FRENCH PRUNE

CULTIVATION OF THE FRENCH PRUNE IN HEDGE

AN INNOVATIVE, EFFICIENT, AND SUSTAINABLE PROPOSAL

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The cultivation of prune in Chile for dehydration is mainly based on the French variety grown with the traditional open vase with usual planting distances of 20 to 23 ft between lines and 13 to 16 ft between trees.

Differences in the volume and canopy architecture of the traditional open vase hedge-grown trees for the French variety at Agrícola San Miguel (Peralillo, O'Higgins, Chile).

Background

In the last 25 years, different production models proposed and promoted by AGROMILLORA have been developed in Spain and in other countries of the world, based on hedge management, also named SHD, in species such as **olive trees, deciduous fruit species, almond trees, and more recently with prunes, citrus, and hazelnut.**






These models aim at efficient and sustainable production based on the efficient use of inputs in the production process, particularly labor, water, and fertilizers.

OLIVES
The olive tree is the species with that these models were started with 25 years ago; it has more than 1,200 million acres planted in the world, mainly in Spain and Portugal.

ALMONDS
For almonds, the first plantations began in 2010 in Spain, and at present, there are about 15,000 acres planted worldwide.

CITRUS
For citrus, the first experimental and commercial plantations are available in Spain, Brazil, and the United States, which started 5 years ago.

PRUNES
Regarding prunes trees, the first commercial hedge prune plantation was carried out in Chile in 2014 with the French variety, with the second plantation being carried out in California in 2019.

The proposal of the French Prune hedge model is based on specific objectives to respond to the requirements of both producers and the environment:

1. Reduction of the unproductive period by intensifying plantation.

2. Minimal dependence on labor for pruning and harvesting.

3. Trees in hedges with small-volume, two-dimensional crowns, highly efficient in the use of inputs and mechanizable plantations for pruning and harvesting.

4. Mixed suitability of plantations, with manual harvesting for fresh consumption in the domestic and export markets, or mechanically when the destination is dehydrated prunes, or combining both options depending on the prices.

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Basis of the Hedge Model and Plantation Management

The productive model of the French Prunes tree in hedges is based on the efficient combination of three factors:

1. The French variety. Nowadays, it is the most important of the varieties grown in Chile due to the characteristics of the fruit, the taste quality, and the double suitability as fresh or dehydrated.

2. **The Rootpac®20 rootstock**, obtained by Agromillora, it gives naturally controlled vigor and good adaptation to a wide range of soils, especially the heaviest ones. Vigor control is key to having small volume crowns that are easily machinable and efficient in light distribution inside the canopy.

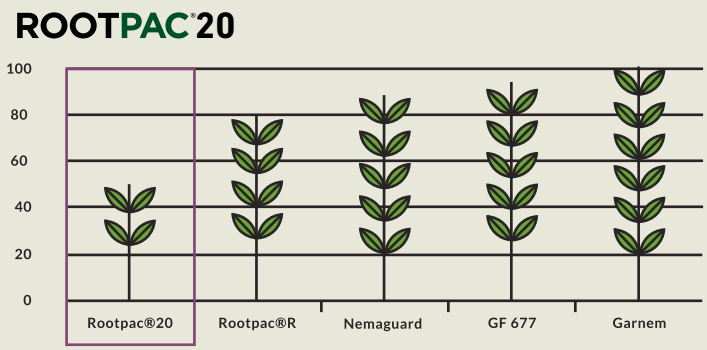
3. Hedge management as a small-volume, two-dimensional formation system. Adapted to mechanization for pruning and harvesting with rover-the-row machines used in vineyards and for almond trees.

The three key factors for the new productive proposal for prunes

1

Variety: French Prune

2



Rootstock: Rootpac ® 20

3

Training system: in hedge

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Hedge management is based on small trees and a two-dimensional canopy made up of multiple branches that should efficiently occupy the small space allocated. Starting from a Smarttree tree and through subsequent trimming throughout the training period, in the 4th year, the tree will fully develop, occupying the assigned space and reaching full production in the 4th or 5th year.

The planting distances range from 10 to 11.5 ft between lines and from 3 to 4.5 ft between trees. This is equivalent to planting densities of 1,389 to 850 trees/acre. The distance from the lowest branches to the ground should not be less than 20in to facilitate harvesting and to avoid the loss of fruit due to the movement of the ride-on machine.

A Smarttree tree with a protector prepared for planting.

