

‘Vayro’, ‘Marinada’, ‘Constantí’, and ‘Tarraco’ Almonds

Francisco Vargas¹, Miguel Romero, Joan Clavé, Jaume Vergés, Josef Santos, and Ignasi Batlle

Institut de Recerca i Tecnologia Agroalimentàries (IRTA), Mas de Bover, Ctra. Reus-El Morell, km 3,8. E-43120 Constantí, Reus, Tarragona, Spain

Almond [*Prunus amygdalus* Batsch syn. *P. dulcis* (Mill.) D.A. Webb] is the main tree nut crop in world production. Successful almond production requires cultivars adapted to the environmental conditions of the growing region. Thus, in wide areas of the Mediterranean Basin, cultivars have to be adapted to avoid late spring frost by late flowering. In California, delayed flowering can help to avoid rain damage at bloom time. A number of agronomic and commercial features (self-compatibility, production, vigor, growth and branching habit, training and pruning ease, disease resistance, nut quality, and so on) are also very important in almond production.

The availability for making crosses of a range of cultivars (late flowering and self-compatible from Apulia, southern Italy, very late blooming from Ukraine, high nut quality from Spain and France, and so on) and selections derived from controlled crosses have enhanced the prospects of almond breeding (Godini, 1996; Grasselly and Crossa-Raynaud, 1980; Socias i Company, 1990; Vargas et al., 1984). With these aims, in the almond breeding program of IRTA Mas de Bover, active since 1975, more than 35,000 seedlings have been raised and a few cultivars selected. The first cultivars registered from this program were ‘Masbovera’, ‘Glorieta’, and ‘Francolí’, which are widely grown in Spain (Vargas and Romero, 1994).

Four new late-blooming almond cultivars, ‘Vayro’, ‘Marinada’, ‘Constantí’, and ‘Tarraco’, have been released. ‘Vayro’, ‘Marinada’, and ‘Constantí’ are self-compatible and self-fruitful. ‘Tarraco’ instead is self-incompatible and thus it needs cross-pollination. The four cultivars are very productive, giving consistent yields. Nut quality is good, with near absence of double-kernel nuts. The almond shells are hard, reducing worm damage (and thus preventing aflatoxin contamination) and also avoiding bird damage. They are well suited to the European industry based on hard-shelled cultivars. The

four cultivars are easily trained and pruned and adapt to mechanical harvesting (easy nut removal).

Origin

‘Vayro’ (Breeder’s reference IRTAMB A21-323), ‘Marinada’ (IRTAMB A23-57), ‘Constantí’ (IRTAMB A22-120), and ‘Tarraco’ (IRTAMB A21-169) are seedlings

selected from different crossing origin. In Figure 1, the pedigree of the four cultivars is presented. The crosses were made in 1991 to 1994. The four selections have been assessed during 9 to 12 years at Mas de Bover, Tarragona, and since 2000 are being evaluated at different locations in Spain.

Description

Main vegetative and agronomic characteristics are presented on Tables 1 and 2. Table 3 shows some important commercial nut traits (Figs. 2–5). In the three tables, widely grown reference cultivars (‘Desmayo Langueta’, ‘Ferragnes’, ‘Guara’, ‘Marcona’, ‘Masbovera’, and ‘Nonpareil’) are included for comparison. In Table 4, the productive performance of the three self-compatible cultivars (‘Vayro’, ‘Marinada’, and ‘Constantí’) compared with two self-fertile and highly productive standard cultivars (‘Lauranne’ and ‘Guara’) is given.

