

# Almonds

Innovation  
is in our nature



**AGROMILLORA**

## SYSTEM CHANGE














# How to make almond farming sustainable














Almond farming currently produces over 1.6 million tons of kernels worldwide, with the United States being the leading producer, accounting for 79%, followed by Australia with 7.6% and Spain with 6.6%.

Most of the production is destined for the U.S., which represents 22% of global consumption.

The industry generates over 12 billion euros in revenue and employs more than 20 million people.

Of all the almond-growing hectares worldwide, more than 7,000 are cultivated using a more sustainable system: the Super High Density model.

Production	Production in tons	
 United States	1.298.200 	79%
 Australia	124.439 	7,6%
 Spain	109.200 	6,6%
 Türkiye	18.000 	1,1%
 Tunisia	16.500 	1%
 Others	77.500 	4,7%
Total	1.643.839 	

Consumption	Consumption in tons	
 United States	370.723 	22,4%
 India	167.659 	10,2%
 Spain	114.164 	6,9%
 China	86.372 	5,2%
 Germany	83.938 	5,1%
 Others	828.594 	50,2%
Total	1.651.450 	

## Global almond area

2.243.892 ha



20%  
Irrigation



80%  
Dryland



73%  
Traditional



25,7%  
High Density



1,2%  
Super High Density

The data presented have been extracted from the study 'El Cultivo Permanente Leñoso: Un estudio internacional de sus principales magnitudes y tendencias'

# Hedge Cultivation Models



Everything about  
SHD Almond

We are leaders in the hedge model and are always at the forefront of innovation to respond to new trends in the international agricultural sector.

We work to provide growers, technicians, and companies in the sector with solutions to the new challenges that continue to arise: the development of new varieties and rootstocks, new hedge training and management systems, increasing production levels, and in general, new opportunities for the industry.



## Advantages of the hedge model



Fully mechanized harvesting.



Total mechanization of cultivation tasks from the moment of planting with a significant reduction in costs.



Early entry into production, with a faster amortization of the initial investment.



Mayor eficiencia en la aplicación de productos fitosanitarios. Reducción de la pérdida de productos fitosanitarios al medio ambiente.



Higher product quality, high harvest quality (proper ripening, minimum damage to the fruit, and the fruit does not touch the ground, thus avoiding contamination and possible browning of the fruit).

# Considerations for achieving a productive hedge

## Planting frameworks:

- Dryland planting: (Self-rooted varieties) 4 x 1.5 m in dryland (1,600 plants/ha).
- Irrigated planting: 3-3.5 m x 1-1.35 m (> 2,400 plants/ha).

Productive structure: disorganized growth, without a central axis.

Genetic material: The choice of a low-vigor rootstock is essential for the success of the planting, along with self-fertile varieties.

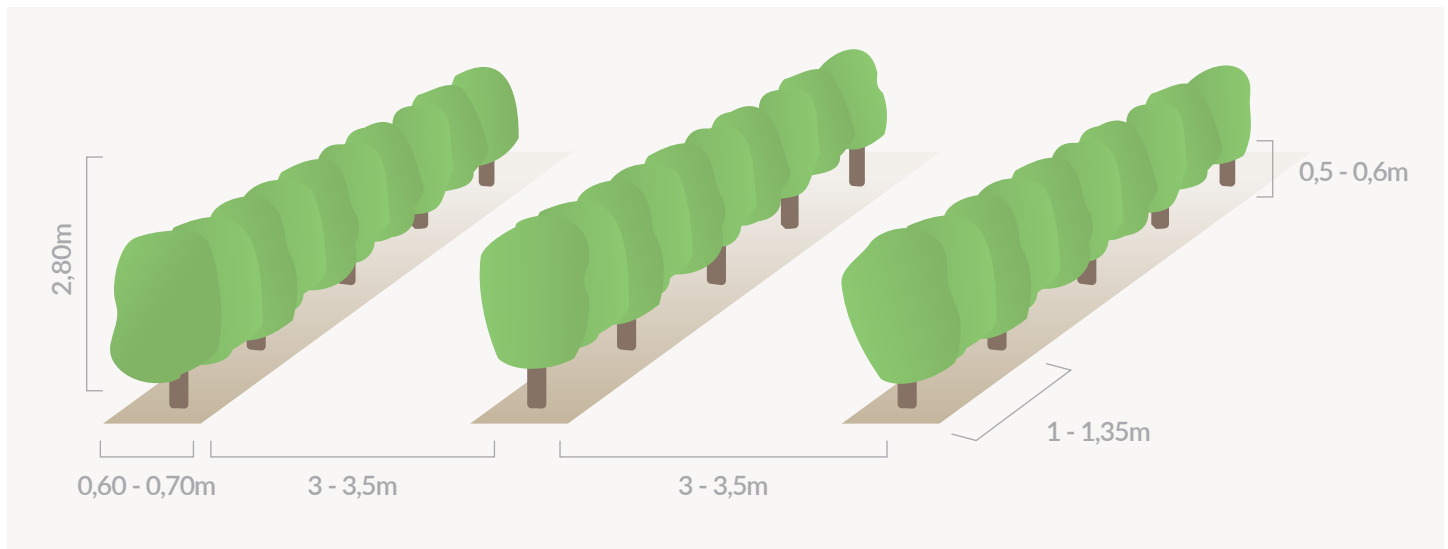
- Self-rooted: self-fertile varieties without rootstock.