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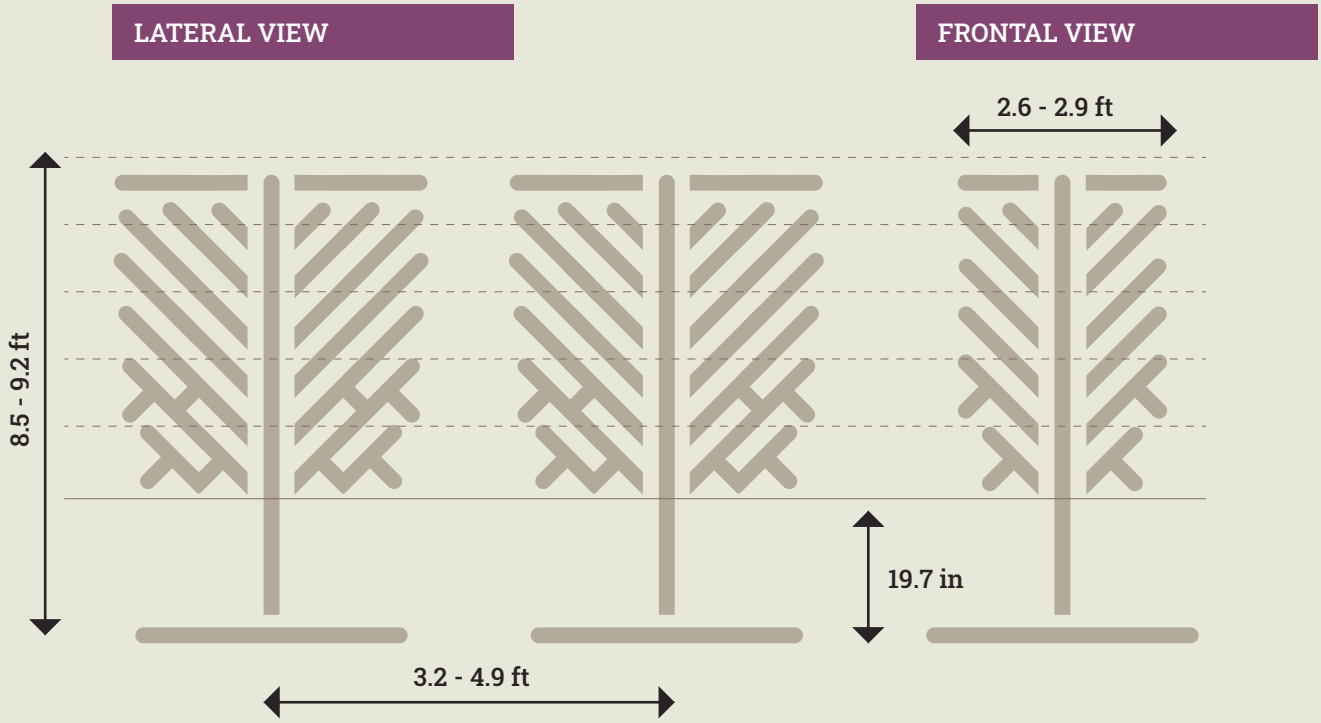
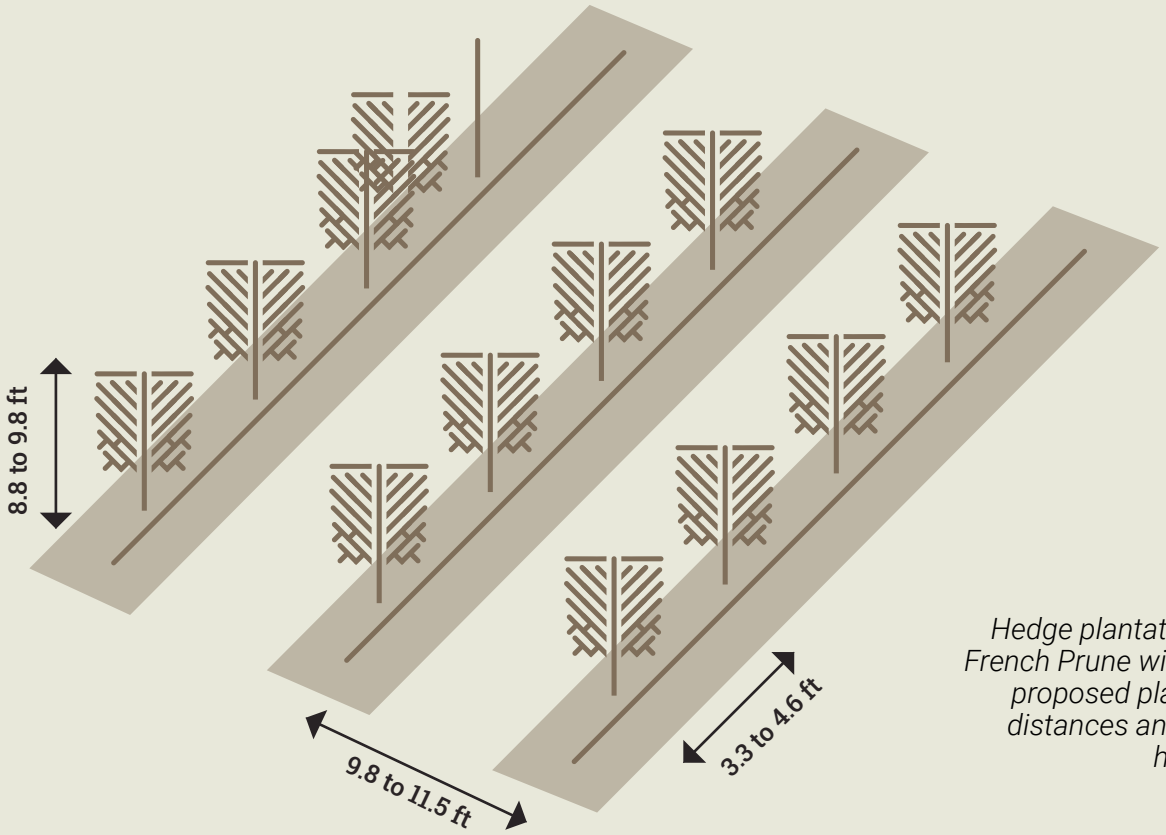
It is important to note that t
he majority of European prune varieties,
such as French, are erect
and medium branching.



