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Pregledni članak
Scientific review

Kultura sitnog voća u Grčkoj

Small fruit culture in Greece

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SAŽETAK

Najvažnija kultura sitnog voća je jagoda a sve druge (malina, kupina, ribiz borovnica) smatraju se manje važnim kulturama. Proizvodnja jagoda/godina iznosi 25.000 tona a sve ostalo iznosi do 1000 tona.Glavni sustav uzgoja jagoda su podignute gredice između staza, za proizvodnju "izvan sezone" a najvažniji kultivar je Camarosa.

Biljke malina i kupina većinom se uzgajaju u sustavu živice. Najvažniji varijeteti maline su Autumn Bliss, Heritage, Meeker i Glen Lion. Najvažniji varijeteti kupina su Silvan, Lotata, Choctaw, Comanche, Cherokee, Black Satin, Hull Thornless, Thornless Evergreen, Chester, te hibrid Tayberry. Većina sadnog materijala se uvozi.U zadnje vrijeme poraslo je zanimanje za proizvodnju kupina zahvaljujući mogućem povoljnom djelovanju na zdravlje.

Ključne riječi: jagoda, malina, kupina, sustavi proizvodnje

ABSTRACT

The most important small fruit crop is that of strawberry and all others (raspberries, blackberries, currants, blueberries) are considered minor crops.

The strawberry production/year accounts for 25 000 tons and all others produce up to 1000 tones. The main system in strawberry culture is raised beds in walks in tolls (4 rows/toll), for ‘off season’ production and the most important strawberry variety is ‘Camarosa’.

Raspberry and blackberry plants are mostly trained in hedgerow systems. The most important raspberry varieties are: ‘Autumn Bilss’, Heritage, ‘Meeker’ and ‘Glen Lion’. Regarding blackberries the most important varieties are: ‘Silvan’, ‘Kotata’, ‘Choctaw’, ‘Comanche’, ‘Cherokee’, ‘Black Satin’, ‘Hull Thornless’, ‘Thornless Evergreen’, ‘Chester’ and the hybrid ‘Tayberry’. Most of the planting material is imported.

Recently there is increasing interest in blueberry production due to potentially health benefit effects.

Key words: strawberry, raspberry, blackberry, production systems

1. STRAWBERRY PRODUCTION SYSTEMS IN GREECE

1.1 Introduction

Worldwide strawberry is found in every country from the arctic to the tropics. It is widely distributed due to environmental tolerance of the plant because of the genetic background, which permits considerable variation and flexibility in culturals systems; and the high profit levels that can be realized by the strawberry grower (Galletta and Himelrick, 1990). Strawberries are highly consumable, delicious, low-energy fruits, rich in several bioactive phytochemicals with antioxidant and other beneficial properties offering protection against cardiovascular and neurological disorders and oxidative stress dysfunctions (Pantelidis et al., 2007; Neocleous and Vasilakakis, 2008).

It should be recognized that there is a large variation in successful strawberry production methods among strawberry growing regions. In Greece there is a strong trend toward controlled growth and continued interest in protected culture, possibly with more disease, insect, drought and salt tolerance in cultivated varieties. The prevailing production system consists of plants cultivated in soil raised beds under protection (walk in tolls) without heating.

1.2 Strawberry production

Strawberry production in Greece at present is concentrated by 80% in Peloponnesus (S. Greece) and the total strawberry production is estimated at about 20 000 -25 000 tons/year. Nursery plant material is mainly imported (75%) and Greek origin plants account only for 25%. (Vasilakakis, 2007)

1.3 Planting time

'Fall' planting is actually done in mid to late fall. Fresh-dug plants are harvested in late October, no later than the first week of November and planted directly or after very short storage. A high elevation nursery plant source is preferable to achieve early chilling. This system is useful only in areas (S. Greece) where the winter temperatures are relatively warm.

'Summer' planting depends on the availability of coldstored (frigo-plants). Plants are harvested from the nursery field in January – February and stored (in 50_s) after cleaning at -2 °C and finally planted from April to September. 'Summer' planting dominates in the cooler N. Greece.

When plants are developed in trays, which might be more expensive but they could be planted any time of the year.