## Mechanical pruning:

- Formation pruning: Topping every 25-40 cm.
- Production pruning: Topping and lateral pruning.



Video on  
formation and  
maintenance





# ROOTPAC<sup>®</sup> 20

## Dwarf rootstock with high productivity

### Agronomic Characteristics

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**Vigor:** Low, around 40-50% less than GF-677.

**Compatibility:** Good with peach, nectarine, Japanese plum, and almond varieties. Compatible with some apricot varieties, though more information is needed about its affinity with more varieties.

**Growth habit:** Erect and compact.

**Productivity:** Highly productive.

**Caliber:** Produces very good fruit size and quality. It accelerates ripening in most varieties.

**Adaptability:** Very adaptable to all production conditions, both warm and colder climates.

**Other characteristics:** Ideal for high-density SHD plantations. Good adaptation to heavy soils and colder areas.

### Resistances and tolerances

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**Cold:** Tolerant.

**Chlorosis:** Moderately tolerant.

**Root-knot nematodes:** Moderately resistant.

**Agrobacterium tumefaciens:** Susceptible.

**Rosellinia necatrix:** Moderately tolerant.

**Chlorosis:** Moderately tolerant.

**Root asphyxia:** Highly tolerant.

**Salinity:** Moderately tolerant.

**Lesion nematodes:** Unknown.

**Armillaria mellea:** Some degree of tolerance is suspected.



# ROOTPAC<sup>®</sup> 40

## Anticipates ripening

### Agronomic Characteristics

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**Vigor:** Medium, around 25-30% less than GF-677, though with a highly developed root system.

**Compatibility:** Good with peach, nectarine, almond, and some Japanese plum varieties.

**Growth habit:** Upright, similar to Garnem.

**Productivity:** Highly productive.

**Caliber:** Ripens 3 to 7 days earlier depending on the variety. Produces fruit with good size.

**Adaptability:** Adapts very well to all climates, especially those with low chilling requirements.

**Other characteristics:** Green-leaf rootstock. Rigid stem (early lignification) with little to no branching in early development stages. Easy to manage in nurseries

### Resistances and tolerances

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**Cold:** Tolerant.

**Chlorosis:** Moderately tolerant.

**Root-knot nematodes:** Moderately resistant.

**Agrobacterium tumefaciens:** Susceptible.

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**Root asphyxia:** Highly tolerant.

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**Lesion nematodes:** Unknown.

**Armillaria mellea:** Some degree of tolerance is suspected.



# ROOTPAC<sup>®</sup>R

## Fatigued and replant soils

### Agronomic Characteristics

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**Vigor:** High with peach, nectarine, and plum varieties. Similar to Mariana-2624.

**Compatibility:** Good with plum, peach, and nectarine varieties. It has also proven to be compatible with some almond and apricot varieties.

**Growth habit:** Open, with medium branching.

**Productivity:** Highly productive.

**Caliber:** Ripens 2 to 5 days earlier compared to other rootstocks. Produces good fruit size in both plum and peach/nectarine.

**Adaptability:** Very adaptable to different climatic conditions, with varying chilling requirements. Ideal for replanting sites. Adapts well to dense and suffocating soils.

**Other characteristics:** Green-leaf rootstock, with an appearance between plum and almond. Rigid and erect stem in the early development stages.

### Resistances and tolerances

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**Cold:** Tolerant.

