

Adara, A Plum Rootstock for Cherries and Other Stone Fruit Species

M.A. Moreno, M.C. Tabuenca, and R. Cambra

Departamento de Pomología, Estación Experimental de Aula Dei (Consejo Superior de Investigaciones Científicas), Apartado 202, 50080 Zaragoza, Spain

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Adara is a plum rootstock developed at the Estación Experimental de Aula Dei, Zaragoza, Spain, for use as a rootstock for sweet cherry (*Prunus avium* L.) and sour cherry (*P. cerasus* L.). A high proportion of peach and nectarine [*P. persica* (L.) Batsch] cultivars, as well as Japanese plum (*P. salicina* Lindl) cultivars, have shown a good response, although the interest in Adara for these species may be more limited.

Adara was selected from an open-pollinated population of Myrobalan (*P. cerasifera* Ehrh.), although its genetic identity has not been defined.

Scions of cherry grafted on Adara grow well; most cherry cultivars have shown good graft-compatibility, although some cultivars are incompatible (Table 1). Further tests are needed to explore the full range of compatible cultivars as has been demonstrated with other cherry rootstocks (Perry, 1987). Trees are more vigorous than on Colt (*P. avium* × *P. pseudocerasus*) or St. Lucie 64 (*P. mahaleb* L.), and yield efficiency of cultivars on Adara is higher than that on either of these other rootstocks (Table 2). Furthermore, Adara appears to be more efficient in the uptake of some mineral elements; higher concentrations of N, K, and Mn have been found in leaves of 'Van' cherry scion compared to 'Van' on St. Lucie 64 or Colt (M.A.M., unpublished).

Adara is easily propagated by hardwood cuttings. About 90% of hardwood cuttings treated with indole-3-butyric acid (indolebutyric acid) at 500 mg-liter⁻¹ rooted (Moreno, 1989).

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All nursery and orchard trials were performed on heavy clay and calcareous soils, with alkaline pH (8 to 9) and high total (30% to 35%) and active (10% to 11%) lime. Adara adapts well to these soils, being resistant to Fe chlorosis and root asphyxia. Adara appears to be a promising rootstock for many cherry cultivars grown in heavy and poorly drained soils or under irrigation where other rootstocks fail to survive (Table 3).

Origin

Adara was selected from an open-pollinated population of Myrobalan. Selection work was performed at Estación Experimental de Aula Dei. The clone initially was tested as plum 2977 AD and was released because it had good rooting ability (Moreno, 1989); it is highly resistant to root asphyxia and associated diseases and has a higher yield efficiency than other cherry rootstocks. In addition, Adara shows a lower tendency to sucker compared to St. Lucie, a rootstock widely used for cherries in calcareous and well-drained soils. Soil adaptability problems experienced with St. Lucie or other *P. mahaleb* stocks, when grown under irrigation and waterlogging conditions, stimulated the clonal selection of Adara.

Compatibility

Adara has shown good graft compatibility with 44 sweet and some sour cherry cultivars (Table 1) when tested in nursery or in orchard trials (Moreno and Tabuenca, 1991; Tabuenca and Moreno, 1988). Nevertheless, a few cultivars of sour and sweet cherry have shown graft incompatibility (Table 1), according to the criteria of Herrero (1951) and Mosse (1962). Peaches and nectarines grafted on Adara display different compatibilities depending on the cultivar, but a high proportion appears to be compatible with this rootstock (Table 4). Adara also is graft-compatible with Japanese plum, although the range of cultivars tested is not extensive (Table 5). This rootstock also has been tested with apricot (*P. armeniaca* L.) and almond [*P. dulcis* (Mill.) D.A. Webb]; the compatibility depends on the cultivar (Table 5) (Moreno and Tabuenca, 1991; Tabuenca and Moreno, 1988). 'Moniqui' apricot and 'Desmayo' almond have shown graft-incompatibility on Adara, although to a lesser degree than when they were on Myrobalan B.