1.4 Production systems

The production systems manipulate certain strawberry variables to program for predictable annual performance, under favorable environmental conditions, and minimal risk. With this objective on mind the strawberry production systems in Greece are the following:

1. Open plain field culture in single rows with a density of 10 000 plants/ha. Plantation produce from the second year (3 year culture, in season production).
2. Plants on raised beds, with black or white plastic mulch over the beds, containing mainly one row of plants, occasionally two or even four rows of plants with a density of 50 000 plants/ha. This production system has been widely used for 1–2 year culture and under two directions:
   a. Open field production - in season production.
   b. Protected culture systems - tolls – 'off season' production.
3. Soilless culture in vertical sacks with a density of 200 000 plants/ha under plastic or glasshouse conditions for 'off season' production. This system of culture had been used for some years in the past but not any more.
4. *Soilless strawberry culture in Cyprus* mainly exists in two different substrates (Cocosoil or Rockwool). This production system provides plant density of 250 000 plants/ha with most of the crop harvested off season.

1.4.1 Open plain field system of production, containing single or double rows of plants (10 000 plants/ha), has the following characteristics:

- Extensive system
- Planting period: April.
- 10 000 refrigerated plants/ha.
- 'Camarosa' is the main variety.
- 1st year- production of daughter plants- no crop.
- 2nd and 3rd year – full crop.
- Harvesting period: April – August.
- Yield, depends on the prevailing weather conditions during harvest.
- Fruits destined to fresh market, as well as to pastry or processing industry.
- Very limited acreage.

*1.4.2 Plants on raised beds***.** The features of this system are as follow:

- 50 000 plants/ha.
- Plants are cultivated on soil raised beds, covered with black polyethylene film.
- Drip irrigation and fertigation.
- a) Open field.
  -Semi–intensive, very limited acreage, spring rainfalls are usually the problem.
- b) Protected culture.
  -Intensive system for 'off season' production.
  1. Very low tunnels.
  2. Low tunnels.
  3. Walk in tunnels or tolls.

Very low tunnel (experimental field), slightly raised beds

Good system under certain climatic conditions, easy to be handled, very limited acreage.

Low tunnel, very uncomfortable for the workers

It was used by a few farmers for a few years but soon it was abandoned, system with many disadvantages.

Walk in tolls, prevailing production system

Tunnels or tolls made of iron bars and covered with translucent polyethylene film, 3-4 beds/toll. Plants in soil raised beds, in single or double rows without heating.

1.4.3 Soilless culture is considered a very intensive system of production:

- Productivity of the system proved to be inconsistent, stabilization of plants difficult (many losses), very expensive.
- 200 000 plants/ha.
- Offers a variety of practice and management schemes.
- Cultivation in vertical plastic sacks, filled with perlite, in greenhouses, glass or plastic, was tried in the past but it is not in use any more.
- *Soilless strawberry culture in Cyprus* is gaining much attention by local growers, since this production system in substrates (cocosoil, rockwool) offers higher plant density (250 000 plants/ha) compared to the cultivation in raised soil beds in tunnels. This leads to higher yield and superior prices for the producers. The most important cultivar is

'Camarosa' and the planting material is imported. Usually the planting season is late October – early November ('fall' planting) and the harvesting period is from late January to early May ('off season' production).

1.5 Strawberry varieties

The most important cultivars in Greece, at present, are: 'Camarosa' (80%), 'Fentana' (8%) 'Selva' (10%) and 'Fern' (2%). Older varieties used are 'Brighton', Iko, Douglas, Cruz, Tioga and Toro.

1.6 Harvesting

Strawberries are hand harvested and the fruit is placed in plastic containers of 250-500 g in hard paper or wooden boxes. A special device for caring fruits between rows in tolls is used. Berries are stored at 3 °C only for a few days.

1.7 Production Examples

1.7.1 Fresh plants- 'Fall' plantation

- Harvest of plants: Late October- early November.
- Plants in storage for 1-3 days (5 °C).
- Planting period: Late October- beginning of November.
- Adapted to locations with mild winter - S. Greece.
- Plants continue to grow during winter period (tolls or tunnels are covered in December).
- Plants produce for a long period, 1 or 2 year culture, depending on the area.
- Harvesting period:
- Feb. – March- April- May: S. Greece (1 year culture).
- April- July & August: N. Greece (2 year culture).
- Yield: 15–20 tons/ha (1st year), 25-30 tons/ha (2nd year).

