

## Jagoda, proizvodni sustavi u Francuskoj

### Strawberry Production Systems in France

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#### SAŽETAK

Jagoda je tradicionalna kultura u Francuskoj već skoro tri stoljeća. Nacionalna proizvodnja se uvelike smanjila zadnjih petnaest godina: od 82,000 t 1990. do 1995. na 46,000 t 2007. Zadnjih pet godina površine su se smanjile od 3,780 ha 2002. na 3.265 ha 2007. Uvozno/izvozna bilanca pokazuje veliki deficit: više od 110,000 t se uvozi godišnje, uglavnom iz Španjolske i Maroka. Gotovo sva proizvodnja ide u svježju potrošnju; samo vrlo malen postotak (1,300 t u 2007.) se prerađuje. Polovica francuske proizvodnje prodaje se između konca travnja i početka lipnja, ukupno razdoblje branja počinje sredinom veljače i završava u prvom tjednu studenog. Četiri glavna područja čine 3/4 nacionalne proizvodnje: jugozapad (39% 2007), jugoistok (14%) Rona-Alpe (11%) i Dolina Loire (11%). Francuska nacionalna proizvodnja je danas usmjerena na kakvoću i visoke cijene, većinom temeljena na francuskim kultivarima koji dozrijevaju u lipnju (Gariguet, Darselect), s manjom proizvodnjom jagoda koje stalno rode za vrijeme ljeta (Mara des Bois, Charlotte). U trideset godina proizvodnja se pomaknula iz dominantnog sustava otvorenog polja na dominantan sustav visokog tunela, te u manjoj mjeri staklenike (staklenici visoki tuneli: 62% ukupne površine 2007.). Otvorena polja i mali tuneli veoma se smanjuju svake godine, dok visoki tuneli rastu. Kultura supstrata u visokim tunelima i staklenicima sada se procjenjuje na oko 400 ha i još uvijek raste. Kultura supstrata omogućuje uzgajalima proizvodnju deset mjeseci u godini. Istovremeno kombinirajući kultivare, vrstu biljaka i grijanje. Novi izazovi u nacionalnoj proizvodnji su suzbijanje nametnika i bolesti, te troškovi rada. Francuski sustavi proizvodnje očito se razvijaju prema više tehničkom upravljanju usjevima, s ukusnim kultivarima za razliku od jeftinijih uvoznih jagoda.

Ključne riječi: Francuska, proizvodni sustavi, agoda.

#### ABSTRACT

Strawberry has been a traditional culture in France for nearly three centuries. National production greatly decreased over the past fifteen years: from 82,000 T between 1990 and 1995, to 46,900 T in 2007. In the last five years, the surface regularly decreased from 3,780 ha in 2002 to 3,265 ha in 2007. The import/export balance shows a high deficit: more than 110,000 T are imported yearly, mainly from Spain and

Morocco. Nearly all the production goes to the fresh consumption; only a very small percentage (1,300 T in 2007) is processed. Half the French production is sold between the end of April and early June, but the general picking period starts mid-February and ends in the first week of November. Four main areas totalise  $\frac{3}{4}$  of the national production: South-West (39% in 2007), South-East (14%), Rhône-Alps (14%), and Loire Valley (11%). French national production is nowadays focused on quality and high prices, mostly based on French Junebearing cultivars ('Gariguette', 'Darselect'), with a minor everbearer production during summer ('Mara des Bois', 'Charlotte'). Within thirty years, production systems moved from dominant open field system to dominant high tunnel systems, and to a lesser extent glasshouses (high tunnel glasshouses: 62% of the total surface in 2007). Open field and small tunnels are strongly decreasing each year, while high tunnels are increasing. Substrate culture in high tunnels and glasshouse is now estimated at about 400 ha, and is still increasing. The substrate culture enables the growers to produce "ten months a year", while combining cultivars, type of plants and heating. New challenges for national production are pest and disease control, and labour costs. French production systems clearly evolve to more technical crop management, with tasty cultivars, to differentiate from cheaper imported strawberries.

