aragonese society, as befits a developed country's vibrant population, has excellent economic activity, work,

# River Water Quality and Irrigated Agriculture in the Ebro Basin: An Overview

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**ABSTRACT** *Irrigated agriculture notably increases crop productivity but may negatively impact river water quality because of the salt and agrochemical loadings in irrigation return flows. We evaluated the salinity and ion concentrations in 31 river stations of the Ebro basin, characterized the quality of waters for irrigation, and analysed the influence of irrigation on river water quality. River water quality is generally good in regard to salinity (EC), NO<sub>3</sub> and PO<sub>4</sub> concentrations, and water quality for irrigation of the most important schemes within the Ebro basin is excellent for crops although it may promote the degradation of sensitive soils. A preliminary analysis of the impact of irrigated agriculture on river water quantity and quality indicates that it is significant in rivers collecting high salt and NO<sub>3</sub> irrigation return flows. Nevertheless, due to the low salinity of most irrigation waters, maximum irrigation efficiencies are attainable in the Ebro basin without compromising crop yields due to root zone soil salinization.*

## Introduction

Irrigation is needed for increasing, securing and diversifying agricultural production, and for promotion of the socio-economic development of rural areas. Thus, Tanji & Kielen (2002) concluded that the irrigated surface of the world will have to increase by 20–30% by 2025 to meet the food demands of the growing world population.

The Spanish National Irrigation Plan (PNR) foresees by 2008 the transformation of 224 791 ha into irrigation and the modernization of some 1 134 891 ha of old irrigation schemes (MAPA, 2002). The PNR does not envisage new large irrigation schemes (the figure above refers mainly to actual transformations) but includes 86 426 ha of new 'Social Interest' irrigated lands in impoverished or declining regions. Thus, modernization is regarded as the key strategy in the PNR to secure profitable crop yields, meet adequate living standards for farmers, and conserve water resources in terms of quantity and quality.

Along with its social and economic benefits, irrigation may have a negative impact on water quality because of the salt and agrochemical loadings in irrigation return flows (IRF). According to FAO (Ongley, 1996), sediments, fertilizers (N and P) and pesticides are the main pollutants affecting water quality. Agricultural-induced nitrate pollution has long been recognized as a significant problem in Europe (EU, 1991). Thus, the EU (1998) set the maximum allowable concentrations in public water supplies at 50 mg/L for

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# Instruments for Water Quantity and Quality Management in the Agriculture of Aragon

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**ABSTRACT** *The traditional policy of developing new irrigated areas in Aragon has been changed to irrigation modernization through investments in distribution networks and on-farm irrigation equipment. This new policy creates opportunities to introduce more profitable crops, conserve irrigation water and abate agricultural nonpoint pollution. Several alternatives open to irrigated agriculture are bioethanol and biodiesel technologies (which could provide a support price for grains), the expansion of profitable fruits and vegetables under drip irrigation, and the diversification of water using activities (animal farming, industries, residential areas and sport utilities). Alternative measures to abate agricultural nonpoint pollution are examined in this paper. Modernizing irrigation structures leads to a large reduction of pollution, and introduces reasonable costs to farmers (in terms of their rent). Results also show that water pricing—advocated by the European Water Framework Directive—is a wrong policy in irrigation, because irrigation demand does not respond to prices and also because water pricing is not cost efficient to abate pollution.*

## Irrigated Agriculture in Aragon: A Historical Perspective

The agricultural sector in Aragon represents about 5% of the regional gross domestic product (GDP), and employs 7% of the working population. The Aragonese agriculture is linked to an important agribusiness sector, the second regional industrial activity (14% of industrial production and 12% of industrial employment). The final agricultural production amounts to €2900 million, with a share of €1100 million for agriculture and €1300 million for livestock production. Agriculture is concentrated in the provinces of Zaragoza and Huesca, and the main crops in economic terms are grains, fruits, vegetables, forages, vineyards and olive trees. The main crops by province are barley, rice, alfalfa and fruits in Huesca; corn, vegetables and vineyards in Zaragoza, and olive trees in Teruel.

The average precipitation in Aragon reaches 500 mm, although this figure is subject to a large space and time variability. The flat lands in the central Ebro River depression receive little rain (about 250 mm), with large year-to-year fluctuations. As a consequence, irrigation is required for most crops. Additional climatic limitations are hail and frost, which can result in incidental, relevant economic losses.

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# The Rise and Fall of the Ebro Water Transfer†

## ABSTRACT

*This article analyzes the Ebro inter-basin transfer, which was the main project of the Spanish National Hydrological Plan. The Ebro transfer was prompted by pervasive pressures, scarcity, and degradation of southeastern basins in Spain. The heated policy debate on the Ebro transfer highlights the difficulties of achieving a sustainable management of water resources because of the conflicting interests of stakeholders and regions. Alternatives to the Ebro transfer show that acceptable outcomes combine demand and supply measures. Nevertheless, implementation could be difficult, requiring compensation to farmers; otherwise, an excessive burden on farmers would be met by social opposition, leading to the failure of the measures.*

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