**Chlorosis:** Highly tolerant.

**Root-knot nematodes:** Highly tolerant.

**Agrobacterium tumefaciens:** Unknown, though likely susceptible, like most plums.

**Rosellinia necatrix:** Has shown resistance in highly infested sites of this soil fungus.

**Asphyxia:** Tolerant to asphyxia, similar to Mariana-2624.

**Salinity:** Moderately tolerant.

**Lesion nematodes:** Slightly susceptible.

**Armillaria mellea:** Unknown. Its high survival rate in replanting sites suggests it has tolerance



# PILOWRED

## Low vigor rootstock

**VIGOR INDUCED TO THE VARIETY:** 50-60% less than its sibling Garnem® depending on planting density.

**CHARACTERISTICS:** Red leaves with a different shade than Garnem®, with an upright growth habit and little branching.

**CHILL REQUIREMENTS:** Lower chill requirements. Buds 2-3 days earlier than Garnem®, allowing for shorter nursery production periods.

**COMPATIBILIDAD:** Very good with all almond, peach, nectarine, and diploid plum varieties

**COMPORTAMIENTO EN PLANTACIÓN:** High productive efficiency and good fruit quality.

**RESISTANCE TO BIOTIC STRESSES:** Rootstock resistant to nematodes of the Meloidogyne genus (*M. armenaria*, *M. incognita*, and *M. ethiopica*), same as Garnem®.

Behavior against *Phytophthora* is similar to Garnem®.

**TOLERANCE TO ABIOTIC STRESSES:**

**Drought:** Shows higher water use efficiency (WUE) than Garnem® and GF-677, making it more drought-tolerant, similar to Garfi.

**Chlorosis:** Similar to the red hybrids Garnem®, Felinem®, Monegro®, or GF-677.

Root asphyxia: Susceptible.



# INTENSIA

## Medium vigor rootstock

### Agronomic Characteristics

**Tree vigor:** Reduced, 40-50% less than the rootstock 'GF-677'.

**Compatibility:** Very high.

**Blooming period:** Can delay the cultivar's flowering period by 2-3 days compared to 'GF-677'.

**Ripening period:** Ripens 3-4 days earlier compared to 'GF-677'.

**Yield capacity:** Very high, similar to 'GF-677'.

**Yield regularity:** Very good, low yield alternation, similar to 'GF-677'.

**Yield efficiency:** Very high, similar to 'GF-677'.

**Earliness in production:** Early, more so than 'GF-677'.

**Fruit and seed size:** Similar to 'GF-677'

### Resistance and/or tolerance

**Chlorosis:** Tolerant, similar to 'GF-677'.

**Drought:** Tolerant, similar to 'GF-677'.

**Asphyxia:** Susceptible, similar to 'GF-677'.

**Salinity:** Medium, similar to 'GF-677'.

**Nematodes:** Susceptible, similar to 'GF-677'.

**Soil pathogenic fungi:** Under evaluation.



# Vigorous Rootstocks



## GARNEM

**ORIGIN:** Interspecific hybrid of peach × almond (Garfi × Nemared).

**BREEDER:** CITA, Zaragoza (Spain).

**VIGOR/REGENERATIVE SHOOT EMISSION:** High/Not sensitive.

**CHARACTERISTICS:** Red leaves, upright growth habit with very little branching.

**COMPATIBILITY:** Good with all varieties of peach, nectarine, some plums, and almonds.

**PLANTING PERFORMANCE:** Good resistance to root-knot nematodes of the *Meloidogyne* genus, which is beneficial for replanting or in sandy soils. Low winter chilling requirement; interesting for areas with low availability of chilling hours. Sensitive to root asphyxia. Good to medium productivity depending on species and variety.

**GLOBAL EVALUATION:** PWidely distributed rootstock, of special interest in the Mediterranean area in calcareous, poor soils, and vigorous varieties. Interesting for medium to low-density plantations

## GF 677

**ORIGIN:** Spontaneous interspecific hybrid of peach × almond selected by INRAE at La Gran Ferrade (France) in the 1950s.

**VIGOR/REGENERATIVE SHOOT EMISSION** High, lower than Garnem/Not sensitive.

**CHARACTERISTICS:** Green leaves, upright growth habit with little branching.

**COMPATIBILITY:** Good with all varieties of peach, nectarine, and almond.

**PLANTING PERFORMANCE:** Sensitive to nematodes, but due to its high vigor, it can tolerate (*Meloidogyne* spp.) when the infestation is not high. Sensitive to root asphyxia. Low winter chilling requirement; interesting for areas with low availability of chilling hours.