Key Words: France, production systems, strawberry

## 1. INTRODUCTION

Since L. A. Frézier, a French naval engineer, brought back the first four plants of *Fragaria chiloensis* from a spying tour in Chile in 1714, strawberry has been a traditional culture in France. It used to be limited to Brittany in the early seventeenth century, and then expanded to all regions. Nowadays, strawberries are widely cultivated throughout France, with cultivation techniques adapted to the various French climates, from continental to Mediterranean and oceanic. In France, strawberry is rather considered as a spring production before summer fruits (cherry, apricot). The summer everbearer consumption is low, as it is often considered as an "out of season" fruit. French fresh strawberry consumption is about 2.0 kg/year/capita; it is a very popular fruit. For the consumer, three levels of quality are defined, first based on price, and then on cultivar and origin:

- Low price strawberries from Morocco and Spain (Camarosa cultivar),
- Standard quality: strawberries from France (Darselect, Clery...) but also from Belgium and the Netherlands (Elsanta), and Germany,

- Highly flavoured: it is based on French cultivars such as ‘Gariguette’, the most popular French cultivar, ‘Ciflorette’ and, for the everbearers, ‘Mara des Bois’ and ‘Charlotte’. These varieties are produced in France.

French production represented 46 900 T in 2007 on 3,266 ha, and is estimated at 42,000 T in 2008, cultivated on 3,100 ha. Nearly all the production goes to the fresh consumption, and only a very small percentage (1,300 T in 2007) is processed. The global trend is a slow decrease of the area, about 5% each year. The surface cultivated in 2007 represents only 75% of the 1999 surface (Table 1). The traditional production period is from March to mid July, with some production (everbearing cultivars) continuing until early November. Almost half of the production takes place in May.

**Table 1: French national production**

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Production (T)	61 345	59 820	54 743	51 693	47 386	53 387	51 491	51 192	46 900
Surface (ha)	4 345	3 971	3 860	3 779	3 687	3 578	3 451	3 403	3 266

The import/export balance shows a strong deficit, which has been increasing in terms of value over the past ten years (Table 2). The two main destinations for exports are Germany (2007: 6,600 T) and Italy (2007: 4,530 T). Imports are coming mainly from Spain (2007: 77,900 T), Morocco (2007: 14,850 T), Belgium (2007: 6,340 T) and Germany (2007: 4,290 T). Spain and Morocco are competitors to French production during March and April, and for Belgium and Germany in May and June.

**Table 2: French imports and exports of fresh strawberry, in volume and value.**

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Export (T)	16 348	21 840	18 727	24 960	27 083	32 535	40 999	34 439	23 998
Export (1 000€)	37 172	40 041	39 728	53 633	52 611	59 320	73 936	62 248	48 058
Import (T)	81 621	88 354	82 702	91 821	93 596	115 312	123 036	117 435	110 243
Import (1 000€)	129 996	130 827	131 885	175 469	154 985	176 128	184 846	176 766	187 079

## 2. PRODUCTION AREAS

Strawberry is cultivated in all French regions, but more than 3/4 of the production is concentrated in four main areas (cf. figure 1):

- the South-West is traditionally the most important, 18,345 T in 2007, 39% of the national production. The production begins in early March with a heated substrate cultivation system and continues until the end of October with everbearing cultivars.

- the South-East (6,360 T in 2007, 14% of the national production) has a Mediterranean climate and is specialised in early production from beginning of March to beginning of May. The commercial challenge for this region is to maximise its production before Easter.