1.7.2 'Frigo'-plants - 'Summer' plantation

- Plants are harvested in January- February and stored at -2 °C.
- Planting period: Late July- September.
- One year crop.
- Adapted to locations with cold or cool winter.
- Stolons and flower trusses are removed the first 2 months.
- Tolls are covered in December- January, depending on the location.
- Harvesting period :
- Feb. - March - April: S. Greece.

- April - May: N. Greece.
- Yield : 25-35 tones/ha.

1.8 Problems in strawberry production

Heavy snow might be a problem in N. Greece (demaging plastic tolls). Furthermore, low temperature may lead either to flower frost damage leading to lower yield or poor pollination. However, high temperature in late spring might be a problem in tolls and need to be cooled off (large side openings and shading). Often spider mites can become very serious problem, particularly in high temperature conditions and fruit end rot due to Ca deficiency is not rare in winter greenhouse conditions. Moreover, botrytis some times is a problem, even under toll conditions. Finally, the major problem is the cost of production, which is getting higher and higher every year and the culture has become problematic.

1.9 Trends in production

Summer planting will continue to be used in areas where winters are too cold for successful winter planting. In areas where winter planting is successful or potentially so, summer planting will be replaced with winter planting as better varieties become available and the economics of the business will force this issue. We would expect continued interest in protected and soilless culture, possibly with more efficient varieties than we have now. We also expect sustainable strawberry production systems with more disease, insect, drought and salt tolerance in cultivated varieties. It is also a matter of great interest that strawberry fruit production systems deliver high quality fruits with higher biologically active substances and potential health benefits.

2. RASPBERRY AND BLACKBERRY PRODUCTION

2.1 Introduction

Raspberries and blackberries were introduced in the past, by the Greek Ministry of Agriculture, as alternative crops, with the hope that they would be exported to N. European countries as off season fruits. However, the expansion of both crops was not expected and they are considered as minor crops. Currants are grown in a very small scale, while blueberries are gaining special attention due to the high antioxidant components.

2.2 Production

Raspberry and blackberry production in Greece at present is concentrated in Central and North Greece and the total commercial acreage is over 150 ha as a

normal yearly level. Total berry production is estimated at about 500-1000 tons/year. Nursery plant material is mainly imported. (Vasilakakis, 2007)

2.3 Raspberries

The acreage does not exceed 50 ha and a large part of the crop (fresh fruit) is purchased by big hotel enterprises and some (expensive) groceries and pastry shops for decoration purposes. Some of the crop is sold to processing industry to be used in flavored yogurt, ice cream, and refreshing drinks (fruits of the forest). Small quantities are exported by air mainly to UK.

2.4 Cultivated raspberry varieties,

hybrids and their characteristics (Fig. 1 and 2)

Fall-bearing

'Autumn Bliss': very early, good size fruit.

'Heritage': more vigorous than 'Autumn Bliss', fruit less susceptible than 'Autumn Bliss'.

'Fallgold': yellow fruit, very aromatic, vigorous canes, as early as 'Autumn Bliss'.

Yield: 500-700 g/m^2.

June-bearing

'Glen Lion': very early, short canes, good size fruit.

'Meeker': late maturing, vigorous canes, good size fruit, susceptible to cane blight.

Yield: 700 g/m^2.

Hybrids (Raspberry x blackberry)

'Tayberry': early, good size fruit, susceptible to agrilus.

'Sunberry': very productive, early maturing, difficult fruit harvest.

Yield: 700 g/m^2.