Table 1. Compatibility rating for cherry scion cultivars on Adara rootstock.

Cultivar	No. trees	Compatibility ^a
<i>Prunus avium</i>		
Ambrunes	35	C
Bing	10	C
Blanca de Provenza	20	C
Burlat	50	C
Burlat C1	29	C
Colalarga	19	C
Compact Stella	10	C
Coeur de Pigeon	10	C
Corum	5	C
Cristobalina	10	C
Cherovina	10	C
Chinook	10	C
Ebony	10	C
Garrafal de Lérida	10	C
Gorda Negra Dura	20	C
Guillaume	10	C
Hedelfinger	20	C
Jaboulay	10	C
Jarandilla	10	C
Lapins	30	C
Moreau	50	C
Picota	15	C
Precoce Bernhard	28	C
Rainier	5	C
Ramón Oliva	10	C
Ripolla	110	C
Sam	22	C
Sparkle	5	C
Star	20	C
Stark Hardy Giant	50	C
Sue	5	C
Sunburst	30	C
Summit	15	C
Tardif de Vignola	110	C
Ulster	10	C
Valera	20	C
Van	125	C
Vega	15	C
Velvet	30	C
Vic	10	C
Villaretta	10	C
Viscount	25	C
Vogue	29	C
Wño (Daiber)	10	C
Gil Peck	40	A
Larian	19	A
Nero II	28	A
Spalding	30	A
Napoleon	44	I
Taleguera Brillante	40	I
<i>Prunus cerasus</i>		
Ferracida	10	C
Negra de Serra	20	C
Reina Hortensia	10	C
Temprana de Sot	18	C
Montmorency	20	I
Montmorency Sauvigny	10	I
<i>Prunus serrulata</i>		
Shirofugen	20	C

^aC = compatible, normal trees, continuous bark, and wood in the union; A = abnormal scion behavior, leaf yellowing, reduction in vigor; I = incompatible, cambial, or vascular discontinuity in the union. The cases of abnormal scion behavior and discontinuity in the union already were shown during the first 3 years following grafting. Nevertheless, tests were continued and macroscopical examination of the unions also were made when trees were 5 years old. Some compatible cultivars have been in commercial orchards for 12 years.

Description

Adara is similar to 'Myrobalan', the latter also known as cherry plum for its comparative similarity of fruit to cherry (Ramming and Cociu, 1989; Tukey, 1964). Unworked maiden trees of Adara have a vigor similar to 'Myrobalan B'. Their growth habit is semi-upright, with branches spreading more than those of 'Myrobalan B'.

One-year-old shoots are purplish red-green in spring and summer and brown and purplish red in winter. Internodes are short-medium in length, and leaves are those of a fast-growing plum type, medium in size, and green with wavy dentate margins. Mean length : width ratio of the leaf blade is 1.41 ± 0.06 , slightly lower than that of 'Myrobalan B' (1.86 ± 0.03). Leaf petioles are channeled and a pink-purple color. At the beginning of growth, leaves present small stipules. Leaf fall is late in the autumn.

Flower budbreak on Adara occurs earlier in spring than on *P. domestica* L. or *P. insititia* L. Bullace plums and at the same time as 'Myrobalan B' or 'Myrobalan GF 31'. Adara has small white flowers with one pistil. The stigma position is at the same level as the anthers or slightly lower. The anthers are yellow just before dehiscence. Fruit are rounded, symmetric, and similar in size to those of 'Myrobalan B'. The skin is yellow, with a little skin bloom. Flesh is yellow, juicy, and, in our judgement, sweet and pleasant to eat. The stone is semi-adherent and light pink, with round-elliptical and asymmetric shape in lateral view (length : breadth ratio = 1.34 ± 0.07) and semi-globular in front view (length : width

Table 2. Rootstock effects on trunk cross-sectional area (TCSA) and yield efficiency of 'Van' cherry cultivar for the first 9 years in the orchard.