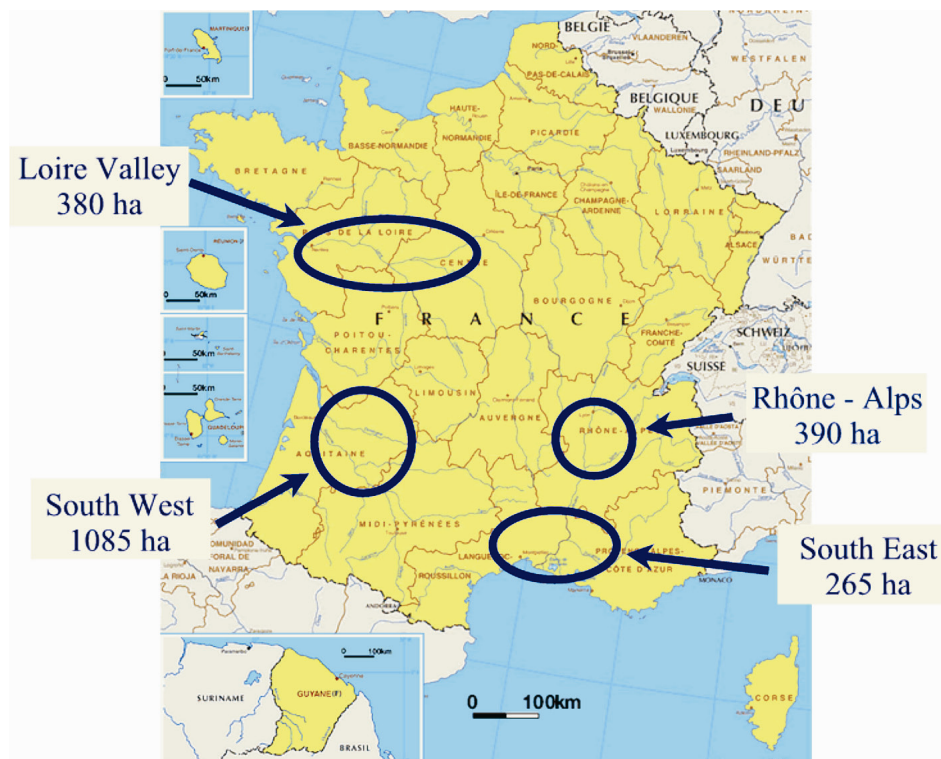


Figure 1: Main strawberry production areas

- the Rhone-Alps region produces mainly in April, May, and June (6,000 T in 2007, 14% of the national production) due to its continental climate. It also has a summer production of everbearing cultivars.
- the Loire Valley (5,305 T in 2007, 11% of the national production) also has the main production from April to June, followed by the everbearer production in summer and autumn.

The typical harvest planning begins late in February in the South-East region, followed by the South-West in March, the Loire Valley and then the Rhône-Alps region in April. The traditional season ends in the first 10 days of July, even if a small production continues in the South-West, the Loire Valley and Rhône-Alps.

### 3. CULTIVARS

Three breeding programmes are currently releasing new strawberry varieties (Junebearing or everbearing varieties). CIREF Création Variétale is supported by Producer Organisations, whereas Darbonne Pépinières and Marionnet SARL are private.

The most popular and cultivated cultivar is ‘Gariguette’, released in 1976 by INRA (French National Institute for Agricultural Research). It is so popular that French people think of ‘Gariguette’ when they talk about highly flavoured strawberries. It has a good balance between sweetness and acidity. It is low yielding and expensive for the consumer, some problems may occur concerning shelf life ability, and its flavour can be variable. ‘Gariguette’ is so popular that alternative highly flavoured cultivars are difficult to develop: ‘Ciflorette’ (CIREF Création Variétale) was released in 1996. It has a better shelf life ability and a stable flavour, but has hardly developed.

‘Darselect’ (Darbonne Pépinières) is the most widely grown cultivar after ‘Gariguette’. It is a full-season cultivar, and has replaced ‘Elsanta’ on the standard quality level. It is highly yielding, has a good taste. Its main problem is a risk of misshapen fruits; the causes are not clearly known and are difficult to control.