**GLOBAL EVALUATION:** A widely distributed rootstock in the Mediterranean basin due to its adaptation to calcareous, poor soils and vigorous varieties. Interesting for medium to low-density plantations. Replaced by Garnem in areas with nematode problems.



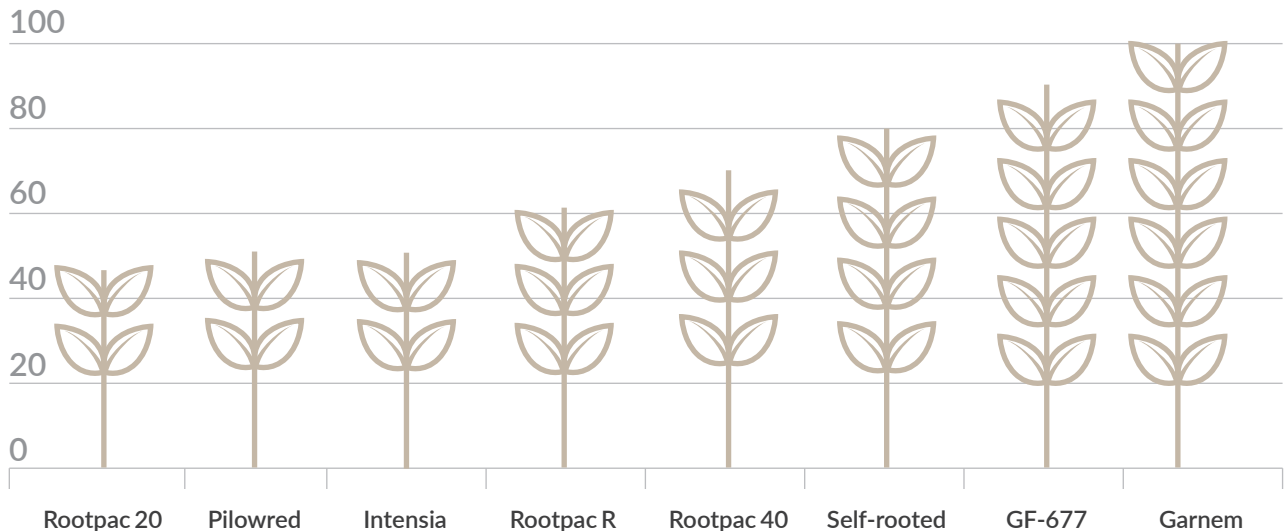


For dryland plantations  
or with deficit irrigation

## SELF-ROOTED

- Medium vigor (30% less than GF-677). Ease of pruning management and complete mechanization.
- High hardiness and drought resistance.
- Taproot system with rapid soil colonization.
- Suitable for deficit irrigation conditions.
- Adapts excellently to hedgerow plantings.