Side and front views of the hedge with its dimensions.

The characteristics of hedge plantation based on the management concepts set out above translate into a plantation whose design will not exceed 10ft in height and in any case must be adjusted to the dimensions of the over-the-row harvester machine to be used.

The dimensions of the hedge allow variations and adjustments depending on the variety and the specific soil-climatic conditions where the plantation is located.



Hedge plantation of French Prune with the proposed planting distances and tree height.

HEDGE CULTIVATION OF THE FRENCH PRUNE TREE

CULTIVATION OF THE FRENCH PRUNE IN HEDGE

The dimensions of the hedge described above allow for the mechanization of the summer pruning tasks (pinching off), treatments, soil maintenance, and harvesting in the case that it is with over-the-row machines, or facilitating it when it is manual. In the first year of planting, pruning will be done manually in the first passes and in the first and second year for pruning between trees where mechanical pruning cannot access.

Different summer pruning and harvesting operations for the French Prune in hedges from year 1 to year 4 and beyond.

Production and Cost

Chile has the oldest farm with French hedge in the world.

The characteristics of the farm are the following:

Farm/location/producer: Agrícola San Miguel, Peralillo, O'Higgins region (Chile), Andrés Schurter management.

Variety/rootstock: French/Rootpac®20

Area: 7.5 acre

Planting spring 2014. Grafting July 2014. Equivalent to planting with Smartree in winter 2014-2015. Fifth year of planting in 2020.

Plantation distances: 11.5 x 4.9 ft = 13,5 trees/acre

Management system and volume: hedge, canopy volume = 5,029 m3/ha

At the end of the 2017 season, equivalent to 2 years after planting or two years old trees, the tree had occupied 60% of the final volume. The unproductive period will be reduced 2 years, starting yields in the 3rd leaf. The first production was obtained in 2018, reaching the final canopy volume in 2019, and in 2020, almost full production that could be established at 35,700 lb/acre.

The yields obtained throughout the years of the plantation and those expected have been represented if the plantation framework had been 10.5 x 4 ft, which is the framework that would best fit the same plantation and it would make it possible to significantly increase both the intercepted light and the productive potential without affecting quality, either for fresh or for industry. The expected productions for a 10 x 3.3 ft spacing have also been included, which would be interesting when the destination is dehydration, as this would be the closest to the optimum plantation density based on the path width-hedge height ratio (1/1 ratio).

The harvest was carried out with the New Holland VX 7090, used in Chile for vineyards, olive trees, and almond trees, with a working speed of 1,86 mi/h. The VX9090 is also available with an olive head, which is taller and would make it possible to increase the total height of the hedge to 10 ft.

The Gregoire, OXBO, and trailed Pellenc olive ride-on machines could also be used. With minor modifications, any of these machines can be used for the French Prune. The damage caused by ride-on machines to the fruits for the 2020 harvest was estimated at 2.8% of damaged fruits, similar to a side-by-side, compared to 4.4% corresponding to the traditional head-pruned collected manually.