‘Clery’ (C.I.V., Italy) is developing. It is considered as a standard quality cultivar. Its earliness is intermediate between ‘Gariguette’ and ‘Darselect’. If not carefully cultivated, it may have shelf life ability problems. ‘Naiad<sup>®</sup>’ (C.I.V., Italy) has been developing in the South-East region, as a standard quality variety, and is medium early. Long dominating in the South-East, ‘Pajaro’ is now decreasing from year to year. ‘Cireine’ and ‘Cigaline’ (CIREF Création Variétale) are quite specific to the Loire Valley. ‘Matis’ (Marionnet SARL) is a

late cultivar, mainly for the Loire Valley. In recent years, new varieties were made available to growers: ‘Candiss’ (CIREF Création Variétale), ‘Donna’ and ‘Diana’ (Darbonne Pépinières), ‘Manille’ (Marionnet SARL).

Among everbearers, ‘Mara des Bois’ (Marionnet SARL) is highly flavoured. ‘Charlotte’ (CIREF Création Variétale) is very productive and has been replacing older varieties (‘Seascape’, ‘Diamante’, ‘Selva’...) over the past three years. With early plantings in February, ‘Charlotte’ also begins to replace late Junebearing varieties.

#### 4. PRODUCTION SYSTEMS

The evolution of production systems is linked to the evolution of shelters. It began in the early '70s, with the introduction of small tunnels to improve earliness and quality. In the '80s, large tunnels were the new step towards improved quality and earliness, and their profitability made it possible to use new plant types (frigo plants, potted plants). At the end of the '90s, the development of soilless culture was the latest evolution. It gave the opportunity to offer the consumer strawberries ten month a year, with the combination of heating, type of plants and Junebearing/everbearing cultivars. The decrease of the strawberry production area is due to the decrease of the open field and small tunnels. Large tunnels for soil and substrate culture are becoming more important each year.

##### **4.1 Open field**

Open field production is the oldest production system, still important in the Rhône-Alps region. It is used by small growers, mainly for direct or “pick your own” sales. It still represents 17% of the 2007 area. Frigo plants or bare root fresh plants are planted from June to August in raised beds, with or without plastic row covers. Harvest occurs late, from end of April to July, with Junebearing cultivars. The production costs are low, but the quality differs and is weather-dependent, and yield is low. Weeds are an increasing problem since the European active ingredients revision. The surface using an open field production system is decreasing every year.

##### **4.2 Small tunnels**

Small tunnels on raised beds represented 21% of the surface in 2007. They are used for both Junebearing and everbearing cultivars in every region. Frigo plants are planted from June to April in raised beds in a double row arrangement with plastic row covers used in winter (hoops + thermal polyethylene). Drip fertigation allows supplementary fertilisation during autumn and spring for

Junebearers, or during summer for everbearers. Fruit quality and yield are improved compared to open-air production (due to protection from frost, sun and rain), and production is earlier. For everbearers, higher temperatures in autumn lead to higher production in October and even in early November. However, growers have to be careful with temperature management, and foliar treatments are more difficult to carry out.

### **4.3 High tunnels and glasshouses**

High tunnels and glasshouses represented nearly 62% of the area in 2007. Their production supplies supermarkets. High tunnels are at least 5m wide, single or multispan, and covered with thermal polyethylene. These tunnels are used for soil and substrate culture. Glasshouses are old tomato glasshouses, turned into substrate strawberry production, representing a small area.

#### **4.3.1 Soil culture:**

The plantation is arranged in a double row on raised beds, with plastic row covers and drip irrigation. Supplementary fertilisation is provided with irrigation water. High tunnels and glasshouses are equipped with automatic climate and irrigation management. The production is earlier and the crop and harvested fruits are protected from adverse weather conditions resulting in improved fruit quality. Yield and profitability are increasing due to better climatic conditions, with less labour costs. Foliar treatments are easy, leading to a better phytosanitary protection. Frigo plants are widely used but new plant types (potted plants, trayplants) provide growers with the opportunity to expand and to stabilise the picking season. The main drawback is that moving the tunnel is impossible or very difficult, leading to crop rotation problems, a serious disadvantage as methyl bromide is now prohibited. Even if labour conditions are improved, working in the tunnels remains hard work, requiring skilled workers accepting low wages.