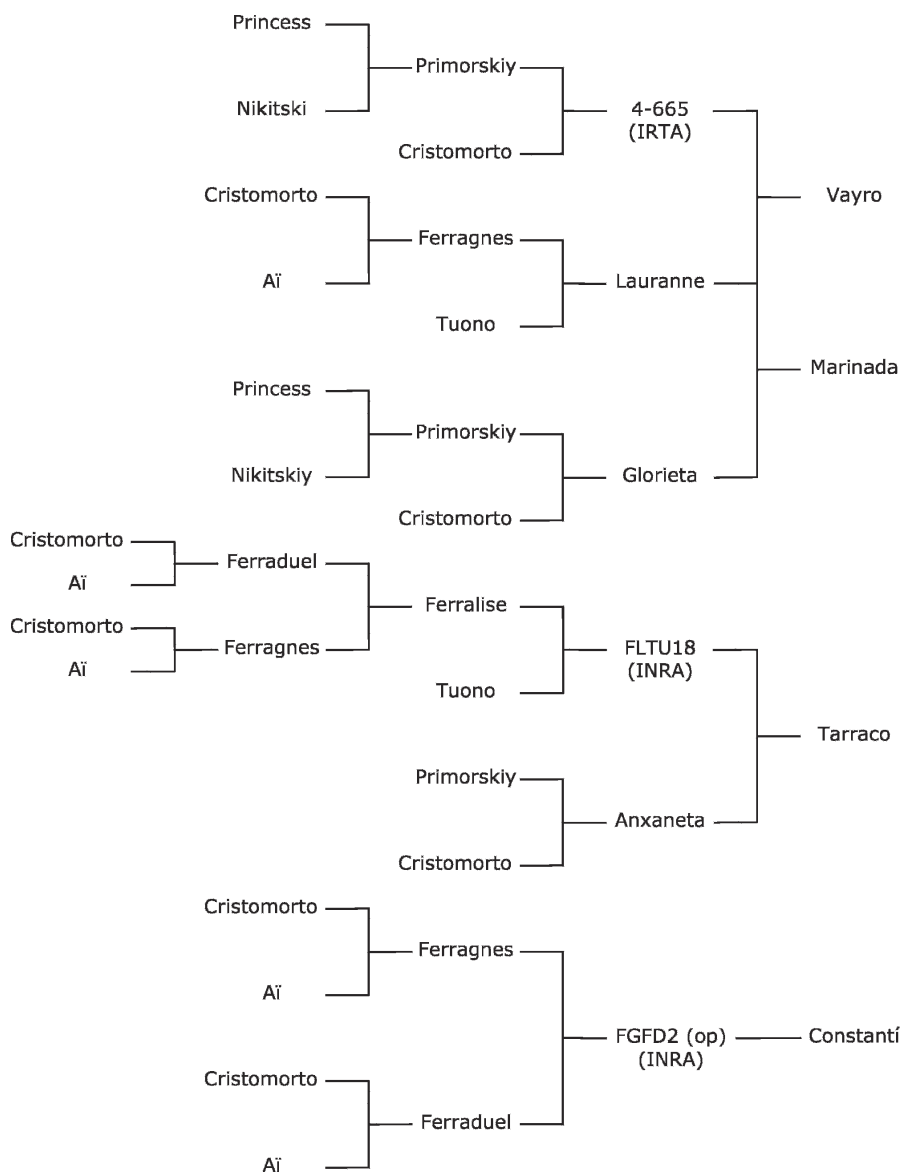


Fig. 1. Pedigree of the four new almond cultivars released by IRTA.

Received for publication 26 Feb. 2007. Accepted for publication 7 Oct. 2007.

IRTA’s public almond scion breeding program is partially conducted under three INIA (Spanish Ministry of Science and Technology) projects (SC97-049, RTA01-081, RTA04-030, and TRT06-021).

¹To whom reprint requests should be addressed; e-mail francisco.vargas@irta.es

Table 1. Blooming date, self-compatibility, production (yield potential and precocity), and harvesting season.

Cultivar	Mean blooming date (STD) ^z	Self-compatibility (S genotype ^y)	Yield potential ^x	Bearing precocity	Harvesting season
<i>New:</i>					
Vayro	26.6 (7.8)	Yes (S_9S_9)	Very high	Early	Early
Marinada	35.1 (10.7)	Yes (S_3S_3)	Very high	Very early	Mid
Constantí	27.4 (9.5)	Yes (S_3S_3)	High-very high	Early	Mid
Tarraco	36.1 (11.2)	No (S_7S_9)	Very high	Very early	Mid
<i>Reference:</i>					
D. Largueta	0	No (S_7S_{25})	Mid-high	Mid-late	Late
Ferragnes	29.4 (8.9)	No (S_7S_3)	High-very high	Mid	Mid
Guara	27.7 (9.3)	Yes (S_7S_7)	High-very high	Early	Early
Marcona	15.6 (5.3)	No ($S_{11}S_{12}$)	High	Early	Mid
Masbovera	29.8 (9.8)	No (S_7S_9)	High-very high	Mid	Mid
Nonpareil	18.0 (7.1)	No (S_7S_8)	Low-mid	Mid	Early

^zMean full blooming date (and standard deviation) of 9 years (1998–2006) at Mas de Bover as number of days from Desmayo Largueta full bloom (mean, 30 January).