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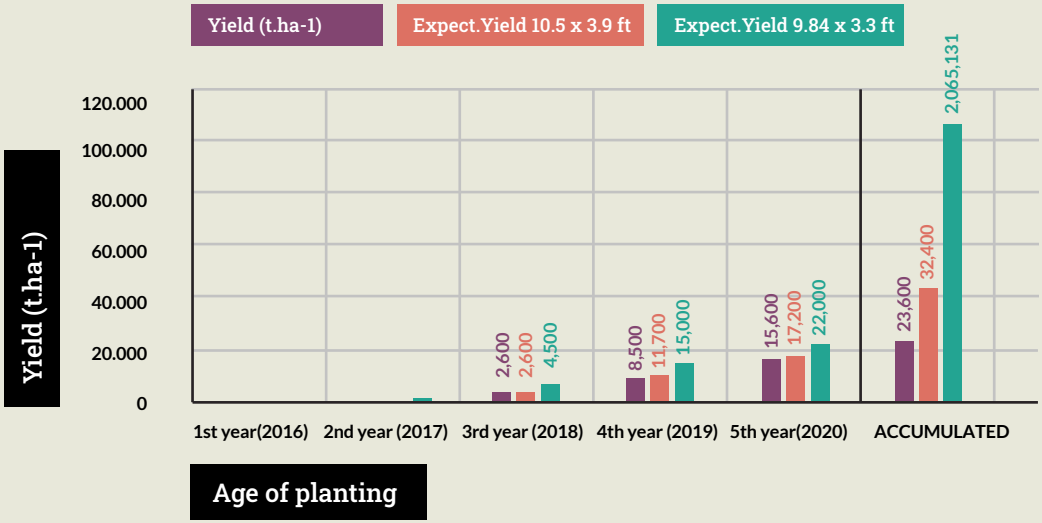

Annual and accumulated yields of the French variety at Agrícola San Miguel (Peralillo, O'Higgins, Chile), up to the fifth year of planting with a 11.5 x 4.9 ft framework and potential production expected for 10.5 x 3.9 ft and 9.8 x 3.3 ft planting frameworks.

Planting costs, as well as those corresponding to the 5th year and beyond, where it is observed that planting involves an investment of 17,000$/acre for the 11.5 x 4.9 ft framework used, but it would be higher if the planting density is increased.

The annual production costs of French Prune with the hedge system compared to the traditional head-pruning are reduced between 7,508 and 9,015 US $/acre, mainly due to lower pruning, harvesting, and phytosanitary treatment costs.

Planting	Year 1	Year 2	Year 3	Year 4	Year 5 and +
17,000 $	2,400 $	3,000 $	5,500 $	7,900 $	9,100 $

Planting cost and annual costs (US $/acre) corresponding to French Prune planting in Peralillo (O'Higgins, Chile). Full production is estimated in the 5th year.

Fruit Quality Parameters

The quality of fruit for French prune for fresh consumption is determined by the fruit size and the sugar content (°Brix), quality parameters also used for dehydration, which also include the % of humidity of the fruit for the fresh weight/dry weight conversion. The ideal sizes are those larger than 1.3 in with sugar content greater than 16°Brix.

It can be observed that the sizes obtained are in the range of 1.18 to 1.30 in, with high sugar content and firmness values higher than those used for fresh consumption (4-6 lb).

Harvest/year	lb/acre fresh	lb/acre dehydrated	Average size (in)	Sugar Content (°Brix)	Firmness (lb)
1st harvest Feb. 2018	5,709	1,900	1.1-1.2 in	25,0	6-7
2nd harvest Feb. 2019	19,000	6,000	1.1-1.3 in	18,5	6-7
3rd harvest Feb. 2020	28,000	10,300	1.1-1.3 in	24,0	7-8

Production and quality parameters for French prunes in hedges corresponding to the years 2018, 2019, and 2020 at Agrícola San Miguel (O'Higgins, Chile).

Conclusions

Hedge cultivation of the French prune, whether for fresh or dehydrated consumption, represents a disruptive change with respect to the traditional open vase method of production.

The change in the tree architecture of the tree, from a voluminous shape canopy to a bi-dimensional shape with reduced volume, results better accessibility to the cannopy for people/workers when harvest is done manually and for machines when it is done over-the-row harvesters.
In addition to reducing production costs due to the greater efficiency of inputs such as labor, pesticides, irrigation water, or fertilizers, this system allows to get early yields and provides a double ability: harvesting prune for fresh consumption or for dehydration, depending on market price.

This hedge system follows the path of other fruit species, characterized by the transition to smaller, two-dimensional canopies and efficient in the use of inputs; therefore, more sustainable environmentally and for producers' incomes by reducing the cost of production and being less dependent on labor.

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