## Vigor of different rootstocks

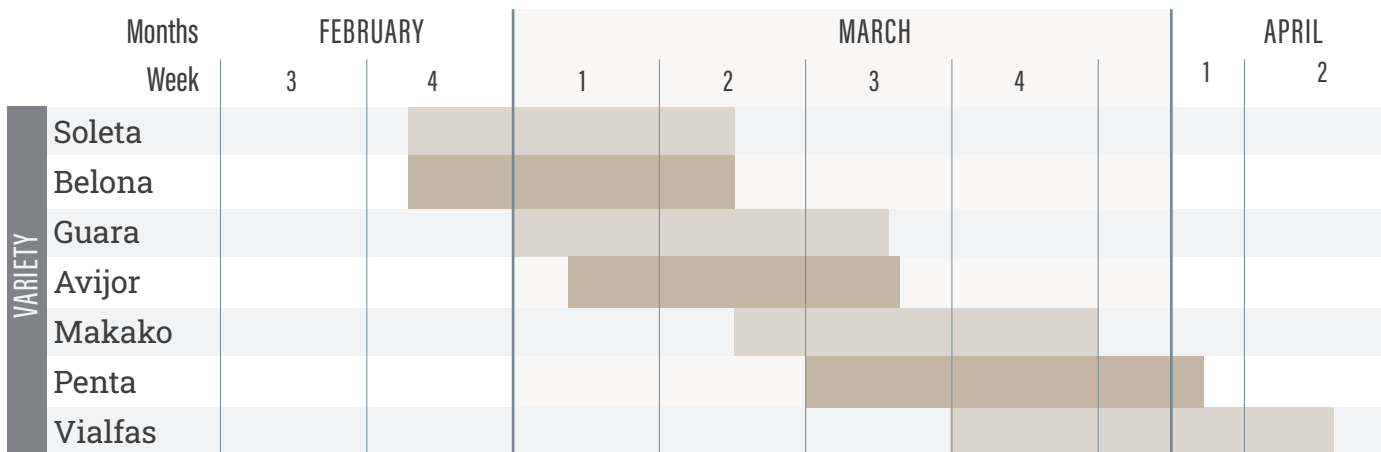


\*The climatic conditions and specific soils of each area can modify the results shown in this graph.

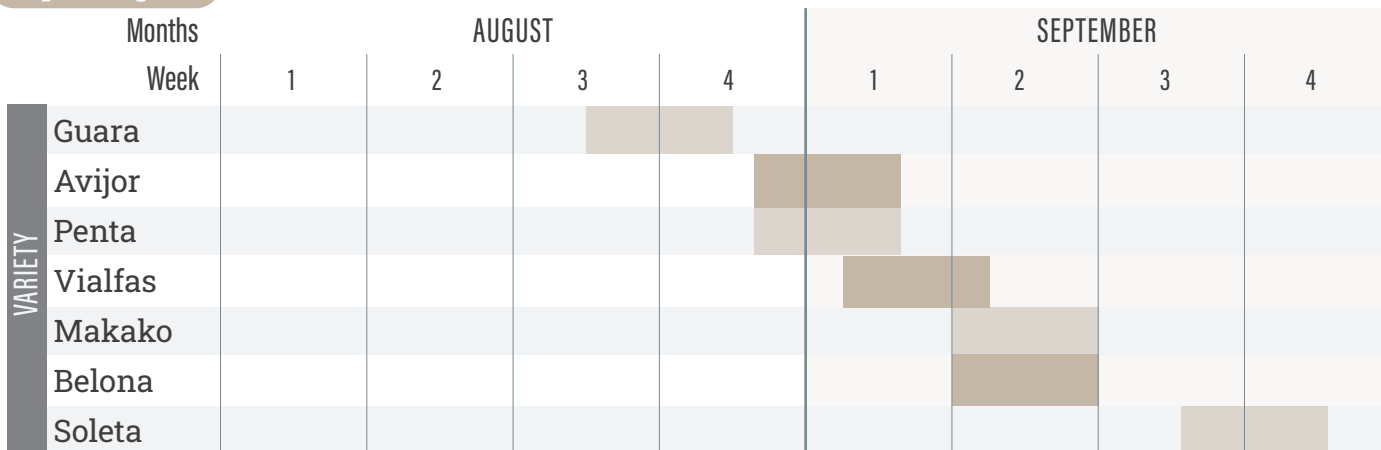
# Varieties

The choice of a suitable variety from the moment of planting largely defines the production and marketing capacity of the harvest. Late or extra-late self-fertile varieties with low to medium vigor, good branching, and a tendency to develop fruitful structures have proven to be the most suitable for this type of planting.

## Blooming



## Ripening



*\*The specific climatic conditions of each area can modify the results of the tables. The data shown in the tables have been obtained from the book "El cultivo del almendro". Estimated average data for cold and early areas)*

# Self-fertile varieties

Soleta®



Vigor: Medium  
Blooming period: Late  
3 days earlier than Guara

Branching: Medium  
Productivity: High

Belona®



Vigor: Medium  
Blooming period: Late  
2-3 days earlier than Guara

Branching: Medium  
Productivity: High

Guara



Vigor: Medium  
Blooming period: Late

Branching: Low  
Productivity: High

Avijor



Vigor: Medium  
Blooming period: Late

Branching: Medium  
Productivity: High

Penta®



Vigor: Medium  
Blooming period:  
Extra late

Branching: High  
Productivity: High

Makako®



Vigor: High  
Blooming period:  
Extra late

Branching: Medium  
Productivity: High

Vialfas®



Vigor: Medium  
Blooming period:  
Extra late

Branching: Medium  
Productivity: High



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*The data and results presented in these graphic resources are for informational purposes only and it is not guaranteed that they will necessarily be achieved in all cases, due to multiple factors that influence plant growth, such as climatic and geographical conditions, soil characteristics, as well as management practices and agricultural uses.*