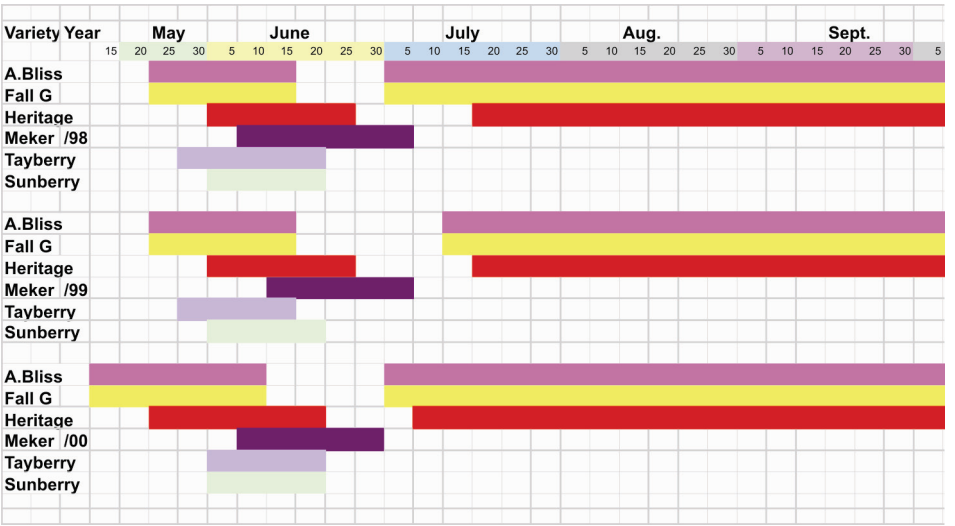

Fig. 1. Harvesting period of raspberries and hybrids, N. Greece.

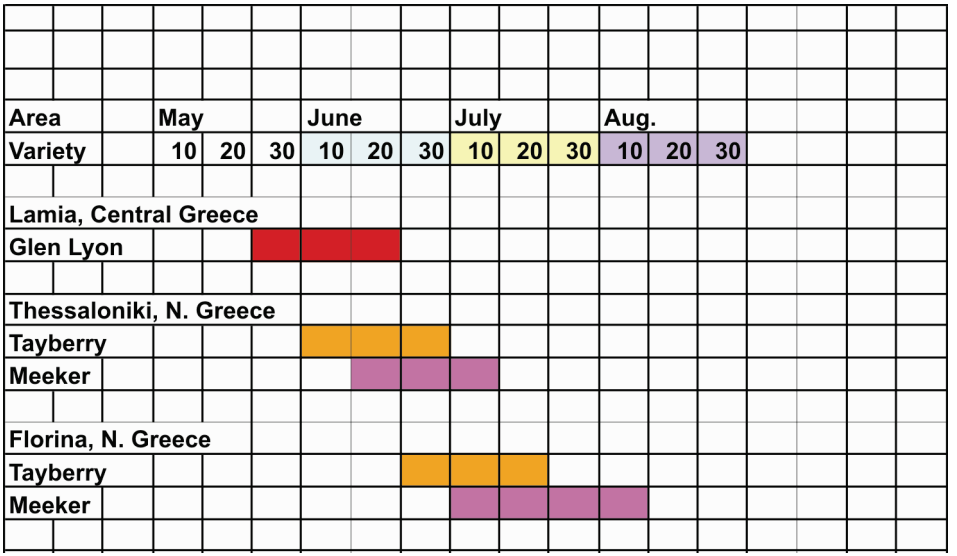

Fig. 2. Harvesting period of June-bearing raspberries and hybrids in Greece

2.5 Management system

Raspberries are most commonly maintained in T –system- hedgerows (N. Greece) in open field cultivation. A V- hedgerow system has been used in greenhouses (shading necessary) for off season production in Crete (S. Greece). However, in greenhouse production lack of chilling may result in very tall canes and bumbles bees are necessary for nice berry formation. Most of the planting material is imported.

2.6 Blackberries

Although wild blackberry species are native to many parts of Greece little domestication and commercial use has been made. Most of the planting material is imported. There are many cultivars of blackberries available from which to choose; however, only a few are well adapted to any specific region. An essential prerequisite to success in blackberry production is to start with disease –free planting material. The most common cultivation system is the hedgeraw system

2.7 Blackberry varieties and their characteristics (Fig. 3 and 4)

Early maturing trailing varieties (June harvesting)

'Silvan': thorny long canes, early, good size and shape black fruit that bleeds easily, sweet.