These tunnels allow to extend the everbearer production until November. The early planting in February/March is becoming increasingly important compared with summer planting. Both use frigo plants. Trayplants are also planted in winter to achieve early production in April/May. Some potted plants (“Charlotte” cultivar) are planted in autumn, also for early production.

The Junebearing cultivars are planted in June/July by frigo plants (main plant type), August/September by potted plants, late November/mid December by trayplants. Frigo plants remain the reference. Potted plants avoid flower and runner removal in autumn, thus reducing labour costs. Tunnels are closed or covered in winter after sufficient chilling. Low heating may be used to avoid frost damage in spring. Harvest occurs from March to early July. Growers may

combine different types of plants to regulate harvest volumes. The expansion of 'Gariguette' (early cultivar) in the past is linked to its adaptability to high tunnels.

#### **4.3.2 Substrate culture**

Substrate culture enables growers to produce ten months per year, combining cultivars, plant types and heating. It also avoids soil-borne diseases (mainly *Phytophthora cactorum* and *P. fragariae*) and crop rotation problems, a great advantage since methyl bromide is prohibited. On the other hand, powdery mildew (*Sphaerotheca macularis*) is difficult to control. The substrate is most often coco fibre or peat supplemented with perlite or composted pine bark. The substrate is mainly in bags. In very rare cases, bags are placed directly on raised beds, but this does not improve working conditions. Bags are generally raised at about 1.5 m high; a lot of supports of all kinds are available. Together with high densities (8 to 10 plants/m<sup>2</sup>), Substrate culture increases yield, and working conditions are far more convenient for employees.

Early, heated crops are the most profitable, but also the most risky production. 'Gariguette' and 'Ciflorette' cultivars are planted in summer (frigo plants), September (potted plants), or late November/mid-December (trayplants). Heating (8°C/14°C) starts in January and some lighting may be used to supplement chilling. Picking takes place from mid-February to mid-April for the first bloom and May-early June for the second bloom. For unheated crops the same technique is used, with early ('Gariguette', 'Ciflorette', 'Cigaline', 'Clery') or full-season varieties ('Darselect', 'Naiad<sup>®</sup>...'). Harvest occurs from mid-March to end of June.

For autumn + spring production with Junebearers ('Darselect', 'Elsanta', 'Gariguette'), frigo plants, trayplants, or Chilean 'Gariguette' frigo plants are planted mid-August. This production system is quite limited and used only in South-West France.

For everbearers, end of October planting (potted plants) or February/March will lead to a mid-April to end of October production. Planting frigo plants from mid-June to early July results in a picking period from early September to October for the first year, and the second-year harvest beginning mid-April.



## 5. CONCLUSION

The evolution of French production systems is mainly due to strong commercial pressure from the supermarkets and wholesalers. Production for processing practically disappeared because of high production costs. The demand is for a tasty fresh fruit with a good appearance, good keeping ability until consumption, and that can be differentiated from imported strawberries. Open-field and small-tunnel production systems are becoming outdated and are decreasing each year. Nowadays, high-tunnels and glasshouse production systems can meet quality requirements with a “ten months a year” production using substrate culture. Strawberry is becoming a risky crop with costly inputs (tunnels, plants), high labour costs (more than half the production cost) and changeable selling prices. Pests (aphids, ...) and diseases (soil-borne diseases, mildew,...) are becoming more and more difficult to control: the European active ingredient revision led to the withdrawal of a large number of commercial phytosanitary products and new ones are slow to be brought to market. Biological pest control could be effective, but its cost has to be lowered and the insecticides must be harmless to beneficial. As the future is clearly linked to the ability to decrease production costs while improving quality, it is necessary to find labour-saving techniques. With all these challenges, French cultivation systems are evolving towards more technical crop management, with tasty cultivars, in order to differentiate the French production from cheaper imported strawberries.

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