^yLópez et al. (2006) for the reference cultivars.

^xNonpareil is not well adapted to Catalonian environmental and growing conditions (low production).

'Vayro'. It was bred from a '4-665' × 'Lauranne' cross made in 1991. It is late-flowering, self-fertile, very productive, and precocious. The tree shows very strong vigor and medium branch density, bearing nuts mainly on spurs. It seems tolerant to *Phomosis*

amygdali. The kernel is nice, without doubles, having medium size and a pointed shape.

'Marinada'. It is a seedling from a 'Lauranne' × 'Glorieta' cross made in 1994. It flowers very late, is self-fertile, highly

productive, and very precocious. The tree shows midvigor and has medium-upright growth and medium-scarce branch density, bearing nuts mainly on spurs. The kernel is nice, without doubles, medium size, and rounded.

'Constantí'. It is an open-pollinated seedling from the selection 'FGFD2', obtained in 1993. It is late-flowering, self-fertile, productive, and precocious. The tree is vigorous and it has a medium-upright growth. Its branch density is medium, bearing nuts mainly on spurs. The kernel shape is round.

'Tarraco'. It was bred from the cross 'FLTU18' × 'Anxaneta' made in 1991. It blooms very late, it is self-incompatible, highly productive (heavy and consistent bearer), and very precocious. The tree shows midvigor and has medium-upright growth and branch density is medium-scarce bearing nuts mainly on spurs. It seems tolerant to *Phomosis amygdali*. The kernel is large, nice, without doubles, and has an oblong shape.

All four cultivars ('Vayro', 'Marinada', 'Constantí', and 'Tarraco') have shown heavy and consistent cropping in experimental trials.



Fig. 2. 'Constantí' almonds.



Fig. 3. 'Marinada' almonds.



Fig. 4. 'Tarraco' almonds.



Fig. 5. 'Vayro' almonds.

Table 2. Tree vigor, growth habit, branching density, bearing habit (mostly), and training and pruning ease.

Cultivar	Vigor	Growth habit	Branching density	Bearing habit	Training	Pruning
<i>New:</i>						
Vayro	Very strong	Medium	Mid	On spurs	Very easy	Easy
Marinada	Mid	Medium–upright	Mid–scarce	On spurs	Very easy	Very easy
Constantí	Strong	Medium–upright	Mid	On spurs	Very easy	Easy
Tarraco	Mid	Medium–upright	Mid–scarce	On spurs	Very easy	Very easy
<i>Reference:</i>						
D. Largueta	Mid	Spreading	Mid–high	On 1-year-old shoots	Medium	Medium
Ferragnes	Strong	Medium–upright	Mid	On spurs	Very easy	Easy
Guara	Mid	Drooping	Scarce	On spurs	Difficult	Easy
Marcona	Mid	Medium	High	On 1-year-old shoots	Easy	Medium
Masbovera	Very strong	Medium–upright	Mid	On spurs	Very easy	Easy
Nonpareil	Mid	Medium	Mid	On 1-year-old shoots	Easy	Easy