Rootstock	TCSA (cm ²)	Cumulative yield (kg/tree)	Yield efficiency (kg/cm ² TCSA)
Adara	387 c ^a	240 c	0.62 c
Colt	158 a	65 a	0.41 a
St. Lucie 64	294 b	150 b	0.51 b

^aMean separation within columns by Duncan's multiple range test at $P \leq 0.05$.

Table 3. Percentage of dead trees for the first 10 years of 'Van' and 'Tardif de Vignola' cherry grafted on the various rootstocks when grown in an orchard with a heavy clay soil and under irrigation conditions (n = 16).

Rootstock	Dead trees (%)	
	Van	Tardif de Vignola
Adara	0	0
Colt	6	19
St. Lucie 64	13	38

Table 4. Compatibility rating for peach and nectarine scion cultivars on Adara rootstock.

Cultivar	No. trees	Compatibility ^z
Peaches		
Alejandro Dumas	10	C
Amarillo de Calanda	20	C
Amarillo de Gallur	20	C
Borracho de Jarque	10	C
Calanda San Miguel	20	C
Catherina	50	C
Cofrentes	10	C
Corona	20	C
Dixon	20	C
Halford	10	C
Klamt	10	C
Maluenda	20	C
Maruja Porvenir	10	C
Miraflores	20	C
Paloro A	10	C
Paloro B	10	C
Rojo del Rito	10	C
San Lorenzo	20	C
Stanford	20	C
Sudanell 2	20	C
Sudanell 3	20	C
Zaragoza	20	C
126 AD	20	C
Carolyn	10	A
Kakamas	10	A
Nuevo	10	A
Babygold 5	40	I
Babygold 6	40	I
Babygold 7	40	I
Babygold 9	40	I
Baladín	20	I
Brasileño	50	I
Calanda del Pilar	30	I
Carson	50	I
Cherryred	50	I
Fortuna	40	I
Jerónimo	50	I
Jungerman	40	I
Loadel	30	I
Maruja	20	I
Sástago	30	I
Shasta	20	I
Sudanell 1	20	I
Suncling	20	I
Vesuvio	20	I
Vivian	30	I
Nectarines		
Armking	30	C
Fantasia	10	C
Flavortop	10	C
Fuzalode	20	C
May Grand	10	C
Nectared 6	10	C
Nectarose	10	C
Flamekist	40	I
Granderli	40	I
Independence	20	I
Nectared 8	40	I
Sun Grand	10	I

^zC = Compatible, normal trees; A = abnormal scion behavior, leaf yellowing; I = symptoms of translocated incompatibility, reddening of leaves and shoots, curling of the leaf along the midrib, early senescence. Data from Moreno and Tabuenca (1991).

Table 5. Compatibility rating for several plum, apricot, and almond scion cultivars on Adara rootstock.

Cultivar	No. trees	Compatibility ^z
Japanese plums		
Delbarazur	32	C
Friar	30	C
Golden Japan	30	C
Santa Rosa	20	C
European plums		
President	10	C
Reine Claude Tardif	10	C
Reine Claude de Bavay	10	C
Apricots		
Paviot	15	C
Moniqui	80	I
Almonds		
Marcona	10	C
Desmayo	10	I

^zC = Compatible, normal trees, continuous bark and wood in the union; I = localized incompatibility, cambial or vascular discontinuity in the union. Data from Moreno and Tabuenca (1991).

ratio = 2.07 ± 0.09). The stone is small, similar to that of 'Myrobalan GF 31' and slightly larger than that of 'Myrobalan B'.

Availability

Adara registration is in progress. Small amounts of rooted cuttings or budwood can be obtained from the Estación Experimental de Aula Dei. Adara is free of all known viruses (Moreno, 1989; Moreno and Tabuenca, 1991).

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