'Kotata': chimeric not thorny with long and thin canes, early, good size and shape fruit, sweet, easily handled.

Yield: 700 g/m^2.

Early maturing, thorny erect varieties (June harvesting)

'Choctaw': early, very good size fruit, sweet, resistant to handling.

'Comanche' and 'Cherokee': look alike, fruit matures a few days later and is a little smaller than 'Choctaw', easily handled.

All of them susceptible to sunburn, phytophthora and agrilus.

Yield: 700-1000 g/m^2.

Late maturing blackberry varieties (July-August harvesting)

Black Satin (fruit very acid), Hull Thornless, Thornless Evergreen, Chester.

Yield: 1500-2000 g/m^2.

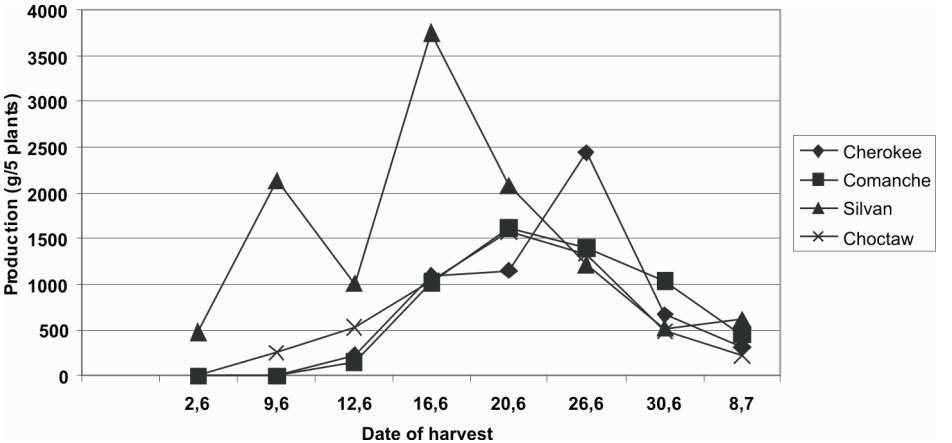

Fig. 3. Harvesting period of blackberry in Greece

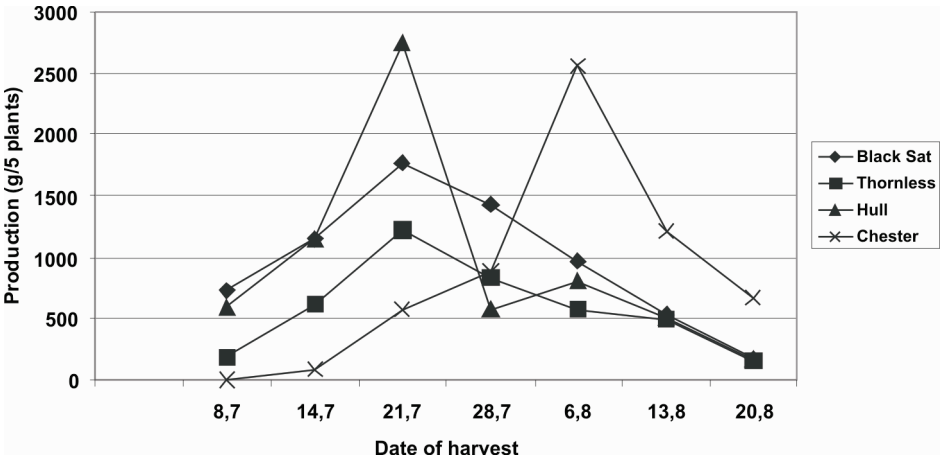

Fig. 4. Thornless blackberry production in N. Greece.

2.8 Pest and Diseases

Serious pest and disease problems: Agrilus ruficollis, Oxythyrea funesta, Mealy bugs Coniothyreum (cane blight), Botrytis, Phytophthora.

2.9 Future perspectives

Bramble production in Greece is facing some of the following problems leading to limited acreage and production:

- Difficult to find pickers.
- Cost of harvesting is very high.
- Fruit susceptible to sunburn, shading might be necessary.
- Postharvest handling not easy, precooling devices not always available.

Since these problems will continue to exist in the following years no increases in acreage and production will be occurred.

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