Table 3. Nut characteristics.²

Cultivar	No.	Nut wt	Kernel wt	Shelling percentage	Double kernels	Kernel appearance
<i>New:</i>						
Vayro	29	4.2 (0.5)	1.19 (0.15)	28.4 (2.6)	0.1 (0.3)	7.0 (0.5)
Marinada	24	4.2 (0.5)	1.30 (0.19)	31.1 (3.6)	0.3 (0.6)	6.8 (0.6)
Constantí	32	4.5 (0.6)	1.20 (0.16)	26.8 (2.7)	1.4 (1.6)	6.2 (0.6)
Tarraco	17	5.4 (1.1)	1.68 (0.25)	31.5 (4.2)	0.1 (0.3)	6.9 (1.0)
<i>Reference:</i>						
D. Largueta	85	5.0 (1.2)	1.34 (0.27)	27.2 (2.3)	1.4 (2.2)	6.7 (1.2)
Ferragnes	262	4.4 (0.7)	1.49 (0.22)	33.8 (3.4)	0.1 (0.5)	6.4 (0.9)
Guara	84	3.8 (0.7)	1.31 (0.23)	34.6 (5.1)	11.6 (11.1)	6.3 (0.7)
Marcona	209	5.1 (1.0)	1.33 (0.19)	26.4 (2.5)	2.7 (3.6)	6.5 (0.8)
Masbovera	170	4.9 (0.9)	1.35 (0.29)	27.8 (3.2)	0.4 (1.1)	6.4 (1.0)
Nonpareil	14	2.0 (0.3)	1.24 (0.11)	62.7 (4.9)	3.3 (3.4)	7.1 (0.8)

²Mean values (and sd). No. = number of samples analyzed (during 9 to 30 years), nut weight (g), kernel weight (g), shelling percentage (%), double kernels (%), and note on kernel appearance (scale 1–9, with 9 being the highest mark).

Table 4. Mean year and accumulated production of kernel (kg/tree).²

Cultivar	2002	2003	2004	2005	2006	Accumulated production (2002–2006)
<i>New:</i>						
Vayro	0.61 b	4.04 b	5.39 a	5.54 a	6.35 a	21.93 a
Marinada	1.66 a	5.16 a	2.50 b	5.23 a	4.57 abc	19.13 ab
Constantí	0.57 b	3.74 b	2.27 b	4.59 a	2.74 c	13.91 b
<i>Reference:</i>						
Guara	0.32 b	3.59 b	2.16 b	5.21 a	4.80 ab	16.08 ab
Lauranne	0.47 b	3.99 b	3.87 ab	5.31 a	4.14 bc	17.76 ab

²Self-compatible cultivar trial at Corbins, Lleida, under deficit irrigation conditions. Trees planted at 7 m × 6 m in 1995 and regrafted in 2000. Randomized blocs design, three repetitions and five trees per plot. Comparison of means by Duncan's multiple range test. Values with the same letter are not significantly different (95%).

Use

As to establishing new almond orchards and design according to flowering time and vigor (related to tree spacing), two cultivar pairs can be considered: 'Marinada' and 'Tarraco' (very late-blooming and midvigor) and 'Vayro' and 'Constantí' (late-blooming and strong vigor). They set better crops when bees are placed in their orchards.

Availability

The four cultivars bred by IRTA are in the process of being registered by the Oficina Española de Variedades Vegetales (OEVV) belonging to the Spanish Ministry of Agriculture, Fish and Food (MAPA). The cultivars can be propagated under royalty agreements with IRTA. Limited amounts of virus-free budwood for research purposes are available from IRTA Mas de Bover after signing a nonpropagation agreement (www.irta.es). IRTA has granted a multiplication license for the four cultivars to ALMERIPLANT (www.almeriplant.com).

Literature Cited

- Godini, A. 1996. Attuali conoscenze sull'autocompatibilità nel mandorlo. Rivista di Frutticoltura 1:70–75.
- Grasselly, C. and P. Crossa-Raynaud. 1980. L'Amandier. Maisonneuve et Larose, Paris.
- López, M., F.J. Vargas, and I. Batlle. 2006. Self-(in) compatibility almond genotypes: A review. Euphytica 150:1–16.
- Socias i Company, R. 1990. Breeding self-compatible almonds. Plant Breed. Rev. 8:313–338.
- Vargas, F.J. and M.A. Romero. 1994. 'Masbovera', 'Glorieta' and 'Francolí', three new almond varieties from IRTA. Acta Hort. 373:75–82.
- Vargas, F.J., M.A. Romero, M. Rovira, and J. Girona. 1984. Amélioration de l'amandier par croisements des variétés. Résultats préliminaires à Tarragone (Espagne). Options Méditerranéennes IAMZ 84:101–122.